Montana Bighorn Sheep Conservation Strategy

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Montana Fish, Wildlife & Parks

Wildlife Division • Helena, MT 59624

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Montana Department of Fish, Wildlife & Parks

Wildlife Division

1420 East Sixth Avenue
Helena, Montana 59620

Montana Fish, Wildlife & Parks

For more information, visit: fwp.mt.gov

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CONTRIBUTORS

Tom Carlsen has worked for Montana Fish, Wildlife and Parks for 27 years with most of that time spent as a management biologist in Townsend, Montana. Tom was on special assignment to head the effort to develop this conservation strategy and wrote much of Chapter 1 as well as compiling the entire document and completing initial edits.

Glenn Erickson first began working on bighorn sheep in 1970 as a graduate student at Montana State University studying the ecology of bighorn sheep in the Sun River area of Montana. Glenn retired from Montana Fish, Wildlife and Parks in 2007 with 34 years with the agency. As Wildlife Management Bureau Chief, Glenn was instrumental in developing Montana's bighorn sheep program to what it is today. Glenn wrote the historical sections in Chapter 1 of the conservation strategy.

Additionally, the following biologists for FWP produced the management plans for individual bighorn sheep populations found in Chapter 2.

Vanna Boccadori
Bob Brannon
Jerry Brown
Howard Burt
Tom Carlsen
Vickie Edwards
Craig Fager
Bob Henderson
Craig Jourdonnais
Tom Lemke
Cory Loecker
Brent Lonner
Gary Olson
Justin Paugh
Al Rosgaard
Jenny Sika
Bruce Sterling
Shawn Stewart
Tom Stivers
Mark Sullivan
Tim Their
Ray Vinkey
John Vore

ACKNOWLEDGMENTS

The primary authors of Chapter 1 of the Conservation Strategy were Tom Carlsen (Montana Fish, Wildlife and Parks) and Glenn Erickson. Wildlife management biologists for Montana Fish, Wildlife and Parks (FWP) from across the state produced the individual management plans found in Chapter 2 for each bighorn sheep population. Neil Anderson (FWP) wrote portions of the Health section. The section on Genetics was provided by Gordon Luikart (University of Montana). Initial editing was by Tom Carlsen and Tom Palmer (FWP). Wayne Klinkel provided the design layout for the document with final proofreading and editing by Ann Seifert and final layout by Connie Lere (FWP). A special thanks to Dr. James Bailey for thorough review of the entire strategy and the valuable comments provided from that effort. Adam Messer (FWP) produced the maps and conducted the GIS analysis for habitat evaluation. Justin Gude (FWP) provided assistance in model development for harvest management. Ken Hamlin (FWP) offered valuable comments on the Population Monitoring and Management sections. Fred Jakubowski (FWP) provided support in many ways, which made this effort possible. Marjorie Smith with the Montana State Library was very helpful in acquiring literature from a wide variety of sources. Terry Lonner (Media Works, Bozeman, MT) provided the cover photo. Other photos were provided by Brent Lonner (FWP), Andrew McKean (FWP), and Tom Carlsen. Quentin Kujala, Wildlife Management Bureau Chief, supervised the development of the conservation strategy and provided constructive support throughout that process. Funding for this project was provided by FWP, Pittman-Robertson Wildlife Restoration program, and the Montana Wild Sheep Foundation.

EXECUTIVE SUMMARY

These individual management plans are essential in the future management of bighorn sheep in Montana.

Montana has never developed a statewide comprehensive document for managing Rocky Mountain bighorn sheep. Despite of lacking such a guiding document, Montana has had a very viable bighorn sheep program. Much effort has been expended to understand the ecology of bighorns in Montana and to reestablish populations in historically occupied habitats. Trapping and transplant efforts have established bighorns in much of their former range and provided stock to many western states in their efforts to also establish populations. This Conservation Strategy, compiled by Montana Fish, Wildlife & Parks (FWP) documents the history of bighorns in Montana and defines future management direction for this popular big game species.

The decision was made early in the development of the Conservation Strategy to produce as comprehensive a document as possible. The document is divided into two chapters, with Chapter 1 providing a history of past and current management of bighorn sheep in Montana plus overall direction for future management. The reestablishment of bighorn sheep through trapping and transplanting is documented as well as the role hunting has played in managing bighorns in Montana. In Chapter 2, the concepts developed in Chapter 1 for managing populations are actually applied in detail, and management recommendations are correlated to monitoring efforts.

Chapter 1 contains subsections, which provide overall direction on how populations, herd health, and habitat will be monitored and managed. Herd health currently is focused on maintaining separation between wild sheep and domestic sheep and goats to prevent potential disease transmission. In the event mixing does occur, a protocol for resolving those situations has been developed as part of this document. Further, if a die-off of bighorns occurs, a protocol on how FWP will respond has also been developed.

FWP's Translocation Program has been revised and now includes a process for evaluating potential new habitat. As part of these revisions, criteria for moving bighorns to new areas, augmenting existing populations and prioritizing potential transplants have been developed.

A focus of bighorn sheep management in recent years is the concept of managing subpopulations of bighorns as a metapopulation. Implications for this type of management for bighorns in Montana are discussed.

Chapter 2 contains individual management plans for bighorn populations in each of Montana's bighorn sheep hunting districts as well as five small populations that are not currently hunted. These individual management plans are essential in the future management of bighorn sheep in Montana. Each individual management plan contains a comprehensive history of the population, objectives for habitat and population objectives, and strategies for meeting those objectives. The objectives for each population of bighorns will direct the future management of the species in that area. The Population Management section in Chapter 1 includes processes for managing population numbers and characteristics of the herd. Where it is appropriate, management is based on an Adaptive Harvest Management (AHM) approach, which depends on where populations are in relation to objectives.

In spite of extensive restoration efforts, bighorn sheep have not recovered across the West as successfully as other big game species. Continued health issues tied to disease transmission from domestic animals restrict full recovery and distribution of bighorns. The exact mechanisms of disease transmission from domestic animals to bighorn sheep may not be known, but there is considerable evidence that indicates significant risk of disease transmission exists. In fact, significant die-off events correlated with contact with domestic animals have affected many bighorn populations in Montana. Nine populations that have gone through a die-off have yet to recover, some after more than a decade and in spite of augmentations of more sheep. Additionally, 60% of Montana's 45 bighorn sheep populations have less than 125 animals and because of the small number of sheep, threatens their long-term viability and makes it less likely the population can sustain a major mortality event.

While Montana's human population hasn't

increased significantly in recent years, the western portion of the state has attracted development activities that have contributed to loss of habitat, which has negatively impacted wildlife including bighorn sheep and has the potential to increase the opportunity for contact with domestic sheep and goats.

Bighorn sheep management plans, status reports, and other such documents produced by other states and Canadian provinces have been used extensively in developing this Conservation Strategy. Further, in 2007 the Western Association of Fish and Wildlife Agencies (WAFWA), which is comprised of 23 state and provincial wildlife agencies from the western United States and western Canada, established a Wild Sheep Working Group (WSWG). The WSWG, which includes wildlife professionals from across the West, was tasked with developing management guidelines dealing with potential contact or interaction between wild sheep and domestic sheep and goats. The WAFWA directors subsequently endorsed a report and recommendations produced by the WSWG titled "Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat." This report is the basis for recommended actions in this Conservation Strategy in relation to health issues that can be caused by the interaction of wild sheep and domestic sheep and goats. The protocol developed by FWP to address the use of domestic sheep and goats for noxious weed control in the vicinity of existing bighorn sheep populations is one example.

Two items not addressed in detail in the Conservation Strategy are the basic ecology of bighorns and the effect of predation on bighorn sheep. To learn more about basic ecology of bighorns, the reader is advised to refer to several excellent texts on bighorn sheep that are referenced in the Conservation Strategy. Predation on bighorn sheep can be a significant form of mortality affecting populations. The primary predator of bighorns across much of the West is the mountain lion. Montana has a relatively large and viable lion population that is effectively managed through hunting. At this time, predation of bighorn sheep is not a significant factor influencing bighorn populations in Montana.

Bighorn sheep are a special wildlife species to many Montanans and are cherished as both a trophy animal and species that fosters memories of wildlife encounters long remembered. During the development of this Conservation Strategy FWP has made a concerted effort to meet with all interested parties to discuss the future of bighorn sheep management in Montana. That effort has included meeting with a diverse consortium of individuals and groups across the state including groups often at odds regarding bighorn sheep management. As a wildlife managing agency part of FWP's focus is to make sure the species managed are healthy and have the greatest distribution and abundance societal and environmental constraints allow. Across the west where bighorn sheep occur there often is controversy where that distribution overlaps with domestic animals, particularly domestic sheep. The controversy stems from the concept that when domestic sheep or goats come together with bighorn sheep the bighorn sheep often die. While supported by research and widely recognized, this concept is not accepted by all parties. The way most wildlife management agencies attempt to deal with this issue is to keep the different species from coming together. Much of this Conservation Strategy provides direction in those regards. One potential response to this complex situation is to adjust domestic animal use where feasible on public lands and where it may conflict with bighorn sheep. While FWP should vigorously defend existing bighorn sheep populations against recognized threats to the bighorn sheep or to their habitat and should vigorously pursue additional bighorn sheep where circumstances allow, FWP believes that any localized removal, transfer, or conversion of established domestic sheep allotments on public lands for the benefit of bighorns should only come with the willing participation of the producer and land managing agencies. FWP has spent much time listening to all sides of this issue and while it is FWP's direction to see bighorn sheep populations expand in distribution and numbers, as a wildlife-managing agency FWP readily acknowledges the contribution of livestock producers in providing valuable wildlife habitat and wildlife presence on their private lands. Additionally, something heard repeatedly in conversations with livestock producers was their desire to see viable populations of bighorn sheep in Montana. That feeling appears not to be held universally across the west where these domestic and wild species come together. FWP believes that bighorn sheep will prosper in Montana by diverse groups of interest working together and respecting the contribution those groups make not only to local and statewide economies but also to Montana's rich cultural diversity.

The Conservation Strategy is intended to provide management guidance for bighorns for at least the next 10 years. It is intended to be flexible and incorporate new ideas and technological and scientific advances, and adapt management efforts to changes in bighorn populations and their habitats as they occur. Ultimately, this document will assist biologists

in making decisions regarding the management of particular populations, provide direction to other agencies relative to their management efforts that may affect bighorn sheep, and aide the FWP Commission in their decisions regarding bighorn sheep in Montana. Although the Bighorn Sheep Conservation Strategy will serve as a source of information and guidance to the FWP Commission, it does not preempt Commission authority to formulate annual rules, augment or transplant, set hunting seasons and regulations, or implement emergency actions in response to unexpected events or circumstances.

To assist the reader, a glossary of terms associated with bighorn sheep is included in Appendix A. Additionally, bighorn sheep have been the focus of much scientific research in Montana. Appendix B contains citations for research projects conducted on bighorn sheep in Montana, listed by specific topics.

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We understand that serving the people of Montana to achieve this vision is both a privilege and a responsibility.

Mission of FWP

Mission

FWP, through its employees and citizen commission, provides for the stewardship of the fish, wildlife, parks, and recreational resources of Montana while contributing to the quality of life for present and future generations.

Vision for the 21st Century

FWP will provide the leadership necessary to create a commitment in the hearts and minds of people to ensure that, in our second century, and in partnership with many others, we will sustain our diverse fish, wildlife, and parks resources and the superior recreational opportunities that are essential to a high quality of life for Montanans and their guests.

Guiding Principles

We understand that serving the people of Montana to achieve this vision is both a privilege and a responsibility. We also understand that we cannot achieve our vision alone. The following principles will guide FWP as we pursue our objectives:

We will maintain the long-term viability of Montana's natural, cultural, and recreational resources.

We will actively involve people in decisions that affect them, help people to participate by providing them with credible and objective information, and develop programs with a clear understanding of public expectations for FWP service.

We will serve as an advocate for responsible management and for equitable allocation of public use of the limited resources, that we are entrusted to manage.

We will manage fish and wildlife resources with pride in Montana's hunting and angling heritage.

We will create and strengthen working partnerships with individuals, organized groups, and other natural, historical, and cultural resource management agencies.

We will use innovation and technology to improve our services.

Agency Goals

Create a work environment where priorities are clear; the decision-making process is efficient and effective; and where employees feel a sense of accountability, value, and satisfaction in their achievements and their contributions to the agency mission.

Provide quality opportunities for public appreciation and enjoyment of fish, wildlife, and parks resources.

Maintain and enhance the health of Montana's natural environment and the vitality of our fish, wildlife, and cultural and historical resources through the 21st century.

Emphasize education, communication, and responsible behavior to afford citizens the opportunity to better understand and participate in the decision-making processes that will sustain our natural, recreational, and cultural resources for future generations.

Statewide Objectives

The structure of this Conservation Strategy is such that management objectives and efforts are largely implemented at the population level. Chapter 2 of the Conservation Strategy contains the individual management plans for each hunting district where populations are hunted and for populations that currently aren't being hunted. These individual management plans contain the specific objectives for habitat and population management along with strategies designed to meet those objectives. Chapter 1 is intended to provide some overall direction to help facilitate the implementation of the objectives and strategies developed at the population level.

To provide overall direction statewide objectives have been developed. Strategies for implementing and details regarding each objective are contained in the appropriate heading in Chapter 1. The statewide objectives are:

1) Monitor bighorn sheep populations in a consistent manner statewide to determine demographic trends, which will aide in making management decisions.
2) Manage populations at levels consistent with available habitat, other land uses, and at levels providing consumptive and non-consumptive use of the wildlife resource.
3) Identify metapopulation structure and function and develop strategies to protect and enhance the long-term connectivity in those populations.
4) Work with private landowners and land managing agencies to identify, maintain and enhance bighorn sheep habitat. FWP will provide science-based and other reasonable comment to private landowners and land managing agencies regarding opportunities and limitations for bighorn populations in relation to identifying, maintaining and enhancing bighorn sheep habitat. FWP will participate in discussions and negotiations on opportunities and techniques to eliminate and/or mitigate possible negative impacts of bighorn transplants or introductions.
5) Manage existing populations at objectives as outlined in Chapter 2. Note: There are 45 actively managed populations of bighorn sheep in Montana of which 20 are at objective, 7 are over objective and 18 are below objective. Statewide objectives for the total number of bighorns in the 45 populations are 6,615 sheep and numbers are currently 921 below that objective. FWP needs to assess on a population basis what feasibly can be done to achieve those objectives.
6) Establish five new viable and huntable populations over the course of the next 10 years and augment existing populations where appropriate.
7) Monitor the health of all bighorn sheep populations under the management authority of FWP including source (sheep used as transplant animals) and non-source populations.
8) Implement strategies designed to facilitate the effective separation between wild sheep and domestic sheep and goats.
9) Pursue the better understanding of bighorn population genetics to evaluate genetic diversities of herds and overall genetic fitness of populations and subpopulations forming metapopulations.
10) Develop a central database for storing and analyzing bighorn sheep data, including population survey, harvest, health, (including genetic status), and translocation data.
11) Continue involvement with the Western Association of Fish and Wildlife Agencies and associated Wild Sheep Working Group to ensure coordination of bighorn sheep management issues with western states and provinces and to provide information to FWP staff on the latest management issues with wild sheep.

Process for Changing Population Objectives and Regulation Packages

As the AHM process evolves and we gain additional information from this process, there may be a need to change population objectives and regulation packages. Similarly, catastrophic events that create significant habitat changes or declines in populations, reasonable recommendations from community working groups, and changes in landownership might also affect bighorn sheep populations, objectives, and regulations. The public has been concerned about how and when such changes might be possible.

We suggest that internal or external proposed changes resulting from factors and events such as described above be submitted annually to FWP Wildlife Division by July 1. Any proposals submitted would be reviewed internally and, if determined to be appropriate, have merit, or wide public support, would be forwarded to the FWP Commission for their consideration at the August commission meeting to adopt as tentative proposals for public comment. The Commission would take final action at the September commission meeting on these proposals. Changes to objectives and/or regulation packages would then be in place to guide Commission action during the general season-setting process in December and February of each year.

Initial Public Participation

Public Scoping Process

FWP announced on November 9, 2007, its intention to prepare a Rocky Mountain bighorn sheep conservation strategy. Public comment was sought through December 20 on issues and concerns associated with bighorn sheep and bighorn sheep hunting. Comments were solicited through news releases to Montana newspapers and radio stations and by announcement on the FWP Web site. The announcement indicated

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this was to be the first statewide conservation strategy developed for bighorn sheep and FWP intended to document Montana's bighorn sheep management history and future goals and objectives, and to include survey priorities and techniques, hunting seasons, recommended permit levels, health and habitat monitoring, and guidelines for trapping and transplant activities. The following initial issues were cited as concerns by wildlife managers:

- Systematic long-term health monitoring
- Genetic integrity of native populations
- Health issues related to contact with domestic sheep or goats
- Establishment of bighorn sheep populations to new areas
- Loss of habitat and development impacts to some bighorn populations
- Hunting and other recreational opportunities

FWP received a total of 31 comments, with the majority (19) coming from the FWP Web site. Respondents were from 18 different Montana towns, and one was from out of state. Respondents were from Lewistown, Missoula, Stockett, Bozeman, Thompson Falls, Glendive, Belt, Plains, Stanford, Livingston, Dillon, Lakeside, Trout Creek, Laurel, Florence, Butte, Helena, and Noxon. The out-of-state comment was from Boise, Idaho. One comment was received from a federal land management agency, the Charles M. Russell National Wildlife Refuge. Organizations providing responses were Montana Chapter of the Foundation for North American Wild Sheep (FNAWS), Gallatin Wildlife Association, Hellgate Hunters and Anglers, Montana Wildlife Federation, Montana Woolgrowers Association, Friends of Makoshika, and Beaverhead Outdoors Association.

Issues Identified Through Public Involvement

Listed below are the seven major issues and 46 sub-issues identified by the public. The majority of comments were related to more than one issue. Issues raised that were not relevant to the bighorn sheep Conservation Strategy are not discussed in this summary. The issues here are not listed in any particular priority. The number of comments pertaining to the issue is shown in parentheses.

A. Restore Bighorn Sheep to Suitable Habitats (42)

1) Transplant sites suggested include Hunting District 410 south of the Missouri River and east of Fred Robinson bridge, Little and Big Belt Mountains, Crazy Mountains, Snowy Mountains, Bridger Mountains, Lewis and Clark Caverns, Makoshika State Park, Smith River, Bighorn Mountains, Sheep Mountain north of Yellowstone River, Bull Mountains, Greenhorn Mountains, East Pioneer Mountains (15)
2) Transplant sites in Montana should be given priority (10)
3) Hunting pressure on ewes should be decreased to provide additional transplant stock (3)
4) New transplant sites should be identified; experiment in previously rejected or unsuccessful locations (2)
5) Restock herds following die-offs (1)
6) Consider private or mixed private and public lands for future transplants, with landowner agreement (2)
7) Do not transplant sheep into areas where domestic sheep currently occur (1)

B. Expand Hunting Opportunities (29)

1) Ensure harvest of mature rams in unlimited areas (2)
2) Stop poaching; increase fines (3)
3) Maintain unlimited areas; evaluate unlimited areas periodically to determine if public remains supportive (2)
4) Implement landowner preference (1)
5) Increase ram-license cost; keep cost affordable; consider once in a lifetime licenses; change preference point system to benefit 20-plus-year applicants (4)
6) Sell more out-of-state tags during archery season (1)
7) Lower the cost of ewe licenses; remove seven-year wait for ewe license after obtaining a ram license (3)
8) End season earlier, before rams come to lower-elevation roads (Oct 31); consider full-curl and early seasons in some areas to reduce success and allow for an increase in hunter numbers (3)
9) Continue to favor residents over nonresidents in license allocations (1)

10) Improve access to hunt on or to travel through private land (1)

11) Require only application fee in application process (1)

C. Long-Term Survival of Bighorn Sheep (37)

1) Manage metapopulations and encourage interconnectivity between herds to reduce risk of loss

2) Develop individual herd management plans (3)

3) Obtain conservation easements or fee title to critical sheep winter range (3)

4) Improve bighorn sheep habitat (1)

5) Monitor changes in bighorn sheep habitat (3)

6) Work cooperatively with conservation groups, Canadian provinces, and Indian tribes (5)

7) Establish one FWP point of contact for sheep program (2)

8) Manage predators (wolves) (4)

9) Increase funding for sheep management program; request funding support from the national WSF (3)

10) Monitor conservation strategy effectiveness (1)

11) Provide for genetic diversity; improve genetics through transplant of sheep from other areas (e.g., Cadamin mine area in Alberta) (2)

12) Work to prevent land development in critical sheep habitats (2)

13) Evaluate mountain goat competition in Absaroka range (1)

14) Evaluate fences that hinder sheep movement to critical habitats (1)

15) Use preemptive measures to combat negative effects of wildfires and drought (1)

16) Combat invasion of noxious weeds in bighorn sheep habitat (1)

D. Bighorn and Domestic Sheep and Goat Interactions (18)

1) Use sound science and provide for public education on issues associated with domestic sheep and goat interactions with bighorn sheep (2)

2) Limit domestic sheep incursions into bighorn sheep areas; confront issue of domestic sheep allotments in bighorn sheep ranges; encourage buy-outs of domestic sheep and goat grazing leases in critical areas by organizations; terminate domestic sheep trailing agreement on Rob Ledford WMA; use preventative measures; use medicated licks (12)

3) Discourage the proliferation of small domestic sheep and goat herds (1)

E. Bighorn Sheep Herd Health and Disease (14)

1) Develop plan to monitor herd health (1)

2) Develop protocol to decrease impact from disease (2)

3) Provide for research on disease (2)

4) Maintain native herd genetic integrity (1)

5) Decrease bighorn sheep road fatalities; provide for public road safety education; establish speed limits at sheep crossings on narrow highways (e.g., Weeksville Road to Thompson Falls 50 mph); consider width changes for narrow roads at crossings; build fence along highways at crossings; substitute sand for road deicer where it attracts sheep to roadway (9)

6) Give priority to herd health (1)

7) Conduct sheep trapping in sensitive manner; reduce harassment (1)

F. Public Enjoyment and Viewing Opportunities (2)

G. Damage to Private Property (3)

1) Increase ewe permits to address landowner damage complaints (e.g., Lower Rock Creek) (2)

2) Continue to use 1995 Bighorn Sheep Transplant Policy (1)

CHAPTER 1

BACKGROUND INFORMATION FOR BIGHORN SHEEP CONSERVATION STRATEGY
WILD SHEEP IN NORTH AMERICA

Origin

Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) are believed to be descendants of wild sheep from Asia, which migrated to the North American continent over the Bering Sea land bridge during the late Pleistocene (Clark 1964). Isolation of the ancestors of bighorn sheep in the western United States during the following Wisconsin glaciation period resulted in the differentiation of Rocky Mountain bighorn sheep and desert bighorns (*Ovis canadensis nelsoni*) (Korobitsyna et al. 1974 in Demarchi 2000). Today two species, Dall's sheep (*Ovis dalli*) and Rocky Mountain bighorn sheep (*Ovis canadensis*), are recognized by taxonomists in North America.

Early Distribution and Classification

James Clark, in his 1964 book titled *The Great Arc of the Wild Sheep*, described the distribution of wild sheep of the world as an arc extending across three continents from the islands of Corsica and Sardinia off the coast of Italy, and the middle east, through Central Asia and Siberia, across the Bering Sea to Alaska and south along the Rocky Mountains into Mexico and the lower peninsula of California. Within this arc all the species of wild sheep are distributed–the mouflons, urials, argalis, Asiatic, Dall's, and the bighorn of North America. Of the nine geographic races or subspecies of North American wild sheep listed by Cowan (1940), six are recognized today: Dall's (*O. d. dalli*), stone (*O. d. stonei*), Rocky Mountain (*O. c. canadensis*), Audubon (*O. c. auduboni*), California (*O. c. californiana*), and

desert (*O. c. nelsoni*). Taxonomists continue to debate the true existence of the California and the Audubon sheep races. Ramey (1999) recommends that the Rocky Mountain and California subspecies be treated as one subspecies (*O. c. canadensis*). His research was based on not only skull and horn measurements, but also protein and mtDNA analysis. Ramey and Wehausen (1996) also dispute the true existence of the Audubon subspecies, which was thought to exist in much of what is now eastern Montana.

The Audubon Sheep

With few actual specimens available of the Aububon sheep (*Ovis canadensis auduboni*), it was very difficult for early taxonomists to demonstrate the true existence of the subspecies. Lewis and Clark, in the early 1800s, and Audubon, in the 1830s, encountered bighorn sheep along the breaks of the Missouri River and the Badlands of North and South Dakota. Many years later, in 1901, C. Hart Merriam named this eastern population (*O. c. auduboni*). The type specimen was a young adult male from South Dakota taken in 1855. Audubon sheep were considered to be "heavier jawed" with "lighter pelage" and "darker eyes" than those of the Rocky Mountains (Couey 1950, Thompson 1950).

Cowan (1940) reviewed the classification of all North American wild sheep and based his conclusions primarily on skull measurements. He described the range of this eastern population as "the badlands adjoining the Missouri River in North and South Dakota, extreme western Nebraska, and probably into eastern Wyoming." He measured only two male (both four years old) and two female (one immature and one six years old) skulls from the eastern population area, none from Montana. He reported that *auduboni* ewes have wider nasal and maxillary widths and possibly mastoid breadth, while rams have wider basioccipital and longer upper tooth row length. He regarded the specimens as a "weak race" because of the slight cranial differences and small number of specimens. Ramey (1996) examined seven male (two from North Dakota, ages three and six; two from South Dakota, ages four and four; and three from Montana, ages seven, seven, and eight) and four female (three from Montana, ages four, four, and five) specimens. He found the upper row tooth length measurement in ewes to be longer for *auduboni* specimens than Rocky Mountain. For rams he found palates to be shorter and the cranial length measurement to be larger for *auduboni*. These few differences were not sufficient to persuade Ramey that *auduboni* deserved recognition, because similar variation was noted in other areas west of the Rockies and thus recognizing the Audubon subspecies would have necessitated designating many other subspecies. Also, based on the lack of geographic barriers between Rocky Mountain and Audubon, he concluded it is difficult to imagine that the two remained separate "especially given that during periods of Pleistocene glacial advance, most of the foothills of the Rocky Mountains and plains to the east were open steppe habitat and therefore, open to bighorn dispersal."

If one accepts the *auduboni* as a separate race or subspecies, then it follows that the race probably developed as a result of long periods of separation from those sheep occupying the Rocky Mountains to the west. Ken Thompson (1950) speculated that the breaks of the Missouri River were first occupied by badland sheep that then expanded their range down the Musselshell River to the Bull Mountains, eastward along the badlands of the Missouri River to its junction with the Yellowstone River, and into the Dakotas by way of the Missouri. Along the Yellowstone, the route of migration reversed and left well-established bands in the Glendive breaks, the Sheep Mountains around Terry, and then westward to about Forsyth. Thompson found no data documenting mountain sheep west of Forsyth. He continues that another branch of the Yellowstone movement moved down to the Powder River breaks and sent offshoots as far as the Chalk Buttes and the Finger Buttes of Carter County. Although this description is highly speculative, it does provide a good picture of the early distribution of the Audubon sheep in Montana. Picton and Lonner (2008) provide a series of maps depicting historical distribution of bighorn sheep in Montana (Figure 1). The earliest distribution of bighorn in Figure 1 is for 1890. By 1890, the impact of European man through excessive hunting and disease (scabies) had already caused major declines numerically and in overall distribution of bighorn sheep (Buechner 1960). It is quite likely that the historical distribution of bighorns in Montana was significantly greater than depicted in Figure 1 and included most of the western part of the state.

Most reports of the numbers of Audubon sheep observed in the late 1800s in eastern Montana were of "bands of five or six to fifteen or twenty" (Thompson 1950). Prior to this time, numbers were probably higher in the best habitats as witnessed by Lewis and Clark and Maxmillian in the early 1800s. Following a die-off of the Two-Calf herd in the Missouri

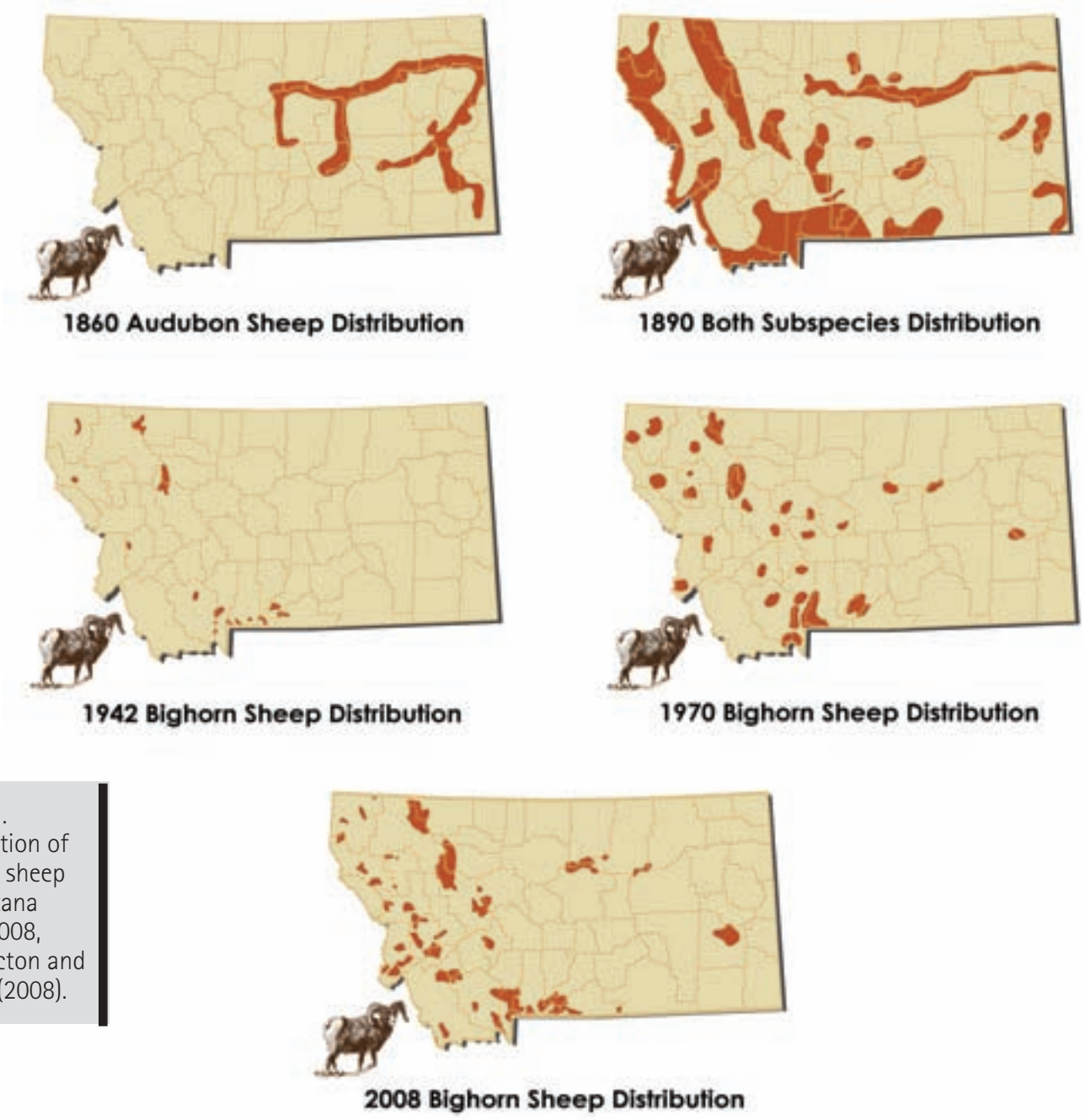


Figure 1. Distribution of bighorn sheep in Montana 1860–2008, from Picton and Lonner (2008).

Breaks, C. R. Watts, former FWP wildlife biologist, and Larry Eichhorn, former Bureau of Land Management natural resource specialist, speculated that Rocky Mountain bighorns (*O. c. canadensis*) might not be able to adapt to the breaks-type habitat (Eichhorn 1972). Today, as a result of transplants, the large number of Rocky Mountain bighorn along the Missouri River testifies to the fact that the habitat in that region can support large numbers of sheep and probably did prior to the westward movement and settlement of Montana.

The Lewis and Clark Expedition crossed into what is now Montana on April 27, 1805, and sighted their first bighorn near the current town of Culbertson on April 29, 1805. Ironically, this was the same day Lewis and another man killed their first grizzly bear (Moulton 1987). Lewis wrote in his journal that Joseph Fields of the expedition had first reported seeing bighorn earlier in North Dakota, near the junction of the Yellowstone and Missouri rivers. Clark first wrote about these animals when they "procured two horns of the animale the French Call the rock mountain sheep…" He continued that the Mandans called this sheep "Ar-Sar-ta" which Moulton (1987) determined was probably the Mandan term "ánse xte," or "big horn." On

May 25, the corps killed their first bighorn (river mile 133), about one mile below the old ferry and power plant, which was built in the 1800s to provide energy for mining in the Little Rocky Mountains to the north (Graetz 2001).

Ken Walcheck, in his 1980 *Montana Outdoors* magazine article titled "The Riddle of Existence: Audubon Bighorn Sheep," wrote that the journals of Lewis and Clark show 18 references of bighorn made east of the Marias River (possibly the Audubon subspecies). In his article, he also includes 48 separate sightings of bighorn within the area occupied by Audubon sheep. A list of sightings of Audubon sheep can also be found in Thompson (1950). He states that the last known Audubon sheep in Montana were reported as seen in the following areas: Powder River Breaks (1893), Chalk Buttes (1898), Larb Hills (1914), Glendive Breaks (1915), and Billy Creek in the Missouri River Breaks (1916).

The assumed last known Audubon bighorn at that time was killed at Billy Creek in 1916, within the Snow Creek Game Preserve, which was established in 1911 to protect the vanishing species (Thompson 1950).

Early Explorers and Early Recorded Distribution

The first sighting of an American wild sheep was recorded in California by the Spanish explorer Coronado in 1540. It was not until 1697 that a fuller description came from a Spanish missionary to California, Father Picolo (Nisbet 2005). Seton (1927) estimated that prior to 1800 there were between 1.5 and 2 million bighorn sheep across North America and into Mexico. Demarchi (1977) disputed this figure as being 10 times too high because bighorn sheep currently occupy a fairly narrow niche of habitat and Seton's area encompassed a wide expansive area, that included habitats not known to be occupied by bighorns.

On November 13, 1800, Duncan McGillivray and David Thompson, while exploring the waters of the Bow River near Banff, Alberta, came upon a band of sheep. Recognizing them as something new, they saved a complete specimen. This new animal was described by Dr. George Shaw in 1804 and named *Ovis canadensis canadensis*. In an 1803 issue of the scientific journal *Medical Repository*, edited by Dr. Samuel Mitchill, Duncan McGillivray described the expedition as follows: "While Mr. Thompson was taking a meridian altitude, I went forward with the Indian to have a shot" at a small herd of animals. McGillivray recorded the latitude and longitude of the place where the sheep was killed and noted the Cree name for the sheep translated as "ugly rein deer," that Canadian explorers called the animals "mountain rams," and that their flesh was "the sweetest feast in the forest" (Nisbet 2005). Nisbet speculates that, since Thomas Jefferson was well acquainted with the *Medical Repository*, and a friend of Dr. Mitchill, the president probably read about the existence of this animal and learned about the explorations of the Northwest Fur Company, perhaps encouraging him to launch the Lewis and Clark Expedition in 1804.

The History of Bighorn in Montana

Lewis and Clark recorded sightings of bighorn sheep 27 times while traveling through Montana in 1805 and 1806 (Walcheck 1980). The majority of the sightings of bighorns recorded on the expedition were along the Missouri and Yellowstone rivers. Lewis and Clark do not mention bighorns when they crossed the Rocky Mountains, but other references to their existence there can be found. Bradbury described Indian bows made from the male horns of an animal the French called "gros corne" (Thwaites, *Early Western Travels*, Vol 5, 1809-11), and Gabriel Franchers, in his voyage to the northwest coast of America described an animal with great curved horns like domestic sheep (Thwaites, Vol 6, 1811-14). Thompson "saw about 50 or 60 sheep in a herd" on the Clark Fork River near Saleesh House, March 24, 1810 (Nisbet 2005). Alexander Ross, in March 1824, subsisted chiefly on mountain sheep for about a month in Ross Hole in the Bitterroot Valley (Koch 1941). He stated that mountain sheep were plentiful in the mountains and reported one of the ram's horns measured 49 inches in length and had a circumference of 28 inches, weighing 11 pounds (Koch 1941). Bighorn sheep were also noted by Captain Mullan, a road engineer, in the peaks around the Deerlodge Valley (Koch 1941). Bighorn sheep were also well known in and adjacent to what is now Yellowstone National Park. Osbourne Russell, an early trapper in the West, noted bighorn in the area from 1834 to 1839 (Haines 1955). He issued this statement to hunters about the perils of sheep hunting: "Hunting sheep is often attended with great danger especially in winter season when rocks and precipices are covered with snow and ice but the excitement created by hunting them often enables the hunter to surmount obstacles which at other times would seem impossible."

Conquest of the American West – The Bighorn Sheep Decline

Although bighorn sheep were numerous in Montana and were used for food and other implements by Native Americans and the early explorers, the settlement of the West led to significant declines of bighorns and other big game species (Mussehl 1971). The causes most often cited were contact with domestic sheep, range competition from livestock, contraction of diseases, and subsistence hunting. Contact between domestic sheep and wild sheep has been implicated in several large die-offs of the latter. Often poor range conditions, severe weather events, and high numbers of wild sheep were cited as concurrent factors present during reported outbreaks of scabies, anthrax, lungworm, and pneumonia-related diseases.

Montana's largest bighorn sheep herd occurs in the Sun River drainage within the Rocky Mountains. Die-offs of this population were recorded in 1925, 1927, 1932, and most recently in 1984.

An estimated 1,500 bighorns were present in Glacier National Park in 1916, but had declined to 180 by 1965 (Biennial Report 1941-42 in Couey and Schallenberger 1970).

Attempts to save sheep included the artificial feeding of them along the Gardiner River in 1919, before the area was included in Yellowstone National Park (Picton 2002).

Other major die-offs in earlier years were noted in the Stillwater River and Rock Creek areas.

By 1930, bighorn sheep were reduced to small remnant bands and were considered by some to be an endangered or rare species (Couey and Schallenberger 1971). Poor range conditions and severe winter weather led to significant losses of sheep in the Sun River area in 1932 (Picton and Picton 1975). Couey and Schallenberger (1971) stated the department records of 1941 indicated bighorn were "at a low ebb both in density and distribution."

Reestablishment of Bighorn Sheep in Montana

The present distribution and status of bighorn sheep in Montana is due to improved range conditions, reduced competition for forage from livestock and other wildlife, reductions in domestic sheep and goats, regulated hunting, and transplanting. Prior to the turn of the century, public sentiment turned toward wildlife protection and predator control due to uncontrolled hunting, the fate of the buffalo, and low numbers of other game species. The following account of the early game laws comes from Couey and Schallengerger (1971):

The first conservation law, passed in 1869 by Montana's Territorial Legislature, closed the hunting season on introduced game birds. In 1872 the hunting season on buffalo, moose, elk, deer, bighorn sheep, mountain goats, antelope and hares was closed February 1 to August 15 each year. The first state laws of 1889 set the open season on bighorn sheep from September 15 – December 31. In 1895, the legislature established a board of Game Commissioners and specified a bag limit of 8 sheep.

The Montana Fish and Game Department was formed on April 1, 1901, and a charter created eight fish and game districts and authorized the appointment of deputies to enforce the game laws. The game laws became increasingly restrictive, and the limit on sheep was reduced to one each season in 1907. Ultimately the sheep-hunting season was closed statewide in 1915. In 1921, the Fish and Game Commission was given the power to open and close seasons. By 1935, a total of 46 game preserves had been established across the state (Musshel 1971) in an attempt to protect the remaining wildlife populations from hunting and human harassment.

At the turn of the century, Montana sportsmen, landowners, and agency personnel worked together to begin to restore Montana's wildlife populations. In 1910, elk from Yellowstone National Park were relocated to Fleecer Mountain, thus beginning the effort to restore wildlife populations through a trapping and transplanting effort. Butte and Anaconda sportsmen paid the cost of $5 per elk to cover the transportation. Soon after that, the first transplant of bighorn sheep into Montana occurred on the National Bison Range near Moiese in 1922, with 12 bighorn from Banff, Alberta.

Passage of the Pittman-Robertson Act in 1937 by the U. S. Congress initiated the Federal Aid in Wildlife Restoration Program, which provides federal funds from excise taxes on firearms, archery equipment, and ammunition to states for wildlife restoration projects. This funding allowed the Montana Fish and Game Department to begin a bighorn sheep research and management program in 1941, with the objective of increasing populations (Couey and Schallenberger 1971). Bighorn sheep slowly began to increase in the Sun River and a few other areas of the state. Acquisition of the Sun River Game Range provided winter range for elk, improving bighorn sheep winter range conditions in areas where range competition with elk was noted previously. Domestic sheep numbers decreased significantly beginning in the mid-1940s throughout Montana, reducing the potential for disease transmission and

competition for forage. The first effort to trap sheep in the Sun River area and move them to other areas, although unsuccessful, was attempted in 1938 (Picton and Picton 1975).

The 1941 research program culminated in the publication of a 1950 Montana Fish and Game Commission Bulletin titled "Rocky Mountain Bighorn Sheep of Montana" by Fay M. Couey. In the bulletin, Couey estimated that about 1,200 bighorns occupied 16 different areas within the state in 1950. The bulletin also provided an excellent description of the habitat utilized by bighorns, their food habits and behavior, susceptibility to disease and parasites, the influence of predators, and poaching. Couey's following observation provides a good summary of bighorn sheep status in 1950:

Most of the bighorn herds in the state are not increasing. Some remain in a static condition. Others may build to fair numbers and then suddenly die off from diseases. This fluctuation has been reported as occurring for the last fifty years, probably since white men came in and reduced their numbers by hunting; then they were crowded into small areas where they had to compete with other game, man and his livestock. Their low resistance to disease, coupled with a drain from predators and poachers, has been enough to keep their numbers in check.

Couey (1950) also recommended: 1) establishing a "ranch" to hold captured bighorns for disease studies and future transplant stock; 2) using salt blocks containing Phenothiazine to treat bighorns for intestinal nematodes; 3) offering limited permit hunting of rams; 4) trapping and transplanting bighorns to new areas to expand distribution; 5) controlling predators; and 6) posting signs to educate hunters on the characteristics of bighorns to prevent accidental shootings.

Although the "ranch" was never established and the salt-block treatments proved to be unsuccessful, the limited permit hunting season was reopened in 1953 when 30 licenses were issued and 20 sheep were taken. The number taken that year was less than 2% of the estimated statewide sheep population at that time. Conservative harvests, primarily focused at the larger male (¾-curl or larger) segment, were the norm until 1974 when adult ewe licenses were first implemented. Since that time, harvest levels have increased to control herd size in several locations.

Although the first transplant of bighorns into Montana occurred on the National Bison Range near Moiese in 1922, the availability of Pittman-Robertson (federal) funding provided the impetus for transplants of all game species including bighorns. From 1941 to 1950, new populations of bighorn sheep were established through transplants to Wildhorse Island in Flathead Lake, the Gates of the Mountains, the West Fork of the Gallatin River, and Billy Creek in the Missouri Breaks. From 1939 to 2009, 2,067 bighorns have been trapped within Montana for transplants within the state. An additional 465 bighorns were trapped in Montana and made available to other states for transplants, including Oregon, Idaho, Washington, Nebraska, Utah, Wyoming, Colorado, and North Dakota.

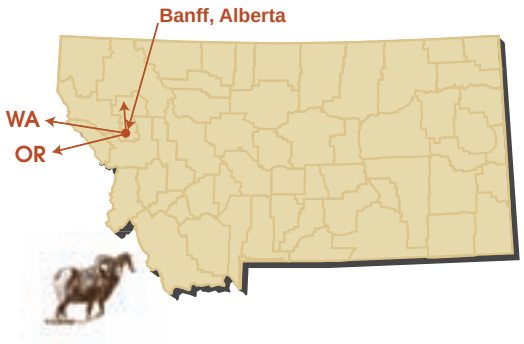
Since 1922, Montana has received 28 bighorns for transplants from other states or provinces. Sixty-six bighorns have been trapped for research efforts and zoos. Most transplants in Montana occurred after 1960. A majority of transplant source animals have either come directly from Sun River populations or from transplants established from Sun River stock (Appendix C). A graphical depiction of transplant history is shown in Figure 2.

Unpublished FWP Wildlife Division records show statewide bighorn population estimates by Merle Rognrud, then Wildlife Division bureau chief, of 2,000 in 1957 and 1,500 in 1968 based on the estimated percent of the population harvested. By the early 1970s, 11 major herds were known to exist in the state and 13 other areas had been stocked by transplanting. Of those areas with transplanted stock, at least four were considered not successful at that time.

Current Status

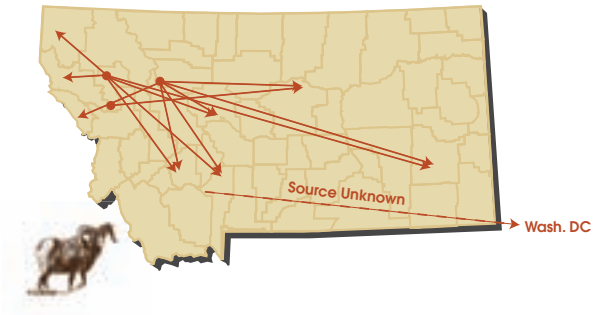
Today (as of 2008), there are 45 different populations in the state, with an estimated 5,694 total bighorn sheep (Figure 3). Figure 3 begins in the year 1950 as that is the first estimate of bighorn sheep numbers in Montana (Couey 1950). Seton (1929) estimated there were one and one-half to two million bighorn sheep in the west prior to European man arrival. Based on that estimate and with an abundance of suitable bighorn habitat in Montana it is reasonable to think historic numbers of bighorns in Montana could have been well above one hundred thousand. There are an additional 650 to 700 bighorns in Glacier National Park and Waterton Lakes National Park in Alberta, Canada (Kim Keating personal communication). The habitat occupied is diverse, from the badlands and breaks habitat of eastern Montana to the high alpine mountains of south-central Montana, and from the lower mountain foothills of southwestern Montana, including portions of Yellowstone National Park, to the intermountain valleys and higher elevations of northwestern Montana, Glacier

Figure 2. Bighorn sheep transplant history in Montana, 1922-2008, from Picton and Lonner (2008).



1922 - 1939 Bighorn Sheep Transplants

1940 - 1949 Bighorn Sheep Transplants



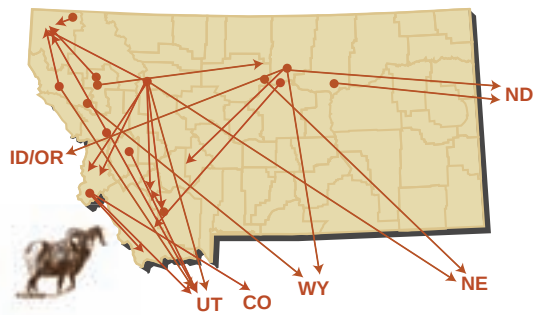
1950 - 1959 Bighorn Sheep Transplants

1960 - 1969 Bighorn Sheep Transplants

1970 - 1979 Bighorn Sheep Transplants

1980 - 1989 Bighorn Sheep Transplants

1990 - 1999 Bighorn Sheep Transplants



2000 - 2009 Bighorn Sheep Transplants

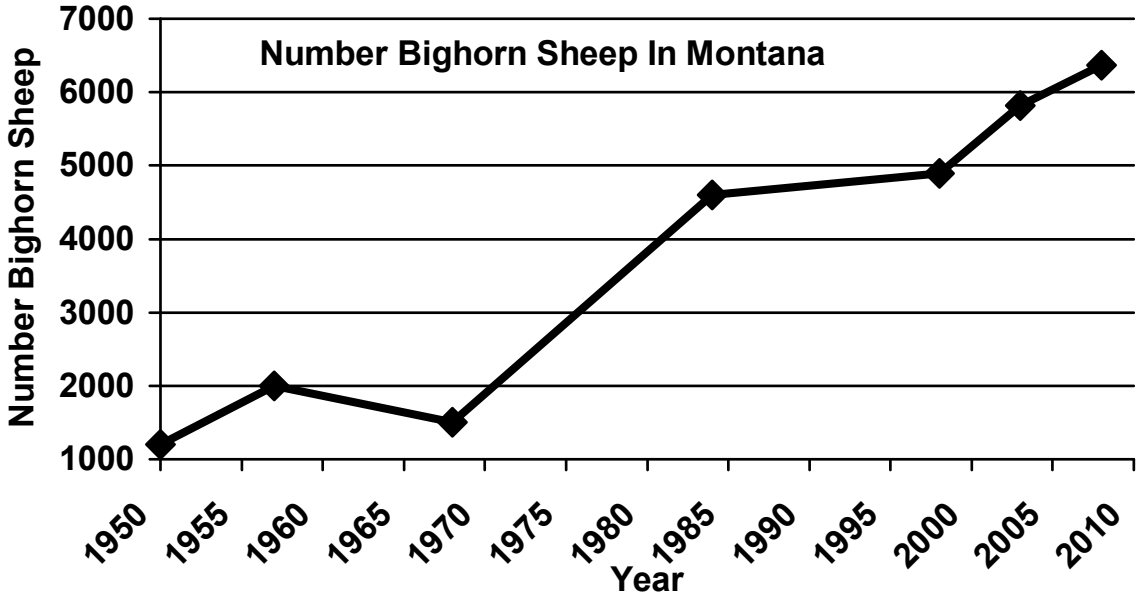


Figure 3. Trend in the number of bighorn sheep in Montana, including Glacier National Park and Waterton Lakes National Park, 1950-2008.

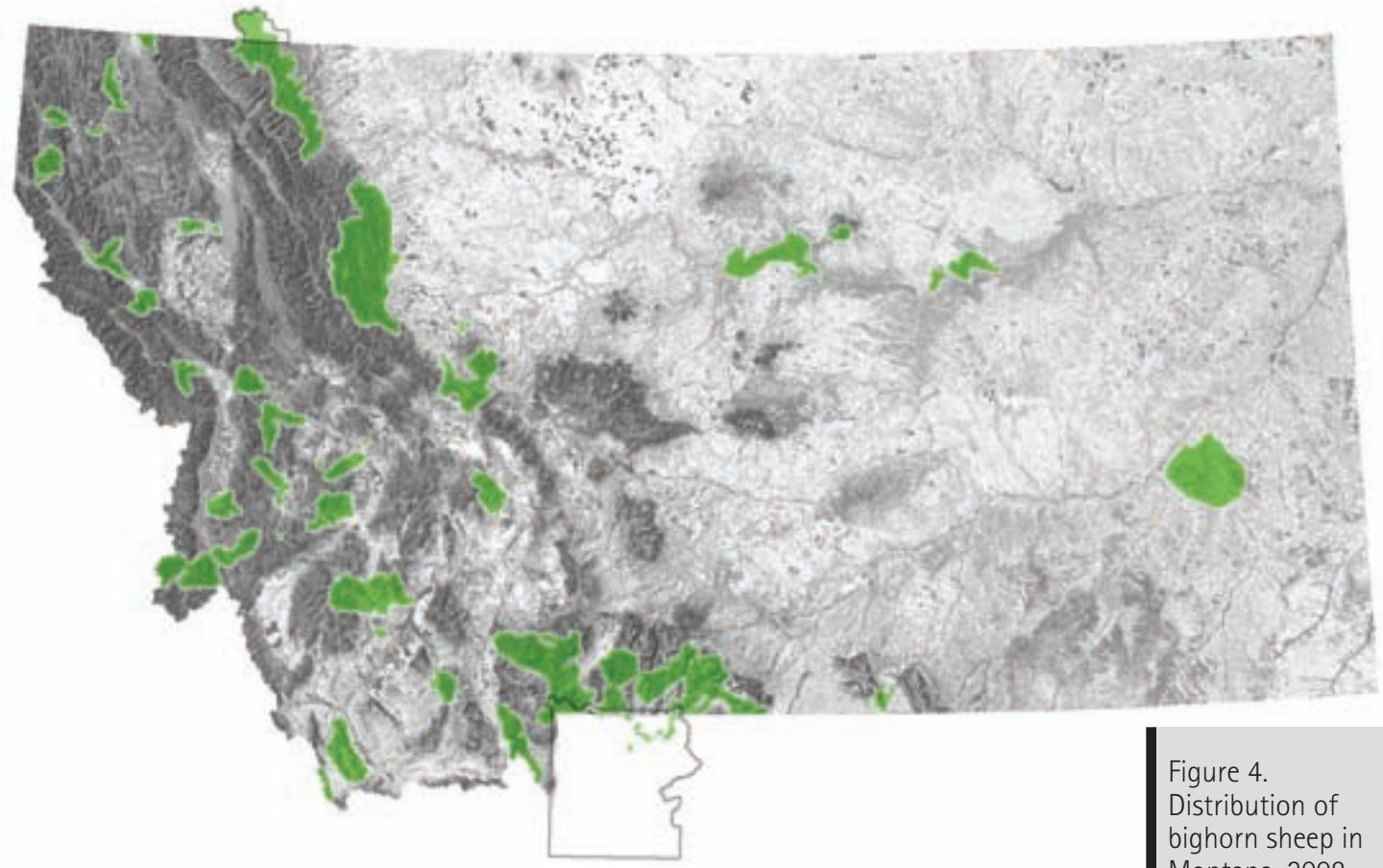


Figure 4. Distribution of bighorn sheep in Montana, 2008.

Park National Park, and Waterton Park in Canada (Figure 4).

Although bighorn numbers have partially recovered through transplant efforts, populations continue to, as Couey observed in 1950, "build to fair numbers and then suddenly die off." Bighorn sheep die-offs have been recorded in Montana since the early 1920s. Not only did the native Sun River herd experience die-offs, but those in Glacier National Park, the Stillwater herd in south-central Montana, and the Rock Creek herd in western Montana all experienced die-offs and were reduced to small remnant bands by 1930. Couey (1950)

described the cause this way: "The bighorns were primarily infested with lungworms (*Protostrongylus stilesi*) with secondary invasion of *Corynebacterium pyogens*, although *Pasteurella* was always present."

Nothing has changed during recent times, except the cause of die-offs has been further researched. Bighorn populations still build in numbers and suddenly die off. Since 1984 there have been significant die-offs in 14 bighorn populations as well as smaller declines in other herds (Table 1). Most native populations tend to experience periodic gradual declines or less severe drops in population due to weather events. Although many transplanted herds seem to prosper for a decade or two, they tend to be more vulnerable to the catastrophic all-age die-offs often associated with *Pasteurella* outbreaks. Although many transplanted herds tend to recover, often following augmentation, some do not, and those that do tend to be less in number and have reduced lamb survival for many years.

Most of the herds experiencing die-offs recovered, some due to augmentation, but the specter of another die-off still exists. Although many different attempts were made over the years to prevent die-offs from occurring, none were proven effective enough to be applied broadly. Thus, prevention turned into minimizing the effects of the die-offs by maintaining lower populations (herd segments generally less than 200), issuing adult ewe licenses and transplanting to control herd size, maintaining separation between populations to minimize interchange, maintaining separation from domestic sheep and goats to minimize disease transmission, and inoculating transplant stock to reduce likelihood of disease or parasite transfer to new areas.

Role of Hunting in Bighorn Sheep Management

Early Hunting Seasons

The passage of state legislation to protect wildlife and to create the first hunting seasons were predicated on the fact that once numerous and widely distributed wildlife populations in the West were declining or had completely disappeared by the early 1900s. Early efforts were made to control hunting through first establishing a license to hunt and then restricting seasons by time of year and the number of animals that could be taken. This was followed

Table 1. History of recent die-offs in Montana bighorn sheep populations, 1984-2008.

Population	Hunting District	Pre die-off number	Post die-off number	Native or Transplanted	Year(s) Transplanted	Year(s) of Die-off
Sun River	441, 421,423, 424	900	500	Native		1984
Ural Tweed	101	200	<100	Native	Augmented 1963	1999
Mickey Brandon Buttes	622	150	50	Transplanted	Transplanted 1980	1997,01
Kootenai Falls	100	100	30	Transplanted	1954, 55	1995
Spanish Peaks	301	200	<100	Native	Augmented 1944, 47	1999
Pryor Mtns	503	250	145	Transplanted	1971, 74	1995
Highlands	340	400	12	Transplanted	1967-69	1994
Tendoys	315	150	20	Transplanted	1984-86, 96	1994
Lost Creek	213	400	100	Transplanted	1967	1991
Beartooth WMA	455	300	50	Transplanted	1971, 73, 75	1984
Taylor/Hilgards	302	>100	20-30	Native	Augmented 1988, 89, 93	1997
Lower Boulder River	504	100	2	Transplanted	1985, 87, 89, 95, 97	1999, 2000
Sleeping Giant	381	115	39	Transplanted	1992, 93	2001, 06
Elkhorn Mtns	380	230	20	Transplanted	1996, 97, 00	2008

by further restrictions on the sex and size of the animal to be taken.

In 1872, the hunting season for bighorn sheep was closed February 1 to August 15 each year. Prior to that, there was no hunting season. Bighorn sheep could be taken at any time of the year, and there were no limits on the number that could be taken. In 1889, the open season was shortened again to September 15 to December 31. Then, in 1895, a bag limit of eight sheep was imposed, and the open season was set from September 1 to January 1. Based on FWP records compiled by Wildlife Division staff, the season in 1903 was set from September 1 to December 1, and the bag limit was one sheep. The first Montana resident hunting and fishing license was created in 1905, cost one dollar, and was valid for the whole family. In 1909, the sheep season was shortened to October 1 to December 1. In 1913, only rams were legal, and in 1915, the sheep season was closed in Montana.

Couey (1950) recommended opening a hunting season on bighorn in the Sun River area:

It would be desirable to take about 10 rams annually from the Sun River area by hunting. A regular open season would not be advisible as there is danger of taking too many. If these rams could be taken by a special license system under the supervision of Department representatives or guides, some benefit would be realized from the herd, no harm would be done, and the resultant activity might make the remaining sheep more alert and conscious of danger from humans.

Following Couey's recommendation, the bighorn sheep season was again opened in 1953 after 38 years of closure. A limited number of licenses for rams with at least a ¾-curl were made available in three areas: Sun River (Hunting District 42), Gallatin-Madison (Hunting District 201), and Stillwater (Hunting District 202). A sheep license that year cost $15 for both residents and nonresidents, and a drawing was used to award licenses.

Evolution of Regulation Types in Montana

As populations continued to expand in distribution and number, hunting seasons became more liberal. Although transplant efforts initially met with highly variable results, newly established herds provided another opportunity for expanded hunting. In 1954, hunting began in the Ural and Rock Creek areas of western Montana. A sheep season was also held for two years (1955-56) on the Fort Peck Game Range in eastern Montana. In the 1960s, hunting seasons were established in the West Fork of the Bitterroot (Hunting District 25), Clark Fork (Hunting District 12) near Thompson Falls, and in the Blue Mountains (Hunting District 760) of eastern Montana. A season was also held for two years in the Buck Creek/Dudley Creek (Hunting District 301) area of the Gallatin from 1966-67 and in the Armells Creek (Hunting District 482) area of the Missouri Breaks for four years.

During the 1970s, seven new areas were added. In 1975, the Sun River area (Hunting District 42), following the recommendations of a four-year research project (Erickson 1972; Frisina 1974), was divided into four new areas (Hunting Districts 421, 422, 423, and 424) to better distribute harvest (Erickson et al. 1976).

In the 1980s, an additional 12 hunting areas were established; some were portions of previously hunted areas, but several new areas were also included. In 1989, hunting in the Blue Mountains (Hunting District 760) was closed due to the lack of hunter access to private land.

During the 1990s southwest Montana was hit particularly hard with bighorn die-offs, and previously hunted locations were closed periodically. Closures occurred in the Tendoys (Hunting District 315), Highlands (Hunting District 340), Spanish Peaks (Hunting District 301), and Elkhorns (Hunting District 380). Hunting has since resumed in the Tendoys, and the population in the Spanish Peaks has recovered sufficiently for reopening that area.

Trophy Hunting

There have been numerous reports and articles in magazines discussing the pros and cons of harvesting older "trophy" rams. Morgan (1974) sparked considerable controversy when he questioned trophy ram hunting and what he called "the pro-hunting bias" of the state managing agencies. As a result, the Boone and Crockett Club co-sponsored a workshop in 1974 along with the Wildlife Management Institute and National Audubon Society to bring together all the evidence available at the time. This effort refuted "trophy" ram hunting as the cause of population declines, but also identified needed research. Coltman (2002) questioned harvesting older large-horned rams because of the potential to deplete genetic variation for large horns by removing genetically superior rams from the gene pool before they have a chance to pass on their genes. However, the study was conducted at the same time as a significant increase in the population; thus, the observed decline in horn growth could have been a result of density and nutrition factors. Singer and Nichols (1992) reported on the results of their 15-year study of heavily hunted Dall's sheep populations in Alaska. Their study

found no evidence that removal of all or nearly all rams with greater than ¾-curl for the first 11 years and greater than 7/8-curl for the last four years influenced productivity, recruitment, or survival.

Three-Quarter Curl Ram Seasons

Early seasons in Montana restricted harvest to greater than ¾-curl rams. With a few exceptions, this season type remains primarily associated with unlimited license areas today, where the number of sheep harvested is regulated by a harvest quota and the backcountry nature of the hunting districts.

No records were found that indicated why a greater than ¾-curl ram regulation was first recommended in Montana, but it was apparently first used in Wyoming in 1930 (Trefethen 1975). Merle Rognrud, an FWP game manager in Missoula at the time, indicated they typically looked at what was being done in other areas before recommending hunting seasons.

From its beginning in the 1940s, game management in Montana had three major objectives: 1) to develop and sustain the maximum game populations consistent with available habitats and other uses of the land; 2) to ensure maximum production and utilization of game surpluses; and 3) to provide the maximum possible amount of recreational opportunities for sportsmen (Mussehl 1971). As wildlife populations began to return to viable numbers, managers sought ways to sustain them within the habitat and other land use capacity while striving for maximum recreation by sportsmen. Allowing the harvest of a limited number of "surplus" older (¾-curl) rams fit well with these goals and was implemented widely throughout bighorn sheep ranges by the state management agencies of the time.

As populations continued to expand during the second half of the 20th century, regulations were liberalized, and hunter demand also began to influence greatly what seasons and bag limits were imposed. Since ram horns grow continually throughout life, the resulting natural curl of the horn lends itself to limiting harvest by horn curl size. The ¾-curl regulation was essentially a permutation of the old "buck laws" of the same time period. Since the ¾-curl regulation typically protected rams two to three years of age and younger, and knowing that rams typically can breed by 18 months of age (Nichols 1978), the ¾-curl regulation essentially provided some protection to maintain breeding potential, but allowed for nearly maximum sustained harvest of rams by hunters. There was an underlying premise, however, to begin harvest of the female segment early on to control population size within habitat carrying capacity, but this would take a few more years to develop.

Initially, the ¾-curl regulation in Montana was loosely defined. It was depicted in Montana hunting regulations as rams with horns crossing into the third quarter of a circle when viewed from the side (Figure 5). Although this early depiction was further clarified with wording changes in the regulations in the early 1970s, it wasn't until 1977 that the ¾-curl definition was essentially eliminated in favor of the current "legal ram" definition:

Judging A "Legal Ram" 3/4-Curl

When a straight line extending from the front base of the horn through any portion of the eye opening intercepts any portion of the horn, the ram is legal. If the horn is not long enough to be intercepted by the line, the ram is not legal.

Base of the horn shall be considered as the point where the horn meets the hairline of the head.

Determination of a legal ram should be made from a broadside view of the head.

Figure 5. Graphic depicting a legal ram according to Montana's definition.

During the preceding year, 1976, nine of the 14 sheep harvested in the Spanish Peaks (Hunting District 301) did not meet the previous ¾-curl regulation. Prosecution was attempted in four cases, two of which were successful. The county attorney felt the ¾-curl regulations were too obscure. As a result, the legal ram definition was recommended based on ram horn growth characteristics (i.e., although a few two-year-old rams would be legal under the definition, most three-year-old and older rams would have horn growth well beyond the requirement, thus making it easier for hunters to identify a legal ram in the field). At the time, a questionnaire was sent to all 1976 license holders (N=550) in

the unlimited areas (301, 500, 501, and 502). Out of 348 returned questionnaires, it was determined that 63% supported the proposed change in definition and 9% did not express an opinion one way or another; 28% opposed the change or offered another recommendation. It was stated by the department at the time that the proposal was favored by the public because:

1) It is simple much easier to apply.
2) It is well defined, with specific and interpretable reference points.
3) It is less subjective than the current one.

Influence of Age, Habitat, and Environmental Conditions on Horn Growth

Because ram horns grow throughout life and approximate a full circle at maturity, the legal age of rams for harvest has been defined by the degree of horn growth (the portion of a full circle) attained. Male mountain sheep possess three basic horn forms: convergent (tight curl); parallel (medium or average curl); and divergent (open or flaring curl) (Clark 1964). Although the subspecies tend to possess different forms of horn growth, there is considerable variability within each subspecies. Geist (1971) categorized rams using age and horn growth characteristics into four classes. Class IV rams were those eight years of age (rarely seven) or older with horns protruding well beyond eye level. If broomed (broken tips), the tips must reach at least the eye level if the ram is to be included in this class. He described these rams as the leaders of bands, doing most of the breeding, and as the most dominant sheep. Rams from different areas tend to reach the same curl category at nearly the same age, but the size (mass and horn length) of their horns can vary greatly. This variability is thought to be a result of genetics, habitat, and environmental conditions.

In Montana, many of the largest rams taken have come from transplanted herds. Examples include the Missouri Breaks (Hunting Districts 482 and 680), Flint Range (Hunting District 213), Rock Creek (Hunting District 216), and the Highland Mountains (Hunting District 340). Yet the breeding stock from these areas has come from the Sun River herd, which is not noted for producing the largest rams. Hook (1998) compared the horn growth by age class of 703 bighorn rams harvested from four areas of Montana from 1978 to 1997. Data from the original Sun River herd was compared to the three transplant populations in Lost Creek, Upper Rock Creek, and the Missouri River Breaks. The analysis showed greater horn growth in the transplanted herds than in the parent population, particularly in the younger age classes.

Picton (1994) reviewed the horn growth characteristics of 59 rams representing 18 Montana hunting districts. The study compared ram horn measurements based on herd location, horn mineral content, and precipitation. Rams from high-altitude areas surrounding Yellowstone National Park have long been known for their smaller, tightly curled horns. Although previous work (Stewart and Butts 1982) had proposed that the difference in horn size among different populations could be related to genetic bottlenecking and consequent inbreeding, asymmetry measurements by Picton did not support this hypothesis. Picton stated, "It appears that the sheep of the high-altitude ranges surrounding Yellowstone National Park may represent an adaptive suite that includes smaller tightly curled horns." The iron, aluminum, magnesium, phosphorus, calcium, lead and zinc mineral levels reported previously for this area also did not show significant correlations with annual growth increments (Picton and Eustace 1986). The study did find that areas notable for large horn sizes had particularly high rates of growth in the early years of life (ages two to four).

Either-sex and Any-Ram Seasons

Either-sex licenses were first utilized in 1961 in the Rock Creek area (Hunting District 220) in an attempt to initiate some ewe and younger ram harvest. Although the regulation was also implemented in the Bitterroot area at about the same time, it was not until the early 1970s that it became more widely applied.

The first season established in the Highlands (Hunting District 340) was either-sex, and the season type was soon applied to the Sun River and several other areas.

The reasons for implementing either-sex seasons were: 1) to initiate some limited ewe harvest; 2) to remove some pressure on the older rams; 3) to allow a hunter to choose freely what animal to harvest and remove the fear of an animal being confiscated; and, finally, 4) to reduce or eliminate abandonment of harvested sub-legal rams in the field.

Either-sex seasons are currently applied in 28 of 31 limited-entry hunting districts in the state. Under the limited-entry season structure, the number of licenses issued controls the number of hunters, and thus the ram harvest. Currently, the number of either-sex licenses issued has been generally based on taking a percentage of the number of more than

¾-curl rams observed the previous winter or spring. McCarthy (1986) listed the following advantages to this type of season:

1) Because permits are based on a percentage of rams that will be in the ¾-curl or better category during the hunting season, rams taken that are just ¾-curl or less essentially leave an older, larger ram in the population.
2) This type of season does away with the inconsistency with which rams enter curl categories. It also allows for the taking of animals that will never reach a prescribed category no matter how long they live. The combined factors of genetics, habitat, and age determine whether or not an animal will become ¾-curl or better and at what stage in life this will happen. Herds in Montana seldom have rams over 10 years of age. There are, however, males entering the ¾-curl category anywhere from 3.5 to 5.5 years of age, and reaching the 7/8-curl category by the age of 5.5. Others, because of brooming, genetics or natural mortality, never reach this 7/8-curl category.

In Montana, any-ram seasons were first established in northwestern Montana (Hunting Districts 100, 121, and 123) in 1979. The basis for this season type was similar to an either-sex season but limited harvest to the ram segment. The end result of this season type has proven to be essentially the same as the either-sex season due to hunter preference for and selection of larger rams.

Half-Curl Ram Seasons

Half-curl or less ram seasons were first initiated in two areas of northwestern Montana (Hunting District 216 in 1984 and Hunting District 121 in 1985) as a population control measure. This regulation was only used for a few years. McCarthy (1986) states the theory behind this season as:

Younger rams may be removed from a population without affecting the future number of larger animals as long as removal rates are compensatory for, and not additive to, natural mortality. As long as this requirement is met these smaller rams may be taken from a population without reducing either the reproductive base, or the numbers of larger rams available to the hunter.

Ewe Seasons

The first hunting season on ewes in Montana was established in the Blue Mountains area (Hunting District 760) of eastern Montana in 1968. This season type became more widely utilized in the early 1970s following a report of the results of implementing ewe seasons in Alberta, Canada (Wishart 1976). The following summarizes the findings of research conducted on the Ram Mountain bighorn sheep herd in Alberta.

Alberta implemented its first "ewe season" in 1966. In 1968, the ewe season was changed from any bighorn with horns less than 12 inches in length to the shooting of ewes and lambs only, because of problems with hunters shooting yearling rams. The year prior, yearling rams comprised over 20% of the harvest. Between 1968 and 1975, ewe seasons in Alberta resulted in 40% of the harvest being less than three years old. The percentage of lambs, yearlings, and two-year old ewes was in reverse to their normal occurrence in nature. Wishart (1976) stated that there appeared to be hunter selection against lambs, less selection against yearlings, and a heavy selection for two-year-old ewes compared to three year olds. He surmised this resulted from a selection by hunters against ewes with lambs, since the majority of ewes do not have lambs until they are three-years old.

The first ewe seasons also created concern that unknown numbers of lambs would be orphaned and increased mortality would occur. To test the impact of orphaning on lamb development and survival, a sheep study on Ram Mountain was initiated in 1971. The study found that survival of orphan and non-orphan lambs was similar. There was, however, evidence of some of the surviving orphans becoming stunted by the age of one year (Wishart 1971). Further analysis determined that in the Ram Mountain population, a 10% harvest could potentially result in 4% of the yearlings being stunted. Stunting was evident primarily in rams. Although not in all cases, orphaned rams tended to have shorter horn lengths, smaller horn bases, and smaller live weights than non-orphans. This resulted in a recommendation to account for this additive factor in calculating ewe quota levels, since the benefits of population control far outweighed the negative effects of orphaned lambs.

Jorgenson (1993) tested whether ewe hunting would cause a decline in population size or in trophy ram production and whether a reduction in ewe density would increase the size of ram horns. The experiment was conducted from 1971 to 1991 again on Ram Mountain in Alberta. The number of ewes remained stable during nine years despite the removal of 12-24% of the total ewe population. The removals did not affect ewe mortality from other causes, lamb production by adult ewes, or lamb survival. The number of trophy rams in

the population and the number shot by hunters were independent of ewe numbers. A threefold increase in ewe numbers over the 10-year post-removal period did not affect the number of trophy rams, but rams born during the removal years had larger horns at four and five years of age than rams born in the post-removal years. Researchers summarized that ewe seasons have the potential to limit population increase and can increase trophy ram size. In absence of predation, about 12% of the ewes could be harvested annually. Jorgenson (1993) also cautioned against ewe removals in populations with a history of pneumonia, because in these herds, population growth following die-offs appears slow and density independent, and hunting mortality would likely be additive.

Currently, adult ewe permits are issued in 15 hunting districts in Montana to control population size. The number of licenses issued is influenced by the success of trapping sheep in the area and transplanting them to other locations. Fitzsimmons and Buskirk (1992) recommended maintaining sheep populations at over 150 animals to avoid short-term loss of genetic variability. Overpopulation clues can be displayed in poor lamb crops, poor growth rates in young ewes, and poor early incremental growth in ram horns (Wishart and Jorgenson 1998). One aspect of high population numbers can be high densities. However, it is possible to have a large population with a relatively low density and conversely, a small population with a relatively high density. Density of bighorn sheep is largely a function of the amount and quality of habitat available. It's often stated that density of bighorns plays a role in disease transmission. Cassirer (2002) tested the hypothesis that population density was a causal factor in precipitating disease outbreaks in bighorn sheep. They monitored four herds in the Hells Canyon area of Oregon, Washington, and Idaho over a six-year period. Their preliminary analysis did not support the hypothesis that high population density triggered a disease outbreak.

The term "adult ewe" versus ewe was first utilized in 1974 in the Sun River area. The current definition describes an adult ewe as "a female bighorn sheep one year old or older. Lambs (young of year) are not included."

Since 1974, ewe seasons have been used to manage bighorn populations and to provide additional bighorn sheep hunting opportunity. The number of licenses issued has varied over time depending on the objectives for certain populations and the status of those populations (Figure 6). In 2006, there were a total of 15 hunting districts providing some level of ewe harvest, and there were a total of 169 ewe licenses issued through special drawing.

In some years, some of the more productive bighorn populations, such as in the Sun River and Missouri River Breaks areas, require a combination of translocation and ewe harvest to manage population numbers. Success on ewe licenses varies depending on the area, increasing with ease of access, and ranges from 75% to 90%.

Unlimited Areas

When bighorn sheep hunting in Montana reopened in 1953, a total of 30 (¾-curl) ram

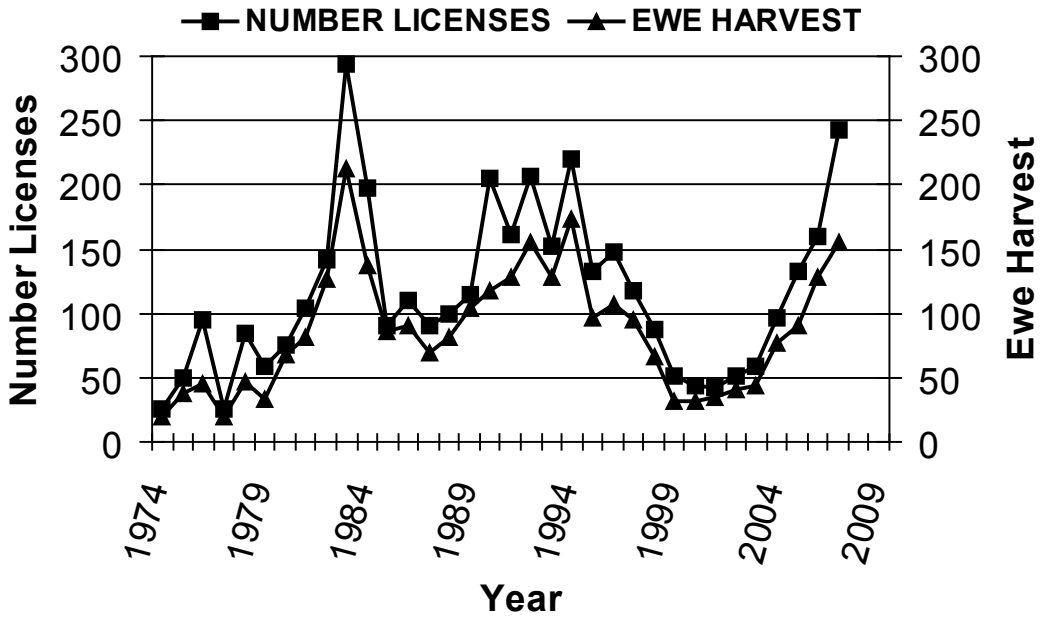
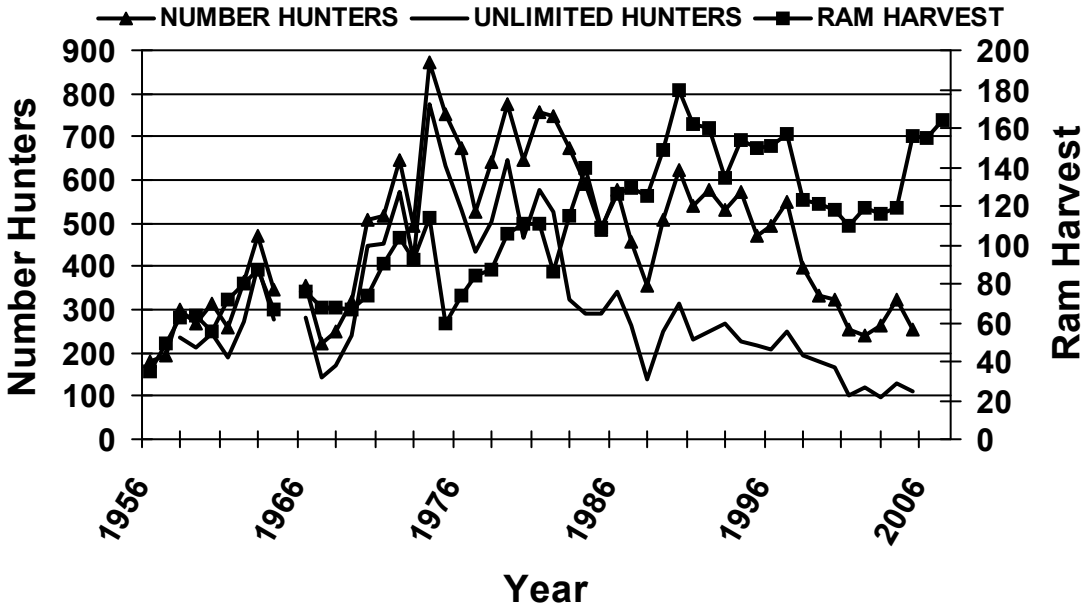


Figure 6. Number of ewe licenses and ewe harvest in Montana, 1974–2007.

permits were issued in three areas. In 1956, two areas, the Spanish Peaks and the Absaroka-Stillwater, were combined and established as "unlimited" hunting districts. This area has remained in an unlimited status for the most part, although some districts have closed due to declines, and the area has also been portioned into smaller districts over time. Initial hunting regulations consisted of a ¾-curl regulation and a long season (McCarthy 1986). Beginning in 1967, some districts went to an either-sex regulation, and the hunting of ewes in certain populations was implemented in 1974 as a method of managing numbers. To control harvest, a quota was implemented in the unlimited districts in 1975. In 1977, a simplified legal ram definition was implemented primarily in the unlimited districts to make it easier for the hunter to determine what a legal ram is in the field.

The unlimited districts, which allow anyone to purchase a license and go hunting, have over time provided significant hunting opportunity and harvest. In 1974, when hunter numbers and harvest peaked, the six unlimited districts accounted for 89% of the hunters and 47% of the ram harvest. Following that hunting season, population declines in some unlimited districts resulted in their closure and a subsequent decline in hunting opportunity and harvest (Figure 7). In 2005, the remaining four unlimited districts accounted for 43% of the state's bighorn sheep hunters but just 6% of the ram harvest.

Figure 7. Total number of hunters, number of hunters in unlimited districts, and ram harvest in Montana, 1956–2007.



Current Season Structure

In 2008, there were a total of 35 hunting districts open for bighorn sheep hunting. Thirty hunting districts were limited-entry, and there were a total of 168 either-sex, 245 adult ewe, 1 legal ram, and 5 any-ram licenses issued. In the five unlimited hunting districts, there was a total quota of 11 legal rams. In the unlimited districts, licenses were purchased at license providers or through the regular drawing. Nonresidents were eligible for up to 10% of the licenses. License costs in 2008 for resident and nonresident hunters were $130 and $755, respectively, and ram and ewe license costs were the same.

Waiting Periods and License Requirements

In 1956, a 10-year waiting period was imposed on all bighorn sheep license holders in Montana, whether they were successful in harvesting an animal or not. This regulation was also made retroactive to 1953. The 10-year waiting period remained in place until 1963 when it was replaced with a seven-year waiting period for those who were successful at harvesting a sheep in the limited permit areas. Those unsuccessful at harvesting a sheep were required to return their unused license to be eligible the next year. Unlimited permit area license holders remained exempt from this requirement until 1972, when those successful at harvesting a sheep in the unlimited areas were also required to wait seven years before becoming eligible for another license. In 1975, hunters in the unlimited areas were also required to purchase their licenses by August 31 of each year, and unlimited seasons with quotas could close on 48 hours notice. That same year, transportation permits and plugging of all ram horns was required for all harvested rams taken in Montana. Hunters

taking a bighorn sheep were also required to show, on demand for inspection, the kill site and complete head.

Comparison of Other State and Canadian Province Regulations and Seasons

A summary of Rocky Mountain bighorn sheep hunting regulations is shown in Table 2. With the exception of four to six unlimited license areas (depending on the year) surrounding Yellowstone National Park in southern Montana, all states utilize limited numbers of licenses to control the number of hunters allowed to hunt. The Canadian provinces of Alberta and British Columbia have unlimited seasons. With the exception of the very small harvest of ewes and lambs experienced under either-sex seasons, all jurisdictions allowing the harvest of ewes utilize limited licenses. Limiting the number of licenses significantly reduces hunting opportunity but provides control over the harvest and reduces or eliminates hunter overcrowding.

Although unlimited hunting areas place no limit on the number of hunters that may hunt, wildlife management agencies do partially control hunter numbers by other means. The Canadian provinces of Alberta and British Columbia require nonresident hunters to utilize a licensed guide. The guides, in turn, are allocated an area to hunt and are further restricted by harvest quotas for that area. In Montana, hunters may purchase an unlimited license by May 1, or apply in the drawing by May 1 and choose between a limited or unlimited area as their first choice. Since the demand for limited licenses is high, many hunters choose not to apply for the unlimited areas, thus reducing the number of hunters in those areas each year.

Horn Curl Restrictions

Bighorn sheep have been managed under a variety of horn definitions throughout North America. Curl-size regulations were first used as a means to control overharvest of the ram segment and to prevent assumed breeding problems, since it was known that the older rams typically did most of the breeding. Hunter demand for larger "trophy" sheep also contributed to implementing the first ¾-curl laws, which came about at the same time as the old "buck laws" for deer. Both Montana and Idaho implemented a ¾-curl regulation in 1953 (Demarchi 1978). Alberta followed in 1956, and British Columbia first used a ¾-curl restriction in 1966. As hunter numbers increased and sheep populations became more accessible to the hunter, horn curl restrictions became more stringent. Objectives also changed from only preventing overharvest of the ram segment and protecting breeding potential, to one of producing trophy rams for the hunter. Alberta instituted a 4/5-curl regulation in 1968, and British Columbia implemented a 7/8-curl regulation in 1972. Montana revised its ¾-curl regulation in the early 1970s and adopted the current "legal ram" definition in 1977 in the unlimited areas. Both Alberta and British Columbia retained their unlimited hunting areas and currently utilize horn curl regulations (Alberta: 4/5-curl; BC: full-curl).

Horn Curl Regulations in Limited License Areas

Nearly all jurisdictions surveyed utilize ram only or either-sex regulations to regulate the harvest of rams in limited license areas. The number of licenses issued controls the number of rams taken. In Colorado, limited license holders have been restricted to taking ½-curl or larger rams in nearly all areas since 1983. Since hunters tend to select the larger and older rams, the result of the ½-curl regulation is nearly the same in most cases.

Horn Curl Regulations in Unlimited License Areas

Alberta and British Columbia in Canada both utilize unlimited hunting seasons together with a horn curl regulation to manage the ram segment of sheep populations. Of all the states, Montana is the only one to currently utilize the unlimited season with a horn curl regulation, and it is restricted to only four to six areas in the south-central part of the state. In Montana, the horn curl restriction is defined as a "legal ram." This restricts harvest to only rams four years old or older (rarely three) and is similar to the previous ¾-curl regulation but is easier for hunters to determine a legal ram in the field. With the exception of four areas managed under a full-curl regulation, Alberta utilizes a 4/5-curl definition. British Columbia began using a full-curl regulation to limit harvest to older Class IV rams in 1976. In addition, an eight-year or older regulation has been implemented in some areas where heavy brooming of horns by rams has been noted. The full curl regulation is intended to maintain a more diverse ram age structure and still provide for hunting opportunity.

Dall's sheep hunting in Alaska and British Columbia, Canada, is also restricted to full curl, but there are dramatic differences in horn growth between the two species. One significant

Table 2. Summary of 2007 Rocky Mountain bighorn sheep hunting regulations in western states and provinces.

Jurisdiction	License Restriction	Horn Curl Restriction	Ewe Season	License Limit	Earliest and Latest Season Dates	Mandatory Inspection	License Cost		Other
							Ram / Trophy	Ewe/Non Trophy	
Alberta, CA	Mostly Limited-some unlimited Entry	28 areas 4/5- curl 4 areas Full-Curl	Non-trophy limited entry	1 kill/yr	Sept. 5 - Nov. 30	30 days inspection/ plug horns	Res: $50.09 Nonres: $316.35	Res: $26.58 Nonres: NA	Guide Required for Nonres.
Arizona	Limited	Any ram	None	1 license/ life	Nov. 1 - Dec. 31	Within 3 days close of season inspection/ seal	Res: $272.50 Nonres: $1407.50	NA	
British Columbia, CA	Mostly Limited Entry some Unlimited	¾-curl, Full-Curl, Mature Ram (> 8 yr)	None	1 kill/yr	Aug. 15 - Oct. 20	30 days inspection/ plug horns	Res: $60 Nonres: $620	NA	Guide Required for Nonres.
Colorado	Limited	½-curl, ¾-curl	Ewe > 5”	1 kill/5-yr Preference System	Aug. 6 - Oct. 11 + Special Archery	5 day inspection/ plug horns	Res: $251 Nonres: $1716	Res: $251 Nonres: $1716	Mandatory hunter harvest report
Nebraska	Limited	Any ram	None	1 permit/ life	Dec. 1 - 22		Res: $25	NA	
New Mexico	Limited	Any ram	None	1 license/ life	Aug. 22 - Jan.17	10 days inspection/ seal	Res: $162 Nonres: $3,172	NA	
North Dakota	Limited	One male bighorn	None	1 license/ life	Oct. 5 - Oct. 28	Inspection / plug horns	Res: $20 Nonres: $500 +$100 app. fee	NA	
Idaho	Limited Unsuccessful must return license	Rams Only	None	1 kill/life	Aug. 30 - Oct. 31	10 day inspection/ plug horns	Res: $174.50 Nonres: $1759.50	NA	Mandatory Course/ Exam
Montana	Limited	Either-Sex/ Legal Ram	Adult Ewe 1yr and older	1 license/ 7 year (rams) Preference System	Sept. 15 - Nov. 25	48 hr inspection / 10 day plug horn	Res: $130 Nonres: $755	Res: $130 Nonres: $755	
	Unlimited	Legal Ram	None	1 kill/7 yr	Sept. 1 - Nov. 25	48 hr inspection / 10 day plug horn	Same	Same	Harvest quota/ 48 hr closure
Nevada	Limited	Any ram	None	1 license/ 10 years	Sept. 1 - Oct. 30	5 days inspection/ seal	Res: $120 Nonres: $1,200	NA	
Oregon	Limited	One bighorn ram	None	1 license/ life	Aug. 30 - Oct. 31	72 hr inspection/ plug horns	Res: $101.50 Nonres: $1083.50	NA	
South Dakota	Limited	Any bighorn sheep	None	1 license/ life	Oct. 3 - Nov. 30	24 hour inspection/ marking horn	Res: $255	NA	
Utah	Limited	One bighorn ram	None	1 license/ life Preference System	Sept. 22 - Nov. 30	72 hr inspection/ plug horns	Res: $508 Nonres: $1513	NA	Mandatory harvest report within 30 days of end of season
Washington	Limited	One bighorn ram	None	1 kill/life	Sept. 15 - Nov. 30	10 day inspection/ plug horns	Res: $109.50 Nonres: $1095.50	NA	
Wyoming	Limited	Any ram	Any bighorn sheep in one area	1 license/ 5yr	Aug. 15 - Oct. 31	15 day inspection/ plug horns	Res: $96 Nonres: $1901	NA	

difference is the frequency and extent of ram horn brooming. Nearly all bighorn rams broom their horns and many broom back their horns to nearly ¾-curl. Severe brooming of horns is typical of slow-growing or stable native bighorn sheep populations. Only those bighorns with the fastest growing horns (typically in expanding transplanted herds) seem to escape this tendency. Heimer (1998) noted the following about the use of a ¾-curl regulation for Dall's sheep management in Alaska:

Although brooming is common in Dall's rams, they seldom break both horns and broom as severely as bighorn. Since Dall's sheep grow horns faster than bighorn, the ¾-curl regulation resulted in the harvest of significant numbers of young juvenile rams in some areas of Alaska. As hunting pressure increased in Alaska, and virtually all-legal rams were removed from some populations, negative impacts were noted; lamb production declined and mortality of younger rams greatly increased. Some lambs were still produced by adult ewes, but 95% of these adult ewes reproduced only in alternate years. Frequency of reproductive activity among 18-month-old ewes rose from about 5% to 25%. These young ewes typically conceived late and delivered stunted lambs well after the normal peak of lambing by adult ewes. Survival of rams was also impacted because immature rams became more active breeders and mortality increased. This then lowered the sustainable ram harvest. Instituting the full-curl regulation allowed for increased harvest of mature rams through doubled lamb production and increased young ram survival.

U.S. states and Canadian provinces have at one time or another revised their definitions to enable hunters to better determine a legal ram in the field and to enable enforcement of these regulations. Although similar, each jurisdiction has a slightly different definition for legal sheep. The following lists each jurisdiction's current definition:

"Full-Curl" Ram Definition

Alberta – A male bighorn sheep with horns, one of which is of sufficient size that when viewed in profile, its tip extends upward beyond a straight line drawn from the rear-most point of the base of the horn to the centre of the nostril.

British Columbia – Any male bighorn mountain sheep, the head of which, when viewed squarely from the side, has at least one horn tip extending upwards beyond a straight line drawn through the centre of the nostril and the lowest hindmost portion of the horn base. If the skull and horns are presented for examination, when viewed squarely from the side with both horns in alignment, at least one horn tip extends upward beyond a straight line drawn through the lowest hindmost portion of the horn base and lowermost edge of the eye socket.

"Mature" Bighorn Ram

British Columbia – Any bighorn ram mountain sheep that has attained the age of eight years as evidenced by true horn annuli as determined by the regional manager or designate, or whose horn tip, when viewed squarely from the side, extends upwards beyond the forehead-nose bridge.

"4/5-Curl" Ram Definition

Alberta (trophy sheep) – A male bighorn sheep with horns, one of which is of sufficient size that a straight line drawn from the most anterior point of the base of the horn to the tip of the horn extends beyond the anterior edge of the eye when viewed in profile.

"3/4-Curl" Ram Definition

British Columbia – Any male bighorn mountain sheep, the head of which, when viewed squarely from the side, has at least one horn tip extending beyond a straight line drawn through the back of the eye opening and at right angles to a line drawn between the centre of the nostril and the lowest hindmost portion of the horn base. If the skull and horns are presented for examination, when viewed squarely from the side with both horns in alignment, at least one horn tip extends beyond a straight line through the back edge of the eye socket and at right angles to a line drawn through the lowest hindmost portion of the horn base and the lowermost edge of the eye socket.

Colorado – A male sheep with a horn or horns that have one or both tips grown at least through three-quarters (3/4), or 270 degrees, of a circle to be measured by first establishing a reference line that bisects the eye and the base of the ear; then by establishing a line that intersects the reference line at the base of the ear and is perpendicular thereto; and which has horn tips that have grown at least as far as the downward projection of the perpendicular line.

Montana (legal ram) – When a straight line extending from the front base of the horn through any portion of the eye opening intercepts any portion of the horn, the ram

is legal. If the horn is not long enough to be intercepted by the line, the ram is not legal. Base of the horn shall be considered as the point where the horn meets the hairline of the head. Determination of a legal ram should be made from a broadside view of the head.

"1/2-Curl" Ram Definition

Colorado – A male sheep with a horn or horns that have one or both tips grown at least through one-half, or 180 degrees, of a circle to be measured by first establishing a reference line that bisects the eye and the base of the ear; and which has horn tips that have grown at least as far as the projection of this reference line.

Montana – No definition provided in regulations.

Ewe Seasons

Currently, ewe seasons are held in Alberta, British Columbia, Colorado, and Montana. The definition used by the four jurisdictions to describe a legal sheep in an ewe season varies. Alberta and British Columbia allow the harvest of lambs of both sexes, while Colorado and Montana do not. Montana and Colorado's definitions are similar in that they both limit harvest to adult ewes. However, Colorado uses a horn length to determine a legal female sheep, while Montana uses the age class of one year old or older. Essentially both definitions protect female and male lambs, but the five-inch requirement in Colorado takes that one step further and has the potential to protect some yearling females as well, depending on how successful hunters are at determining the length of horns in the field.

"Ewe" Definition

Alberta (non-trophy sheep) – A female bighorn sheep or a male bighorn sheep under one year of age.

British Columbia – A lamb or ewe.

Colorado – Any female sheep having a horn or horns of at least five inches in length as measured on the outside curve of the horn from the skull to the tip.

Montana (adult ewe) – A female bighorn sheep one year old or older. Lambs (young of year) are not included.

License Limits

All 10 of the states and provinces surveyed restrict the number of licenses a hunter can have in a lifetime. Four of the 10 restrict a hunter to one bighorn harvested in a lifetime. Three restrict the hunter who draws a license to one in a lifetime whether the hunter is successful or not during the season. Other restrictions used are one harvested bighorn for every five or seven years, or one license obtained for every five or seven years.

Competition between resident hunters and nonresident hunters is a frequent topic of discussion by the regulatory agencies in the states and provinces and in the hunting community. British Columbia and Alberta have implemented increases in license costs and guide requirements to control nonresident sheep harvest and alleviate overcrowding and competition. In British Columbia, nonresident hunters are required to have a guide, and the guides are restricted to an area and an annual quota. These regulations controlled the minority of guides that had overexploited the mature ram segment in their hunt area in the past, promoted the outfitting industry, and reduced nonresident competition with residents, especially in the more accessible and less rugged areas of the province (Demarchi 1978). At the same time, license costs for nonresidents were raised to account for the loss in revenue from these nonresident restrictions.

The western states control nonresident sheep hunters through the price of the license, drawing procedures, and a limit on the percentage of nonresidents that can draw a license in any one year. Montana, Oregon, and Utah limit nonresidents to hunt only in certain hunting districts. Wyoming has separate drawings for resident and nonresident licenses.

Season Dates

General hunting season dates are similar between all jurisdictions surveyed. With few exceptions, hunting is limited to a period between September and the end of October or November. Shortened seasons are utilized in some areas to restrict harvest of older rams. Late seasons were implemented to harvest rams that were unavailable to hunters in the earlier hunting period due to migration from a protected area or inaccessible, rugged, and difficult to traverse terrain. Wyoming, Oregon, Idaho, and North Dakota close the season at or near the end of October, before the major rutting period begins. This restricts harvest of mature rams because they are less available prior to the rut, and prevents disruption of the rutting period. Montana's limited seasons occur primarily from September 15 through the Thanksgiving weekend in late November. A few areas close at the end of October, and later seasons were implemented in the past in

areas where the sheep were unavailable during the regular hunting season. The unlimited areas primarily open in early September and close within a few days, or when the harvest quota is reached.

License Costs

Resident bighorn sheep license cost ranges from $20 in North Dakota to $508 in Utah (Table 2). Nonresident bighorn sheep license cost ranges from $316 in Alberta to $3,172 in New Mexico. The cost of Montana's resident license ($130) and nonresident license ($755) are in the middle of the other jurisdictions. Alberta reduces the cost of their non-trophy or "ewe" license from that charged for ram hunts, but Colorado and Montana do not.

Nonresident and Resident Permit Allocations

Most states and Canadian provinces provide opportunities for nonresidents to hunt. Wyoming sets aside 10% of the sheep licenses for nonresidents in a separate drawing. The states of Idaho, Oregon, Utah, Colorado, Washington, and North Dakota all limit nonresident sheep licenses. British Columbia and Alberta limit nonresident hunters through requirements to hire a guide and to hunt areas with sheep quotas for each guide or outfitter.

In Montana, nonresidents are restricted to certain districts. Nonresidents are also limited to, but not guaranteed, 10% of a region's quota. Districts where nonresidents may apply are listed on the moose, bighorn sheep, and mountain goat nonresident application but may change when final quotas are set in June. This procedure has been implemented as a result of state legislation (Mont. Code Ann. 87-2-506 (2)) limiting nonresidents to 10% of big game licenses when applications exceed the number to be issued. In practice, the number of licenses available in an administrative region (seven regions in Montana) is first totaled. Nonresidents are eligible for up to 10% of the licenses, so they could actually be issued less than 10% of the licenses if they aren't successful in the random drawing. All districts with 10 licenses available get one of the regional total nonresident licenses allocated (10%), and those with 20 get two (10%) and so on. Then, each district in the region with less than 10 licenses gets one of the regional nonresident licenses allocated until they are all allocated. This same procedure occurs in each region where sheep licenses are available. Since there are usually more districts than licenses available in a given year, a rotation is used beginning with the remaining districts in sequence the next year. This results in a nonresident having a chance of drawing a license in each district approximately every third year. Since the actual number of nonresident licenses issued in a year is set after the applications are due and is based on the luck of the draw, fewer than 10% of the licenses available typically go to nonresidents.

A court case in Arizona in 2002 made national headlines when the federal court based its ruling on the premise that states' disparate treatment of nonresidents violated restrictions imposed on activities involving state commerce (Conservation Force v. Manning 301 F.3d 985 (9th Cir. 2002)). This was significant, because some 30 years earlier, a U.S. Supreme Court case had determined that recreational hunting was not a privilege protected by the Privileges and Immunities clause of the Constitution, that state residents bore more of the burden of wildlife conservation, and that the states had the right to treat nonresident hunters differently from resident hunters.

The issue also divided the hunting community. At the request of the state wildlife agencies, Senator Harry Reid (D-NV) introduced a bill called the "Reaffirmation of State Regulation of Resident and Nonresident Hunting and Fishing Act of 2005." On May 10, 2005, the president signed into law House Bill 1268. Section 6063 of Senator Reid's bill has essentially made subsequent court challenges involving the constitutional issues of limits placed on nonresident licenses moot by providing:

It is the policy of Congress that it is in the public interest for each State to continue to regulate the taking for any purpose of fish and wildlife within its boundaries, including by means of laws or regulations that differentiate between residents and nonresidents of such State with respect to the availability of licenses or permits for taking of particular species of fish and wildlife, the kind and numbers of fish and wildlife that may be taken, or fees charged in connection with issuance of licenses or permits for hunting or fishing.

Boone and Crockett Records

Horn size is a good reflection of animal health and the quality of habitat it occupies as well as genetics, and therefore should be a good source to review when determining overall population vitality.

Prior to 1974, no rams legally harvested in Montana were recorded breaking a 200-point score in the Boone and Crockett records. Of the 10 rams recorded with a score over 200,

seven were taken in Alberta and two in British Columbia; one with a recorded score of 200 was taken in the Wind River Range of Wyoming in 1883. The world record, at the time, scored 208 1/8, and was taken in Blind Canyon, Alberta, in 1911.

The current Montana state record scored 204 7/8 Boone and Crockett points and was taken in Granite County in 1993. According to the 2005 Boone and Crockett Record Book, six rams exceeding 200 points have been harvested from Montana since 2000. Forty-five percent of the Boone and Crockett record book rams scoring between 190 and 200 were harvested in Montana. Forty-eight percent of the entries meeting the minimum score of 180 were harvested in Montana.

The Winter 2007 issue of Boone and Crockett's *Fair Chase Magazine* contained an article entitled "Destination – The Biggest Bighorns," by Wayne Van Zwoll. In the article Van Zwoll compared the records for bighorn sheep and found that over the last 10 years, Montana had more entries than any other state or province with 261. Alberta was the next closest with 54. The top seven Montana counties were Granite (56), Sanders (44), Blaine (33), Fergus (28), Missoula (23), Ravalli (23), and Lewis & Clark (20).

Trapping and Transplant Program

Early Transplants and Policies

Between 1947 and 1950, five corral-type traps were constructed in Montana for the capture of bighorn sheep (Couey 1950). One was constructed on the Kootenai in the Ural-Tweed area, one on the West Fork of the Gallatin River, two on the Sun River, and one on Deep Creek in Teton County. The latter was primarily for catching mountain goats.

As Couey (1950) described them, the traps were constructed of poles set in the ground and covered on the inside by woven wire to the height of eight feet, making an enclosure of about 12 feet by 24 feet. A trap door was left open at each end until the sheep felt comfortable entering the trap, which was baited with salt. The trap door at one end was then closed, and when sheep entered the trap a person could pull a trip wire closing the door. Eventually, the woven wire was covered with boards or canvas/burlap to prevent injury caused by sheep jumping into the wire. The sheep were captured by rope or hand and loaded in a crate that was carried on a horse. The sheep were unloaded to a stock truck and taken to a holding pen where they were kept for several weeks. They were fed hay and rolled oats. Then the sheep were captured again and taken to the release site.

The traps used today are very similar with rough-cut boards or nets used as the sidewalls and, in some cases, the addition of side chutes for working individual animals.

Even in those early years, agency personnel took great care in selecting transplant sites. Couey described the sites chosen as places with rehabilitated range, free from parasites and disease and with few predators. The early efforts also used holding pens at the transplant location to allow the sheep to stay together and get used to the area before release. Transplants to Wildhorse Island in 1941 and 1947, and a transplant in 1947 into the Billy Creek area of the Missouri River Breaks were two of the first areas selected.

The early transplants were often unsuccessful and, according to Alan Schallenberger, then Choteau Wildlife Biologist, this led the wildlife division to consider suspending further transplants of bighorn in 1966. Prior attempts at capture were primarily conducted in the spring using salt followed by releases on spring or summer range. Animals typically dispersed widely and then died out. Schallenberger suggested: 1) trapping 25 -30 sheep during the winter and releasing them on winter range; 2) supplementing the transplant the following year or as soon as possible; 3) choosing an area with suitable winter range and escape cover for the transplant; 4) trapping in very cold weather and baiting with hay rather than salt; and 5) releasing the sheep as soon after capture as possible, without holding pens. These changes to policy resulted in much better success in the following years, and subsequently formed the basis for more formally adopted protocols.

The use of snowmobiles and crates with sleds to haul captured bighorn in Sun River from remote locations along Gibson Lake also prompted Schallenberger, in 1967, to work with Murray Duffy of Central Air Services in Lewistown and Bert Goodman, then Sun River Game Range Manager, to design an angle iron, strap iron, rebar, and wire crate with a plywood bottom which could be slung below a helicopter. This device was first used on January 7, 1968, to transport sheep from Reclamation Flat in the Sun River to Blacktail and subsequently proved very successful at significantly reducing the labor involved with moving sheep from remote locations to vehicles for further transport to the release site.

Current Transplant Program and Policies

One way to judge the success of the trapping and transplant program is through review of the

number of herds in the state and the estimated total population at various times in Montana's history. Following major die-offs along the Rockies in 1925, 1927, and 1932, bighorn sheep in Montana were considered rare or even endangered. Couey (1950) described 16 herds in the state with an estimated population of 1,200 bighorns. Unpublished Wildlife Division records show estimates by Merle Rognrud, then division bureau chief, of 2,000 in 1957 and 1,500 in 1968; these estimates were based on the estimated percentage of the population harvested. By the early 1970s, 11 major herds were known to exist in the state, and 13 other areas had been stocked by transplanting. Of those areas with transplanted stock, at least four were considered not successful at the time, resulting in a total of about 20 established herds within the state. In 1998, there were 42 herds with an estimated population of 4,890 (Toweill and Geist 1999). In 2001, there were 43 herds in the state with an estimated population of 4,230 (Erickson July/Aug 2001 *Montana Outdoors*). In 2008, there were 45 different herds in the state with an estimated 5,694 total bighorn sheep, not including Glacier National Park.

Transplants have always been a cooperative venture, involving sportsmen and sportswomen, landowners, public and state land management agencies, and FWP. An example of the importance placed on the cooperative approach was the 1969 directive from the FWP director of the time, which stated the following requirements before a transplant could proceed:

1) An investigative report on suitability of the transplant site.
2) A signed agreement by the landowner where the transplant was to occur
3) A cooperative agreement signed by the U.S. Forest Service or Bureau of Land Management if the transplant involved public land.

FWP Policies

Today, FWP and public land management agencies have policies that guide trapping and transplanting efforts. FWP policies and guidelines are directed by state law (MCA 87-5-701-721), which provides for the importation, introduction, and transplantation of wildlife. This statute provides that transplantation or introduction of any wildlife is prohibited unless the FWP Commission "determines, based upon scientific investigation and after a public hearing, that a species of wildlife poses no threat of harm to native wildlife and plants or to agricultural production and that the transplantation or introduction of a species has significant public benefits."

In the statute, transplantation is defined as the "release of or attempt to release, intentional or otherwise, wildlife from one place within the state into 'natural habitats' in another part of the state." Natural habitat means "any area in which the introduction of wildlife species may result in an uncontrolled, naturally reproducing population of that species becoming established."

The requirements of this statute have been interpreted by FWP legal counsel to apply to transplants to new areas where bighorn do not currently exist but not to the augmentation of existing herds.

FWP's Wildlife Division first adopted "Bighorn Sheep Transplant Guidelines" on October 9, 1986. These guidelines provided the internal procedures for personnel to follow when planning for a bighorn sheep transplant. Additionally, in 1995 the FWP Commission adopted the "Bighorn Sheep Transplant Policy," which provided the criteria about how sites were to be selected for transplant. This policy was adopted following an extensive review of disease issues and evidence at the time that new transplants to locations in close proximity to domestic sheep and goats should not be undertaken due to the increased risk of a significant bighorn sheep die-off. Among other provisions, the policy gives preference to sites that are not in close proximity to domestic sheep or are separated by physical barriers and that have sufficient habitat and landowner agreement to provide future access to hunters, so that the population can be managed within objectives through hunter harvest.

The 1986 Transplant Guidelines and the 1995 Transplant Policy are the basis for the translocation program presented in this document (see Translocation Program section).

Forest Service Direction

The USFS has recognized the importance of finding solutions to the incompatibility between domestic and bighorn sheep (Schommer and Woolever 2001). Since most wildlife biologists and veterinarians have now concluded that bighorn and domestic sheep should not occupy the same ranges and should not be managed in close proximity to each other, the 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. To implement this, Schommer and Woolever (2001) recommended a collaborative approach between lessees, the USFS, and other interested parties,

with options including finding replacement grazing allotments for domestic sheep when transplants of bighorns are contemplated, provisions to keep bighorn and domestic sheep separated by herding, and alternate time periods for grazing by domestic sheep in areas of seasonal use by bighorn sheep.

BLM Policies

In 1992, the BLM issued Instruction Memorandum 92-264, "Guidelines for Domestic Sheep Management in Bighorn Habitats," as part of an effort to restore bighorn into historically occupied habitats on public lands. These guidelines were reviewed in 1997 and updated following a meeting of bighorn and domestic sheep specialists in April 1998. The BLM continues to utilize the revised guidelines whenever reintroductions, transplants, or augmentations of wild sheep populations, or proposed changes in a livestock grazing permit on BLM administered lands, are being considered (Reference BLM Instruction Memorandum No. 98-140). The significant provisions of these guidelines are:

1) When agency and industry agreement has been reached to maintain and/or expand native wild sheep numbers, the agencies and the domestic sheep industry will be held harmless in the event of disease impacting either native wild sheep or domestic sheep and goats.
2) Domestic sheep or goat grazing and trailing should be discouraged in the vicinity of native wild sheep ranges.
3) Native wild sheep and domestic sheep or goats should be spatially separated to reduce the potential of interspecies contact.
4) Except where topographic or other barriers exist, buffer strips of up to 13.5 km (9 mi) surrounding native wild sheep habitat should be established when reviewing new domestic sheep or goat grazing applications or when conversions of cattle permits to sheep or goat permits are proposed in areas with established wild sheep populations.
5) Domestic sheep and goats should be closely managed and carefully herded where necessary to prevent them from straying into native sheep areas.
6) Trailing of domestic sheep or goats through native wild sheep ranges is permitted when safeguards can be implemented to adequately prevent physical contact between native wild sheep and domestic sheep or goats.
7) Cooperative efforts should be undertaken to quickly notify permittees and appropriate agencies to remove any stray domestic sheep or goats or wild sheep in areas where contact could occur.
8) Unless cooperative agreement has been reached to the contrary, native wild sheep should only be introduced into areas where domestic sheep or goat grazing is not permitted.

Montana State Lands (DNRC) Policies

The Montana State Land Board adopted a domestic sheep grazing policy and Administrative Rule (36.25.127) in 1998. This policy was a direct result of a ruling by the Supreme Court of Montana in 1995. Sportsmen had filed suit against the Department of State Lands, which had granted a change in a livestock-grazing lease from cattle to domestic sheep on state trust lands in the Sula area of Ravalli County. The sportsmen were concerned about the potential adverse affects on bighorn sheep in the area. The court ruled that the Department of State Lands had not adequately determined the significance of the impacts associated with grazing domestic sheep on lands adjacent to bighorn sheep, and had acted arbitrarily, capriciously, and unlawfully when it concluded that changes to the lessee's grazing plan reduced the probable significant impact to bighorns. The policy adopted in 1998 requires DNRC to identify state tracts that lie within or immediately adjacent to occupied bighorn sheep ranges. The lessee/licensee is to notify DNRC if he/she has not grazed sheep on the allotment within the previous 10 years and intends to graze domestic sheep. Authorization to make a change to accommodate grazing of domestic sheep would then require preparation of an environmental analysis under the Montana Environmental Policy Act (MEPA) by DNRC. In preparation of the MEPA document, DNRC is to consult with FWP and seek comment from surrounding landowners and the interested public.

Trapping and Transplant Techniques and Methods

The techniques used to trap and transplant bighorn sheep began with the use of corral traps constructed of logs, poles, and woven wire and baited with salt blocks and alfalfa hay. Drives, using sportsmen on foot, were first used on Wildhorse Island (Picton 2002). Permanent corral traps were replaced with net traps constructed similarly, and blasting caps instead of a trip wire were frequently

used to trigger closure of the gate. Transport included the use of crates on packhorses, rafts, snowmobiles with sleds, boats, and finally helicopter slings. Captured sheep were loaded into small ¾-ton stock trucks and horse trailers for transport to the release location. Use of a helicopter in driving sheep into nets supported by poles was tried successfully on sheep capture in the 1980s. Today, sheep are captured almost exclusively using a hand-held net-gun fired from a helicopter.

Schmidt (1976) described the drop-net technique of capturing bighorn sheep and use of apple pulp as bait. They used a 70-square-foot drop-net that weighed 280 pounds including the supporting poles. The net was dropped using a radio-controlled detonator.

Devos et al. (1999) evaluated post-capture survival of 711 bighorn following captures by drop-nets, darting with chemical compounds, and aerial net-gunning. Survival rates ranged from 0.942 for aerial net-gunning to 0.983 for aerial darting with chemical compounds. They concluded that all methods tested yielded high survival rates in bighorns and that selection of a particular technique should be based on project objectives, terrain, and personnel training. Aerial capture methods allow selection of specific age and sex ratios, whereas drop-netting captures large numbers of bighorns at one time with sex and age ratios determined by the bighorns that come under the net. Aerial captures may also optimize genetic diversity because bighorns can be captured from several areas.

Hunter (1999) reviewed immobilization techniques used in the capture of free-ranging bighorn sheep. Hunter stated that the most effective and safest agents for field immobilizations are the narcotic agents (Schedule II drugs). These drugs are extremely potent, and human exposure must be avoided. Special handling and safety precautions are mandatory.

The net-gunning technique of capturing wild ungulates and sheep is described by Innes (1999). After capture, he recommended getting the animal to its feet as quickly as possible and back into the field. Slinging animals upside down without the use of drugs is an effective way for animals to be quickly moved from the capture location to the processing area. Although regurgitation problems have been encountered in some instances during transport upside down, this has been rare, and the review of capture records in several states did not show a difference in survival between the use of sling bags and slinging the animal upside down. Recently, it has been shown that sheep and goats and other animals of similar size can be taken inside the helicopter for transport, if properly restrained.

Capture and Handling Recommendations

The 2nd North American Wild Sheep Conference held in Reno, Nevada, in 1999 provided extensive recommendations for sheep capture, handling, and transplants. The pertinent recommendations are summarized as follows:

1) Wild sheep should be reestablished in all vacant historical ranges that still provide suitable habitat.
2) Transplants may be used to establish new herds or to augment existing herds. Maintenance of metapopulations should be considered when selecting transplant sites, and transplant sites should have the potential to support at least 100 animals.
3) Potential transplant sites should be fully evaluated, including habitat, predator abundance, and the potential for livestock or other wild ungulate competition.
4) Transplant stock should be native subspecies, utilize similar habitat, and have food habits and habitat-use patterns compatible with the transplant site.
5) Initial transplants should include at least 30 sheep; higher numbers and multiple transplants enhance success. Smaller numbers used to supplement small herds is a viable technique. Transplanted sheep may be released at multiple locations.
6) Do not remove large numbers of sheep from small source populations.
7) Test source herds for diseases and do not transplant sheep from herds with recent histories of pneumonia.
8) Obtain adequate samples for genetics analysis from each group of transplanted sheep.
9) Monitor transplanted sheep for at least a year, use mortality sensing collars, and collar as many animals as possible.
10) Maintain a database of transplant histories, including genetics and disease information.
11) If propagation pens are used to maintain a source herd and provide transplant stock, maintain numbers of sheep with supplemental feed ad libitum, if food quantity or quality is limiting, and remove primarily

young rams to maintain a 1:5 ram: ewe ratio.

12) Develop written protocols for capturing, handling, and transplanting sheep. Capture teams should include veterinarians. Soft release, using a temporary enclosure, is not recommended.

The conference's effort to standardize practices was incorporated in "Wild Sheep Capture Guidelines," prepared by Craig Foster, Oregon Department of Fish and Wildlife, and adopted by the Northern Wild Sheep and Goat Council in 2005. This document provides a detailed guide for wildlife managers listing 1) the requirements for transport of bighorn sheep from Canada to the United States, 2) animal health and testing procedures, 3) capture and handling procedures, and 4) transport and release protocol.

POPULATION MONITORING

In November 2002, the Legislative Audit Division of the State of Montana reported on a performance audit of the FWP big game inventory and survey process (Legislative Audit Division, 02P-05, 2002). Conclusions and recommendations in the report as summarized in the 2005 Elk Management Plan are as follows:

1) The department employs game management methods that compare to accepted standards, but could improve its process.
2) The current techniques used to assess game population status have evolved from compromise among needs for accuracy, financial restrictions, and personnel availability.
3) The department could refine its techniques for all species to better incorporate strategies that relate to more thorough and objective analyses.

More specifically, the legislative auditor recommended the department refine its survey and inventory techniques for all species to better incorporate the concepts of:

1) Repetitive surveys of representative management areas;
2) Standardized and documented protocol that is easily transferable;
3) Use of visibility bias adjustments and required sample sizes;
4) Tying survey results directly to management objectives and subsequent recommendations;
5) Understandable and concise presentation to the public based on objective analysis.

In a formal response to the legislative auditor, FWP recognized the validity of the recommendations but pointed out the difficulty and expense in attempting to estimate exact population numbers. Instead, for most big game species, FWP conducts trend surveys to determine relative change in population numbers across several years. Trend counts are the basis for monitoring populations in relation to objectives and for making hunting season permit/license level recommendations to meet objectives.

In most bighorn sheep hunting districts in Montana, annual surveys are conducted with an attempt at total coverage of bighorn sheep distribution within the district. Montana has not used any type of population estimation but has relied on the trend in actual number of bighorn sheep counted to make management decisions and hunting season recommendations.

Because bighorn sheep are hunted conservatively, FWP biologists believe the need for precise population estimates is outweighed by reliable trend data collected systematically over time. Surveys are conducted annually in 34 hunting districts and periodically for five smaller populations that currently are not hunted. Almost all surveys are conducted using helicopters, and surveys are flown, with few exceptions, in late winter to early spring, prior to animals moving from winter ranges.

Wildlife biologists and researchers generally recognize that some form of population estimation, if done correctly, can provide a more accurate assessment of actual bighorn numbers (Irby et al. 1988; George et al. 1996; Rabe et al. 2002). However, George et al. (1996) found that while sightability probabilities were similar between survey flights in alpine habitats, they varied widely in timbered habitats. A similar situation exists in northwestern Montana where habitats used by bighorn sheep, particularly rams, consist of dense coniferous forests making observability of rams difficult and results variable. While long-term population trend data in this area may be reliable, other data gathered

in conjunction with aerial survey data, such as the average age of rams in the harvest, are used when making recommendations for the number of either-sex licenses to issue.

Differences in survey methods and results and differences in demographic responses of deer among five ecological/habitat management units (Northwest Montane, Mountain Foothills, Prairie/Mountain Foothills, Southern Mountains and Prairie/Breaks) were recognized in Montana's Adaptive Harvest Management for mule deer (Wildlife Division, FWP, 2001). Bighorn sheep are distributed within these same habitat units and also have somewhat different population dynamics as a result of the variations in habitat. To develop accurate sightability models for bighorn sheep across Montana, individual models would have to be developed for each management unit. Accomplishing this task would require marking an adequate number of animals in at least one population in each management unit and doing repetitive surveys to develop the sightability index.

FWP has accomplished this in some areas for elk and mule deer but not for bighorn sheep. Because of budget constraints, FWP annually prioritizes survey efforts for most big game species, and the cost of developing a sightability index for bighorn sheep on even one management unit is probably not realistic. One possibility, as suggested by Rabe et al. (2002), is to stratify a state by habitat type (in this case by management unit) and randomly select a sample of the hunting districts in each unit to develop sightability models, or survey the same selected districts annually to develop trend data. Presumably, the information collected would be applicable to other districts/populations in a particular unit.

Two concerns that confront any wildlife survey effort are: 1) what is the information going to be used for (objectives) and 2) is the quality of the information collected adequate to choose between alternative management actions in order to meet objectives.

In Montana, survey information is used to assess whether population objectives for individual hunting districts are being met. Season recommendations are made based on survey information that informs a basic population model in order to estimate allowable harvest (see Population Management section). Survey results also are used to evaluate the health of various herds locally and statewide. Specifically, biologists examine lamb production and recruitment to assess to some degree the health of individual populations on an annual basis (e.g., low recruitment may indicate poor herd health).

Survey methodologies in Montana have evolved over time and are for the most part specific to the individual population or region where habitats and bighorn sheep seasonal use of habitat is similar. Choice of methods considers the type of aircraft utilized, the best time of year to observe sheep in a particular habitat, conducting flights in the best observational conditions, flying with experienced pilots and observers, and consistent coverage of areas considering bighorn sheep distribution at the time of survey.

As is the case in any wildlife survey effort, variables encountered during surveys add uncertainty to survey results, so survey data should be interpreted by or in collaboration with the person doing the survey. Biologists in Montana believe the current survey efforts are adequate to answer questions about population objectives and herd health. Specifically, trend data has been sufficiently accurate to determine the number of ewe licenses to issue for population management in larger herds, to determine lamb production and recruitment rates in relation to herd health, and to recommend harvest rates that sustain the desired age structure in the ram segment.

The challenge for the future is to maintain the current level of survey efforts on bighorn sheep. With increasing costs of aircraft rental and potential loss of qualified pilots and observers, it is possible survey efforts will have to be scaled back and locations and frequency of survey efforts prioritized.

If resources to survey not only bighorn sheep, but also all big game species become more limited, we recommend the following prioritization criteria:

1) Hunting districts that are at population objective and are currently being managed either through harvest of ewes and/or translocation should be surveyed annually.
2) Hunting districts that typically issue more than three licenses for rams should be surveyed on an annual basis, if possible, to determine the number of licenses to issue.
3) Newly established populations should be surveyed annually to determine seasonal distribution and population status in relation to objectives.
4) Hunting districts that issue one to three licenses for rams or have quotas for that number of rams could be surveyed every other year.

Information Collected

A difference in the method used to classify rams, which occurs in only a few hunting districts, is the primary inconsistency in statewide data collection. This is not a large problem, and to a degree is merely a matter of semantics, but we recommend that rams be classified by the degree of curl and not class of ram. A suggested form for data collection is contained in Appendix G.

When surveying bighorn sheep, most biologists record waypoint locations. This information is important for developing seasonal distribution maps, and actual location data is also being used as the primary input into a habitat evaluation model (see Translocation section).

FWP has been slowly implementing statewide databases for big game survey data. These databases are essential for timely assimilation of data for a regional, statewide, and range-wide analysis.

Harvest Survey Information

Hunters are surveyed by telephone after the hunting season ends to determine their success. Although the success rate on ram (either-sex) licenses is generally at or near 100%, it does vary in some districts where ewes are hunted. Reported average success rates by district are important to help determine the number of ewe licenses to issue in a district to achieve a certain harvest level (see Population Management section).

Hunters harvesting a ram must personally present the complete head and intact cape within 48 hours to any FWP office, game warden, or designated employee in the administrative region where the bighorn ram was taken. At that time, FWP employees record biological and other data on a Bighorn Sheep Harvest Form.

In the past, there was no central repository for these forms and information was frequently lost. Beginning in 2007, FWP began entering data from harvest forms for a number of species directly into a Mandatory Reporting Response Entry System (MRRE) soon after the form was filled out. The MRRE is located on FWP's internal site and is available to employees. This system has greatly enhanced access to bighorn sheep harvest data and will be an asset in summarizing this data for hunting districts, as well as on a regional and statewide basis, in a timely and accurate manner.

POPULATION MANAGEMENT

Although there are some statewide objectives for bighorn sheep management in this Conservation Strategy, it is the objectives for individual populations/hunting districts that define bighorn sheep management in Montana.

Chapter 2 of the Conservation Strategy presents the objectives, demographic criteria, and strategies, including harvest prescriptions, for individual populations/hunting districts. In this section, there is a brief description of the history of bighorn sheep management in Montana, how the "prescriptive process," which uses Adaptive Harvest Management (AHM) concepts, was developed, and how prescriptions work to achieve specific objectives.

Montana currently manages hunting of bighorn sheep through a number of different hunting regulations (see Hunting, Chapter 1). In 2008, there were 36 hunting districts open for hunting, with hunting of rams managed with either-sex licenses for 28 of those, a legal ram regulation for seven districts and an any-ram regulation for one district. Population levels of bighorn sheep are managed primarily through issuance of adult ewe licenses, translocation, a combination of the two, or are self-regulating (i.e., generally due to habitat constraints). In 2008, FWP issued a total of 245 ewe licenses in 16 hunting districts. Additionally, populations that have gone through a die-off are generally slow to recover to former status due to decreased lamb recruitment. Such populations may recover sufficiently to provide limited ram harvest, but in the case of significant mortality due to a pneumonic event, recovery may only reach what may be considered a minimum viable population (see Translocation section). Harvest of ewes would not be necessary or justified in such cases. Populations that have gone through a significant die-off generally should have objectives reduced, even if the population may have sustained significant ewe harvest prior to the die-off. This reduction reflects what the population could produce and sustain and not raise expectations to the public that may not be attainable. If populations do recover, this Conservation Strategy is intended to be flexible enough to allow revision of objectives to reflect recovery.

In the past, the process for recommending the number of licenses to be issued has not been consistent among biologists across the state. Because bighorn sheep populations are relatively small and management is often designed around producing "trophy" males, license/quota levels have been conservative. One of the primary objectives in the development of this Conservation Strategy is to tie the existing and proposed hunting season structure and license/quota levels to the monitoring program. As part of this effort, objectives for populations and ram characteristics within those populations that are currently hunted have been developed; likewise for populations where hunting may occur in the future and for populations that have gone through declines and are in a recovery stage. These objectives are presented in the individual hunting district/population management strategies in Chapter 2.

In small, self-regulating populations or populations that have gone through a recent die-off event, generally populations of less than 125, no ewe licenses are issued and the number of ram licenses issued is usually based on the number of legal rams (¾-curl) observed during annual or periodic surveys. In 2008, FWP offered one to three either-sex licenses in 11 hunting districts and one to three legal ram licenses in seven districts. In the case of the five unlimited districts, these were quotas, not licenses. Monitoring and management of these districts in relation to hunting is straightforward, and licenses/quota levels have changed little over time.

Monitoring and meeting objectives for individual populations becomes more complex

in districts where FWP issues more licenses for the ram segment, ewe licenses are issued, and/or trapping and transplanting may occur. In recent years, Montana has implemented AHM concepts into the hunting regulation process for mule deer and elk (Wildlife Division, FWP, 2001, 2005). Comparable bighorn AHM consists of:

1) Objectives for numbers of bighorn sheep and counted sex/age ratios in the populations.
2) A strong monitoring program (post-season aerial surveys) to measure total numbers of bighorn sheep counted and sex/age ratios in the populations
3) Sets of hunting regulation alternatives to implement when bighorn sheep are at Standard Package, Liberal Package (above), or Restrictive Package (below) objectives.

FWP then monitors results of the implementation of regulation alternatives to determine if objectives are being achieved. If monitoring indicates that regulation packages are not achieving objectives, the AHM process will be flexible enough to permit design and implementation of new regulation packages. The AHM process also affords the opportunity to use multiple competing models of population dynamics, which can be used along with monitoring data to provide insight into the population dynamics of bighorn sheep, such that the prescriptive abilities improve over time as learning occurs. The Conservation Strategy will therefore evolve, and as objectives can change, learning from the AHM process occurs.

At this stage of implementation, the AHM process for bighorn sheep management assumes only a single additive mortality/density independent reproduction population model that is used to predict the effects of regulation alternatives on bighorn sheep populations relative to objectives. AHM is a dynamic, learn-as-you-go process. There will be a need to adjust population objectives, monitoring parameters and guidelines, population models, and hunting regulation packages as results of the initial efforts are determined through monitoring. Therefore, the public should realize that the Conservation Strategy is not set in stone, but will evolve as learning takes place through the AHM process. Further, although the Conservation Strategy will serve as a source of information and guidance to the FWP Commission, it does not preempt Commission authority to formulate annual rules, set hunting seasons and regulations, or implement emergency actions in response to unexpected events or circumstances.

Population Management Through Ewe Harvest

Population objectives for individual populations have been developed by local biologists based on a number of factors including:

1) The ability of the habitat to support a given number of bighorn sheep (particularly winter range).
2) Amount, type, and distribution of other grazing animals (both native and domestic).
3) Public access to bighorn sheep and the habitat they use, which influences the ability to manage numbers through hunting and translocation.
4) Populations are managed below what is considered carrying capacity to keep densities down in an attempt to reduce the potential for disease outbreaks.

The ability to manage for these objectives varies depending on the current status of the overall population and thus the different season packages or prescriptions for some populations. In 1995, the U.S. Fish and Wildlife Service (USFWS) began using AHM concepts in managing waterfowl. Subsequently, in 1997, a specific strategy was developed using AHM for northern pintails (*Anas acuta*) and is still in use today. The goal of the strategy, which is pertinent to managing bighorn sheep, is to maintain harvest opportunity consistent with current population status while reducing acrimony about annual regulation setting by basing it on objective biological criteria (USFWS 2007).

FWP used some of the basic concepts in the pintail strategy to develop the basic population model for managing bighorn sheep populations, particularly the female segment. The model is described by the following equation, and its application is also explained below:

Ewe Harvest Model

The predicted ewe population (E_{t+1}) in year t + 1 is calculated as:

$$E_{t+1} = \{[E_t + (L * 0.5)] * 0.95\} * (1 - HR)$$

where:

E_t = number of ewes at time of survey

L = number of lambs at time of survey

L * 0.5 = number of female lambs at time of survey

0.95 = annual survival rate (Jorgenson et al. 1993, 1997) (In this model it is assumed to be equal for lambs and adult females)
HR = harvest rate (Harvest rate varies depending on population status)

In this model $\{[E_t + (L * 0.5)] * 0.95\}$ is the number of ewes entering the fall hunting season and (1 – HR) is the survival rate during the hunting season. The utility of the model is to calculate the number of licenses to issue to achieve a desired ewe population level the following year. This is accomplished by varying the harvest rate based on the status of the other elements in the model.

HR is calculated by:

$$HR = \frac{TH}{\{[E_t + (L * 0.5)] * 0.95\}}$$

where:

TH is total harvest = number of licenses issued multiplied by the management success (MS). Management success varies depending on hunting district; a recent 5-year average specific to that district would be used in the model and is the number of animals harvested divided by the number of licenses issued.

therefore:

$$HR = \frac{Issued * MS}{\{[E_t + (L. * 0.5)] * 0.95\}}$$

and:

$$E_{t+1} = \{[E_t + (L * 0.5)] * 0.95\} * \left\{1 - \left\{\frac{Issued * MS}{[E_t + (L. * 0.5)] * 0.95}\right\}\right\} \quad (1)$$

For a stable population, where $E_t+1 = E_t$ and solving for the number of licenses to issue:

$$Issued = \frac{0.95(L * 0.5) - 0.05\ E_t}{MS}$$

For an increasing population where the number of ewes is greater than objective, the specific values for E_t+1 and E_t are entered into equation (1) above and (Issued) is solved for, providing the number of licenses to issue to achieve the objective number of ewes.

This equation can be used to predict the number of ewe licenses to recommend depending on current status of the population. By knowing the number of ewes entering the fall hunting season, the number of ewes that need to be harvested can be calculated to achieve objectives of increasing, stabilizing, or reducing the size of the ewe segment in the population. The number of licenses issued is the variable that is adjusted to achieve that objective, which is tied to the number of ewes harvested via the management success rate.

An example of how this process is applied to a population is contained in Table 3.

Additionally, for some larger populations there can be a fourth prescription where ewe harvest and translocation are both utilized to meet objectives.

Ram Harvest Characteristics

Other than for smaller populations of bighorn sheep, where a very limited number of licenses are issued, harvest of rams is based primarily on three criteria. Those criteria consist of where the population stands in relation to overall objectives, the ram: ewe ratio, and the number or percent of rams greater than or equal to ¾-curl in the ram segment, or in some populations, the average age of rams in the harvest (Table 4). Again, these parameters vary, primarily by habitat or ecological region. In the management plans for individual populations in Chapter 2, many of the populations where a significant number of rams are harvested annually have objectives for rams that include an overall ram: ewe ratio and an average age of harvested rams. Because bighorn rams in Montana are largely managed as a trophy animal, with an average age of 6 to 7 years old, the ram: ewe ratio is based, in part, on the total number of rams it takes to produce a given number of rams that are at least ¾-curl in the harvest. The average age of rams in the harvest is based on the ability of an area or population to produce and sustain that age criteria at a given harvest rate. To recruit a relatively large number of rams into the age class depicted in objectives, it takes 40 to 60 rams: 100 ewes, depending on the area. In more productive populations or in habitats where horn growth is more rapid, rams produce horns that most hunters would consider trophy status at a younger age. For example, rams in the Missouri River Breaks (Hunting Districts 482, 622, and 680) might achieve a ¾-curl by age 3½. In comparison, a ram from the Rocky Mountain Front might not reach ¾-curl status until 5½ years of age. To achieve a similar harvest level of mature rams, or rams that meet objectives, in the Breaks situation, a lower ram: ewe ratio would be required as well as a lower average age of rams in the harvest than in the Front example.

In larger, more productive populations, ram harvest can contribute to overall population management. In such populations, the number of rams harvested can be combined with ewe harvest to determine the status in relation to population demographics.

The number of licenses issued for rams is based, in part, on harvest rates established over

MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	± 10% of 250	Between 30-40	Limited Entry Ewes	Up to 15% of Ewes
Restrictive Regulation	More than 10% below 250	Less than 30	Fewer than 5 ewe licenses	Less than 5% of ewes
Liberal Regulation	Greater than 10% above 250	Greater than 40	Limited Entry Ewes or translocation if > 25 sheep including rams are available	Up to 20% of Ewes

Table 3. Summary of regulation types under different population criteria for ewe harvest and population management.

MOUNTAIN-FOOTHILLS	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of Rams with ≥ ¾-curl
Stanard Regulation	Up to 15% of the ¾-curl rams	± 10% of 250	40-60:100	≥ 30
Restrictive Regulation	Up to 10% of the ¾-curl rams	More than 10% below 250	< 40:100	< 30
Liberal Regulation	Up to 20 % of the ¾-curl rams	Greater than 10% above 250	> 60:100	≥ 30

Table 4. Summary of potential ram harvest under different population parameters and criteria.

time that achieve the objective of producing trophy status animals. In the Conservation Strategy, these harvest rates are reflected through the AHM process by different season packages specific to population objectives. In most ecological regions, the number of greater than ¾-curl rams can be determined during annual surveys. The number of greater than ¾-curl rams is one of the key variables used in recommending license levels for rams. However, in the Northwest Montane Ecological Zone, which is characterized by heavily timbered bighorn sheep habitat, it is difficult to observe rams and accurately classify them. In this case, the average age of rams and horn size in the harvest, monitored over time in conjunction with aerial survey data, is used in formulating recommendations for license levels on rams.

Criteria for Reopening Hunting in Populations Having Gone Through Major Declines

Several bighorn sheep populations in Montana have gone through major declines as a result of die-offs. In 2009, there are currently four hunting districts that are closed to hunting as a result of die-offs or declines. Bighorn sheep populations are often slow to recover following die-offs but over time several populations in Montana have gone through these types of declines and recovered sufficiently to reopen hunting. The question arises, at what stage of recovery is hunting reinstituted? Criteria have been developed and are being used in two such populations (Hunting Districts 340 and 380) and a third (Hunting District 381), which is in a declining stage and may have to be closed. These criteria are included in the management plans for those districts in Chapter 2 and reflect a recovering population that can sustain a minimal harvest. Hunting of bighorn sheep in these hunting districts will be recommended when at least three of the following four criteria have been met for a minimum of three successive years:

1) The population is at least 75 observable sheep,
2) There are at least 30 rams: 100 ewes,

3) More than 30% of the rams are at least ¾-curl, and

4) There are at least 30 lambs: 100 ewes.

Monitoring of these sheep will continue at a level sufficient to determine if these criteria are being met. If so, license levels for rams will be based, in part, on the number of ¾-curl rams observed during surveys. While these criteria may not be appropriate in every situation, similar criteria should be developed for each population that has gone through a major decline resulting in closure of the district to hunting.

Other Opportunities

Two additional harvest opportunities exist that could contribute to population management efforts. The first is the opportunity to harvest rams of ½-curl or less. Montana initiated a ½-curl or less regulation in 1984 but used it in only two hunting districts as a population control measure (McCarthy 1986). Typically, rams ½-curl or less are three years old or younger. McCarthy (1986) further stated that younger rams might be removed from a population without affecting the future number of larger animals, as long as removal rates are compensatory for, and not additive to, natural mortality. Jorgenson et al. (1997) found annual mortality rates for two- to three-year-old males at two study areas ranged around 8-13%. Some populations have almost an equal number of rams and ewes, and the number of ½-curl or less rams can make up a significant number of the total ram population. Therefore, harvest under this regulation could contribute moderately to population management. Additionally, younger rams tend to wander and have the greatest potential for mixing with domestic animals. Limited harvest of young rams may reduce the risk of the mixing of wild sheep and domestic livestock.

Another harvest opportunity, which would be a new concept and need FWP Commission approval, is to allow the holders of either-sex licenses for hunting districts that are over population objectives to purchase an additional license to allow them to harvest an ewe. The idea is that to many holders of an either-sex license, which for most people will be their only opportunity to harvest a bighorn in Montana, it would be of interest to them to harvest a ewe along with a ram. This would be another way to increase ewe harvest where needed.

The opportunity to combine aspects of the current unlimited season structure with aspects of a limited-entry structure in certain areas is a hunting season concept in need of consideration and discussion. Montana is the only state that currently offers unlimited hunting in some areas. Historically, districts that offered some unlimited hunting opportunities provided a tremendous amount of hunter opportunity and at times contributed significantly to statewide harvest. Most of Montana's bighorn sheep populations would not be able to sustain an unlimited season structure, primarily because of ease of access, which could result in excessive harvest of the ram segment. However, FWP needs to explore situations, innovative season structures, and other possibilities for improving hunter access to harvest bighorn sheep in Montana.

Metapopulations – Positive and Negative Aspects

The concept of using a metapopulation approach to ensure the sustainability of bighorn sheep has in recent years become popular among conservation biologists and wildlife management agencies. A metapopulation is a set of populations distributed over a number of patches that are connected, to varying degrees, by dispersal (Hess 1996). A patch in relation to a bighorn sheep metapopulation would be a defined portion of the landscape that contains all the elements (food, cover, and water) that support a subpopulation of the metapopulation. The functionality of a metapopulation is determined by population dynamics and population movements. Corridors are the mechanism providing interchange among populations. The objectives of metapopulation management include:

1) Minimizing extinction rates of species threatened by habitat loss and fragmentation.

2) Distributing members of a species among several geographically disjointed areas of suitable habitat to provide protection against extinction caused by a single catastrophic event.

3) Providing movement to recolonize areas in which a population has gone extinct (Hess 1996).

Bailey (1992) points out the need for developing long-range plans to maintain or enhance bighorn sheep herds and metapopulations. Risenhoover et al. (1988) indicated that as a first step in maintaining or reestablishing traditional movement patterns of bighorn sheep, seasonal ranges and migration corridors should be identified.

Once identified, specific projects to maintain or create interconnections among populations can be implemented (Bailey 1992). In a review of studies on corridors, Beier and Noss (1998) cited several studies offering evidence that population viability is improved in habitats connected by corridors.

Metapopulations – Positive Aspects

Some of the benefits of a viable metapopulation are maintaining or increasing genetic variation, which increases the fitness of the individual as well as the population (Lacy 1997). Further, lower genetic variation depresses individual fitness, resistance to disease and parasites, and flexibility in coping with environmental challenges. Fitzsimmons and Buskirk (1992) suggested that corridors providing for connectivity, dispersal, and gene flow among populations can offset habitat fragmentation and herd isolation, thereby providing for genetic variability and population viability. Generally, metapopulations have a larger population size than isolated populations of bighorn sheep, and metapopulations also have a larger patch size. Singer et al. (2001), in analyzing 24 translocated populations of bighorn sheep, found that population size and patch size played a significant role in the ability of a population to recover rapidly from an epizootic event.

In a program to restore bighorn sheep populations in and near several western national parks, Singer et al. (2000) attempted to establish metapopulations. This approach was thought to produce populations that would be less vulnerable to extirpation than small, isolated populations due to demographic or stochastic events or contact with domestic sheep. Also, metapopulations would be less susceptible to rapid losses of genetic heterozygosity, inbreeding depression, or genetic drift associated with small population sizes and insularity.

To simulate the process of genetic flow created by a metapopulation, wild sheep managers have augmented isolated populations with a few sheep from other populations. Hess (1996) stated that it is not clear that moving individuals among populations to increase genetic diversity will provide protection against exotic diseases introduced into naïve populations. However, Hogg et al. (2006) were able to demonstrate that, due to augmentation of an isolated bighorn sheep population with a few individuals from an outbred population, there was marked improvement in reproduction, survival, and other fitness-related traits.

Metapopulations – Negative Aspects

While maintaining connectivity among subpopulations can have positive benefits, there is some evidence that increased contact increases the prevalence, incidence and rate of disease spread in the overall population, and increased contact can enable a disease to persist within the metapopulation (Hess 1996). Corridors connecting subpopulations can act as conduits for contagious diseases, domestic animals, and predators (Simberloff and Cox 1987). Cassirer and Sinclair (2006) described a situation in a Hell's Canyon bighorn sheep metapopulation where chronic although sporadic pneumonia-caused mortality was the primary factor limiting population growth during their six-year study. Similarly, a pneumonia epizootic in Colorado in a bighorn metapopulation beginning in 1997 reduced survival and recruitment, primarily of lambs, decreasing the population in the winter of 2006-07 to about half of that estimated prior to the epidemic (George et al. 2008).

Onderka and Wishart (1984) describe a pneumonia epizootic in bighorn sheep originating in southern British Columbia and caused by contact with domestic sheep. The epizootic began in December of 1981, by the fall of 1982, the epidemic had moved east across the Continental Divide into southern Alberta (Waterton Lakes National Park), and by early winter 1983 had moved into Glacier National Park. This same epizootic is suspected of moving farther south into populations in Montana along the Rocky Mountain Front and Sun River during the winter of 1983-84 (Andryk and Irby 1986). Through the analysis of mtDNA from bighorn sheep in several western states and provinces, including the aforementioned, Luikart and Allendorf (1996) demonstrated the likelihood of gene flow having occurred on a regional scale at some time in the past. This type of connectivity, as illustrated by disease transmission over long distances, may have been common prior to human-caused habitat fragmentation, which has made such movements more difficult. While this example of movement of animals among bighorn sheep populations probably represents an extreme in recent times, the end result is likely less potential for genetic exchange between populations but rather an increased risk of disease transmission.

Metapopulations in Montana – Current Situation

Montana is fortunate to have large blocks of bighorn sheep habitat supporting approximately five separate metapopulations. Each of the five ecological regions (see Habitat Monitoring and Management) sustains at least one metapopulation. While there is known or in some cases suspected interchange between

populations within these metapopulations, the degree of interchange and subsequent effect on genetic structure is largely unknown. These metapopulations generally consist of indigenous populations that persisted through the major declines that occurred around the turn of the 19th century. Perpetuation of these populations has been largely due to the separation of wild sheep and domestic sheep and goats and the reduction in potential for disease transmission associated with contact between these species. Some metapopulations in Montana occur in largely unfragmented habitats, and from that perspective are relatively easy to manage. Other metapopulations, however, are faced with increasingly fragmented habitats, and connectivity of subpopulations includes movements across major highway systems and increasing human development in movement corridors.

As part of this Conservation Strategy, a Translocation Program has been developed which includes a Habitat Evaluation Procedure (HEP) and criteria for selecting new transplant sites. Realizing the potential value of establishing metapopulations, preference would be given to sites with the potential for interchange with existing populations, provided that separation criteria with domestic animals is met. A facet of the HEP is to look at the proximity of potential transplant population distribution in relation to existing domestic sheep and goat distribution. As part of the HEP, a Geographic Information System (GIS) analysis identifying bighorn sheep habitat is being conducted. That analysis includes the mapping of the current distribution of domestic sheep grazing allotments on public lands (Figure 10). A preliminary examination of that distribution reveals that, although there is suitable unoccupied habitat, the proximity of domestic sheep to potential bighorn sheep habitat, and the potential for contact with domestic sheep based on minimum distance between the species, may preclude translocating wild sheep in some areas. This situation is compounded by the lack of knowledge of domestic sheep and goat distribution on private lands, which can further restrict the ability to establish bighorn sheep populations in some areas.

The HEP as described in the Translocation section of this document will be an ongoing analysis and will undoubtedly identify some potential transplant sites. While connecting existing populations with new populations established through translocation is desirable to improve genetic flow, this should not occur if the potential for disease transmission exists because contact with domestic animals is a possibility. We agree with Bleich et al. (1996) that the protection of the integrity and health of existing populations and metapopulations has to be the first priority in management of bighorn sheep as opposed to creating new metapopulations. Bleich et al. (1996) also concluded that demographic (recruitment and mortality) processes are more important than genetics in the long-term persistence of populations within metapopulations.

In isolated populations where metapopulations can't be established and genetic variation is suspected in affecting population viability, it may be desirable and less expensive to move individuals manually than to try to establish linkages among populations (Simberloff and Cox 1987). Hogg et al. (2006) demonstrated that augmentation can improve the fitness of a population in a relatively short time period. Ramey et al. (2000) listed five issues that need to be addressed when considering augmenting such populations, including whether a severe genetic bottleneck actually exists and how the sex and age of an augmentation should be structured.

There is a lack of knowledge regarding certain aspects of bighorn sheep metapopulations in Montana, and there is a need to focus research efforts to ensure their long-term maintenance. Movement studies were conducted in some metapopulations, which provided seasonal movement patterns including use of corridors, but largely this information is lacking. We need to know more regarding seasonal movements, dispersal patterns, habitat connectivity, and characteristics of corridors important to making and keeping existing metapopulations functional. Finally, as Hilty et al. (2006) suggested, we need to identify and protect corridors that provide connectivity among bighorn sheep populations before habitats are fragmented, rather than trying to restore corridors after fragmentation.

HEALTH MONITORING AND MANAGEMENT

Introduction

Rocky Mountain bighorn sheep, *Ovis canadensis canadensis*, are susceptible to many diseases and parasites. While most diseases and parasites do not cause severe morbidity or mortality by themselves, in combination they can result in reduced reproductive potential and death. Much research has been conducted regarding disease issues in bighorn sheep, particularly respiratory disease, or pneumonia. The decline of bighorn sheep in the late 1800s is thought to have occurred largely because of the introduction of domestic sheep (Buechner 1960). Domestic sheep are host to pathogens for which bighorn sheep have little or no immunity. Transmission of disease agents from domestic animals to bighorn sheep is not entirely understood; however, it is widely recognized by those who deal with animal health (wild and domestic) that when domestic sheep and wild sheep intermingle, wild sheep can die in significant numbers (Martin et al. 1996).

In January 2007, the Western Association of Fish and Wildlife Agencies (WAFWA), comprised of 23 state and provincial wildlife agencies from the western United States and western Canada, established a Wild Sheep Working Group (WSWG). The WSWG was charged with developing a comprehensive, west-wide assessment of all facets of wild sheep management, from the desert Southwest to the far north. The first task undertaken by the WSWG was to develop a framework of recommendations for state, federal, and provincial agencies to use when developing management guidelines for dealing with potential contact or interaction between wild sheep and domestic sheep and goats. Recognizing the diversity and complexity of applying such guidelines across the wide variety of habitats and jurisdictions represented within WAFWA was critical. The members of this initial WSWG were specifically selected based on their familiarity with and knowledge of this issue and represented a diverse mix of wildlife veterinarians, wild sheep managers, and agency wildlife program leaders from the United States and Canada. While not official members of WAFWA, the U.S. Forest Service (USFS) and the Bureau of Land Management (BLM), because of the role these agencies have in managing wildlife habitats, became adhoc members on the WSWG.

Through an exhaustive literature review, an extensive body of scientific literature on the effects of disease on bighorn populations was accumulated. The literature includes: 1) numerous examples of bighorn die-offs due to disease, 2) documentation of bighorn die-offs occurring as early as the mid-1800s and in every state in the western United States, 3) information linking bighorn die-offs to known or suspected contact with domestic sheep, 4) experimental studies where clinically healthy bighorn sheep have developed pneumonia and died within days to weeks following contact with clinically healthy domestic sheep, 5) identification of a variety of diseases and pathogens implicated in die-offs, particularly bacterial pneumonia (Pasteurellosis)

caused by *Mannheimia haemolytica* (formerly *Pasteurella haemolytica*) or other species of closely related *Pasteurella* bacteria, 6) a wealth of information suggesting consensus among wildlife biologists and veterinarians experienced in bighorn sheep management that domestic sheep and goats and bighorn sheep must be kept separated in order to maintain healthy bighorn populations (Foreyt and Jessup 1982; Goodson 1982; Onderka and Wishart 1988; Foreyt 1989; Desert Bighorn Council Technical Staff 1990; Callan et al. 1991; Cassirer et al. 1996; Martin et al. 1996; USDI Bureau of Land Management 1998; Bunch et al. 1999; Singer et al. 2000a, 2000b, 2000c, 2000d; Monello et al. 2001; Singer et al. 2001; Dubay et al. 2002; Garde et al. 2005).

The WSWG concluded that there is a preponderance of evidence that indicates significant risk exists for disease transmission from domestic sheep and goats to wild sheep. In some cases where contact occurred, consequences to wild sheep have endangered entire populations. Consequently, the WSWG recommended that wild sheep managers take appropriate steps to minimize, mitigate, or eliminate the opportunities for disease transmission through commingling of wild sheep with domestic sheep and goats.

The report and subsequent recommendations produced by the WSWG titled "Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat", was transmitted to WAFWA directors on June 21, 2007, and was unanimously endorsed by the directors on July 12, 2007. This report can be accessed currently at the WAFWA website (http://www.wafwa.org/html/wswg.shtml). The president of WAFWA, Jeffery R. Vonk, forwarded the report to federal land management agencies on August 31, 2007, recommending that the report and the recommendations included therein be used as the basis for creation or revision of policy-level direction in the federal agencies. This report is the basis for much of the content and many of the recommendations made in this section.

Extensive research has been conducted in an effort to understand the mechanisms involved in disease transmission from domestic animals to bighorn sheep. A number of penned experiments have been conducted where domestic sheep were placed in contact with bighorn sheep (Foreyt 1989, 1990, 1994; Onderka and Wishart 1988). In most experiments all bighorn sheep subsequently died of respiratory disease (pneumonia). Other experiments included mixing bighorn sheep with elk, white-tailed deer, and mule deer; elk alone; domestic goats; mountain goats; llamas; cattle; horses; and steers (Foreyt 1992a, 1994; Foreyt and Lagerquist 1996) . In these experiments only two of 39 bighorn sheep died. Other research included the inoculation of *Mannhemia haemolytica* cultures, which is the strain of bacteria most often implicated in pneumonia in bighorn sheep, from domestic sheep into bighorn sheep (Foreyt et al. 1994; Foreyt and Silflow 1996; Onderka et al. 1988). Of the 13 bighorn sheep inoculated with these bacteria, 12 died of acute bronchopneumonia.

Other strains of bacteria, specifically *Pasteurella multocida* and *Bibersteinia trehalsoi*, have been identified as the pathogenic agent in other bighorn sheep die-offs. Coburn (2005) provides a good contemporary discussion of diseases in bighorn sheep and how stress may contribute in outbreaks of disease in bighorn populations.

While the exact mechanism for the transmission and subsequent manifestation of pathogenic agents from domestic sheep to bighorn sheep isn't known, research is currently being conducted that implicates another bacteria, *Mycoplasma ovipneumoniae*, as potentially having a role in disease transmission between the species.

Bighorn sheep populations in Montana are generally robust and reproductive. However, disease-related issues have affected lamb recruitment and population vitality. Reduced lamb production and recruitment for two or more years is a common complication following pneumonia die-offs (Onderka and Wishart 1984; Coggins and Mathews 1992; Ryder et al. 1994; Aune et al. 1998).

Occasionally, large-scale die-offs have occurred, essentially reducing populations to a few individuals (Aune et al. 1998; Semmen 1996; Coggins and Mathews 1992; Onderka and Wishart 1984). Major population declines due to epizootic events are still a periodic challenge to maintaining bighorn sheep populations. Since 1984, there have been significant die-offs in 14 bighorn populations in Montana.

The preponderance of information on bighorn sheep disease issues suggests that contact between domestic sheep and goats and bighorn sheep should be avoided and that major disease events are more likely to occur in bighorn sheep herds where contact with domestics has occurred. In response to this information, FWP has tried to establish a buffer zone of up to nine miles between domestic sheep and goats and bighorn sheep populations (USDI 1998). This strategy has not successfully eliminated contact between the species, and mortality events have still occurred. However, there are bighorn sheep herds in areas where potential contact with domestic sheep or goats

could occur that have not suffered major die-offs. The association of bighorns and domestic sheep and goats does not result in disease with every contact, but continued or even periodic contact likely increases the risk that a major disease event will eventually occur. In general, maintaining separation of wild and domestic animals is considered an important aspect in reducing the potential for disease transmission between domestic herds and wildlife populations.

Although Montana generally attempts to lethally remove bighorn sheep known to have had contact with domestic sheep and goats, only one of seven administrative regions has such a written protocol. The intent of this removal is to reduce the potential of pathogen transfer from domestics to bighorns. Sick bighorns are generally removed from populations for disease testing purposes and to reduce the likelihood of pathogen transmission from the sick individual(s) to the remaining herd. Attempts have been made to treat animals during and after die-offs to increase survival. While there has been limited success with field treatment of bighorns during pneumonia outbreaks through application of antibiotics, treatment is often difficult to accomplish (Coggins and Matthews 1998). Administration of an adequate dosage of antibiotics to large numbers of free-ranging animals is extremely difficult and expensive. Additionally, treatment of bighorns through application of anthelmintics or vaccines after the die-off event, with the objective of improving lamb survival, has generally not been effective (Aune et al. 1998; Miller et al. 2000; Cassirer et al. 2001). Treatment attempts that result in partial or incomplete control of targeted pathogens could result in resistant strains. Prophylactic treatment should only be attempted after careful consideration of the likelihood of success and all of the consequences of the program, both intended and unintended.

Herd health monitoring efforts have historically been limited to opportunistic tissue and sample collections during bighorn sheep capture events, and tissue collection when sick animals are removed from populations or when bighorns coming in contact with domestic livestock have been killed. Additional health monitoring has occurred through occasional collections of fecal samples in attempts to determine parasite loads. Although these monitoring efforts have supplied important information on the presence of pathogens and overall population health, currently there is no systematic health-monitoring or disease management program in place for Montana bighorn sheep populations.

There are many challenges in assessing and managing the health of bighorn sheep. This section of the Conservation Strategy provides a description of some of the major diseases and parasites that FWP tests for and that potentially compromise bighorn sheep health. In the next section, the proposed "Bighorn Sheep Herd Health Program" is outlined which will provide direction for monitoring the health of our bighorn sheep herds but remain flexible enough to incorporate new methods and technologies as they are developed. As part of FWP's overall bighorn sheep health management and to provide consistency across the state, we have developed a statewide written protocol for resolving situations where bighorn sheep and domestic sheep and goats commingle. One of the major issues surfacing in relation to bighorn sheep health is the use of domestic sheep and goats for noxious weed control in the vicinity of bighorn sheep. FWP has developed recommendations to land managing agencies and others using this management technique. In spite of the best efforts to promote bighorn sheep health, now and in the future, history indicates that catastrophic die-offs will likely occur again sometime in the future. As part of FWP's bighorn sheep health program, a protocol has been developed outlining how to respond to these events.

Diseases and Parasites of Rocky Mountain Bighorn Sheep

Montana FWP routinely collects health status data during bighorn sheep translocation efforts and in the advent of a die-off (Appendix F). This disease and parasite data falls into three categories: bacterial diseases, viral diseases and parasites (protozoa and nematodes). The particular diseases and parasites tested for and a brief description of their significance as a health threat to bighorn sheep follows. Many diseases that bighorn sheep are susceptible to have their origin in domestic livestock. The effect on bighorn sheep for many of these diseases is not fully documented and is inferred from studies done on domestic animals.

During the latter stages of producing this conservation strategy WAFWA and their associated Wildlife Health Committee (WHC) produced a report titled "Wild Sheep Herd Health Monitoring Recommendations". These recommendations can be accessed currently at the WAFWA web site (http://www.wafwa.org/html/wswg.shtml). The WHC recommendations reflect much that is contained in this Health Monitoring and Management section and is complimentary to the content herein. FWP

currently utilizes recommendations produced by the WHC such as in the proper collection of bacterial samples from bighorn sheep.

Bacterial Diseases

1) *Brucella abortus* – *Brucella abortus* is found primarily in cattle, elk, and bison and can cause abortion, birth of nonviable offspring, and infertility (Thorne et al. 1982). Tests for the presence of *B. abortus* in bighorn sheep in Montana have been negative. In a small group of bighorns confined adjacent to a group of confined elk in Wyoming, Kreeger et al. (2004) reported contraction of *B. abortus* by bighorn sheep from contact with an aborted elk fetus. Brucellosis is a zoonotic disease.
2) *Brucella ovis* – *Brucella ovis* occurs in domestic sheep and wild sheep. Bighorn sheep in Idaho and California have tested positive for *B. ovis* (Dubay et al. 2002). The significance of *B. ovis* to bighorn sheep is not known at this time.
3) Anaplasmosis – Anaplasmosis is a vector (tick, biting flies) rickettsial infection-causing anemia in cattle and wildlife (Thorne et al. 1982). Anaplasmosis can be severe in cattle but produces only a mild disease in wildlife. Wildlife may be a minor carrier of the disease.
4) Leptospirosis – Eight species of Leptospirosis are tested for in Montana. Leptospirosis is a contagious disease with clinical signs including fever, jaundice, loss of appetite, abnormally colored urine, and abortion. Animals usually recover from the disease but can carry and shed bacteria after clinical signs cease. Leptospirosis is a widespread zoonotic disease with uncertain status for bighorn sheep but seems to pose a minor health risk (Dubay et al. 2002).
5) *Haemophilus somnus* – Organisms of this genus are normal and sometimes pathogenic inhabitants of the upper respiratory tract of humans and animals. *Haemophilus ovis* has been associated with one outbreak of bronchopneumonia in domestic sheep (Thorne et al. 1982).
6) Infectious Keratoconjunjunctivitis (IKC) – IKC is not routinely tested for but has been a serious disease of bighorn sheep in Montana and other parts of the West. This disease is characterized by ocular irritation, corneal opacity, ulceration, and blindness. *Chlamydia* spp., *Mycoplasma* spp., *Branhamella* spp., and *Moraxella* spp. have been implicated as the causative agents of this disease in bighorn sheep. An outbreak of IKC in Yellowstone National Park in 1981 resulted in mortality of approximately 60% of 500 bighorns (Meagher 1982). It was also detected in the Bitteroot in 1991. Bighorn sheep in the Silver Bell Mountains in Arizona contracted IKC and Contagious Ecthyma from domestic goats in 2003 (Jansen et al. 2007). Thirty-nine percent of the population during the epizootic went blind with 50% of those recovering sight and 50% dying. Those that regained eyesight were blind for an average of 44 days. Primary cause of death in affected animals was predation (lions) and secondarily, starvation.
7) Bacteria of the genus *Mannheimia, Pasturella, Bibersteinia* and *Micoplasma* are tested for according to the WAFWA/WHC protocols during trapping of bighorns for transplant or during a die-off event. Some species of these bacteria are endemic to bighorn sheep and occur as normal bacterial flora of the upper respiratory tract (Thorne et al, 1982). Different species of the above genera are typically implicated and identified during pneumonia outbreaks in bighorn sheep. The exact mechanisms manifesting virulence in these bacteria is not fully understood at this time.

Viral Diseases

1) Blue Tongue (BTV) and Epizootic Hemorrhagic Disease (EHD) – These two closely related diseases can impact many free-ranging and domestic ungulates. Viruses are transmitted by biting midges, and affected animals can die acutely or demonstrate increased respiration rates, weakness, diarrhea, and hemorrhages in most organs (Thorne et al. 1982). In Montana these viruses occur mostly in the central and eastern portions of the state and have caused major die-off events, primarily among deer.
2) Infectious Bovine Rhinotracheitis (IBR) – IBR belongs to the herpes virus group and causes respiratory disease in cattle. IBR is widespread but has not been implicated in bighorn sheep epizootics and appears to pose little risk to bighorn sheep (Dubay et al. 2002).
3) Bovine Viral Diarrhea (BVD) – BVD is a common disease in cattle with

clinical signs including fever, depression, alimentary tract erosions, dehydration, diarrhea, weak neonates and abortion (Dubay et al. 2002). Sero-prevalence for BVD was found in four of nine bighorn sheep populations tested in Montana during the period 1990-1997 and in two of four populations during epizootics during the same time period (Aune et al. 1998). The significance of the presence of BVD in bighorn sheep epizootic events is unknown at this time (Dubay et al. 2002).

4) Para Influenza 3 (PI3) – PI3 is common to domestic sheep and cattle but considered to be of low pathogenicity. Sero-prevalence in Montana bighorn sheep is common and has been isolated in pneumonic cases. However, it is not known if the virus served as a primary pathogen or occurred secondarily to other pathogens. PI3 infection alone is considered a minor disease of free-ranging wildlife (Dubay et al. 2002).

5) Bovine Respiratory Syncytial Virus (BRSV) – BRSV is a respiratory virus that has occasionally been associated with pneumonia complex in bighorn sheep. Whether the virus served as a primary pathogen in pneumonia or as a secondary infection is not known. The detection of BRSV in serologic surveys does not signal impending problems, but BRSV should be monitored and considered suspect should changes in herd health be observed. Six of nine herds tested in Montana showed serologic prevalence for BRSV (Aune et al. 1998).

6) Contagious Ecthyma (CE) – Also known as soremouth or orf, CE is caused by a parapoxvirus and results in painful lesions and scabs around the mouth, face, and teats of ewes (Jessup 1985). While CE is not routinely tested for in Montana, it was detected in the Missouri River Breaks in 1998 and 2003, Sun River in 2002, and the Bitteroot in 2002. The CE virus may remain viable in scabs or soil for up to 22 years (Jessup and Boyce 1993). CE is transmissible to humans, and care needs to be exercised when handling affected animals. Lambs may be more seriously affected as sores on the muzzle make nursing painful (Dubay et al. 2002), or affected ewes may reject suckling lambs because of painful teats (Jessup and Boyce 1993). Malnutrition of the lamb results in either case.

7) Ovine Progressive Pneumonia (OPP) – OPP is caused by a slow-growing retrovirus and can be highly fatal to domestic sheep. Extensive testing of free-ranging bighorn sheep throughout the western United States has not detected antibodies for OPP (Jessup and Boyce 1993).

Ectoparasites

1) Scabies – Scabies is caused by a parasitic mite (*Psoroptes* spp.) infection of the skin, especially of the ears, head, and neck, and was a major cause of bighorn sheep decline throughout their range, including Montana, in the latter half of the 19th century (Couey 1950; Buechner 1960). Severely infected animals may have significantly impaired hearing, making them vulnerable to predation. While Scabies is still a bighorn sheep health issue in parts of the West, it is rare in Montana, with the only recent occurrence in 1999 at the East Fork of the Bitteroot River.

Internal Parasites

Typical monitoring of internal parasites in the past has consisted of analysis of fecal samples collected during translocation of bighorn sheep. Samples are analyzed to determine relative levels of larvae and protozoa and particular species of both parasites in the feces. In addition, three studies were conducted in Montana that analyzed fecal samples along with total worm counts in internal organs (Worley and Seesee 1992; Hoar et al. 1996; Aune et al. 1998; Enk 1999). Worley and Seesee (1992) investigated by postmortem examination 68 bighorn sheep from 11 different populations over an 18-year period. A total of 10 species of nematodes, two species of cestodes (tapeworms), and four species of coccidian (protozoa) were identified. The other two studies looked for the above-mentioned parasites plus the presence and abundance of lungworms, identifying two species. All three studies found a similar number of nematode, cestode, and coccidian species.

Lungworm has often been implicated as a contributing factor in epizootic pneumonic events. However, Aune et al. (1998) looked at *Protostronylus* spp. larval counts in four bighorn sheep populations that suffered die-offs, finding that counts varied from high to low and one population had no lungworms. Festa-Bianchet (1988), in analyzing a pneumonia epizootic in Alberta, concluded that monitoring fecal counts of lungworm larvae was not a reliable way to predict pneumonia epizootics.

The two most common species of gastrointestinal parasites found in bighorn sheep in Montana in the three previously mentioned studies were *Marshallagia marshalli* and *Nematodirus* spp. *M. marshalli* is found in the abomasums (fourth stomach) and causes damage to the mucosa of the stomach, decreasing the assimilation of nutrients, and results in the loss of appetite and slow weight gain (Thorne et al. 1982). *Nematodirus* spp. occurs in the small intestine. Worms penetrate the intestinal mucosa causing considerable destruction that results in a decrease in the absorption of nutrients and other complications (Thorne et al. 1982). When found in large numbers in domestic sheep, *Nematodirus* spp. infestations result in diarrhea, weakness, and weight loss.

Worley and Seesee (1992) identified four species of coccidian in three different bighorn sheep populations in Montana. All species were in the genus *Emeria* with *Emeria crandallis* being the predominanat species. Aune et al. (1998) identified six species of *Emeria* in the Upper Rock Creek herd. Clinical signs of *Emeria* infection include diarrhea, electrolyte imbalances, and damage to the intestinal lining (Worley and Seesee 1992). Severely ill domestic sheep generally have concurrent respiratory or other infections in conjunction with *Emeria* infection (Thorne et al. 1982).

Proposed Bighorn Sheep Herd Health Program

The proposed Bighorn Sheep Herd Health Program is designed to provide general guidance on monitoring and mitigation of health-related risks posed to bighorn sheep populations in Montana. The program must remain adaptive and allow wildlife managers and wildlife health experts within FWP to adjust strategies as needed on a case-by-case basis or as new information or protocols dealing with bighorn sheep health become available. Ultimately, the goal of the program is to provide direction for the management of bighorn sheep populations and to reduce the risk that catastrophic disease events pose to bighorn populations. An objective is to develop risk assessments to guide incorporation of health monitoring and management strategies into management of bighorn populations along with relevant ecological information, habitat conditions, and management goals. The program consists of three components: monitoring, health risk assessment, and management recommendations. The FWP wildlife veterinarian will direct tissue collection and testing protocols and provide guidance and training on health assessment techniques. Area wildlife biologists, in conjunction with the wildlife veterinarians will compile data related to herd health and assess the likelihood or "risk" of a major disease event. Management recommendations aimed at reducing the perceived risk will be developed and provided to the regional wildlife manager to include in routine bighorn sheep management and monitoring programs.

Monitoring

Monitoring efforts should combine routine health evaluations, usually achieved through the testing of blood and tissues for select pathogens; routine evaluation of general body condition based on observations of live animals; population composition information including density estimates, sex ratios, and age structure achieved through surveillance activities; habitat condition evaluations; and the continual monitoring of domestic sheep and goat proximity to bighorn populations.

Health evaluation protocols will follow guidelines developed and recommended by the Western Association of Fish and Wildlife Agencies (WAFWA (2007)) http://www.wafwa.org/5.18.html, while allowing for alterations based on financial funding, testing requirements deemed necessary by FWP wildlife health officials, or other potential activities deemed relevant for evaluating herd health. The WAFWA guidelines were developed by experts in the wildlife health field and incorporate testing protocols designed to detect and assess known pathogens and provide additional information in areas where data is lacking. Collection of tissues for the purposes of conducting health evaluations should, when possible, occur through the use of hunter-harvested animals or animal capture operations associated with existing research projects or proposed bighorn transplant operations. When necessary, capture of animals for the purposes of herd health evaluations may be required but will be evaluated on a case-by-case basis. In populations not used as a source of animals for transplant stock (and therefore not handled on a regular basis), it is recommended that noninvasive techniques be used to assess the health of these populations (see Genetics section). Routine evaluations of body condition should be conducted in a systematic manner by trained individuals, based on parameters established by the wildlife veterinarian. McCutchen (1985) provided a useful method for visually assessing the physical condition of

bighorn sheep. Data about populations such as density estimates, age structure, sex ratios, and lamb recruitment will be conducted as described in the Population Management and Monitoring section of this document. Results of these observations will be made available to the wildlife veterinarian. Habitat evaluations will be conducted as described in the Habitat Monitoring and Management section of this document and also provided to the wildlife veterinarian. The location of domestic sheep and goat herds within the perceivable range of bighorn sheep populations will be mapped and the potential for interspecies contact evaluated. Other additional information deemed important to evaluating the disease risk of a bighorn population will be incorporated into the risk assessment.

Risk Assessment

Risk assessments will be conducted for each bighorn sheep population in Montana based on the above information. Risk assessment will fall on a continuum from low to high based on data obtained through monitoring efforts. In general, bighorn sheep populations in close proximity or with high likelihood of contact with domestic sheep and/or goats will be considered to be at high risk of experiencing a major disease event. Combinations of other parameters such as the presence of highly pathogenic organisms, high densities, poor habitat conditions, reduced lamb production/recruitment, and the presence of stressors that could contribute to potential catastrophic disease events would also result in a designation of "high risk." Bighorn sheep herds believed to be at low risk would have population densities considered suitable for existing habitat conditions, demonstrate adequate lamb production/recruitment, maintain suitable sex ratios, and have low levels of potential pathogens. Populations where adequate information is not available to make an accurate assessment of risk would be considered high risk until information becomes available to lower that assessment. The parameters considered for risk assessment will be based on the best available knowledge, and are subject to change as additional information on elements affecting bighorn sheep health becomes available.

Risk Mitigation

In areas where bighorn sheep and domestic sheep or goats share range or contact is possible, formal agreements between FWP and the producer/owner will be drafted outlining response plans should contact occur (see proposed commingling protocol, next section). Bighorn sheep coming in contact with domestic sheep and goats should be lethally removed immediately either by producers authorized to shoot the animal or by FWP employees who are able to respond to the event in a timely manner. Tissue collections and testing procedures should follow protocols determined by the wildlife veterinarian and/or the wildlife lab supervisor. Additional language should include but not be limited to agreements on timing of range use by domestic sheep and goats, protocols for capture or dispatch of domestic sheep and goats that stray from established herds, and criteria for consideration in developing domestic sheep and goat herd health plans. The goal of these agreements is to allow for the successful management of healthy domestic herds and bighorn sheep populations where ranges overlap or interspecies contact may occur.

Formal agreements should also be drafted with land management agencies regarding domestic sheep allotments, sheep used for weed programs, and habitat management programs and other activities that could impact bighorn sheep populations and herd health. Agreements should delineate agency responsibility and authority. The goal of these agreements should be to propagate responsible stewardship of bighorn sheep habitats and populations while maintaining agency directives.

Management Recommendations

Management recommendations aimed at reducing the overall health risks for bighorn sheep populations will be developed cooperatively with the area biologist and wildlife veterinarian. Recommendations will be made based on risk factors determined through the monitoring activities and population parameters discussed above, the presence of livestock, and the potential for contact and existing mitigation efforts to reduce domestic/bighorn contacts. Recommendations will be presented to the regional wildlife manager for consideration and discussion. The wildlife veterinarian should serve in a consulting role for management decisions with the potential to affect herd health, before implementation of a management action.

Statewide Protocol for Resolving Situations Where Bighorn Sheep and Domestic Sheep and Goats Commingle

Background

Scientific observation and field studies demonstrate that "contact" between domestic

sheep and goats and bighorn sheep is possible under range conditions. Dispersal, migratory, and exploratory behaviors of individual bighorn sheep and the gregarious nature of both wild and domestic sheep may exacerbate the potential, particularly during the rut, for disease introductions and transmission between the species. These behaviors increase risk of contact and subsequent respiratory disease in bighorn sheep, resulting in mortality and reduced future recruitment. The complete range of mechanisms and causal agents that lead to epizootic disease events in bighorns are not thoroughly understood at this point. Regardless, sufficient evidence exists to conclude that it is prudent to prevent contact between these species.

While not all bighorn sheep epizootic disease events can be attributed to contact with domestic sheep and goats, it is generally accepted by wildlife biologists and veterinarians that when bighorn sheep commingle with domestic sheep or goats, bighorn sheep are at an increased risk of a mortality event.

Contact between bighorn sheep and domestic sheep and goats may occur in a variety of situations including but not limited to: 1) grazing allotments and pastures either on private or public lands, 2) trailing through areas where bighorn sheep may occur, 3) hobby farms, and 4) areas where domestic sheep or goats are being grazed for noxious weed control. In any setting, the required course of action following confirmed or suspected contact is the lethal removal of the bighorn sheep. It is the responsibility of each FWP region, where bighorn sheep occur to make the details of this protocol known to producers, managing agencies, and the public at large. In the case of large producers on public or private lands in areas where contact is likely to occur, a written and signed agreement outlining their rights and responsibilities under the terms of this protocol shall be made available to them. Each situation where mixing may occur may be somewhat unique and specifics of the agreement need to be tailored to the circumstances. Additionally, each region is responsible for having local FWP contacts made available to land managing agencies and sheep and goat producers to resolve commingling issues should they occur.

During the later stages of producing this conservation strategy the United States Animal Health Association (USAHA) through a broad-based working group they established in 2007, which included members of the American Sheep Industry, produced a report "Recommendations on best management practices for domestic sheep grazing on public land ranges shared with bighorn sheep". The recommendations contained in that report are similar to and complimentary to those contained in this Health Monitoring and Management section.

This statewide protocol is designed to give guidance to field personnel in handling situations where bighorn sheep come into contact with domestic sheep.

There are a couple of scenarios regarding commingling that warrant different responses.

Situation 1

Because a quick response to a situation where commingling occurs is critical, FWP personnel will respond immediately when the person(s) reporting confirmed or suspected contact is available to further assist or when sufficient information has been obtained for an immediate field response. The following actions will occur:

1) Field personnel need to respond as quickly as possible to reports of bighorns commingling with domestic sheep and goats.
2) When it is confirmed that bighorns have made contact with domestics, the bighorn(s) must be lethally removed and promptly sent to the Wildlife Laboratory in Bozeman or a field necropsy performed by a trained biologist. When feasible, the lab should be contacted prior to removing the animal. This will allow the lab to prepare for necropsy and analysis of the carcass soon after it arrives. If the carcass is being transported to the lab, it should be done immediately (as soon as the animal is killed). As a last resort the carcass can be frozen. Information that should accompany a removed animal includes the name of the person who made the removal, the time and place of the removal, an explanation of the reason for the action, and a description of symptoms, if any, of the euthanized sheep.
3) If contact with domestics is not certain (e.g., a bighorn was observed in the area but may not have made contact), some discretion can be allowed in the field as to what action to take. However, if there is reasonable suspicion that contact likely occurred, the animal should be immediately dispatched.
4) If bighorns are using pastures common to domestic sheep and goats, every effort should be made to discourage animals from commingling. This is especially true in situations where bighorns are just beginning to move onto cultivated lands where contact with domestics could occur over time.

5) There may be situations where extenuating circumstances may dictate different action from that listed above. In these situations, there needs to be agreement between field staff and regional managers as to the action taken.

Situation 2

In situations where communication via cell phone or other timely communication is not possible, such as in remote country with no phone coverage, a previously signed agreement with the producer, as mentioned earlier will facilitate the following actions.

1) Any bighorn sheep contacting domestic sheep may be lethally removed by the producer or their herders on their federal and/or state-managed allotments or on private and leased land.
2) Bighorns close to domestic sheep within the same lands/situations as above, where potential for contact is imminent, may be lethally removed by the producer or their herders.
3) When bighorns are greater than half a mile from domestic sheep and goats on these same lands/situations, producers or their herders will make every effort to contact FWP personnel, haze the bighorns, or move domestic animals to address the situation before lethally removing bighorn sheep.
4) Producers or their herders will inform FWP within 24 hours of lethally removing a bighorn sheep or as soon as practical thereafter, considering access and logistic limitations.
5) The carcass of any bighorn sheep lethally removed as described above will be field dressed and preserved in as practical a manner as circumstances allow, to prevent spoilage. In Situation 2 as described, field dressing is recommended to make future handling easier as it may not be possible to retrieve the carcass for a few days. Testing for disease pathogens under these circumstances and time periods is not feasible.
6) The carcass, including the head and horns, will be left intact for collection by FWP.
7) The person killing a bighorn is required to take an FWP representative to the location of the kill.

In all situations where commingling has occurred and bighorn sheep have been lethally removed, FWP and/or the producer or their herder will continue to monitor the area to determine if there are more bighorn sheep. Likewise, if contact has not occurred but sheep are in the vicinity (within half a mile) of domestic sheep and goats, bighorn sheep distribution will be closely monitored and bighorns may be hazed from the area. When possible, domestic animals will be removed from the vicinity to prevent contact from occurring.

Montana Fish, Wildlife & Parks Recommendations Regarding the Use of Domestic Sheep and Goats for Noxious Weed Control in the Vicinity of Bighorn Sheep

Over the course of the past decade, the use of grazing domestic animals, specifically sheep and goats, has increasingly become a method utilized for controlling noxious weed infestations. The increased use of domestic animals for noxious weed control has been accompanied by much information targeted at producers and interested parties on using this technique. Publications on how to best apply domestic grazing are abundant and informative for those who want to learn more about the details of this weed control method. The common term for this technique has become "targeted grazing." While there is much information available on how to apply targeted grazing, there is little documentation or mention of the potential negative impacts on selected wildlife species.

FWP has long recognized that proper grazing by certain classes of livestock can be beneficial to the vegetation resource and compatible with wildlife management goals and objectives. FWP also fully recognizes the impact that noxious weeds can have on Montana's range resource; hundreds of thousands of sportsperson license dollars are spent annually in the effort to control noxious weeds on lands that FWP owns or administers. However, not all classes of livestock, in this case domestic sheep and goats, are compatible with all species of wildlife. In this situation, domestic sheep or goats in close proximity to bighorn sheep can result in disease transmission to wild sheep with sometimes catastrophic declines in affected wild sheep populations (Buechner 1960; Martin et al. 1996).

The report produced by the WAFWA/WSWG "Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat" is the basis for FWP's recommendations dealing with the use of domestic sheep and goats for noxious weed control in the vicinity of existing

bighorn sheep populations. It is the intent of FWP, through these recommendations, to protect the health of Montana's bighorn sheep by maintaining effective separation of bighorn sheep and domestic sheep and goats that are being used for noxious weed control. FWP realizes that there is a desire by private and public land managers to use domestic sheep and goats for noxious weed control and that at times this can be an effective control method. But because of the high potential for disease transmission when commingling occurs between wild sheep and domestic sheep and goats, it is the intent of FWP to coordinate with local county weed districts or other appropriate agencies/organizations involved with weed management to preclude the use of domestic sheep and goats for noxious weed control in areas where contact between wild sheep and domestics is likely to occur.

FWP's primary tool for helping to determine where contact may occur is the mapped distribution of the 45 bighorn sheep populations in Montana. These maps were updated by FWP biologists in 2008 and will be updated again in two years. Maps depict the primary distribution of a majority of the bighorns in a particular population, but some bighorn sheep, particularly young males, are known for moving outside this mapped distribution.

When identifying the risk of contact between domestic sheep and goats and bighorn sheep, it is important to note that while spatial overlap of bighorn sheep and domestic sheep may occur, temporal overlap may not. An example of this would be where domestic animals are used for noxious weed control on bighorn sheep winter range during the period when bighorns have migrated to higher elevation summer range. In such a situation, it may be appropriate to use domestics for weed control. However, it takes professional local knowledge of bighorn sheep distribution, as not all bighorns in a population may be seasonally migratory. It is common for some portions of bighorn populations to be sedentary and remain on winter range areas year-round. This is especially prevalent with transplanted populations. Additionally, some populations, such as bighorns in the Missouri River Breaks in central Montana, don't have well-defined seasonal ranges and their year-round distribution overlaps. Therefore, the knowledge of bighorn sheep distribution by the local FWP biologist as well as others is a necessary component for determining where it may be appropriate to use domestic animals for noxious weed control. Further, information regarding the potential for parasite transmission is needed when evaluating the effects of temporal overlap of range utilized by bighorn sheep and domestic sheep and goats. Parasite transmission can occur between bighorn sheep and domestic sheep and goats even though the species use range at different times of the year.

The ultimate objective is to maintain effective separation between wild sheep and domestic sheep and goats. When contact does occur, wild sheep must be physically and usually fatally removed to prevent disease transmission to other wild sheep. Because this situation is preventable by the use of other methods of noxious weed control, other methods are the preferable choice when effective separation cannot be reasonably guaranteed.

FWP realizes there may be some risk of interaction between wild sheep and domestic sheep and goats under the best of circumstances. To provide direction to all parties involved when interaction occurs, a statewide protocol has been developed as part of FWP's Conservation Strategy for bighorn sheep and will be referenced where appropriate in this strategy.

The following recommendations have applicability to state wildlife agencies, federal land management agencies, wild sheep conservation organizations, domestic sheep and goat producers/permittees, and private landowners. While many of the recommendations contained in the WAFWA report are broader in scope than the noxious weed issue, the ones pertaining primarily to the targeted grazing concept were used in developing FWP's recommendations regarding that issue. Most of the following recommendations pertain more to land management agencies; however, many are pertinent to all parties involved.

In order to maintain effective separation between bighorn sheep and domestic animals used for noxious weed control, FWP commits to the following actions and makes the following recommendations:

1) Regional FWP personnel will coordinate with county weed districts or other appropriate agencies/organizations involved with weed management to preclude the use of domestic sheep and goats for noxious weed control in areas where contact between wild sheep and domestic sheep and goats is likely to occur. FWP will provide educational information and offer assistance to county weed districts regarding the disease risks associated with domestic sheep and goat use. FWP, through its knowledge of bighorn sheep distribution statewide, will help define when and where the use of domestic sheep and goats for weed control is likely to result in effective separation of the different species.

2) FWP has developed a statewide protocol (see Statewide Protocol for Resolving Situations Where Bighorn Sheep and Domestic Sheep and Goats Commingle) to address dispersing or wandering wild sheep that may contact domestic sheep and goats and continue traveling, either back to their source herd or to other wild sheep herds, with or without infectious disease. This protocol identifies what and when specific actions are to be taken (e.g., kill and medically evaluate wandering wild sheep), and specifies who is authorized to take those actions. Furthermore, this protocol will be openly discussed with affected stakeholders, so there is clear and widespread understanding of subsequent management actions by FWP. This protocol includes notification requirements, wildlife health intervention (if appropriate), and post-contact monitoring strategies. FWP will also work with appropriate state and federal agencies and industry representatives to develop an effective, efficient, and legal response protocol for errant domestic sheep and goats (e.g., feral, abandoned), for which no owner can be determined and which threaten to come in contact with wild sheep.

Recommendations to BLM and USFS (and Other Land Management Agencies)

1) FWP recommends that land management agencies responsible for domestic sheep and goat grazing allotments, trailing routes, vegetation management (e.g., weed control, enhancement of conifer regeneration), or any other uses involving domestic sheep and goats should only authorize such use where mechanisms are in place to achieve effective separation from wild sheep.

2) FWP realizes that under the best of circumstances wandering bighorn sheep may come into contact with domestic animals. When this occurs, land management agencies should require prompt notification of interaction between wild sheep and domestic sheep and goats by permittees and their herders. Notification procedures (including phone numbers/contact information for permittees and use of satellite phones in backcountry settings) should be included in the Annual Operating Instructions for grazing allotments and trailing permits or when domestic animals are used for weed control.

3) Ensure advance written instructions exist (such as USFS Annual Operating Instructions) to address management, retrieval, and disposition of stray domestic sheep and goats used for noxious weed control left on public lands prior to and/or after grazing/trailing/permitted on- and off-dates.

4) FWP recommends to land management agencies that land use and resource management plans, where relevant, should specifically address the issue of potential domestic sheep and goat interaction with wild sheep. Land use plans should evaluate the suitability of permitting activities involving domestic sheep and goats. Plans should address this issue and identify general areas of public land where domestic sheep and goats should not be permitted for weed control, commercial grazing, recreational packing, conifer regeneration, vegetation management, and other management activities.

5) Where mandatory buffer zones (frequently cited as a minimum of nine airline miles [13.5 km]) between domestic sheep and goats and wild sheep are used to ensure effective separation, it should be recognized that buffer zones apply to herds or populations of wild sheep, rather than wandering individuals (most often sub-adult bighorn rams). In some cases, buffer zones have been a very effective strategy to reduce the opportunity for interaction between wild sheep and domestic sheep and goats. However, in continuous wild sheep habitat, where wild sheep movements may eventually exceed a priori expectations, buffer zones may not be the most effective or practical tool (Schommer and Woolever 2001).

6) FWP recommends that land management agencies, in collaboration with state livestock health agencies, work with producers/permittees to develop specific health certification protocols and require certification before domestic sheep are turned out for any vegetation management effort. The objective of these protocols is to prevent the turnout of sick or diseased domestic sheep and goats on grazing allotments, on trailing routes, or when used for weed control. Sick or diseased animals on range should be reported to land management or wildlife agency personnel as soon

as possible after recognition; upon notification, interagency coordination should promptly occur. Analogous to requirements to use certified weed-free hay on public lands, or requirements to clean logging or other heavy equipment that have been operating in areas where noxious weed seed might be inadvertently scattered into new areas, domestic sheep and goats should be healthy before being turned out. Alberta and British Columbia (http://www.for.gov.bc.ca/hfp/publications/00006/) have developed specific health certification protocols that are required before domestic sheep are turned out for vegetative management in conifer reforestation efforts. The higher the risk of contact between domestic sheep and goats with wild sheep, the higher the certainty of domestic animal health must be. It should also be recognized that "healthy-appearing" domestic sheep and goats might still carry pathogens that can be transmitted to wild sheep. Producers/permittees must take appropriate measures to prevent turnout of sick or diseased domestic sheep and goats on grazing allotments, on trailing routes, or in weed control situations. Sick or diseased animals should be removed or otherwise eliminated as soon as possible after their recognition.

7) Proportional to the risk of contact between domestic sheep and goats and wild sheep, land management agencies should work with producers/permittees, state wildlife agencies, wild sheep advocates, and others to implement a variety of mitigation strategies, such as herders, dogs or other guarding animals trained to repel animals foreign to domestic sheep bands or goat flocks (such as wandering wild sheep, various predators), confinement of domestic sheep and goats at night to minimize strays, and adequate fencing configurations designed to achieve the most effective separation possible.

8) Land management agencies should clearly define the process, protocols, and timelines for short-term or emergency management actions when intervention is needed to minimize or eliminate the risk of interaction between wild sheep and domestic sheep and goats.

9) Land management agencies should closely evaluate the timing of permitted domestic sheep and goat grazing and/or trailing activities, to reduce disease transmission risk. For example, grazing domestic sheep when ewes are in estrus heightens the possibility of contact between wild sheep and domestic sheep. Effective separation should be based on temporal and spatial separation of wild sheep and domestic sheep and goats.

Suggested Management Practices on Private Lands

1) Support "effective separation" fencing standards whenever feasible, including the options of electric outrigger fences or double fencing methods to reduce transmission of respiratory disease agents. The goal of separation fencing is the physical prevention of nose-to-nose contact and an adequate physical distance to prevent aerosol transmission. Outriggers of electric wire two feet from page- (woven) wire fencing or double fencing consisting of two page-wire fences, eight feet high, with a minimum spacing of at least 10 feet, are considered effective. A combination of fencing methods may be most effective to ensure that wild sheep do not come into contact with domestic sheep and goats on private land.

2) Where contact between domestic and bighorn sheep may occur, work with private landowners and agencies to consider alternative weed management strategies to reduce risk of contact while adequately managing weed problems.

3) Any observed interaction between wild sheep and domestic sheep and goats should be promptly reported to FWP. FWP will make local contact information readily available to the producer.

Response to Bighorn Sheep Die-Off Protocol

Montana's bighorn sheep populations are generally healthy and robust. On occasion, however, die-offs do occur. Die-offs are sometimes moderate and localized, affecting only a small portion of a population. Such events can lead, however, to an "all-age" die-off where both sexes and all ages of bighorns are subjected to disease and which occasionally results in over 90% mortality of a population. Die-offs are more common in the late fall and winter seasons, and mortality is generally due to pneumonia, which can occur after contact with

domestic sheep or goats but may occur with no known contact between these different species. Once these events begin, often there is little that can be done to effectively slow the progress of the die-off.

Montana FWP, the primary agency responsible for managing wildlife in Montana, needs to respond to die-off events on a number of fronts in a timely and efficient manner. There are two major aspects of equal importance that need to be addressed when FWP becomes aware that a die-off is occurring. First is communication, using appropriate media, depicting the details of the die-off as known at that time to other pertinent managing resource agencies, nongovernmental organizations, stakeholders, and to the public at large. Second is the biological response. An informed decision on an appropriate course of action/intervention must be made using all available biological data, including the extent and stage of the die-off, type of biological samples to be collected, connectivity to other sheep herds, species involved in the die-off, and other pertinent information as deemed necessary. Additionally, communication needs to occur between parties responsible for determining a biological response and parties addressing the media and stakeholders.

The purpose in developing this protocol is to suggest and promote a coordinated process detailing which personnel are assigned to what tasks and which agencies and groups to contact and at what stages of the die-off; deciding some aspects of the biological response; and ensuring that all these actions occur in a timely, efficient, and open manner.

Die-off events are unique and vary to some degree in the extent and stage of a die-off when reported, the method of detecting or determining that or if a die-off is in progress, and access to the area where the die-off is occurring.

The following provides one example of a logical protocol for determining response actions and personnel responsible for carrying out certain duties during a die-off. Particular situations may dictate that the regional supervisor, in conjunction with the Wildlife Division administrator, make variations in responses or personnel from those suggested here.

Actions Items and Timeframes for Responding to a Bighorn Sheep Die-Off

Once a die-off is reported, the following sequential actions should occur. The order of items may vary depending on the situation, and some items are carried out simultaneously.

1. Initial Notification of Die-Off

Once a die-off is reported, the receiving FWP party shall immediately notify the regional wildlife manager and local biologist with details regarding the event (where, when, and who reported the die-off).

2. Assess Status of Die-Off

As soon as feasible, the local biologist shall assess the extent of the die-off. Depending on the situation, the assessment can in most cases be done effectively through the use of a helicopter if occurring over a large inaccessible area such as a bighorn winter range. The biologist should document the number of sick and dead animals. Symptomatic animals are frequently observed coughing if pneumonia is involved. Results of this survey shall be communicated to the regional wildlife manager as soon as possible. The regional wildlife manager shall immediately contact the Wildlife Division administrator/Wildlife Management bureau chief with details of the die-off.

3. Determine Course of Action

The wildlife manager, in consultation with the local biologist and the wildlife veterinarian, formulates a course of action based on the initial assessment by the local biologist. The response can be quite variable depending on a number of factors, including the stage of the die-off and the scope of the die-off (the number of animals and extent of the population affected). Once a course of action is determined, that action is communicated to all parties in detail.

While there has been limited success with field treatment of bighorns during pneumonia outbreaks through application of antibiotics, treatment is often difficult to accomplish (Coggins and Matthews 1998). Administration of an adequate dosage of antibiotics to large numbers of free-ranging animals is extremely difficult and expensive. Additionally, treatment of bighorns through application of anthelmintics or vaccines after the die-off event with the objective of improving lamb survival have generally not been effective (Aune et al. 1998; Miller et al. 2000; Cassirer et al. 2001). A basic course of action in early-stage die-offs would be to remove sick and dying animals and collect biological samples for testing. This in itself may help reduce the extent of the die-off. Die-offs occurring during the rut may be particularly difficult to control, as rams traveling between ewe groups may act as a vector for the disease.

4. Initial Assessment of Possible Cause(s)

An initial assessment shall be made as soon as

possible as to the cause of the die-off. Generally, at this stage it can be difficult to determine the cause(s); however, if there are domestic sheep or goats in the vicinity, potential contact between wild sheep and domestic animals should be investigated. Caution needs to be exercised at this time in definitively stating what the cause may have been or the likely involvement of domestic livestock. However, certain items should be considered, such as the overall condition of live sheep and if the die-off is occurring during the winter shortly after the hunting season. If occurring shortly after hunting season, hunters from that particular hunting district could be contacted and asked about the general condition of harvested animals.

5. Communication Process/Contacts List
The regional wildlife manager informs the regional Information and Education Program manager of the situation, and they jointly develop the process for informing all stakeholders, including who to contact, priority in which contacts will be made, who will make contacts, and drafting a press release. Some contacts need to be made prior to the press release going out. A list of possible contacts, which may vary depending on the situation, would include state and federal agencies that have responsibilities in managing bighorn habitat in the area of the die-off. Contacts to these agencies would be made at the local level where the die-off is occurring by the regional wildlife manager or local FWP biologist. The Montana state veterinarian (Department of Livestock) should be informed of the die-off by the wildlife veterinarian. If contact with domestic sheep may have occurred, the executive director of the Montana Woolgrowers Association should be informed of the situation. Other contacts to appropriate nongovernmental organizations should be made by the regional wildlife manager at this time. Making these contacts will normally take one to two days, at which time the regional Information and Education Program manager can distribute the news release.

6. Designate Primary Contact Person
A designated contact person within the FWP Region where the die-off is occurring shall be identified so that responses to inquiries are consistent and accurate. Normally, the regional wildlife manager serves as the primary contact person providing information on the die-off to the media. Depending on the situation, the local biologist or the regional Information and Education Program manager may fill that role.

7. Biological Sampling
The wildlife veterinarian will coordinate any sampling of dead or dying bighorn sheep according to existing protocol. This includes determination of an adequate sample size of specimens needed to assess the die-off and tissue collection and submission protocols. It is recommended that tissue collection and submission protocols meet or exceed recommendations made by the Wildlife Health Committee of the Western Association of Fish and Wildlife Agencies. Additionally, if any interventions are planned, those actions need to be closely monitored to determine their effectiveness in moderating the die-off. The regional wildlife manager is responsible for assigning adequate field staff to collect necropsy samples, continuing assessment of the die-off, and, in conjunction with the wildlife veterinarian, for determining what follow-up monitoring of the die-off is appropriate by field staff. The wildlife veterinarian needs to communicate to field personnel the symptoms to look for in determining sick animals and provide field staff with training on sample collection and handling protocols.

8. Final Assessment of Extent of Die-Off
Assuming the die-off occurred on winter range, a follow-up aerial survey should be conducted by the local biologist to determine the extent of the die-off. The survey should be conducted prior to animals moving off of winter range. A die-off event may last several months so periodic observation is required to determine if bighorns are no longer dying. The local biologist will relay this information to the regional wildlife manager as soon as possible.

9. Final Assessment of Possible Cause(s) of Die-Off
Once all the biological sample results have been received, a thorough assessment by the wildlife veterinarian, wildlife lab supervisor, and other wildlife health specialists evaluating the potential cause(s) of the die-off will be conducted. The results of this analysis need to be completed in a timely manner, data and interpretation assembled in report format, and the report sent to the regional wildlife manager and the Wildlife Division administrator. However, laboratory results may not be received for several weeks after submission, delaying completion of a final report.

10. Final Communication/News Release
A final communication/news release detailing the extent of the die-off and potential cause(s) should be put together with the parties to be

contacted and those responsible for making the contacts being the same as in item (5) above. This could include whom to contact if skulls/carcasses are found, what information is useful for staff to collect these remains, and the regulations for possessing ram skulls.

11. Future of Bighorn Sheep Population

Once the details of a particular die-off are known, a detailed write-up needs to be done by the local biologist that includes input from the specialist(s) involved in the event and depicts all known details of the die-off. Copies of this report will go to the FWP Region, Helena Wildlife Division, and the wildlife lab. Each die-off event can be somewhat unique. Sometimes die-offs occur rapidly with wild sheep dying within a few days, while other times a die-off may last a couple of months with the animals' condition deteriorating slowly before death. Periodic monitoring of remaining sheep needs to occur. If new lambs are born the following spring, it is likely that lamb survival will be compromised, and this should be documented if possible from the ground. If augmentation of the population may be considered in the future to promote recovery of the population, the cause(s) of the die-off need to be determined and rectified if at all possible prior to any release of bighorn sheep (see Translocation Program section).

Genetics

There are four main reasons why genetics should be considered in the management of bighorn sheep. First, molecular genetic markers can identify populations experiencing a loss of genetic variation and inbreeding, which may be due to reduced connectivity and small population size (Hogg et al. 2006). Second, genetic data can also help detect potential undesirable effects of selective harvest on important attributes such as horn and body size (Coltman et al. 2003; Allendorf et al. 2008). Third, genetic tools can aid forensics by detecting poaching and illegal sale of body parts such as trophy skulls or horns (Manel et al. 2002). Finally, genetic markers can be used to identify the presence of and track the transmission of pathogens or parasites within and among individuals and populations (Archie et al. 2008). Much of the above information can be obtained using polymerase chain reaction (PCR)-based technologies allowing for noninvasive sampling of feces, hair, urine, or saliva (Taberlet et al. 1999; Luikart et al. 2008b; Beja-Pereia et al. 2009).

Loss of Genetic Variation And Inbreeding

Isolated populations with small size will experience rapid loss of genetic variation and inbreeding (mating between relatives). The rate of loss of genetic variation (heterozygosity) is determined by the effective population size (Ne), not the population census size (i.e., abundance). The rate of loss of variation and Ne can be estimated by analyzing approximately 10 to 20 molecular genetic markers (e.g., microsatellites) and DNA samples from approximately 30 to 50 individuals from the population of interest.

In wild populations Ne is almost invariably less than the population census size (Nc). The Ne is reduced below the Nc by phenomena such as skewed sex ratio, variation in reproductive success among individuals, and changes in population size through time. Most estimates of Ne suggest that it is only about 10-50% of Nc (Frankham 1995). Given a breeding structure where few males dominate reproduction, the Ne/Nc ratio of bighorn sheep is probably at the lower end of this range. For populations with 50 to 200 adults, therefore, Ne may be only 10 to 20, resulting in a rapid loss of genetic variation and an accumulation of inbreeding.

Many of Montana's 45 bighorn sheep populations are relatively small, isolated, and were founded with few individuals. Because of small founding size and low abundance, many are likely to have low Ne, making them susceptible to the random loss of genetic variation, inbreeding, and the random increase in the frequency of harmful genetic variation (deleterious alleles). Loss of genetic variation, especially particular variants (alleles) is also expected to result in reduced adaptability and may also increase the susceptibility of the animals to particular parasites and diseases. Furthermore, because of their small size and isolation over time, the amount of inbreeding in many populations will increase and eventually result in inbreeding depression, which is defined as the loss of fitness in inbred individuals. All of these factors act concurrently to increase the risk of extinction (Berger 1990), and many have been observed in bighorn sheep populations (Hogg et al. 2006; Luikart et al. 2008a).

Loss of genetic variation and inbreeding in populations can be ameliorated by transferring individuals among populations, a process commonly referred to as genetic rescue (Westemeier et al. 1998; Madsen 1999; Vila et al. 2002; Tallmon et al. 2004; Hogg et al. 2006; Pimm et al. 2006; Fredrickson et al. 2007). Thus, any bighorn sheep population that has been small (e.g., less than 50 to 100 breeding adults) and isolated for more than two to three

generations (approximately 10 to 15 years) could be considered as a candidate for genetic rescue.

Translocations, however, are not without risk and should be conducted only when data suggest the need, and should carefully consider the potential risks of disease transmission. In the absence of demographic data directly indicating inbreeding, the need for genetic rescue can be assessed indirectly by using molecular genetic data obtained from PCR-based genotyping technologies (e.g., microsatellite genotyping). Such data can be used to estimate degree of genetic isolation among populations, levels of genetic variation within populations, levels of inbreeding or degree of relationship among individuals within populations, and Ne, and also look for signatures of recent population declines (bottlenecks) such as absence of rare alleles (Luikart and Cornuet 1998).

Genetic markers can help identify source populations with the highest genetic diversity for use in translocations. They can also help identify source populations that are genetically distinct and therefore useful for maximizing variation in populations by mixing individuals from different populations (e.g., Maudet et al. 2002). Molecular genetic studies can help address the following important types of questions: Are the native populations from northwest Montana genetically distinct from the Sun River population and thus represent a special genetic resource for translocations? Does the Sun River population have many alleles at disease-related genes that were lost during translocations to found new populations, such as Wildhorse Island? Does the Wildhorse Island population have low genetic variation and thus is not always the best source for augmenting genetic diversity through translocations?

Molecular genetic markers can help estimate rates of gene flow and movement between populations and thus can help to monitor connectivity. Connectivity is important for assessing extinction risk due to isolation (e.g., demographic and genetic stochasticity) but also for assessing risk of disease spread between populations. Genetic markers are now being used directly on parasites to assess parasite spread and disease transmission between populations (Archie et al. 2008). For example, genetic markers for Pasteurella bacteria, viruses, or lungworms might be useful to track parasite transmission among bighorn populations.

Selection on Phenotype

Harvest of wild populations can cause unintended ("unnatural") selection (Allendorf et al. 2008). For example, harvest of only large-horned rams led to reduced horn sizes in an isolated bighorn population from Alberta, Canada (Coltman et al. 2003). If this population were not isolated, it is possible that horn size would not have been reduced and gene flow would prevent loss of genes (alleles) for large horn size. Horn size and other traits (body size) are likely heritable (i.e., have genes underlying the trait). Thus harvest could selectively remove genes (alleles) associated with traits desired by and removed by hunters, such as large horns. Genetic studies combined with studies of phenotype (e.g., horn size) can detect unintentional selection and phenotypic change caused by harvest in wild populations. Managers could collect long-term data on horn size as well as DNA samples (from horn plug drill shavings or skin/muscle tissue) to initiate a long-term monitoring program to watch for genetics and phenotypic effects of harvest on bighorn sheep.

Forensics

Genetic markers can help detect illegal killing and trafficking of bighorn sheep and their body parts (e.g., trophy skulls or horns). Genetic markers determined by analyzing a meat sample or bloodstain can identify the species, individual, sex, and even population of origin of an individual (Manel et al. 2002). Identification of the population of origin of an individual requires having genotyped 20 to 30 individuals from the putative population of origin and ideally other potential populations of origin. FWP could collect high-quality DNA samples from bighorn populations to allow for long-term monitoring of loss of genetic variation, connectivity, and the detection of poaching.

Pathogen Prevalence and Transmission

Finally, DNA markers can help to understand the causes and consequences of parasite infection, including the emergence, spread, persistence and evolution of infectious disease (Archie et al. 2008). Parasite DNA markers can be used to track parasite spread and infer population history (Beja-Pereira et al. 2009). DNA markers are available for macroparasites (gastrointestinal worms and lung worms) and microparasites (lung viruses and bacteria such as Pasteurella) that infect bighorn sheep. Molecular genetic markers are becoming available for an increasing number of parasites and will allow studies of how the spread of disease is influenced by landscape features (domestic animals, livestock feed lines, farms, and rivers) and environmental variables (temperature and humidity). The combination of host and parasite genetic data in a landscape genetics (Manel et al. 2003) framework promises to lend new insight into how landscape features shape the movements of parasites.

TRANSLOCATION PROGRAM

Introduction

The decline of bighorn sheep around the turn of the 19th century and the reasons for those declines has been well documented (Buechner 1960). Rocky Mountain bighorn sheep in Montana were no exception, yet remnant groups of bighorns persisted over time, leaving an estimated 1,200 bighorns in Montana in 1950. It was around this time that the Montana Fish and Game Department (as it was known in those days) began trapping bighorns from the few viable populations remaining and transplanting them into areas of formerly occupied habitat. For a detailed discussion on translocation efforts, see Trapping and Transplanting in Chapter 1.

Through the winter of 2008-09 a total of 2,598 bighorn sheep have been trapped in Montana with 2,067 of those released in a total of 55 different locations within the state. A total of 465 bighorns went out of state to establish new populations or augment existing populations. States receiving bighorns from Montana included Oregon, Idaho, Washington, Nebraska, Utah, Wyoming, Colorado, and North Dakota.

The 1986 "Montana Department of Fish, Wildlife and Parks Bighorn Sheep Transplant Guidelines" and the 1995 "Final Policy for Bighorn Sheep Transplant For Newly Established Herds" provided needed direction for Montana's bighorn sheep program for many years. Since those documents were produced, however, some new laws and policies have been created. It is the intent in this section to revise and combine the original documents to reflect those changes.

Also, other elements of a successful translocation program that have not been part of Montana's bighorn sheep program will be part of this section. The elements include:

1) Criteria for identifying potential new transplant sites.
2) Process for recommending and implementing new transplants.
3) Process for augmenting existing bighorn populations.

As part of the process in evaluating potential habitat for transplanting bighorn sheep, a scoring system and form, Bighorn Sheep Transplant Site Assessment Form has been developed to help determine the feasibility of transplant sites to provide adequate habitat to sustain bighorn sheep (Appendix E).

New Site Habitat Evaluation Procedure (HEP)

A Habitat Evaluation Procedure (HEP) was developed to determine potential transplant sites by identifying suitable but unoccupied bighorn sheep habitats. The process uses a Geographical Information System (GIS) to develop a habitat suitability model that will be reviewed by local biologists to ensure that adequate habitat exists. A three-step process to identify potential bighorn sheep habitat was developed and consists of the following:

1) Candidate areas for bighorn transplant efforts are identified using a habitat suitability index map to display potential habitats on a landscape scale.
2) Wildlife biologists familiar with the candidate area delineate the outer extent of the potential habitat available to the transplant population, using the suitability index and their professional knowledge.
3) Using the delineated extent of the potential population, specific habitat criteria are assessed to determine if the area will support a minimum viable population. This assessment consists of GIS analysis of the habitat criteria that are then reviewed by the biologist to recommend modifications and provide interpretation.

A critical task, which FWP is using computer modeling and GIS analyses to more fully understand, is spatially identifying suitable locations for potential reintroduction sites. While many approaches have been developed to predict species distributions, there has been a movement toward modeling techniques that utilize non-parametric or iterative means to detect patterns in data (Elith et al. 2006). These are often referred to as machine learning approaches, and they would not be possible without modern computer processing capabilities. These approaches are advantageous in that they can fit more complex models than standard parametric methods, and they can be adjusted to prevent over-fitting (Phillips and Dudik 2008). FWP used a technique comparing animal locations to the available landscape, a presence/available approach, for the initial step of identifying suitable habitat, using a program called Maxent. This program generates a habitat suitability index that is used to determine possible species distribution. The analysis conducted is an iterative process that finds the probability distribution of maximum entropy (closest to uniform) to distinguish animal location characteristics from those of the overall study area (Phillips et al. 2006). While there are several caveats associated with the use of this technique, including difficulty in evaluating map accuracy and limited interpretation of how individual predictors influence animal locations, it has been shown to perform well at predicting species distributions when compared to other commonly used and novel approaches (Elith et al. 2006; Hernandez et al. 2006; Phillips et al. 2006; Hernandez et al. 2008).

The habitat suitability analysis requires information on bighorn sheep locations, as well as a suite of predictor variables representing characteristics of the available landscape. Bighorn sheep location data is collected via annual survey and inventory monitoring as well as various research efforts across the state. Predictor variables include biotic and abiotic components of the landscape that characterize or influence habitat conditions. Environmental variables include minimum and maximum annual air temperature, annual precipitation, and a solar radiation index (Keating et al. 2007). Topographical variables include elevation, slope, and a terrain roughness index, (Sappington et al. 2007), which measures slope variability. Landform variables include ecoregions (Omernik 1987), National Land Cover Dataset, geology, STATSGO soil type category, and soil temperature.

To improve the reliability of the analysis, it was conducted separately for each ecological region in Montana. Ecological regions are areas containing a number of bighorn sheep populations and having similar habitat characteristics. Ecological regions are discussed in the Habitat section later in this document. It is important to note that as data sources are updated the performance of the model will change. We anticipate that as new sheep locations are obtained and as GIS data layer accuracy and precision improve, the model performance will improve. The output of the model is a Habitat Suitability Index ranging from 0 to 1, from least to most suitable, respectively. Current results for the Elkhorn Mountains are shown in Figure 8.

Using the habitat suitability model output, biologists familiar with an area will delineate the area thought to be suitable for translocation. Once the area is delineated, we will determine if that area has adequate seasonal habitat to support a minimum viable population (MVP). The HEP, as described by Smith et al. (1991), focuses on quantifying

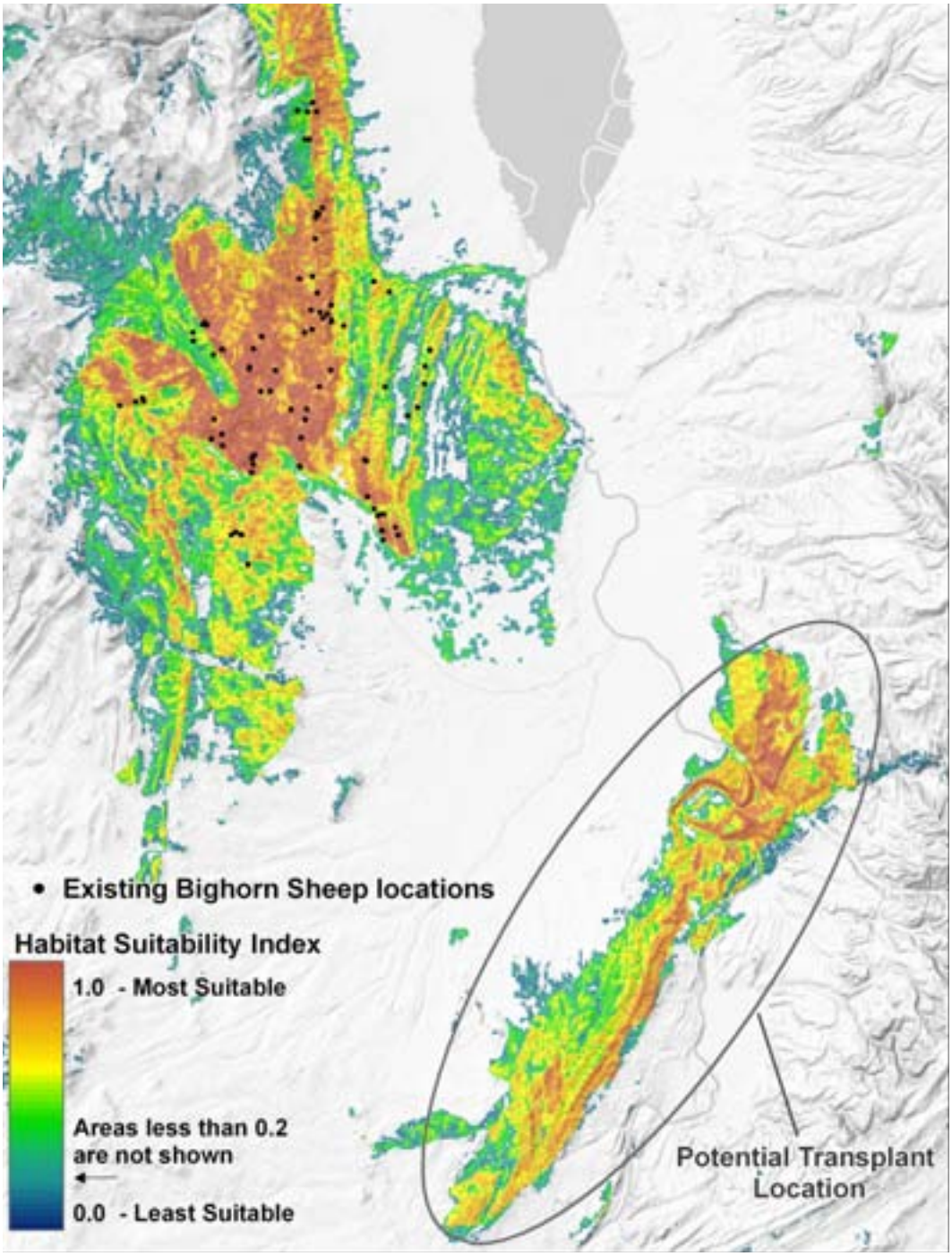


Figure 8. Map of inductive GIS model predicting suitable unoccupied habitat for bighorn sheep based on visual locations.

winter range, lambing habitat, summer range, and, depending on quantities of each, the ability of the area to support an MVP. While there is no consensus in the scientific literature as to what constitutes an MVP, Berger (1990) suggested, based on his assessment of 129 native populations of bighorn sheep in five western states that populations consisting of more than 100 bighorn sheep persisted for up to 70 years. Similarly, Geist (1975) suggested a minimum population of 125 animals for persistence, and Smith et al. (1991) also used this figure. Smith et al. (1991) used a density of 7.7 animals/km^2 for the entire potential habitat, based on their study area in Utah, and thus the area required to support an MVP of 125 animals can be calculated. This may be a high density for some habitats in Montana. It is suggested that if density is known for a nearby existing population from similar habitat to a potential transplant site, then using that figure is appropriate. Zeigenfuss et al. (2000), using a modified version of the Smith model and average bighorn densities for a variety of study sites, found that in prairie-badland habitats and using a density of 3.85 bighorns/km^2, it took 32km^2 of suitable habitat to support an MVP of 125 sheep. Likewise, in Rocky Mountain

habitats with an average density of 1.47 bighorns/km^2 it took 85km^2 of suitable habitat to support an MVP of 125 sheep. For displaying this model, density figures suggested by Smith et al. (1991) have been used. It can now be determined if there is enough potential habitat to support an MVP of bighorns. Again, using the 7.7 bighorn sheep/km^2 (20 per mi^2) and an MVP of 125 bighorn sheep, it would take approximately 17 km^2 (6.5 mi^2) of base or year-round habitat to support an MVP.

To determine how many bighorn sheep each area can potentially support, specific habitat criteria will be used to identify winter, lambing, and summer habitat using a combination of GIS data and biologist knowledge. Escape terrain is the primary habitat component influencing seasonal habitat and the ability of an area to provide suitable habitat to support an MVP. Escape terrain is characterized by areas relatively barren of vegetation, such as rocky slopes, with more than 60% (27 degrees) slope (Smith et al. 1991). Activity patterns for a Utah sheep population indicated that 95% of activity occurs within 300 meters of escape terrain (Smith et al. 1991). Escape terrain was calculated using a digital elevation model from the United States Geological Survey. The stepwise process, illustrated by Figure 9, is as follows:

1) Using the density of 7.7 bighorn sheep/km^2 (20 per mi^2) and an MVP of 125 bighorn sheep, it would take at least 17 km^2 (6.5 mi^2) of base habitat to support an MVP. In this example, there is a total of 78.1 km^2 of core or base habitat.
2) Winter range is defined as all escape terrain that receives less than 25 cm (approximately 10 inches) of snow pack. Research in Utah indicated that bighorn sheep abandoned ranges when snow pack exceeded 25 cm (Smith et al. 1991). Smith et al. (1991) found that when averaging bighorn sheep densities across a number of western winter ranges that densities should not exceed 20 km^2 (50 mi^2). To sustain an MVP of 125 bighorn sheep, it would therefore require 6.5 km^2 (2.5 mi^2) of available winter range. In this example, there is a total of 4.9 km^2 of winter range.
3) Determine if adequate lambing habitat exists to support an MVP of bighorn sheep. Areas qualifying as lambing habitat are defined as escape terrain with southern exposure (90 to 270 degrees). These areas should have good visibility, be within 1,000 m of water, and be at least two ha (five acres) in size. An MVP (N=125) of bighorn sheep would be expected to have 50 to 60 breeding ewes (Buechner 1960; Oldemeyer et al. 1971; Holl 1982). Holl (1982) showed that 60 ha of escape terrain were required to support 10 lambing ewes. Therefore it is estimated that a minimum of 3.0 to 3.6 km^2 (1.2 to 1.4 mi^2) of suitable escape terrain would be required to support 50 to 60 lambing ewes. In this example, there is total of 5.9 km^2 of lambing habitat.
4) Determine if adequate summer range exists to support an MVP of bighorn sheep. Summer range is defined by Smith et al. (1991) as those areas utilized by all bighorns not involved in lambing activities from May through August. Summer range for these animals would not include lambing areas. These areas are defined as all buffer areas adjacent to but not including escape terrain and areas with slopes less than 60% where visibility tends to be good. An MVP of 125 bighorn sheep would have 65 to 75 nonbreeding animals occupying summer range. Using the density figure from Step 1, it would take an estimated 8.4 to 9.7 km^2 (3.2 to 3.6 mi^2) to support this many bighorn sheep. In this example, there is a total of 60.1 km^2 of summer range.
5) Assuming there is adequate habitat to support an MVP of bighorn sheep as defined above, the final step in determining if a site is potential habitat is a qualitative assessment of how the different seasonal ranges are arranged and connected. Escape terrain, water, and forage need to be intermixed throughout the potential range. It is essential that the areas calculated for the different seasonal ranges have areas large enough to support an MVP. The exception would be if there was suitable habitat for fewer than an MVP but a strong likelihood for connection with nearby populations of bighorn sheep existed. In this example, it would appear that there is inadequate lambing habitat; however, some of the winter range actually would overlap with lambing habitat range, so the actual amount of lambing habitat would be sufficient for an MVP.

After assessing the areas of suitable habitat that exist in Montana, we can determine which occupied and unoccupied areas of this habitat are exposed to risks. The primary risk is proximity to domestic sheep, as indicated

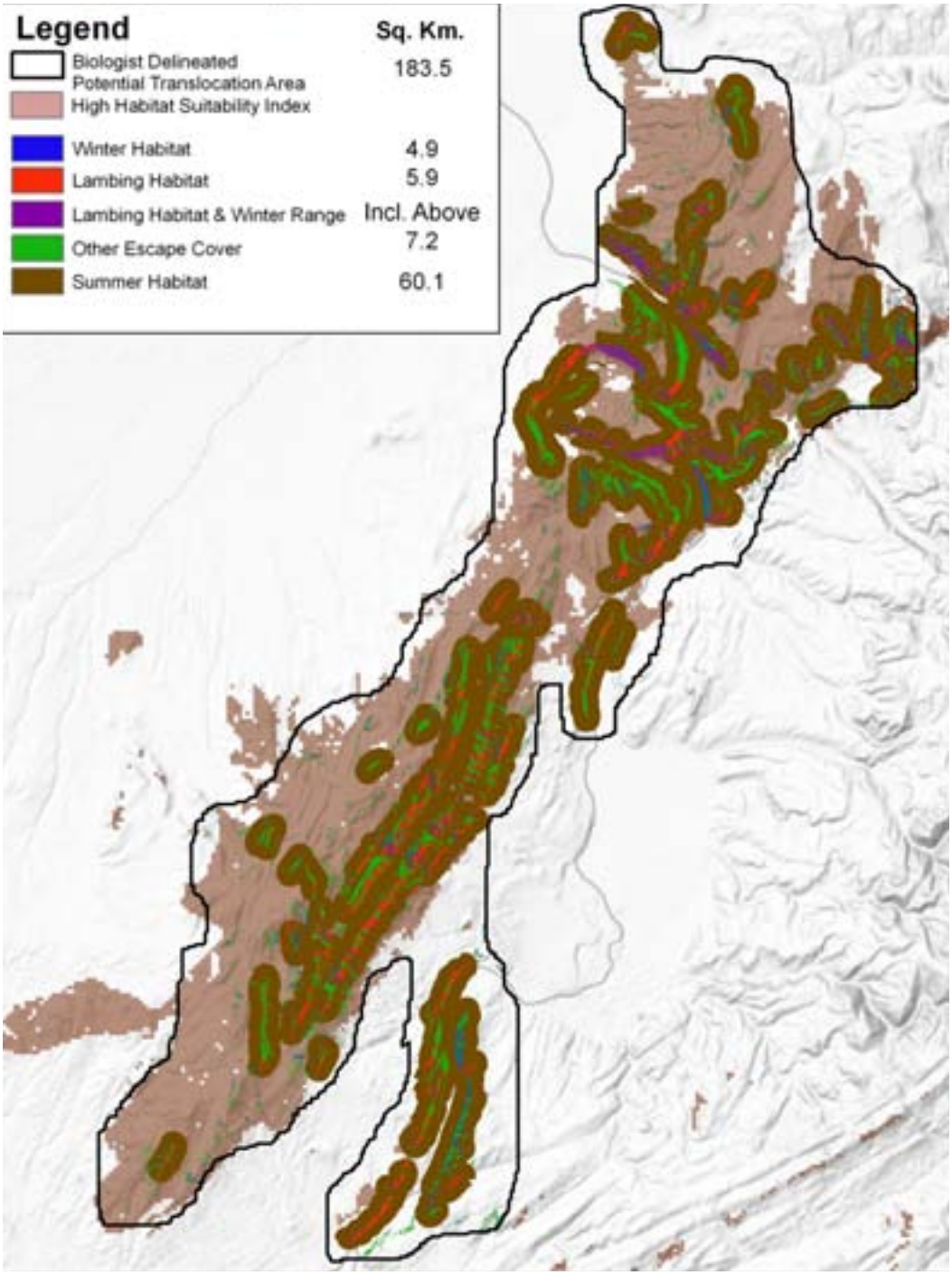


Figure 9. Example of seasonal range identification.

elsewhere in this Conservation Strategy. While some existing bighorn sheep populations in Montana occur in areas close to domestic sheep or goats, ranking of new transplant sites will be higher if there are no domestic sheep or goats in the immediate area. Zeigenfuss et al. (2000), when looking at a number of successful and unsuccessful bighorn sheep transplants, found that successful populations were an average of 23 km (14.3 mi) from domestic sheep. Likewise Singer et al. (2000), when evaluating success of 100 translocations of bighorn sheep, found that successful populations were an average of 20 km (12.4 mi) from domestic sheep. Areas within 23 km of known domestic sheep or goat distribution pose a higher risk for commingling of bighorn sheep and domestics and potential disease transmission. Before a decision to translocate bighorn sheep to such areas is made, other mitigating factors should be evaluated. For example, even though a potential transplant site may be less than 23 km from domestic sheep or goats, other physical characteristics of the site may provide for effective separation between the bighorn sheep and domestic animals. Identifying areas of federal grazing allotments has provided an initial assessment of these risks (Figure 10). However, by comprehensively mapping

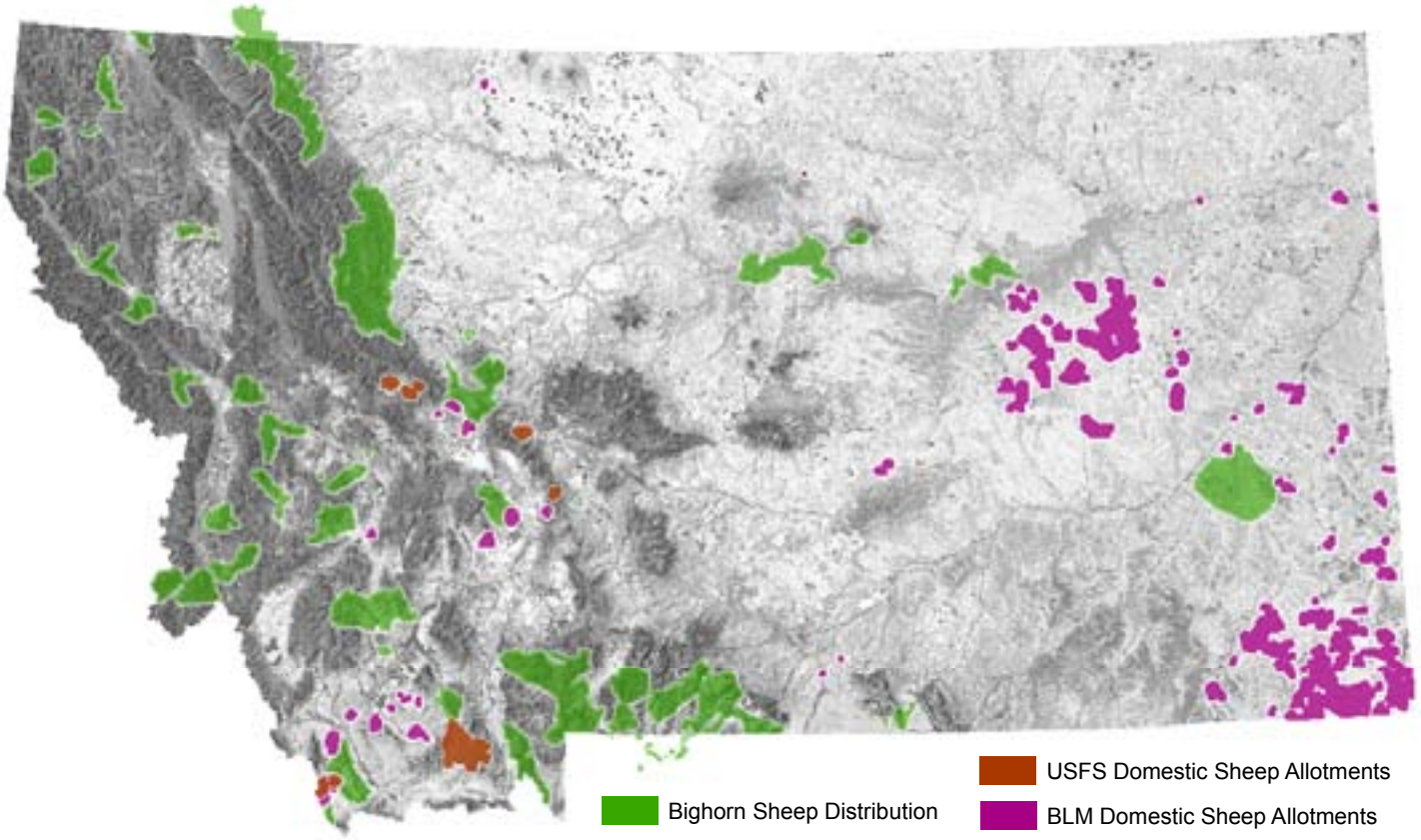


Figure 10. Distribution of domestic sheep allotments on USFS and BLM-managed lands in Montana.

additional locations of domestic sheep grazing, a more complete picture can be obtained.

In addition to the risks associated with domestic sheep, commercial development of suitable habitat patches, including energy and subdivision development, may preclude the presence of bighorn sheep on suitable range. Increased mapping efforts will allow FWP to identify areas recently lost, under immediate threat of development, or that may face development pressures in the future.

Once the above data is generated, the "Bighorn Sheep Transplant Site Assessment Form" (Appendix E) can be filled out and sent to the biologist responsible for the area. The availability of accurate and complete GIS data will allow FWP to continue to refine the models described above. As these layers are refined and data availability increases, model performance will be improved.

Protocols for Trapping and Transplanting Bighorn Sheep to New Areas and Augmenting Existing Populations

New Site Selection Criteria

The FWP Commission recognizes that transplantations of bighorns are absolutely necessary to reestablish this public-trust wildlife species to much of its original range, from which it has been extirpated. Transplanting of bighorn sheep into unoccupied habitat is regulated by and subject to Montana's Importation, Introduction, and Transplantation of Wildlife statutes MCA 87-5-701-721. In particular, statute 87-5-711 "Control of importation and transplantation or introduction of wildlife" in relation to transplanting wildlife species states in part: "Except as otherwise provided, the importation for introduction or the transplantation of any wildlife is prohibited unless the commission determines, based on scientific investigation and after public hearing, that a species of wildlife poses no threat of harm to native wildlife and plants or to agricultural production and that the transplantation or introduction of a species has significant public benefits." To promote the restoration and conservation of historic bighorn sheep populations and their habitats, and to reduce the possibility of disease outbreaks in newly established transplanted bighorn herds, and to avoid harmful effects on agricultural or livestock production, it is the policy of the FWP Commission and Department, to follow the following protocol:

1) FWP will give preference to those sites that are historic habitat for bighorn sheep, on land that is primarily publicly owned. Before initiating a transplant FWP will coordinate and cooperate with local landowners and land management

agencies to ensure domestic livestock use on or near such sites is compatible with bighorn sheep conservation objectives. Additionally, the needs of other native wildlife and plants in the area will be considered.

2) Approve transplants only where FWP has determined (see Habitat Evaluation Procedures in the Translocation Section of the Montana Bighorn Sheep Conservation Strategy) there is sufficient winter and other seasonal range capacity to support the anticipated population size while considering potential competition with other wild or domestic ungulates and the potential for mitigating such competition.

3) Use transplants to establish and encourage bighorn herds into naturally connected metapopulations, for the demographic and genetic benefits of such metapopulations, while maintaining adequate separation from domestic sheep or goats to diminish the potential for commingling and potentially serious disease problems.

4) Consider only transplants to those sites with a majority of public land and/or landowner-granted legal hunter access, which is negotiated for a long enough period to ensure that hunting and/or trapping/relocation can be used to control herd size in the future.

5) Approve transplants only after considering public input on issues relating to the proposal, including possible negative impacts to agricultural production or livestock. FWP will make efforts to notify local landowners of the potential transplant and develop appropriate agreements, prior to approval, with individual landowners and/or agencies that own significant portions of the area where bighorns are expected to establish. FWP will seek to satisfy or mitigate local concerns and eliminate and/or mitigate possible negative impacts to agricultural production or livestock, and maintain respectful landowner relations.

6) FWP will use hunting and trapping for relocation to control herd sizes and distributions. If an increase in herd objective is proposed or an increase in herd distribution occurs, FWP and the Commission will consider habitat limitations, landowner tolerances and other factors in evaluating and responding to the proposal or the increase in distribution; but will not abdicate their public-trust responsibility to manage a population to benefit all citizens, considering all legal and ethical responsibilities of the agency, landowners and the public.

7) Approve transplants only where there are significant public benefits outweighing any public concerns or issues.

8) Assume the risk of transplant failure, holding no landowner or public grazing allotment lessee responsible without proof of negligence or intent.

9) Evaluate the potential for future consumptive and non-consumptive uses, including access. Recently transplanted bighorn, and/or augmented herds, must not be hunted until they have reached 80% of a Minimum Viable Population (N=125) and there is sufficient annual recruitment to maintain herd growth while allowing for anticipated hunter harvest.

10) The FWP Region responsible for the transplant will produce a management plan for the population as it nears objectives, following the format for such plans as in the Conservation Strategy. This will include the criteria and process for implementing hunting, including the process for how license levels are set.

11) In the unlikely event that bighorns from a recently transplanted herd establish in an unexpected area used by domestic livestock, FWP will participate in discussions and negotiations with state and/or federal agencies and private parties, seeking an equitable solution to eliminate, compensate for, or mitigate possible negative impacts of bighorns on ranching operations.

Criteria For Augmenting An Existing Population

1) If translocation is proposed to a historical site, or one with a depressed population, evaluate the habitat to determine the reason(s) for the lack of bighorns and determine if the area can support more. The reasons for the initial extirpation or reduction will be determined and corrective measures taken. If predators are thought to be suppressing bighorns on otherwise healthy range, this issue needs to be addressed in a proposal that includes potential type of predators and

courses of action to reduce predation rates.

2) Determine the health status of the source herd and the recipient herd (e.g., fecal lungworm larvae trends, serological profile) to ensure that sick bighorns are not translocated to healthy populations and vice versa.

3) Keep genetic strains intact as much as possible by emphasizing transplants within contiguous ranges. If the objective of the transplant were to improve genetic variability, the transplant would generally consist of a limited number of rams. These rams could be trapped in conjunction with a new transplant to reduce costs of the augmentation.

4) Evaluate the potential for future consumptive and nonconsumptive uses, including access. Recently transplanted bighorns and/or augmented herds must not be hunted (see Population Management section for criteria) until they have stabilized and can withstand harvest (i.e., close monitoring is needed to demonstrate that there is sufficient recruitment and good health).

5) When augmenting an existing population that has gone through a major decline, it may be desirable, depending on the current status of the population, to provide consecutive year transplants for reestablishment of the population.

Regional Responsibilities

Each FWP Region will annually determine priority areas for transplants and prepare an annual summary with the following criteria and components:

1) Describe augmentation or new transplant.
   a) If augmentation, then give status of the herd already present (include serological profile if available or other indication of herd condition). If a population decline occurred as a result of a die-off, provide an assessment of the cause of the die-off and what course of action has been taken to rectify the situation.
   b) Regions are required to produce an Environmental Assessment in compliance with the Montana Environmental Policy Act (MEPA) for all new transplants.

2) The following processes and timeframes for recommending a new transplant or augmentation of an existing population will be adhered to:
   a) A Habitat Evaluation Procedure and the accompanying HEP Assessment Form needs to be completed for each potential new transplant site and sent to the Wildlife Division administrator at least two weeks prior to the March wildlife managers meeting. Assessment forms will be compiled by the division and sent to the Regions for review prior to the March meeting.
   b) At the March meeting, potential translocation sites, including new sites and augmentation of existing herds, will be prioritized by the division administrator, management bureau chief and regional wildlife managers based on criteria contained in the HEP Assessment Form and the Process for Prioritizing Translocations (see below).
   c) For new transplants, all contacts with appropriate agencies, landowners, domestic animal producers/lessees will have been made regarding the transplant prior to the March meeting. While written agreements and MEPA analysis are not necessary for augmentation of an existing population appropriate agencies and private parties should be notified of the action in a timely manner.
   d) New transplants and proposed augmentations will be presented to the FWP Commission at their May meeting for tentative approval to move forward. Final approval will occur by the Commission at their July meeting.
   e) By August 1, the MEPA process has been completed and all the appropriate parties have signed agreements.

3) Regions will provide listings of the numbers of sheep available for transplant to other areas to the Wildlife Division administrator by December 15 each year.

Process for Prioritizing Translocations

There are a number of qualitative and quantitative factors that help prioritize potential transplant sites that should be considered prior to looking at sites in detail, regardless of the process used to identify sites. These include:

1) Preference will be given those areas that had historical populations and still contain suitable habitat.
2) Preference will be given those sites not in close proximity to domestic sheep and those with limited competition from other livestock or wild ungulates.
3) Preference will be given to those sites with a majority of public land and/or legal access in order to ensure the huntability of the herd in the future.
4) Only those sites with landowner agreements (as defined in number 5 in New Site Selection Criteria) completed and signed will be approved.

Wildlife Division Responsibilities

1) The Wildlife Division administrator will allocate available sheep to sites in priority established under Regional Responsibilities 2(b) above. Implementation will be limited to available funding and bighorn sheep trapped in any one year.
2) Transplant costs excluding personnel services will be borne by the portion of annual bighorn sheep auction revenue budgeted for that purpose during biennial project proposal planning.
3) Monitoring costs to determine success in excess of annual budgets will be borne by the portion of annual bighorn sheep auction revenue budgeted for that purpose during biennial project proposal planning.

Characteristics of the Source Herd, Transporting, Release, and Monitoring

The following are a number of pertinent recommendations in relation to source herd characteristics. A good source of information regarding most aspects of transplanting bighorn sheep can be found in Foster (2004).

1) Source herds should have a recent health profile completed.
2) The number of animals per transplant considered adequate to establish a new population or reestablish (augment) an existing population is a minimum of 20 bighorns.
3) Ewes from various age classes are recommended, so young ewes can learn from older ewes at the new site.
4) A ram to ewe ratio of 1:3 to 5 with rams four years old or younger, as they are more likely to associate with the ewe and lamb groups than older rams.
5) Release animals on good quality winter range near (i.e., within 300 m) escape terrain.
6) To reduce the possibility of introducing disease into an existing population, transplants will in general not be authorized to augment established herds of 100 or more animals.
7) A minimum of 20% of released animals should be fitted with radio collars. If contact with domestic animals is a possibility, the number of animals with radio collars should be increased to facilitate more effective monitoring.
8) Radio collars should be relocated from the air at least once a month to determine seasonal distribution and subsequent home ranges. At the same time, all bighorn sheep should be classified as to sex and age with emphasis on lamb production and survival.

Examples of Memorandum of Understanding (MOU) and Other Agreements in Relation to New Transplants of Bighorn Sheep on Public and Private Lands (on File)

1) MOU between federal agencies managing domestic sheep allotments, permittees, and FWP in relation to a new transplant of bighorn sheep.
2) MOU between mining company, BLM, and FWP in relation to a newly transplanted sheep population on BLM lands leased by a mining company.
3) Examples of landowner agreements in relation to a new transplant of bighorn sheep where private lands may be used by bighorn sheep.

HABITAT MONITORING AND MANAGEMENT

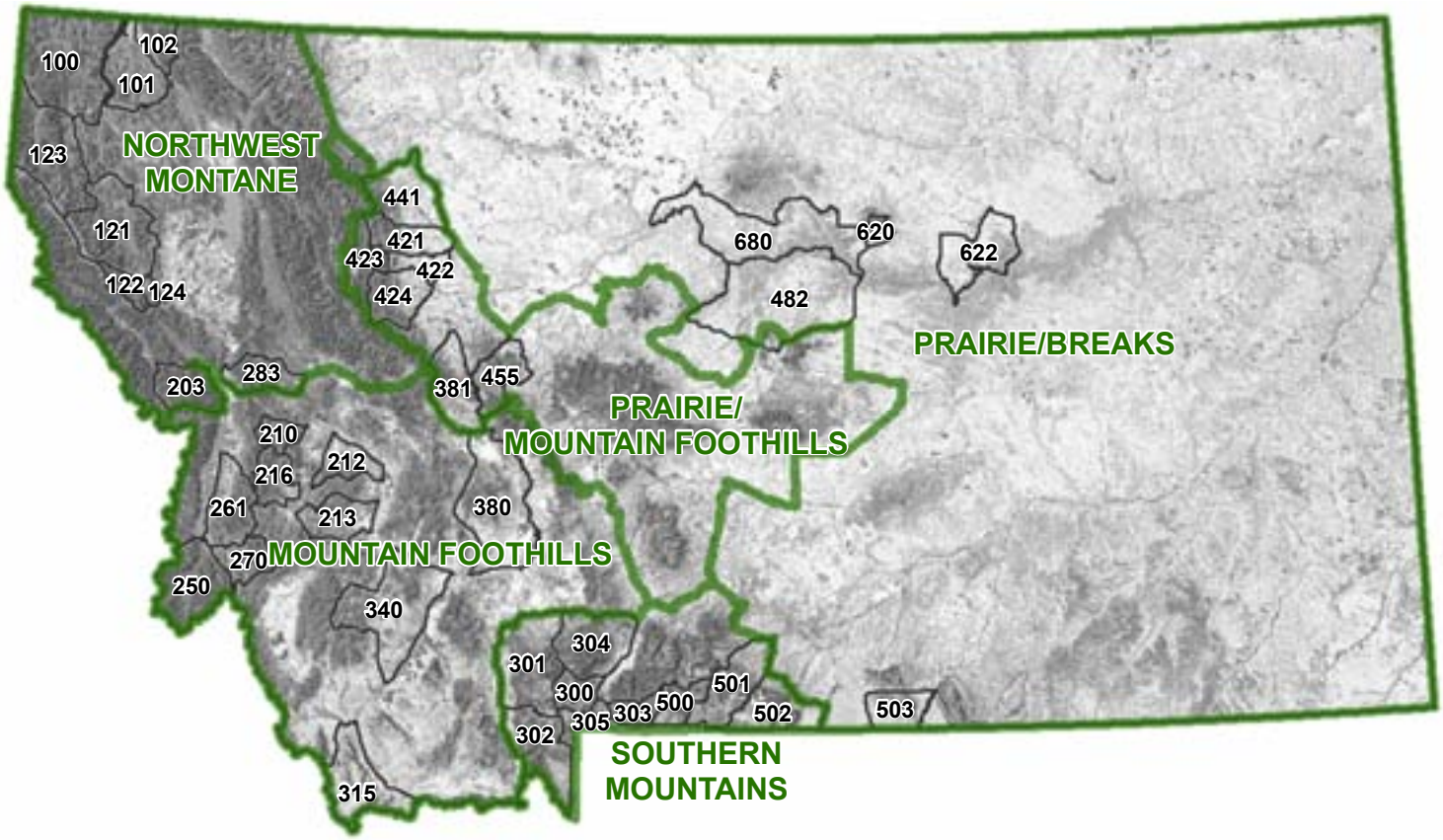
Habitat Description

Bighorn sheep are able to exploit a variety of habitats throughout the West. While most bighorn populations in Montana occur in the western portion of the state, some of the most productive populations are associated with the Missouri River Breaks in north-central Montana. In developing Montana's Deer Management Program, habitats across the state were defined by five distinct ecological regions (Wildlife Division, FWP, 2001). Environmental characteristics (vegetation, topography, elevation, etc.) help determine how deer and, in this case, bighorn sheep, respond demographically. These five ecological regions were slightly revised based on bighorn sheep habitat characteristics and are used here to describe the various habitats utilized by bighorn sheep in Montana (Figure 11). A description of each ecological region follows:

Northwest Montane:

Description: Hunting Districts 100, 101, 102, 121, 122, 123, 124, 203, 283, and Wildhorse Island. This ecological region encompasses 18,378 square miles including all of FWP Region 1 and the northern tier of hunting districts in Region 2.

Topography varies from rugged, mountainous terrain along the Continental Divide, including the Flathead, Swan, and Mission Ranges, to more gentle, smaller ranges such as the Salish Mountains and Nine Mile Divide. Elevations as low as 2,000 feet occur in the northwestern portion of the unit near Troy to over 9,000 feet on the highest peaks



of the Mission Mountains. Climate is strongly influenced by the maritime effect of moisture-laden air from the Pacific Ocean. Precipitation generally decreases from west to east with average annual precipitation at most valley locations varying between 20 and 32 inches, with more than half falling as snow during winter. Vegetation is characterized by the greatest continuous cover of coniferous forest of any ecological region in the state. Forest cover extends across most valley bottoms with natural openings limited in size and distribution. Overstory species that occur at lower elevations include ponderosa pine, Douglas fir, and western larch. At higher elevations, dominant species include lodgepole pine, Engelmann spruce, and subalpine fir. Relic stands of western red cedar, grand fir, western white pine, and western hermlock are confined to moist microsites. Plant communities in the understory are represented by a diversity of species such as pine grass, beargrass, Oregon grape, spirea, huckleberry, twinflower, queencup beadlily, and arnica. Timber-related industries, tourism, mining, and agriculture are important land uses. Public land accounts for nearly 75% of this population management unit, although timber corporations privately own large parcels. Noncorporate private land consists of small parcels confined to major river valleys.

Dense forests preclude efficient aerial surveys for bighorn sheep in this ecological region.

Mountain Foothills:

Description: Hunting Districts 210, 212, 213, 216, 250, 315, 340, 380, 381, and Bearmouth. This ecological region encompasses 21,733 square miles of southwestern Montana including high-to-moderate elevation mountain ranges (e.g., Elkhorn Mountains, Bridger Range, west slope of Big Belts, Tendoy Mountains, Bitterroot Range, Sapphire Mountains, and Garnet Mountains) generally isolated from other ranges by large valleys.

Topography varies from gently undulating foothills to rugged mountainous terrain with elevations ranging from 4,000 to 11,000 feet. Topography and elevation cause variation in local climate and weather conditions across this ecological region. Most mountain ranges are oriented along a north-south trending axis. More persistent snow cover and a more restricted distribution of winter range generally characterize westerly aspects. Easterly aspects occur in drier rain shadow zones and provide more extensive areas of winter habitat. Vegetation in the foothills includes a variety of shrub species (big sage, bitterbrush, mountain mahogany, and juniper) interspersed among bunchgrass communities dominated by bluebunch wheatgrass and Idaho fescue.

Figure 11. Ecological regions and bighorn sheep hunting districts in each region.

Riparian areas support cottonwood, aspen, willow, and hawthorn. Conifer forests of Douglas fir, ponderosa pine, lodgepole pine, subalpine fir, and whitebark pine become prevalent with increasing elevation. Subalpine and alpine vegetation is restricted to elevations above about 8,500 feet. Cattle grazing and both dryland and irrigated crops are primary uses of private land. Timber management, livestock grazing, and recreation are major uses of public land.

Prairie/Mountain Foothills:

Description: Hunting Districts 421, 422, 423, 424, 441, and 455. This ecological region encompasses 14,552 square miles of central Montana and includes the Rocky Mountain Front, east slope of the Big Belt Mountains, and the Little Belt, Judith, Castle, Big Snowy, Little Snowy, Moccasin, and Crazy Mountains.

This population management unit represents a transition zone having characteristics of both the mountain/foothills and the prairie/breaks units. Topography varies from low rolling hills to steep, rugged mountain canyons. Elevations range from less than 4,000 feet to over 9,000 feet near the Continental Divide. Precipitation is highly variable, ranging from 10 to 12 inches at lower, more arid sites to more than 40 inches in the mountains. Vegetation varies from shrub grasslands, through montane forest with intermountain grasslands, to alpine ridgetops. Cottonwood, willow, and aspen dominate riparian areas. Cattle grazing is the primary land use. Cropland is primarily irrigated and dryland alfalfa.

Some of these bighorn populations have complex, long-range migrations between seasonal habitats. Harvest strategies, especially on the ewe segment, should be designed in such a way as to ensure maintenance of these migratory traditions.

Southern Mountains:

Description: Hunting Districts 300, 301, 302, 303, 304, 305, 500, 501, 502, and Mill Creek. This ecological region encompasses 5,989 square miles in the Absaroka, Beartooth, and a portion of the Gallatin and Madison Ranges in south-central Montana.

Topography varies from rolling hills to sheer mountain canyons thousands of feet deep. Elevations range from 4,500 feet to nearly 13,000 feet. Precipitation varies from less than six inches annual rainfall in the Cottonwood Triangle to more than 40 inches per year in the mountain environments. Vegetation varies from shrub desert, through montane forest with intermountain grasslands, to alpine plateaus. Cottonwood, willow, and aspen dominate riparian areas. Cattle grazing is the primary land use. Cropland is primarily irrigated and dryland alfalfa, though the Clark's Fork Valley supports corn and sugar beet production.

Some of these bighorn populations have complex, long-range migrations between seasonal habitats. Harvest strategies should be designed in such a way as to ensure maintenance of these migratory traditions.

Prairie/Breaks:

Description: Hunting Districts 482, 503, 620, 622, and 680. The Prairie/Breaks ecological region encompasses 86,277 square miles in the eastern two-thirds of Montana and includes some hunting districts in FWP Regions 4 and 5 and all hunting districts and populations in Regions 6 and 7 (Figure 12). Landforms consist of flat to rolling benchlands, ponderosa pine savannahs, rugged badlands or breaks adjacent to major rivers, and riparian areas. The semiarid climate is characterized by hot, dry summers and cold, dry winters, but large annual fluctuations in temperature and precipitation during all seasons are common. Dryland small grain farming and livestock grazing are the primary commercial land uses, except in the major river valleys where irrigated acreage produces alfalfa, sugar beets, corn, and small grains.

Native habitats consist primarily of grasslands, sagebrush and grasslands, deciduous shrub grasslands, hardwood draws, breaks, and river bottoms. Grasslands in good condition are dominated by western wheatgrass, thickspike wheatgrass, slender wheatgrass, bluebunch wheatgrass, green needlegrass, little bluestem, and various forbs. Shrubs found in sagebrush and grasslands consist of big sagebrush, silver sagebrush, rubber rabbitbrush, skunkbrush, sumac, and black greasewood, while deciduous shrub grasslands include buffaloberry, chokecherry, snowberry, wild rose, and hawthorn. Ponderosa pine is the major tree species in savannahs and, along with Rocky Mountain and common juniper, predominates in breaks habitats. Hardwood draws feature green ash, boxelder, American plum, and American elm, while river plains cottonwood and willows dominate river bottoms.

Seventy to 90% of the land in this management unit is in private ownership, with blocks of public land scattered throughout. Public lands are primarily under federal management by the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), or the U.S. Fish and Wildlife

Service (USFWS). State lands accessible to the public include areas managed by FWP or the Department of Natural Resources and Conservation (DNRC). Land open and accessible to the public for hunting ranges from a low of l0% in the southeast to 95% in portions of the northeast.

Most populations in this ecological region are associated with the Missouri River Breaks, which provides highly productive habitats with abundant escape terrain.

Habitat Use

Bighorn sheep in Montana are adapted to a wide variety of habitats as characterized by the ecological descriptions above. To understand and address habitat issues, it is important to have a working knowledge of what habitat elements are important to bighorn sheep. Although habitats may vary across the state in relation to vegetation types, ruggedness, elevation, etc, there are attributes of habitat that are consistent across ecological regions. These attributes, to a large degree, influence the ability of a population to achieve it's potential demographically. Three elements are essential to quality bighorn habitat, and it is these elements that are degraded by plant succession or human-induced activities.

1) Escape cover or terrain is a common element in all seasonal habitats. Bighorn sheep, especially ewes, are generally found within 100 to 300 m of escape terrain (Oldemeyer 1971; Erickson 1972; Smith et al. 1991; Douglas and Leslie 1999). Escape terrain is comprised of slopes 60% or greater with occasional rock outcroppings. Escape terrain also has abundant open foraging areas adjacent to it. Areas with dense timber tend to receive little use except in areas in the Northwest Montane ecological region where bighorns have adapted to timbered habitats.
2) High visibility in all bighorn habitats is recognized by most biologists as being highly important in the detection and avoidance of predators as well as access to forage and foraging efficiency (Geist 1971, Risenhoover and Bailey 1985, Wakelyn 1987).
3) Winter range areas tend to be low-elevation, south-facing slopes with escape cover in proximity to foraging areas. Winter range is defined as all escape terrain, which receives less than 25 cm (approximately 10 inches) of snowpack. Research in Utah indicated that bighorn sheep abandoned ranges when snowpack exceeded 25 cm (Smith et al. 1991). Bighorn sheep in the West Rosebud drainage and the Southern Mountains ecological region winter on high elevation windswept slopes and migrate to lower elevations prior to lambing.

To determine if habitat characteristics in these ecological regions influence lamb production and recruitment and ram to ewe ratios, a simple comparative analysis of each region was conducted. Lamb recruitment rates and ram: ewe ratios for each population in the five regions were averaged for the past five years of survey data available for each population (Table 5). Populations having gone through recent major declines due to die-offs were excluded from this analysis.

From this analysis, it appears that lamb: ewe ratios are generally higher in the more productive ecological regions, with the Prairie/Breaks having the highest ratio. Lamb production was correlated more with environmental conditions than ewe harvest rates. Ram: ewe ratios don't vary much among regions, and ratios are more a function of conservative harvest on the ram segment.

Food Habits

Bighorn sheep forage opportunistically and utilize vegetation types that occur within their seasonal distribution. With few exceptions, bighorns utilize forbs heavily in the spring when they are readily available (Oldemeyer 1971; Erickson 1972; Frisina 1974). As forbs desiccate during summer, diets switch to more grass and grass-like plants (Frisina 1974, Stewart 1975).

Table 5. Comparison of lamb recruitment rates and ram ratios by ecological region, excluding populations having recently gone through a die-off.

Ecological Region	Lambs: 100 Ewes	Rams: 100 Ewes
Northwest Montane	37	65
Mountain Foothills	44	55
Prairie/Mountain Foothills	44	64
Southern Mountains	35	41
Prairie Breaks	49	63

Some bighorn populations make substantial use of browse species at certain times of the year. Stewart (1975) found that in the West Rosebud herd, which winters on the high-elevation Beartooth Plateau and migrates to lower elevations in late winter, diets were comprised of as much as 40% big sagebrush (*Artemesia tridentata*). Schallenberger (1966) observed winter diets with 43% browse species in the Sun River bighorn sheep. During periods of heavy snowpack, bighorn sheep in northwestern Montana utilize Douglas fir needles as a winter food source.

Major Habitat Issues

Habitat issues identified for Montana bighorn sheep populations are described in the individual management plans for hunting districts and populations in Chapter 2. Most of the issues identified are similar to those occurring throughout other western states and Canadian provinces where bighorn sheep occur. A review of those individual management plans found that the primary issues affecting bighorn sheep habitat were deterioration, loss, and fragmentation. Major habitat issues include:

1) Residential and resort developments have had a major impact on some seasonal ranges resulting in direct loss of habitat, fragmentation of habitats, and displacement of bighorns to less productive habitats.
2) Highway development and maintenance has fragmented some habitats making connection between subpopulations more difficult. Maintenance of highways, particularly during winter when salting occurs, has attracted bighorns to roadsides resulting in significant vehicle collision losses in some populations. The type of fencing used along highways can impede movements. Illegal use of ATVs on public lands has in some cases been detrimental to bighorn habitats.
3) Industrial developments such as dam development, hard rock mining, oil and gas development and exploration, and electrical transmission lines have resulted in direct loss of habitat, deterioration of habitat, reduced bighorn populations, displacement to less productive habitats, and fragmentation of existing habitats.
4) Livestock grazing on private and public lands has in some cases been detrimental to bighorn sheep habitats. The type of fencing used on some allotments can impede movements. Wild horses have degraded wildlife habitats in a few areas in Montana. Conversion of grazing allotments on public lands from cattle to domestic sheep in areas adjacent to known bighorn sheep distribution has, at times, been an issue. This situation is a habitat as well as a health issue for bighorn sheep.
5) Forest succession or woody plant encroachment into former grasslands or shrub grasslands, caused in part by historical overgrazing by livestock and fire suppression efforts, has resulted in loss of habitat including linkages between habitats and subpopulations.
6) Noxious weeds, especially in the western part of Montana, have resulted in the loss of productivity of seasonal ranges. The use of domestic animals for weed control is an emerging issue that has potential for displacement of bighorn sheep and also is a serious health issue to bighorn sheep should contact occur.
7) Competition for forage with other wild ungulate species has not been a serious issue in most bighorn populations in Montana to date but has the potential to be so in certain habitats.
8) Human disturbance on critical winter and lambing ranges.

A ranking of the above issues and a few other issues listed as management challenges in Chapter 2 by herd unit/population indicates some common challenges for bighorn sheep and sheep managers across the state (Table 6). Of particular concern is that in 57% of the populations, domestic sheep and the potential for contact with wild sheep either on allotments, private land, while being used for noxious weed control or on adjacent hobby farms was listed by biologists as a management challenge. Secondly, noxious weeds and impact on season range vegetation was listed as a major challenge in 48% of the populations, especially in western Montana. Conifer encroachment resulting in habitat loss and decreased visibility was an important management concern in 57% of populations, again mostly in western Montana. Human development with residential and industrial development combined was an issue in 46% of the populations. Direct loss of bighorn sheep through road kill was an issue in 27% of the populations. Impacts of predation were not a major management issue at this time for most populations.

Habitat deterioration, loss, and fragmentation are the greatest threats to the

maintenance and viability of wildlife habitats and populations. Most impacts on wildlife habitats are human induced. The ability to influence human activities that negatively affect wildlife habitats is one of the major challenges facing wildlife and land managers today. FWP doesn't directly manage a significant amount of bighorn sheep habitat. Instead, FWP biologists attempt to work with other state and federal land management agencies by offering input into their managing activities. Additionally, where bighorn sheep habitat occurs on private land, FWP works with the landowners in a variety of ways to ensure wildlife use of private lands is compatible with landowner objectives. FWP recently created a Land Use Planning Specialist position and as a result information is now being provided to local governments (county planning boards) on the location of important fish and wildlife habitats, economic values of resources managed by FWP, and contact information to obtain additional information for those resources from FWP specialists.

Monitoring and Management of Habitats

As part of the effort to develop this Conservation Strategy for bighorn sheep, a statewide Geographic Information System (GIS) analysis has been implemented with one of the objectives being to conduct risk analysis to bighorn sheep habitats due to human activities. This analysis is being conducted by ecological region (see above), as habitats vary across the state and this is a logical partition of Montana in relation to bighorn sheep habitats and human demographics. The intent of this analysis is to look at habitats on a statewide basis that may be threatened and to provide that information to the appropriate region. The analysis is expected to be ongoing as new information becomes available. Outcomes of this analysis will include the identification of which bighorn sheep habitats are at greatest risk due to human activities (primarily development) and help prioritize which habitats FWP and other organizations may wish to target for preservation.

Some of the major impacts to bighorn habitat and movement patterns are human development of critical seasonal ranges. This includes not only subdivisions but also development of resorts. Development and expansion of the Big Sky Resort in the Gallatin Canyon south of Bozeman has resulted in increased vehicle traffic and bighorn mortality due to collisions with vehicles. Areas of bighorn sheep habitat in western Montana that were recently unoccupied and suitable for translocation may no longer be suitable due to subdivision development.

Industrial developments such as dams, hard rock mining, and energy development have had and will likely continue to have negative impacts on bighorn sheep habitats. The dams forming Lake Kookanusa in northwest Montana and Fort Peck Reservoir in eastern Montana flooded historical bighorn range. Mitigation measures designed to replace that loss in northwest Montana through burning and logging were ineffective (Stansberry 1998). Hard rock mines in the Little Rockies and the Stillwater River have had adverse and long-term effects on bighorns in those areas.

The biggest challenge for a variety of wildlife species and associated habitats in the near future will be energy exploration, development, and transmission of those resources. An area that was extensively explored for oil and gas development in the 1980s but currently has been withdrawn from further consideration is the Rocky Mountain Front where the Sun River herds are located. Studies done on bighorn sheep during that exploratory period showed displacement during seismic activity along with decreased home range sizes (Hook 1986). Powerline and pipeline transmission systems are currently being proposed with more being planned. The impact of these systems on bighorn habitat is not known at this time as locations are still being determined. Close monitoring of all such impacts will track potential effects to wildlife habitats, and appropriate recommendations will be made including measures to mitigate impacts if necessary.

Most bighorn sheep habitat in Montana occurs on public land, primarily USFS and BLM lands. It is incumbent on FWP biologists to work closely with wildlife biologists and resource specialists from these agencies and other land managing agencies in their management of bighorn sheep habitats. It should be recognized that the mandates governing the management of USFS and BLM lands are quite different than those of a state wildlife agency; however, the goal of managing natural resources in a sustainable manner is a common goal among many agencies.

There are three major issues concerning the management of bighorn sheep habitats on public lands in Montana. These issues are inter-related and influence each other. The issues are: 1) livestock management on seasonal bighorn sheep habitat, 2) forest succession or the encroachment of conifers into former grassland or shrub grassland habitats, and 3) the influence of noxious weeds on the vegetation

Table 6. Population status of bighorn sheep by hunting district and various threats to these populations.

Herd Unit Name	H.D.	Threats to Population											
		Preda-tion	Dom. Sheep	Weed Control/ Dom.	Hobby Sheep	3/ Human Develop	Road Kills	Conifer Encroach-ment	Small Range Size	Noxious Weeds	ATV's	Wildlife Competition	Social Limits
Kootenai Falls	100				X	X	X	X					
Ural-Tweed	101							X					
Galton Range	102		X					X		X			
North Clark Fork	121				X		X	X					
Clark Fork Cut-Off	122				X		X	X		X			
Cabinet Mountains	123				X		X	X		X			X
Paradise	124				X		X	X		X			
Wildhorse Island								X		X			
Grave Creek Range	203				X	X	X	X		X	X		
John Long Range	210		X			X	X	X		X			
Garrison	212		X	X		X		X		X			
Lost Creek	213		X	X	X	X		X		X			
West Rock Creek-Quigg Peak	216			X	X			X		X			
Watchtower	1/ 250							X		X			
Paint. Rocks			X							X			
Skalkaho	261		X		X	X	X	X		X	X		
E. Bitteroot	270		X		X	X	X	X		X			
Lower Blackfoot	283			X	X	X	X	X		X			X
2/ Gallatin-Yellow-stone	300					X							
Spanish Peaks	301		X			X	X	X			X		
Hilgard	302		X	X			X					X	
South Absaroka	303												
Hyalite	304												
South Yellowstone	305												
Tendoy Mountains	315		X			X							
Highland Moun-tains	340				X	X	X	X		X			

Table 6. continued.

Herd Unit Name	H.D.	Threats to Population											
		Predation	Dom. Sheep	Weed Control/ Dom.	Hobby Sheep	Human Develop	Road Kills	Conifer Encroachment	Small Range Size	Noxious Weeds	ATV's	Wildlife Competition	Social Limits
Radersburg	380		X			X				X			
Sleeping Giant	381		X			X	X			X			
Mill Creek													
Greenhorns			X										
Deep Creek	421												
Castle Reef	422												
Gibson Lake North	423												
Ford Creek	424												
North Fork Birch Creek-Teton	441									X			
Fergus	482												
Beartooth WMA-GMWA	455		X		X					X			
Stillwater River	500								X		X		
Monument Peak													
Beartooth Mountains	501								X		X		
Hellroaring	502												
Pryor Mountains	503		X	X								X	
Little Rockies	620												
Middle Missouri Breaks	622												
Chouteau-Blaine-Phillips	680												
Blue Hills			X	X									

1/ The Watchtower and Painted Rocks subunits have separate winter areas but do have interchange and are considered one population.
2/ Population objectives for the Upper Yellowstone Complex is for a total of 215 bighorn sheep and includes sheep in Hunting Districts 300, 303, 304 and 305.
3/ Human developments include residential and industrial development.

resource. It is generally recognized, in relation to forest succession, that historical overgrazing by livestock along with fire suppression has promoted encroachment on grassland-type habitats (Arno and Gruell 1986). Additionally, improper livestock management can promote the establishment and spread of noxious weeds.

Livestock And Other Wild Ungulate Grazing Issues

Cattle grazing has had variable effects on bighorn sheep habitats. McCollough et al. (1980) found that while cattle and bighorn diets were somewhat similar, bighorn sheep used steep slopes avoided by cattle; thus cattle had minimal impact on winter and spring areas deemed to be critical to bighorn sheep. In another study, bighorn sheep core habitat areas and distance to escape terrain decreased in response to proximity to cattle (Bissonette and Steinkamp 1996). These researchers observed that bighorn sheep moved away from cattle when approached. Cattle use resulted in fragmented habitat, as less area was available to bighorn sheep when cattle were present. Taylor (2001) reported ewes were displaced by the presence of cattle. When cattle stocking rates were excessive, bighorn sheep avoided otherwise suitable habitats due to excessive forage removal. He concluded the activities that attract cattle in bighorn sheep habitats (water development, salt placement, fences corrals) should be avoided. Also, cattle use of forage within 300m of known bighorn escape cover should be closely monitored for excessive use as these areas are important bighorn foraging areas.

The type of grazing system can affect bighorn sheep use of an area. Under season-long grazing of bighorn sheep winter range by cattle, bighorns preferred areas not already grazed by livestock (Bodie and Hickey 1980). Four years after implementing a rest-rotation grazing system, bighorn use shifted from an area closed to livestock grazing to the livestock-use pastures. It appeared that bighorn sheep preferred late-use pastures to early-use or rested pastures. Apparently, this was because late-use pastures were early-use pastures the previous year, and the combination of two years of grazing removed residual vegetation, providing for fall green-up preferred by bighorns. Similarly, Weigand (1994) noted use of rest pastures by bighorn sheep and general avoidance of cattle in a rest-rotation grazing system in the Highland Mountains in Montana. Weigand (1994) also looked at potential forage competition between domestic sheep, other wild ungulates, and bighorn sheep. Domestic sheep and wild sheep had similar food habits but the overriding issue was disease transmission from the domestic animals and not forage competition. Competition for forage with elk, deer, or antelope in this study was low due to the lack of spatial overlap. Weigand (1994) as well as other researchers (Constan 1970; Schallenberger 1966) concluded elk and bighorn sheep could compete for forage on winter range, as both species prefer graminoids at that time of year.

Another wild ungulate in Montana potentially competing for habitat with bighorn sheep is the mountain goat (*Oreamnos americanus*). In other parts of the West and in portions of Montana, mountain goats have been introduced into areas of native bighorn sheep habitat; this has resulted in concerns of competition between the two species for forage and space (Adams et al. 1982; Reed 1986). An area of concern is the Absaroka Mountains of south-central Montana where mountain goats were introduced beginning in 1956. This was an area inhabited by native bighorn sheep. Varley (1996) addressed the potential for competition between the two species in studying the ecology of this expanding population of mountain goats. In this case, there were differences in habitat selection and feeding behavior, which enabled the two species to avoid direct competition. At the time of his study, there was little overlap of the two species on winter range where he believed direct competition for forage could occur.

Cooperrider (1969) looked at the potential for competition for food between mule deer and bighorn sheep on Rock Creek bighorn sheep winter ranges in western Montana. Competition for grass was minimal because of different habitat preferences and high use of sagebrush by mule deer compared to bighorns.

Because of potential interactions between bighorn sheep and other grazers, both domestic and wild, it is essential for biologists and resource specialists from other agencies to assess range use and vegetation condition on important bighorn seasonal ranges. This assessment needs to occur for existing bighorn sheep populations as well as potential new transplant sites (see the Habitat Evaluation Procedure in the Translocation Program section).

Forest Succession and Fire

Arno and Gruell (1986), in studying conifer encroachment in mountain grasslands, concluded that since 1890, when major fires across the West decreased as a result of excessive livestock grazing, fire suppression efforts, and cessation of ignitions by Native Americans, Douglas fir (*Psuedotsuga menziesii*)

has become established in former grassland vegetation types. The importance to bighorn sheep of escape terrain and open habitats with good visibility and acceptable forage has been well documented (Geist 1971; Risenhoover and Bailey 1985; Wakelyn 1987). Further, Wakelyn (1987) found that ranges supporting greater numbers of bighorn sheep in Colorado had more high-visibility habitat, greater area dominated by grassland and rock cover, more habitat near open escape terrain, and greater topographic relief than ranges supporting fewer or no sheep. She also concluded that because of the lack of fire, forest succession has been a major cause of habitat loss for bighorn sheep. Risenhoover et al. (1988) suggested that bighorn sheep populations have continued to decline due to loss of habitat and disease. They further stated that maintenance of migration corridors providing sufficient visibility and escape terrain is critical to maintenance and mobile sheep populations. Additionally, Risenhoover et al. (1988) believed that ineffective management in relation to forest succession has resulted in small, isolated, and sedentary sheep herds. Enk et al. (2001), in studying the slow recovery of a bighorn sheep population in west-central Montana following a die-off, concluded that the lack of migratory behavior affected ewe productivity. Because this herd remained at low-elevation range throughout the year where the nutritional quality of summer forage was low, immunocompetence, susceptibility to disease, and herd productivity was negatively influenced. Risenhoover et al. (1988) recommended identifying seasonal ranges, migration corridors, and factors limiting bighorn range expansion. They further recommended the use of prescribed fire to improve visibility on these habitats, which encourages migratory movements and thus the use of adjacent habitats.

Peek et al. (1985) reviewed the affect of fire on seven bighorn sheep populations in a variety of habitats. They concluded that prescribed fire will not necessarily increase bighorn sheep populations and may have a negative effect. In areas of high fire frequency where plant responses are short-lived the bighorn sheep response may also be short-lived or nonexistent. There was evidence that prescribed fire used in conjunction with controlled livestock grazing plans may benefit bighorn sheep.

Other researchers also have reached varying conclusions on the use of prescribed fire and its affect on bighorn sheep ecology and sheep habitats. Hobbs and Spowart (1984) found that prescribed burning improved nutrition of winter diets but not spring diets and that treatment effects were short-lived (two years). Bentz and Woodward (1988) observed decreased use of four burn sites as distance from escape cover increased. At distances greater than 300m from escape cover, little use occurred. McWhirter et al. (1992) found preference for burned areas occurred in the spring but not in the winter, and that crude protein in simulated diets was greater in the spring compared to controls. Herbaceous production was greater in two of the four burn sites, bighorn sheep spent more time feeding in burn sites, and preferred areas for foraging were those opened up through removal of shrubs and trees.

In any effort to manipulate habitats with the objective of benefiting wildlife, a well-thought out plan must be developed (Peek et al. 1984). Additionally, an adequate monitoring program needs to be implemented to determine long-term affects on the vegetation and responses, in this case, on bighorn sheep populations.

McBratney et al. (1998) discussed the importance of implementing prescribed fire as well as letting wild fire burn in appropriate well-defined areas. The objective is to return fire to a more historical and landscape level to benefit a variety of wildlife species. FWP needs to work with other resource managing agencies to jointly determine where it is appropriate to let naturally ignited fires burn. Part of that decision will involve attempting to map migration and movement corridors in an effort to maintain openness and connection between wildlife habitats. FWP, as part of this Conservation Strategy, is working on a GIS Habitat Risk Analysis. This effort will be ongoing as new information becomes available, but the initial analysis will include known movement patterns of bighorns, critical seasonal bighorn habitats, and habitats that may be threatened by human development. This effort will help FWP, other agencies, and interested parties in prioritizing efforts to protect bighorn sheep habitats and populations now and in the future.

Noxious Weeds

Across Montana there are a little over eight million acres (9%) infested with noxious weeds; this includes every county in the state (Duncan 2008). The ecological and economic impacts caused by noxious weeds are numerous and include impacts to water quality, reduction in long-term production of land, loss of native vegetation species, increased erosion, and loss of wildlife habitat. Knapweeds in Montana cost an estimated $42 million annually (Hersch and Leitch 1996).

As mentioned earlier, most bighorn sheep habitat in Montana occurs on lands managed by the USFS and the BLM. The Forest Service manages 16.9 million acres in Montana with an estimated 900,000 acres (5%) infested with

noxious weeds (Duncan 2008). The BLM manages about eight million acres in Montana with about 1,116,058 acres (14%) currently infested with noxious weeds (Duncan 2008). Both agencies spend about $1.5 million each on noxious weed management annually in Montana. It is estimated that to effectively manage noxious weeds, each agency needs to spend about $6 million annually (Duncan 2008). These statistics point out that inadequate resources are being applied in an effort to control noxious weeds on public lands.

In recent years, wildfires have increased in the West, both in number and size. The use of prescribed fire to manage vegetation has become an integral part of the USFS and BLM's resource management programs and plans. Additionally, both agencies have and are currently developing plans where it is appropriate to let naturally ignited fires to burn. There are obvious benefits to allowing fires burn where appropriate, e.g., fuel reduction, meeting vegetation objectives, and reduced suppression costs; however, one of the primary issues with fire management programs today is the spread of noxious weeds. Most noxious weeds are forbs, which respond positively to the disturbance caused by fire. Frequently, standard protocol on federal lands to address noxious weed infestations that occur in areas targeted for prescribed burning is preliminary identification of the distribution of the infestation, treatment of the infestation one year before burning and one year after burning, and perhaps additional monitoring thereafter. Depending on weed species present and the extent of the infestation, proliferation of the infestation. FWP supports appropriate burning programs and needs to work with land managing agencies to ensure that noxious weeds are adequately treated by an appropriate method in relation to managed fire where wildlife habitats are concerned.

Another emerging issue related controlling noxious weeds in Montana in relation to bighorn sheep is the use of domestic animals to control infestations through grazing. This may be an appropriate technique but not in the proximity of bighorn sheep because of the concern over transmission of disease from domestic sheep or goats to bighorn sheep. As part of this Conservation Strategy, FWP has developed recommendations of where it may be appropriate to use this weed management technique without threatening the health of bighorn sheep (see the Health Monitoring and Managment section).

LAW ENFORCEMENT

Montananans value bighorn sheep in many ways. Beyond opportunities to see bighorn sheep in wild habitats across Montana, various programs such as the SuperTag and Bighorn License Auction—combined with the competition for drawing a license to hunt a bighorn, makes a bighorn sheep hunting license among the most coveted in Montana.

The high regard in which bighorn sheep are held also motivates some to do whatever they feel is necessary to take a trophy, regardless of the law. Illicit activity associated with bighorn sheep mounts and horns and complex poaching schemes continue to be law enforcement focus points. As such, law enforcement plays an important role in the protection and management of Montana bighorn sheep.

As stated previously, in Montana prior to 1974 no legally taken rams breaking a 200-point score were recorded in the Boone and Crockett records. Today, however, Montana is regarded as a likely site for a new world record. The thirst among some for world-record notoriety at any cost, combined with the potential monetary value of a bighorn sheep in the 200-point class, are two factors that contribute to illegal bighorn sheep– related activity in Montana.

Although penalties for the unlawful taking or possession of bighorn sheep have always been substantial (87-1-111 MCA), legislation passed in 2005 (87-1-115 MCA) provided additional restitution for the unlawful taking or possession of trophy animals. Under this statute, restitution for a person convicted of the purposeful or knowing illegal killing, taking, or possession of a trophy bighorn sheep with at least one horn equal to or greater than ¾-curl as defined by FWP Commission regulation was set at $30,000. This is the highest restitution levied for a Montana wildlife offense and reflects the value that the people of the state place on bighorn sheep.

From January 1999 through December 2008, 35 cases involving bighorn sheep were prosecuted, and fines totaling $15,866 were levied along with $126,500 in restitution. Five of those cases involved the $30,000 trophy restitution. In those cases, 12 people had their hunting, fishing, and trapping privileges suspended for a total of 140 years (FWP NTA Database).

During the past 10 years, 1-800-TIPMONT (Montana's natural resource crimes hotline) received 92 calls from the public reporting suspicious or unlawful behavior associated with bighorn sheep. Three of the five bighorn convictions involving trophy restitution initially came in as TIPMONT calls (TIPMONT Program Coordinator, pers. comm.).

Enforcement Challenges

A number of new bighorn sheep challenges confront Montana game wardens, and are summarized below:

In Montana, it is illegal to pick up and possess sheep heads and horns even if the mortality was due to natural causes. Beginning in January 1982, plugging of previously possessed sheep heads was ended and prohibited by FWP rule. Both Wyoming and Idaho, however, allow the possession of bighorn sheep heads/horns found in the wild and require them to be plugged, to ostensibly provide a means through which unlawfully acquired Montana bighorn sheep can be legitimized. There is little prospect of current laws in either state being changed in the near future.

Within Montana, nonresident application restrictions for bighorn sheep licenses in certain districts (87-2-506(2) MCA) have led to unlawful outfitting and poaching convictions, suggesting that, for some, illegally obtaining such a bighorn sheep trophy is worth the risk of fines and restitutions.

In some areas of Montana, leased access through private land that surrounds bighorn sheep habitat on both private and federal Bureau of Land Management lands has led to difficult access for hunters and game wardens. State law requires wardens to obtain landowner permission prior to entering private property (with certain exceptions), which has also limited FWP's ability to investigate alleged illegal activities and check for hunter compliance.

Other enforcement challenges include transferring licenses among family members to conceal illegal harvests, the use of tribal sheep licenses to conceal bighorn sheep illegally taken outside reservation boundaries (Wright and Reno 1999), the use of unlimited sheep licenses for bighorn sheep taken from limited license districts, "finder's fees" for locating trophy class

sheep that some suggest can lead to illegal activity, spotting sheep from the air and hunting the same day, illegal use of cell phones and two-way radios, trespass, and unlawful off-road travel.

Enforcement Strategies

The protection of Montana's bighorn sheep from unlawful exploitation has been and will remain an ongoing effort. Through the use of both covert and uniformed officers, large-scale, commercial and private illicit operations will continue to be pursued. The cost of these complex cases can be enormous, taking months and sometimes years to thoroughly investigate and prosecute. Although restitution from convictions is used to fund regional investigator positions, the time required required of field wardens and covert officers to build cases adds costs in terms of absence from other duties as well as major operational expenses.

Continued cooperation with local prosecutors and the Montana State Attorney General's office (which has a half-time prosecutor dedicated to wildlife crimes) in the pursuit of those involved with illegal bighorn sheep hunting will result in prosecution and convictions. Because of high penalties and trophy restitutions and the willingness of judges to impose significant privilege revocations, cases that are successfully prosecuted will be brought into the public spotlight. The regular imposition of stiff penalties will be a deterrent to some of those who might otherwise pursue unlawful activity. Nonetheless, the value of bighorn sheep, both monetary and intrinsic, remains high, and there will be those who are willing to break the law for monetary gain or personal aggrandizement.

The TIPMONT Program, in concert with work by FWP regional investigators and field wardens, will continue to play a crucial role in abating unlawful activities associated with bighorn sheep. Public understanding of the severity of the issue, coupled with a growing willingness to report suspicious or illegal activity, will continue to provide an important means for FWP Enforcement to expand what is a limited presence, considering the number of officers available in the field and the size of their districts to patrol. In essence, the hunting public plays a huge role in curtailing illegal activity as well as policing their own ranks.

Other strategies include enhanced saturation patrols of trophy and unlimited areas during key periods of the sheep season as well as the use of additional aerial surveillance and other tools to determine the distribution of hunters, particularly in western and central Montana (Wright and Reno 1999). Areas that are becoming popular as "trophy" areas need to receive heightened attention by both uniformed and undercover officers. analysis will include known movement patterns of bighorns, critical seasonal bighorn habitats, and habitats that may be threatened by human development. This effort will help FWP, other agencies, and interested parties in prioritizing efforts to protect bighorn sheep habitats and populations now and in the future.

CHAPTER 2

INDIVIDUAL MANAGEMENT PLANS FOR HUNTING DISTRICTS AND UNHUNTED POPULATIONS

There are 45 distinct bighorn sheep populations managed by Montana Fish, Wildlife & Parks (FWP) in 40 hunting districts, 36 of which were open for hunting in 2008 (Table 7 and Figure 12). There are an additional two populations that occur in Glacier National Park, a couple of populations that move in and out of Montana and Yellowstone National Park, and at least two populations that are managed by different Indian tribes in Montana.

Figure 12. Bighorn sheep hunting districts, Montana, 2008.

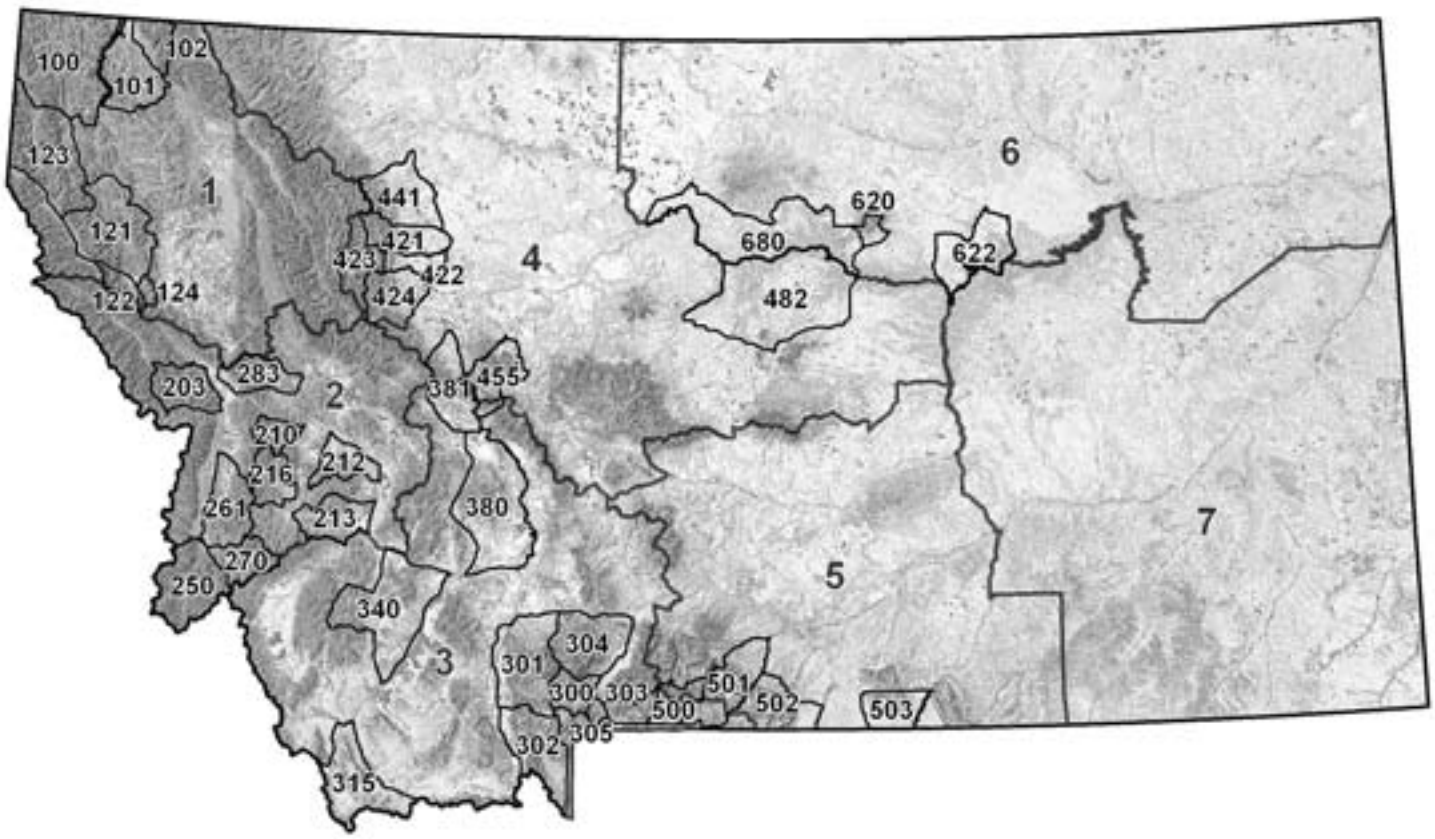


Table 7. Total number of bighorn sheep observed , population objective by hunting district and year(s) of any major die-off.

Hunting District	Herd Unit Name	Current Total	Population Objective		Recent Die-Off Year(s)
			+10% Total	+20% Total	
100	Kootenai Falls	79	175		1995
101	Ural-Tweed	30	150		1999
102	Galton Range	61	150		
121	North Clark Fork	270	250		
122	Clark Fork Cut-Off	141	115		
123	Cabinet Mountains	78	105		
124	Paradise	324	325		
	Wildhorse Island	139	110		
R1 Totals		1122			
203	Grave Creek Range	151	130		
210	John Long Range	201		200	
212	Garrison	65		125	
213	Lost Creek	314		250	1991
216	West Rock Creek-Quigg Peak	342		300	1967
250	Watchtower	18		20	
	Paint. Rocks	120		120	
261	Skalkaho	90		120	
270	E. Bitteroot	170		200	
283	Lower Blackfoot	128	100		
R2 Totals		1599			
300	Gallatin-Yellowstone	35	215 [1/]		1982
301	Spanish Peaks	158		150	1999
302	Hilgard	105		100	1987-97
303	South Absaroka	20			
304	Hyalite	25			
305	South Yellowstone	35			
315	Tendoy Mountains	59	200		1993-99
340	Highland Mountains	12		125	1995-08
380	Radersburg	40		125	2008
381	Sleeping Giant	7		125	2001-07
	Mill Creek	25		25	
	Greenhorns	31		125	
R3 Totals		552			
421	Deep Creek	60	175		1984
422	Castle Reef	215	200		
423	Gibson Lake North	204	200		1984
424	Ford Creek	298	200		1984
441	North Fork Birch Creek-Teton	138	200		1984
482	Fergus	348	325		
455	Beartooth WMA-GMWA	97	250		1984
R4 Totals		1360			

Table 7 continued.

Hunting District	Herd Unit Name	Current Total	Population Objective		Recent Die-Off Year(s)
			+10% Total	+20% Total	
500	Stillwater River	46	55		
	Monument Peak	26	40		
501	Beartooth Mountains	78	70		
502	Hellroaring	41	50		
503	Pryor Mountains	78	85		1995
R5 Totals		269			
620	Little Rockies	80	85		1998
622	Middle Missouri Breaks	202	185		
680	Chouteau-Blaine-Phillips	450	425		
R6 Totals		732			
R7 Totals	Blue Hills	60	60		
Statewide Totals		5694	4505	2110	
Total Statewide Objective			6615		

1/ This objective is for Hunting Districts 300, 303, 304, 305 and Yellowstone Park bighorns along the Northern border of the Park (entire Upper Yellowstone Complex).

Since 1984, 15 populations (33%) have gone through a die-off (Table 7). One additional population that was located in the lower Boulder River (former Hunting District 504) south of Big Timber went through a die-off in 1999 and 2000 and by the following year out of an estimated 100 bighorn sheep none remained. While Montana has a reputation of producing large rams not all populations are meeting desired objectives. Twenty-seven (60%) of the 45 populations have less than 125 sheep, which is a minimum viable population (MVP) (Table 8). Eighteen (40%) of bighorn populations are below objective and 12 populations have an objective less than 125 sheep. Having less than 125 sheep in a population or an objective of less than 125 sheep may not be critical in sustaining a population if the individual population is part of a larger viable metapopulation where genetic exchange occurs maintaining genetic diversity and overall fitness of the population. However, isolated populations with less than a MVP may be difficult to maintain over time. In these small populations factors that may be limiting population growth (habitat, genetic fitness, or other factors) need to be determined.

Nine of the populations that have gone through a die-off have not recovered to their pre die-off status, some after several augmentations. These die-offs tended to be all age epizootic events in introduced populations. Survivors retain pathogenic agents that are toxic to lambs and poor lamb recruitment is the primary reason for lack of recovery in these populations. The status of these nine populations, considering the current knowledge of disease in bighorn sheep, is not likely to improve in the near future and points out the necessity for preventing these types of die-offs from occurring.

FWP Region	Number Populations	Number < 125	% < 125	Number < Objective	% < Objective	Objective < 125	% with Objective < 125
1	8	4	50	4	50	3	38
2	9	3	33	2	22	1	11
3	12	11	92	5	42	1	18
4	7	2	29	3	43	0	0
5	5	5	100	4	80	5	100
6	3	1	33	0	0	1	33
7	1	1	100	0	0	1	100
Total	45	27	60	18	40	12	27

Table 8. Status of bighorn populations in relation to objective by FWP Region.

INDIVIDUAL MANAGEMENT PLANS

The following individual management plans for bighorn populations are essential in the future management of bighorn sheep in Montana. Each individual management plan contains a comprehensive history of the population, habitat and population objectives, and strategies for meeting those objectives. The objectives for each population of bighorns will direct the future management of the species in that area.

KOOTENAI FALLS

(Hunting District 100)

Description: Located in the extreme northwest corner of the state, this 1,414-square-mile hunting district is composed of the Purcell Mountain Range within Montana and is bounded on the north by British Columbia, Canada, on the west by Idaho, and on the south and east by the Kootenai River and Lake Koocanusa, respectively. The terrain is mountainous and heavily timbered, featuring some of the wettest forest habitat types in Montana. Lands administered by the Kootenai National Forest comprise 95% of this hunting district. The remaining 5% of the land base consists of small private holdings located primarily along the major stream corridors (2%), and corporate timberlands, primarily Plum Creek Timber Company (3%). The 172-acre Kootenai Falls Wildlife Management Area (WMA) is situated along the north shore of the Kootenai River in the extreme southern portion of the area, and the 900-acre West Kootenai WMA is situated in the extreme northeast corner of the hunting district adjacent to the Canadian border. Several small roadless areas including Northwest Peaks, Buckhorn Ridge, Grizzly Peak, Roderick Mountain, and Gold Hill exist as scattered islands of unroaded habitat comprising approximately 82,000 acres. Timber management is the dominant land use in the area.

The Kootenai Falls bighorn sheep herd occupies less than 2% of the Purcell Mountains in the extreme southern portion of the range along the Kootenai River canyon near Kootenai Falls. Total habitat occupied is approximately 22 square miles and consists almost entirely of public land managed by the U.S. Forest Service, including the Kootenai Falls WMA administered by FWP. The present sheep population is well established along the Kootenai River escarpments and up small tributaries draining into the river from the north. No long-distance migrations from the Kootenai River corridor to disjunct mountains to the north have been observed. Seasonal distribution patterns are simple elevation movements due to changes in weather and plant phenology. However, in recent years, a small group of sheep has established itself to the south across the Kootenai River into the north end of the Cabinet Mountains, directly across from the parent population. Other small groups of sheep are occasionally observed wandering upstream toward Libby Dam, but appear not to be establishing permanently at this time.

Public Access: The Kootenai Falls bighorn sheep herd occurs on and is surrounded by public land with very few restrictions on public travel. The sheep range is surrounded by roads that are open for public use nearly year-round. The Kootenai Falls WMA, owned and managed by FWP, provides year-round nonmotorized access to the sheep range all along the Kootenai River, and is used by sheep nearly every month of the year. There is a residential subdivision along the Kootenai River at the east end of the sheep range, which does limit public access to national forest lands behind some of the homes.

Bighorn Sheep Population: The Kootenai Falls bighorn sheep population is the result of a 1954-55 introduction of 12 and four sheep, respectively, all originating from Wildhorse Island in Flathead Lake. The initial transplant consisted of five rams and 11 ewes, which continued to increase and establish a viable population that appeared to peak at about 150 to 200 animals by the mid-1980s. The population began showing signs of decline throughout the late 1980s and early 1990s, and eventually experienced a drastic reduction in numbers during the 1994-95 winter. Causative factors for the decline were not identified, but a large wildfire on the sheep range during late summer 1994, with associated fire suppression activities, may have induced stress-related disease agents to reduce the herd by at least 50%. The population showed no signs of recovery over the succeeding five years due to the extremely severe winter of 1996-97 and chronically low lamb recruitment rates. At the same time, the sympatric mule deer population was also declining and the mountain lion population was increasing, which may have plunged the very small sheep population into a "predator trap." At that point, the decision was made to augment the existing population with

Year	Source	Ewes	Lambs	Rams	Total
1954	Wildhorse Island	11		5	16
2000	Thompson Falls	11	5		16
2003	Bonners	1	1		2
2004	Sun River	18	6		24
2008	Wildhorse Island	20	4	14	38

Table 1. Transplant history for Kootenai Falls bighorn sheep herd.

additional sheep from various herds around Montana (Table 1). On March 16, 2000, 16 sheep, consisting of 11 adult ewes, three female lambs and two male lambs were captured from the Thompson Falls herd (Hunting District 121) and released on the Kootenai Falls WMA. Attempts to remove sheep from the Bonner population near Missoula (Hunting District 283) resulted in the capture of one adult ewe and one female lamb, which were released onto the Kootenai Falls WMA on February 12, 2003. During winter 2004, two sheep net-gunning operations conducted on the Sun River area resulted in the capture of 24 bighorns. The first capture episode caught 12 sheep, consisting of seven adult ewes, four female lambs and one male lamb, all of which were transported to and released onto the Kootenai Falls sheep range on January 4, 2004. The second group of sheep, also numbering 12 animals, consisted of 11 adult ewes and one female lamb, all of which were released on the Kootenai Falls WMA on February 23, 2004. The last transplant of sheep onto the Kootenai Falls sheep range occurred on January 15 and 16, 2008. A total of 38 sheep (20 adult ewes, three male lambs, one female lamb, 14 adult rams) were captured on Wildhorse Island in a net-gun operation and released onto the Kootenai Falls sheep range. There was 12 to 15 inches of snow at the release site at the time of the transplant. Snowfall continued for the next six weeks until there was 28 to 34 inches of snow at the release site by the end of February. From mid-January through late March, snow continued to accumulate in the Purcell and Cabinet mountains, creating severe winter conditions for big game animals in the area. There had not been snow of this magnitude on the Kootenai Falls WMA since the winter of 1996-97. Normal snow accumulation on the Kootenai Falls WMA averages about a foot. Due to these severe winter conditions, it is estimated that approximately one-half of the transplanted sheep died due to deep snow accumulation or were predisposed to mountain lion predation. Other big game ungulates also suffered during this winter period as evidenced by low fawn and calf recruitment rates gathered from April 2008 surveys in the area. In spite of the 2008 winter conditions, the observation of 79 sheep on the Kootenai Falls area during April aerial surveys was the highest sample since 1992 (Figure 1 and Table 2). Population parameters from the previous few years (number of adult ewes, lamb:ewe ratios above 35:100, and number of adult rams in the population) are indicative of an increasing population.

Recreation Provided: Recreational opportunities provided by the Kootenai Falls bighorn sheep herd is a matter of longstanding record. This population was the first transplanted herd

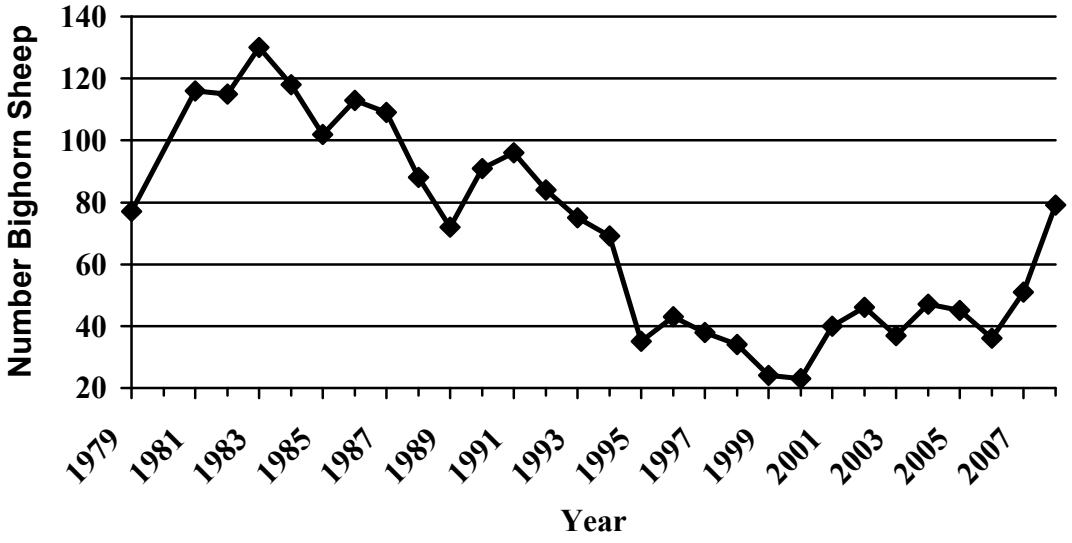


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Kootenai Falls poplulation, Hunting District 100, 1979-2008.

Table 2. Classification data from aerial surveys for the Kootenai Falls population, Hunting District 100, 1979-2008.

Year	Ewes	Lambs	Rams	Uncl.	Total	Lambs: 100 Ewes	Rams: 100 Ewes
1979	35	10	20	12	77	29	57
1981	58	24	34	0	116	41	59
1982	56	15	42	2	115	27	75
1983	69	21	40	0	130	30	58
1984	74	23	21	0	118	31	28
1985	62	17	23	0	102	27	37
1986	59	12	33	9	113	20	56
1987	60	10	39	0	109	17	65
1988	56	9	19	4	88	16	34
1989	42	18	12	0	72	43	29
1990	51	14	26	0	91	27	51
1991	62	10	24	0	96	16	39
1992	45	14	25	0	84	31	56
1993	37	11	27	0	75	30	73
1994	31	7	31	0	69	23	100
1995	22	6	7	0	35	27	32
1996	23	1	19	0	43	4	83
1997	27	4	7	0	38	15	26
1998	24	4	6	0	34	17	25
1999	17	0	7	0	24	0	41
2000	11	2	10	0	23	18	91
2001	24	7	8	1	40	29	33
2002	28	8	10	0	46	29	36
2003	25	4	4	4	37	16	16
2004	25	5	17	0	47	20	68
2005	27	10	8	0	45	37	30
2006	22	8	6	0	36	36	27
2007	21	10	20	0	51	48	95
2008	40	8	31	0	79	20	78

to provide hunting recreation in northwest Montana, and it has provided legal hunting of sheep since 1957. Prior to 1975, the Ural-Tweed native population of sheep along the east side of Lake Koocanusa and the Kootenai Falls population were both included in one hunting district. Hunters with a permit could hunt sheep in either herd, although most sheep hunters had shifted to hunting the Kootenai Falls sheep by 1970. The harvest record may include a few rams harvested from the Ural-Tweed population prior to1975 (Table 3). After the population decline during the winter of 1994-95 and the severe winter of 1996-97, hunting of these sheep was suspended from 2000 to 2005, but reestablished with one either-sex permit in 2006. Well over 120 rams have been legally harvested from this herd over the last 35 years. Many of those rams have been entered into the Boone and Crockett records, with some individuals scoring in the low 190s.

Aside from hunting recreation, the Kootenai Falls bighorn sheep provide inestimable viewing pleasure for tourists and local residents in the Libby-Troy area. U.S. Highway 2, along the south side of the Kootenai River, travels the entire length of the sheep range and provides travelers with several pull offs and viewpoints to look for sheep. On the opposite side of the river, where the sheep actually live, the Kootenai Falls WMA and the old Kootenai Falls portage trail traverse several miles of the sheep range and include an access point at the hanging footbridge just below Kootenai Falls. Access to the Kootenai Falls WMA and the trail/road is closed to unauthorized motorized travel from the east end of the sheep range. However, many visitors use the WMA trail/road as a destination

Year	Either Sex Licenses	Ram Harvest	Ewe Licenses	Ewe Harvest
1970	5	1	0	0
1971	5	4	0	0
1972	5	4	0	0
1973	5	1	0	0
1974	5	5	0	0
1975	5	4	0	0
1976	5	5	0	0
1977	5	3	0	0
1978	5	5	10	6
1979	5	5	10	7
1980	5	5	10	6
1981	7	7	12	7
1982	6	5	4	4
1983	8	8	15	11
1984	8	8	15	8
1985	8		15	
1986	5	5	10	8
1987	5	4	10	10
1988	5	4	10	8
1989	5	5	10	8
1990	5	4	10	8
1991	5	5	10	7
1992	5	6	10	5
1993	5	5	5	5
1994	5	5	5	3
1995	5	4	5	2
1996	3	3	0	0
1997	3	3	0	0
1998	1	1	0	0
1999	1	1	0	0
2000-2005	Closed	Closed	Closed	Closed
2006	1	1	0	0
2007	1	1	0	0
2008	2	2	0	0

Table 3. Harvest data for the Kootenai Falls population, Hunting District 100, 1970-2008.

area for hiking/mountain biking/horseback riding to include wildlife viewing, primarily for bighorn sheep. Bighorn sheep are present on the WMA during every month of the year, but are especially prevalent on the WMA-maintained hayfields during spring and early summer months. Special FWP Commission regulations allows public access to this WMA year-round, whereas most WMAs with big game winter range are closed to the public from December 1 through May 15 each year. The WMA has become a very popular area for recreational activities. Increasing public demands on the WMA may require additional restrictions on public use of the area to allow bighorn sheep and other wildlife some solitude during critical portions of the year.

Current Annual Bighorn Sheep Harvest: Because of improving bighorn sheep population trend monitoring data gathered on this herd from aerial surveys conducted each spring, a hunting season with one either-sex permit was reopened in 2006. One six-year-old ram has been harvested from the herd for each of the past two hunting seasons (Table 3). Two either-sex licenses were issued for the 2008 hunting season. Two rams, both scoring the minimum for entry into the Boone and Crockett records, were harvested from this population in 2008.

Additional either-sex licenses and possibly some ewe licenses will be recommended as the population approaches pre-decline numbers in spring aerial surveys.

Accomplishments: The Kootenai Falls bighorn sheep range has been incorporated into the Kootenai National Forest Integrated Land Use Plan as a big game winter range designation specific to bighorn sheep. Project activities such as logging and prescribed burning on national forest lands within the sheep range will be directed at enhancing bighorn sheep habitat. To date, some prescribed burning and helicopter logging have occurred on this sheep range. Habitat enhancement projects are coordinated with FWP. FWP purchased 172 acres of sheep habitat as a three-mile corridor along the north shore of the Kootenai River, which now comprises the Kootenai Falls WMA. Weed management activities, hayfield maintenance and some salvage timber harvest have occurred to improve forage production on this WMA.

Management Challenges: Habitat deterioration through fire suppression continues to be a problem on the Kootenai Falls bighorn sheep range. Compared with sheep habitats in other regions of the state, sheep ranges in northwest Montana are represented by heavily timbered shrub-dominated communities with very little grassland vegetation types available. Historically, wildfire prevailed on the landscape and maintained vegetation communities of ponderosa pine and bunchgrasses over much of the sheep range. With the advent of effective fire suppression by the USFS over the past 50 years, sheep forage such as bunchgrasses and certain shrubs are being replaced by Douglas fir trees through encroachment onto open foraging sites or under the ponderosa pine canopy. This has resulted in gradual habitat deterioration for bighorn sheep. Recent timber harvest and prescribed burning projects on this sheep range have provided some limited habitat enhancement for bighorns.

Disease issues related to contact between bighorns and domestic sheep has only recently become a problem for the Kootenai Falls bighorn sheep as residential development on the Bighorn Terrace Subdivision, immediately upstream from the Kootenai Falls WMA, has brought in hobby farmers with domestic goats. There are no grazing allotments for domestic sheep or other livestock anywhere near the Kootenai Falls herd. However, bighorns from this herd sometimes take excursions off the sheep range, especially during the rut, and may come in contact with domestic sheep on hobby farms scattered throughout the area. Because public use of the Kootenai Falls WMA continues to increase, future restrictions on human activities may be necessary to provide wildlife sanctuary.

Population Monitoring: Since 1979, annual helicopter surveys of the Kootenai Falls bighorn sheep population have been conducted during the spring grass green-up period in early to mid-April (Table 2). The heavily timbered nature of this sheep range provides considerable cover for sheep to avoid observation, and precludes total population counts during these short aerial surveys. A very simple mark-recapture sightability assessment was conducted on these sheep in the mid-1980s. Information from that trial indicated that we were able to see approximately 65-75% of the sheep on this sheep range during spring helicopter surveys. These surveys should continue as the primary population trend monitoring effort for these sheep.

Summary of Public Comment

The general public has been very supportive of this bighorn population and was involved in its recent augmentation. There is local support for maintaining hunter opportunities in relation to this herd.

Management Goal

Manage for a stable sheep population in a healthy condition consistent with available habitat on public land, with emphasis on maintaining some older age class rams in the population.

Habitat Objectives

Encourage improvement of habitat conditions on publicly owned (primarily USFS) winter ranges and other seasonal ranges so that vegetation conditions on these winter ranges provide adequate forage and security for bighorns and other wildlife.

Habitat Management Strategies

FWP will work cooperatively with the USFS to:

1) Increase consideration for sheep habitat productivity and sheep security needs in the planning of timber sales, transportation systems, and habitat enhancement projects within the sheep range.

2) Identify and map sheep winter ranges.

3) Manage limited winter range to accommodate the current sheep population.

4) Encourage the USFS to maintain open foraging areas on the sheep range through reductions in conifer encroachments onto previously open foraging areas.

Game Damage Strategies

Game damage by bighorn sheep is currently not an issue. As more homes are built on the Bighorn Terrace Subdivision, residents may become annoyed with sheep foraging on lawns and ornamental plants. Fencing around homes and plants will be recommended.

Access Strategies

Because most of the Kootenai Falls bighorn sheep range is located on national forest land and the FWP WMA, hunter access is generally not an issue. However, to ensure continued hunter access opportunities, FWP will:

1) Identify important points of access to public lands and provide recommendations for acquisition, maintenance, and development to the appropriate land management authority.

2) Continue to review USFS road management and travel planning efforts and provide input that encourages maintenance of sheep habitat security and current levels of hunter access.

Population Objectives

1) Maintain the number of bighorn sheep observed during early spring aerial surveys within 10% of 125 observed bighorn sheep (112 to 138).

2) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys no greater than 50 rams: 100 ewes.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 100 is located in the Northwest Montane ecological region (see discussion of ecological regions in Chapter 1) which includes much of northwest Montana. This bighorn population is relatively stable, is characterized as having moderate lamb production with good recruitment rates, is slightly below population objective, and has a relatively high ram to ewe ratio. Bighorn numbers are currently being managed to allow an increase in numbers while providing for a conservative harvest of the ram segment. The population objective of 125 (± 10%) observed bighorn sheep was derived by considering the ability of public lands to provide forage for wintering bighorn sheep.

Prescriptive Harvest Management

Ewes: Not applicable at this time.

Rams: Harvest will remain conservative with the number of either-sex licenses recommended equal to approximately 10% of the rams observed during aerial surveys.

URAL-TWEED
(Hunting District 101)

Description: The Koocanusa/Ural-Tweed herd of bighorn sheep (Hunting District 101) is located on the Rexford Ranger District of the Kootenai National Forest in the northwest portion of the Salish Mountains. It contains approximately 35 to 40 square miles of sheep habitat, all of which is managed by the U.S. Forest Service (USFS), with the exception of two small parcels of private land that total less than 100 acres. It is located along the east shore of Lake Koocanusa and is about 20 miles southwest of Eureka, Montana. It extends from approximately Pinkham Creek on the north to Fivemile Creek in the south. The habitat is characterized as being steep, rocky, and primarily forested, with a variety of forest types. Historically, sheep habitat extended to the valley floor along the Kootenai River. However, with the construction of Libby Dam and the creation of Lake Koocanusa in the 1970s, all of the bottomland habitat was lost, including approximately 4,350 acres of bighorn habitat. In addition, the suppression of natural fires for over 50 years allowed for the establishment of dense conifers on sites that had previously been dominated by bunchgrasses. The Bonneville Power Administration (BPA) has coordinated with FWP and the USFS to mitigate for habitat loss through the use of controlled burns and

logging in order to improve remaining habitat for sheep.

Public Access: Most of the access for this herd is provided by MT Highway 37, which parallels the east shore of Lake Koocanusa and runs the entire length of the sheep distribution. Several Forest Service roads also provide additional access; however, because of the terrain, most of the area is difficult to reach, even on foot. A few trails provide additional access to foot or horse travelers. Given the area is wholly managed by the USFS, foot traffic is not limited.

Bighorn Sheep Population: This herd and the Ten Lakes bighorn sheep herd (Hunting District 102) are native to northwest Montana and are of a different genotype than sheep found elsewhere in Montana. This genotype extends from Koocanusa northward to Golden, British Columbia, and is commonly referred to as "Trench" sheep in Canada, due to their presence within the Rocky Mountain Trench. This herd is native and not the result of transplants from other herds. Efforts have been made to augment this population with genetically similar sheep from the Ten Lakes herd and also from Canada. Results from these efforts have been poor, with only two sheep (one adult female and one male lamb) moved thus far. These sheep were part of the Ten Lakes herd and were moved in 2006. Five rams from the National Bison Range were released in this herd in 1963.

Efforts to increase this population and at the same time maintain its genetic integrity have been further compromised by the establishment of a herd of bighorn sheep at Libby Dam. This herd has its origins from a group of sheep that came from Kootenai Falls, which had its origins from sheep from the Sun River area. Sheep from this "splinter" group have been observed several miles north of Libby Dam on both sides of Lake Koocanusa. Rams from this small herd have not yet infiltrated the Ural-Tweed herd; however, it is only a matter of time before they do. While the introduction of new genetics from Kootenai Falls could increase the reproductive vigor for the Ural-Tweed herd, maintaining the genetic integrity of the "Trench" genotype would become a moot point.

The current number of sheep occupying Koocanusa is low, probably consisting of fewer than 30 sheep. In the mid-1960s, approximately 150 to 200 sheep occupied this area. By the late 1970s, the population had declined to only 20 to 25 animals. Bighorn numbers recovered to approximately 150 to 200 sheep by 1990, before beginning a second decline. In 1999, Hunting District 101 was closed to the hunting of all sheep due to drastically reduced populations and has not resumed since.

Efforts to monitor the population are difficult, due to the forested nature of the habitat. For example, during a three-hour helicopter flight of this area on April 28, 2008, to monitor sheep, mule deer, and elk, only two sheep were observed. As an alternative, significant emphasis has been placed on documenting sightings from the public and others who travel MT Highway 37 on a regular basis. This provides valuable information on group size and location. A compilation of sightings for 2007 and helicopter flights for 1995 to 2008 is contained in Tables 1 and 2, respectively.

Extensive efforts to increase the population of sheep along Koocanusa have included habitat manipulation and improvement in the form of burning, helicopter logging, and timber harvesting. To date, over 28,000 acres of habitat have been manipulated along Koocanusa in a direct effort to improve habitat for bighorn sheep and mule deer, at a cost to FWP of over $1.6 million. In addition, efforts were undertaken to reduce losses due to predation by directing lion hunters to this area, issuing season-long permits to lion hunters from 2002 to 2005 that were not subject to quotas. Efforts were also made to augment this herd with sheep from other areas with the Trench genotype. Due to concerns regarding Mad Cow Disease, the U.S. Department of Agriculture (USDA) halted the importation of all bovids from Canada in 2001. Although restrictions have been eased for cattle, it continues for sheep and goats. Two sheep were successfully moved from the Woods Ranch Wildlife Management Area (WMA) to Koocanusa in March 2006. Concerns regarding inbreeding depression while trying to maintain the genetic integrity of this herd continue to be an issue.

Recreation Provided: From 1990 to 1997, three ram: mits annually were issued for this area. In 1998 this was reduced to a single permit, and in 1999 sheep hunting in Hunting District 101 was discontinued. All permits issued for the 1990 to 1998 period (N = 25) were successfully filled. While no longer hunted, many motorists enjoy observing the occasional sheep while traveling between Libby and Eureka.

Current Annual Bighorn Sheep Harvest: None.

Accomplishments: In 1984, a joint project between FWP, the USFS, and the BPA was

1/22/07	Brad Flickinger saw three rams by Peck Gulch; also several ewes and lambs.
1/23/07	Jerry Brown (FWP Biologist) saw four rams on Horse Range (below Libby Dam) and had reports of people seeing sheep in Dunn Creek, Souse Gulch, and on Hornet Ridge.
1/23/07	Ron Hvizdak saw 10 sheep by Tweed Creek last week.
1/24/07	Jim Roberts (Game Warden) saw about 10 sheep by Stone Hill, which included a ½-curl ram.
2/05/07	Jim Roberts saw 13 sheep at 36 MM (Sheep Creek), which included: four rams, nine ewes and zero lambs.
2/27/07	Jay DeShazer saw four ewes, zero lambs by Rocky Gorge; one ewe with collar.
3/01/07	Jay DeShazer saw four rams by McGuire Creek; two were full-curl and two were ¾-curl.
3/05/07	Brad Flickinger saw three ewes by Rocky Gorge; one had collar.
3/05/07	Jerry Brown saw two ewes, one lamb, and one small ram by Allen Gulch; one ewe had collar.
4/09/07	Jim Williams (Eureka) saw two large rams on east side of Libby Dam.
4/18/07	Arlie Burk saw a single ewe by McGuire Creek.
11/05/07	Jay DeShazer saw three rams, three ewes, and two lambs by Allen Gulch; one ram nearly full-curl and two were ½-curl.
11/19/07	Jim Roberts said Bob DeShazer reported seeing two rams (¾-curl) on the west side of Koocanusa by Cliff Point in Gold Creek on the FDR road
11/20/07	Jim Roberts saw three ewes by Allen Gulch, none collared.
11/23/07	Nathan Alberton reported seeing a single ¾-curl ram two miles south of Koocanusa Bridge.
11/26/07	Jim Roberts said that Chuck Barker (Rexford) reported seeing approximately two-dozen sheep near Stone Hill.
12/18/07	Jim Roberts saw a single ¾-curl ram between Fivemile and Tenmile Creeks on Highway 37.

Table 1. Reported bighorn sheep sightings along Koocanusa during 2007.

initiated with the express purpose to improve the habitat along Lake Koocanusa for the betterment of bighorn sheep and mule deer. To date, over 28,000 acres have been treated and re-treated with various silvicultural prescriptions and fire to encourage grass and shrub growth. In 1984, FWP initiated a study of bighorn sheep along Koocanusa to better determine their status, trend, and use of habitat. A total of 54 bighorn sheep were captured and marked between 1984 and 1993. Study results were published (Stansberry 1996).

Efforts at importing sheep from Canada to augment Koocanusa have thus far been unsuccessful. Contacts were first made with British Columbia authorities approximately eight years ago, and a potential source of sheep was identified. However, in 2001, before final preparations could be made, the USDA closed the border to the importation of all bovids. Two sheep (one adult ewe and one male lamb) were transplanted to Koocanusa from the Ten Lakes herd in 2006. The ewe still resides there, though FWP has not verified that she has reproduced. The male lamb was struck and killed by a vehicle in February 2008.

Management Challenges: The primary challenge facing this herd is increasing the population to healthy and huntable levels, while at the same time maintaining the genetic integrity of the Trench genotype. This is especially difficult given the apparent influx of Sun River genes from the south. One option would be to forego concerns about maintaining the Trench genotype and simply augment the herd with sheep from elsewhere in Montana. While this could increase reproductive rates

Table 2. Helicopter flights for bighorn sheep near Koocanusa, Hunting District 101, 1995-2008.

Date	Total	Ewes	Lambs	Rams
4/05/95	29	14	4	11
12/12/96	3	2	0	1
3/27/97	9	8	1	0
5/31/97	21	17	1	3
4/24/98	6	5	0	1
5/20/98	7	5	1	1
8/27/99	0	---	---	---
1/15/00	0	---	---	---
4/24/01	9	8	1	0
2002	No Survey	---	---	---
4/07/03	11	9	2	0
2004	No Survey	---	---	---
4/12/05	9	4	1	4
2006	No Survey	---	---	---
2/03/07	0	---	---	---
4/28/08	2	0	0	2

and herd size, it would also put the Trench genotype in the Ten Lakes herd (Hunting District 102) and populations to the north in Canada at greater risk of genetic contamination. The northern distribution of the Koocanusa herd is within 15 miles of the Ten Lakes herd. It is certainly conceivable that a number of transplanted individuals could splinter off and establish themselves in the Ten Lakes area.

The ultimate solution to building herd numbers in the Koocanusa area and maintaining genetic integrity probably lies in the augmentation of a significant number of sheep from Canada. By doing so, genes from animals infiltrating from the south by Libby Dam would be diluted or "swamped." The USDA can and should be pressured to reexamine its policy prohibiting the importation of goats and sheep (wild and domestic) from Canada, followed by renewed discussions with Canadian wildlife authorities.

While sheep of the Trench genotype can be captured on the Woods Ranch WMA and moved to Koocanusa, that also has special challenges. Given its proximity to the B.C. border and the fact that most sheep on the WMA winter within 1 mile of the border, sheep immediately run across the border to the north when approached by a helicopter. This makes the capture of an adequate number of sheep by the use of net-guns difficult. A similar problem was experienced in 2005 and 2006 when FWP tried to dart sheep from the ground. When spooked, they immediately ran across the border. Since this herd is shared with Canada and currently numbers about 100 animals, care should be taken not to remove too many at any one time for augmentation purposes.

Population Monitoring: Periodic helicopter surveys of this herd should continue, although, given the number of sheep observed, it is very expensive. The compilation of reported sightings by the public and others is probably the most useful at this time. Further consideration should be given to the capture and radio-marking of a number of sheep from the Koocanusa/Ural-Tweed herd to better determine total numbers and distribution.

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district have not been solicited, but it is anticipated that support would be high.

Management Goal

Manage for a healthy and productive bighorn sheep population of the Trench genotype with a diverse age structure of rams, at numbers adequate to support the harvest of at least three mature rams annually.

Habitat Objectives

1) Continue cooperative programs with the BPA and other partners and USFS land managers to maintain at least 23,000 acres of quality, occupied bighorn sheep habitat.
2) Encourage continued improvement of habitat conditions so that adequate forage for bighorns and other wildlife is provided during the winter.

3) Create safe movement corridors across MT Highway 37 to link bighorn sheep habitats above and below the highway.

Habitat Management Strategies

1) Continue cooperation with the USFS in identifying areas in need of treatment and implementing those treatments.

2) Cooperate with Montana Department of Highways to identify areas of major sheep use and the locations of most vehicle/sheep collisions. Identify what actions might be taken to reduce the number of sheep killed by vehicles.

Game Damage Strategies

Game damage is not an issue, nor will it be an issue in the foreseeable future.

Access Strategies

Access is not an issue, nor will it be an issue in the foreseeable future.

Population Objectives

1) Increase numbers to a minimum of 150 sheep.

2) Maintain a diverse age structure of the Trench genotype.

Population Management Strategies

1) Hunting of the population is not an issue at this time, nor will it be in the foreseeable future.

2) Augment the Ural-Tweed herd with individuals of the Trench genotype to increase genetic vigor and minimize genetic influx from the Kootenai Falls herd.

3) Consider implementing a bighorn sheep harvest on both sides of Libby Dam to minimize infiltration of Sun River genetics into the Trench genotype.

GALTON RANGE
(Hunting District 102)

Description: The Ten Lakes herd of bighorn sheep (Hunting District 102) is located primarily on the Fortine Ranger District of the Kootenai National Forest. The herd is about six miles northeast of Eureka in the Galton Mountains and is shared with British Columbia. It may be the only hunted sheep herd in the continental United States that is shared with Canada. In Canada, it is referred to as the Phillips Creek herd in honor of a drainage just north of the border. It contains about 30 square miles of sheep habitat in Montana, with an approximately equal-sized area in British Columbia. The northern distribution of this herd in Canada is loosely defined, as individuals occasionally intermingle with another herd to the north.

Most of the habitat in Montana is managed by the U.S. Forest Service (USFS) and occurs within the Ten Lakes Scenic Area. FWP's Woods Ranch Wildlife Management Area (WMA) contains a majority of the herd's winter range within Montana. With the exception of a couple of small, remote mining claims and a few acres in the extreme western portion of the winter range, none of the occupied sheep habitat normally encompasses private land in Montana at this time.

Public Access: Access to this herd is good, with most access provided by driving up Forest Service Road 114 (Grave Creek) to the Ten Lakes Scenic Area. The public also has access to the Woods Ranch WMA from May 15 to November 30. Other approaches include hiking trails up Blacktail Creek and Therriault Pass. A third trail up Indian Creek begins on private land; users must obtain permission.

Bighorn Sheep Population: This herd and the Koocanusa/Ural-Tweed herd are native to northwest Montana and are of a different genotype than sheep found elsewhere in Montana. This genotype extends from Koocanusa northward to Golden, British

Columbia, and is commonly referred to as "Trench" sheep in Canada, due to their presence within the Rocky Mountain Trench. Because this herd is native and not the result of transplants from the Sun River area, like other FWP Region 1 herds, efforts were made from 2004 to 2006 to move several sheep from the Woods Ranch WMA to augment sheep along Koocanusa. Results from these efforts were poor, with only two sheep (one adult female and one male lamb) successfully moved.

Unlike the Ural-Tweed herd near Lake Koocanusa, the Ten Lakes herd is doing fairly well and currently is estimated at about 100 sheep based on actual observation of 61 animals in dense habitat where observation of sheep is difficult. It has shown signs of increased growth in recent years, which includes increasing amounts of use of the Woods Ranch WMA during the winter and spring months.

Some of the earliest reliable work on the Ten Lakes herd was conducted as part of a M.S. thesis through the University of Montana (Johnsen 1993). At that time, the total population occupying both sides of the border was estimated at 82 individuals. While sheep lambing was documented in the Ten Lakes Scenic Area, wintering by bighorn sheep in Montana was not observed.

Monitoring of the herd is difficult because of the forested nature of the habitat and the presence of an international boundary through the center of their distribution. Most monitoring flights have been in conjunction with efforts to monitor other species such as mule deer and black bears. Population trend and summary of all data on helicopter flights is contained in Figure 1 and Table 1, respectively. Nearly all flights occurring December through May were on the Woods Ranch WMA, with the exception of the April 6, 1996 flight. Nearly all flights June through October were in the Ten Lakes Scenic Area, with the exception of the August 30, 1999 flight. Results of ground observations, which were mostly made on the Woods Ranch WMA, are contained in Table 2. Not included in either of these two data sets are reports from the public, which in recent years have numbered as many as 90 animals reportedly observed on the WMA by a single observer.

Recreation Provided: From 1994 to the present, a single either-sex permit has been offered annually to bighorn sheep hunters for Hunting District 102. During this 14-year period, hunters shot nine adult rams. B.C. authorities annually offer two permits for full-curl rams for this same herd, although they average taking less than one per year. Montana hunters have occasionally reported difficulty finding mature rams, primarily because they were probably on the B.C. side of their distribution during the hunting period. However, this seems to have been less of an issue in recent years. The fact that this is the only permit offered for this unique, native herd adds to the enjoyment and appreciation of most hunters.

In addition to hunting, many people enjoy seeing bighorn sheep in the Ten Lakes Scenic Area while hiking, and also when the sheep are on their winter range. During winter, they can be observed with spotting scopes from vantage points on the west side of U.S. Highway 93.

The uniqueness of this population is further exemplified in a book published in 1901 by Ernest Thompson Seton entitled *Lives of the*

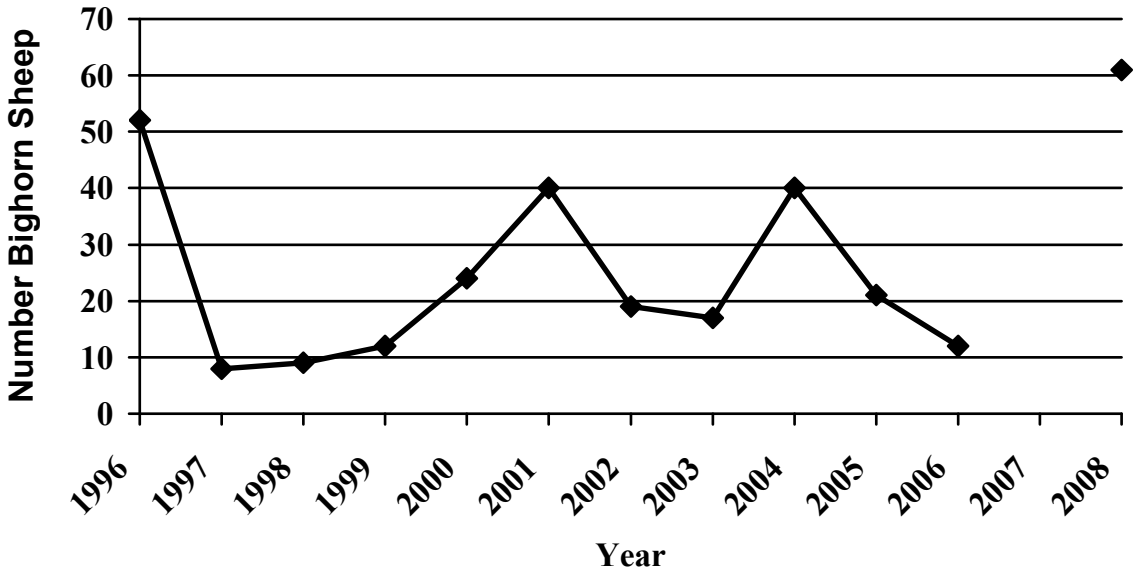


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Ten Lakes population, Hunting District 102, 1996-2008.

Date	Total	Ewes	Lambs	Rams	Uncl.	Lambs/100 Ewes
4/6/96	52	28	8	16	0	29
5/1/97	8	7	1	0	0	---
4/23/98	16	12	3	1	0	23
5/20/98	9	8	1	0	0	---
12/18/98	0	0	0	0	0	---
8/30/99	28	16	6	3	3	37
5/5/99	12	8	4	0	0	---
4/8/00	24	18	5	1	0	28
8/31/00	10	6	3	1	0	---
12/19/00	7	3	1	3	0	---
4/24/01	40	26	9	5	0	35
8/30/01	11	9	2	0	0	---
4/17/02	19	14	3	2	0	21
8/30/02	27	17	8	2	0	47
4/21/03	17	---	---	---	17	---
4/22/04	40	---	---	---	40	---
8/31/04	22	14	5	3	0	36
4/11/05	21	---	---	---	21	---
8/27/05	19	7	3	9	0	---
4/20/06	12	8	4	0	0	---
9/08/06	17	4	3	9	0	---
10/03/06	11	7	3	1	0	---
4/28/08	61	36	13	12	0	36

Table 1. Helicopter flights for bighorn sheep in the Ten Lakes population, Hunting District 102, 1996-2008.

Hunted. In a story titled "Krag, the Kootenay Ram," Seton details his extraordinary efforts in hunting a large ram that lived in this area. Krag Peak and Mount Thompson-Seton in this area were named after the author and his subject.

Current Annual Bighorn Sheep Harvest: See above.

Accomplishments: In 1982, the U.S. Army Corp of Engineers acquired the 1,514-acre Woods Ranch as partial mitigation for the construction of Libby Dam and the creation of Lake Koocanusa. Although not used by bighorn sheep at the time of acquisition, it has now become an area of critical importance for wintering bighorns. Managed primarily for the benefit of wintering ungulates and Columbian sharp-tailed grouse, it has an active grazing program that utilizes domestic cattle to improve forage quality under a rest-rotation basis.

In 2007, FWP purchased a 17-acre tract of private land that was essentially an inholding on the western portion of the WMA. It is bordered by the WMA on three sides and contains some of the best escape habitat for bighorn sheep in the area. It was purchased at a cost of $145,000 with money derived from the auction of sheep licenses.

In addition to using grazing to improve habitat, in 2004 FWP coordinated with the Rocky Mountain Elk Foundation and the

Table 2. Ground observations of bighorn sheep in the Ten Lakes population, Hunting District 102, 1997-2008.

Date	Total	Ewes	Lambs	Rams	Uncl.	Lambs/100 Ewes
3/20/97	19	---	---	---	19	---
3/31/98	4	---	---	---	4	---
4/10/98	3	---	---	---	3	---
4/2/99	15	8	6	1	0	---
4/30/99	24	---	---	---	24	---
3/10/00	25	19	6	0	0	32
3/15/00	17	12	4	1	0	33
6/22/00	15	6	6	1	0	---
4/6/02	20	3	3	14	0	---
3/20/03	16	9	3	4	0	---
3/12/04	20	5	1	14	0	---
3/30/04	28	21	5	3	0	24
4/05/05	45	18	8	19	0	44
5/08/07	15	10	4	1	0	40
4/13/07	13	12	1	0	0	8
2/4/08	65	---	---	---	65	---
2/8/08	21	5	2	14	0	---

USFS in burning of approximately 130 acres on the Woods Ranch WMA in an effort to further improve forage conditions for wintering ungulates.

In 2005, FWP contributed $8,600 to cover some of the costs associated with a conservation easement on 719 acres of property owned by Dave and Priscilla French. This easement was through the Montana Land Reliance and protects property that abuts land managed by the USFS directly adjacent to occupied sheep habitat. Protection of this property further reduces the potential of diseases being spread from domestic sheep to wild bighorns.

In 1993, Steve Johnsen published his MS thesis titled "Evaluation of Bighorn Sheep in the Ten Lakes Scenic Area." In it, Johnsen provides detailed information on bighorn habitat use and movements of a population for which very little was known previously. This study was partially funded by FWP.

Management Challenges: The primary challenges facing this herd are maintaining the genetic integrity of the Trench genotype and protecting it from diseases associated with domestic sheep. Conversion of the sheep range along Koocanusa from its current Trench genotype to one with Sun River origins would increase the risk of contamination of the Ten Lakes herd, should transplanted individuals find their way to the northeast. That is why continued efforts should be made to augment the Koocanusa/Ural-Tweed herd with sheep of the Trench genotype from the Woods Ranch WMA and British Columbia.

Several small, private herds of domestic sheep are known to reside quite close to the Ten Lakes herd. One herd of domestic sheep occurred at the base of the winter range just north of the border. B.C. authorities were notified of the situation several years ago, and they visited with the owner about the dangers the sheep presented. Although the owner's initial reaction was negative, the sheep were eventually removed. Two individuals are known to have domestic sheep dangerously close to the Ten Lakes herd in Montana. Both have been briefed on the dangers their sheep present and have been asked to sell their sheep. To date, they have not done so. They have also been asked to immediately report any wild sheep found mingling with their sheep, should it ever occur. (If so, the wild sheep would be immediately destroyed.) Informal plans are also in place to kill any domestic sheep found unattended on public lands that might pose a threat to the Ten Lakes herd.

The fact that this herd is shared with Canada could potentially present some management challenges, primarily in the form of population monitoring, hunting seasons, and transplant efforts from this area to Koocanusa. In recent years, helicopter and airplane flights over the border have come under much more scrutiny by border authorities than they did six years ago. However, wildlife authorities in Cranbrook have provided excellent cooperation, and we frequently share flight data and other items of interest.

Population Monitoring: Current monitoring efforts should continue, which include annual spring flights for sheep and mule deer while sheep are still on the WMA, and also ground observations. The sharing of monitoring information should continue with wildlife authorities in British Columbia. Post-lambing flights in late August and early September were done in conjunction with black bear flights. Due to funding constraints, these have been discontinued.

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district have not been solicited, but it is anticipated that support would be high.

Management Goal

Manage for a healthy and productive bighorn sheep population of the Trench genotype with a diverse age structure of rams, at numbers adequate to support the harvest of at least three mature rams annually (combined) for U.S. and Canadian hunters.

Habitat Objectives

1) Continue cooperative programs with USFS land managers and others to maintain at least 20,000 acres of quality, occupied bighorn sheep habitat.

2) Work with domestic sheep and goat owners to eliminate the potential for contact with wild sheep.

3) Maintain a high level of habitat quality on the winter range on the Woods Ranch WMA.

Habitat Management Strategies

1) Cooperation with the USFS in identifying areas in need of treatment and implementing those treatments.

2) Renew discussions with owners of domestic sheep regarding the permanent disposition of their sheep. Initiate discussions with the Montana Wild Sheep Foundation and other organizations regarding cooperative double fencing of domestic sheep to prevent nose-to-nose contact with wild sheep.

3) Continue an aggressive weed control program on the Woods Ranch WMA, the rest-rotation grazing agreement, and the seasonal closure to protect wintering animals.

4) Continue to cooperate with land trust organizations to protect private land that borders USFS lands adjacent to occupied sheep habitat.

Game Damage Strategies

Game damage is not an issue, nor will it be an issue in the foreseeable future.

Access Strategies

Access is not an issue, nor will it be an issue in the foreseeable future.

Population Objectives

1) Increase numbers to a minimum of 150 sheep occupying both sides of the border.

2) Maintain a diverse age structure of the Trench genotype.

Population Management Strategies

1) Relieve population pressures by using the Ten Lakes herd as a source population for augmenting sheep along Koocanusa and initiating a new herd on Teakettle Mountain near Columbia Falls.

2) Continue communications with B.C. authorities in management of this shared herd.

Prescriptive Harvest Management

Ewes: Not applicable at this time.

Rams: Harvest will remain conservative with the number of either-sex licenses recommended equal to approximately 10% of the rams observed during aerial surveys.

NORTH CLARK FORK
(Thompson Falls)
(Hunting District 121)

Description: The Thompson Falls bighorn sheep herd occupies approximately 140 square miles along the Clark Fork River Valley, generally between the towns of Thompson Falls and Plains, Montana. The core sheep range, which occupies about 90 square miles, is located from Weeksville Creek west to the Thompson River, up both sides of the Thompson River north to Liver Ridge, Honeymoon Creek across the West Fork of the Thompson River onto Sundance Ridge, then east of the Thompson River to Big Hole Peak and down Spring Creek back to Weeksville Creek. The habitat generally consists of steep, rugged cliff and timbered forest terrain with scattered openings.

There are occasional small groups of sheep found as far north as Jungle/Fishtrap Creek up the Thompson River and as far west as Graves Creek. Bighorns have recently been observed in the rocky cliffs east of Weeksville Creek.

Approximately 90% of the habitat is located on land managed by the Lolo National Forest. The remaining 10% consists of land owned and managed by FWP as wildlife management areas and individual small private landowners along with a small percentage of Plum Creek Timber Company property.

Bighorn sheep in the Thompson Falls herd have a very limited migration that consists mostly of an elevational migration to higher, timbered habitat during the summer months. This migration typically takes place around the end of April through the middle of May and reverses back to lower winter habitat during October.

Public Access: Roads currently provide reasonable vehicle access to most of the lower elevations within the area inhabited by bighorn sheep. Access to higher-elevation habitat is limited to nonmotorized travel by trails or restricted-access Forest Service roads. Some private landowners restrict access across their lands during hunting season. There are two wildlife management areas, Mount Silcox and Roundhorn, and the Bighorn Sheep Viewing Site, which are managed by FWP and provide public access during the summer and fall seasons.

Bighorn Sheep Population: Sheep were reintroduced into the area in 1959 with transplants of 13 sheep (five rams and eight ewes) from the Sun River herd and six bighorns (one ram and five ewes) from Wildhorse Island. By 1974, the herd had grown to 240 animals. The population continued to grow to an estimated 550 to 600 sheep in the early 1980s. Based on the 2008 survey, the total population is estimated to be around 300 to 325 animals (Figure 1).

Since 1981, spring helicopter classification surveys of bighorn sheep have been conducted

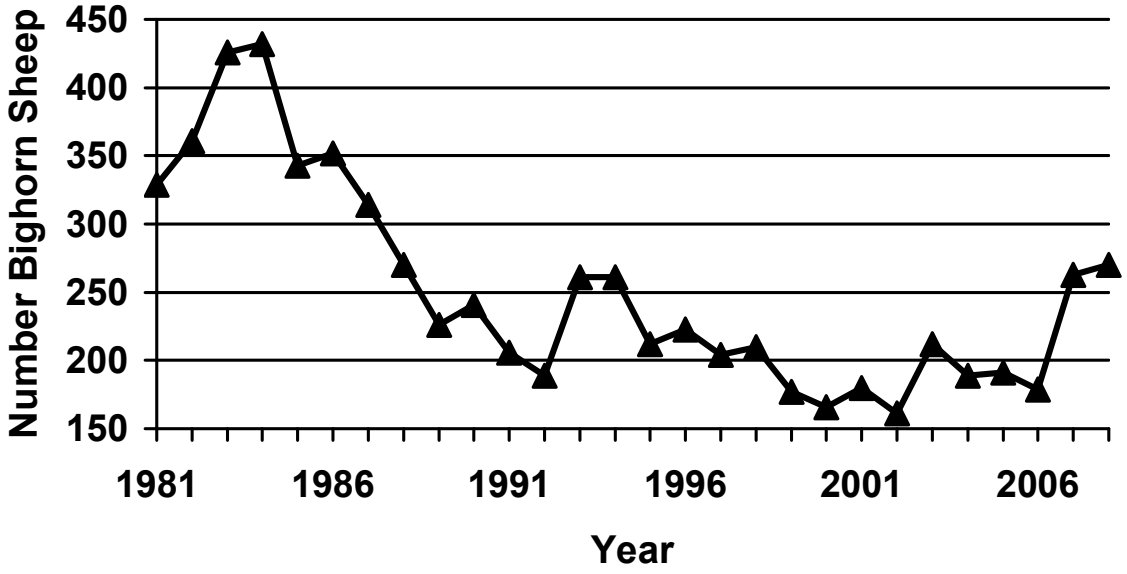


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Thompson Falls, Hunting District 121, 1981-2008.

Year	Ewes	Lambs	Rams	Uncl.	Total Sheep	Lambs: 100 Ewes	Rams: 100 Ewes
1981	109	55	75	90	329	50	69
1982	155	79	66	61	361	51	43
1983	114	45	60	207	426	39	53
1984	76	57	99	200	432	75	130
1985	106	55	135	47	343	52	127
1986	145	80	105	22	352	55	72
1987	106	63	97	48	314	59	92
1988	91	53	91	35	270	58	100
1989	110	46	70	0	226	42	64
1990	120	48	63	10	241	40	53
1991	85	32	54	35	206	38	64
1992	110	49	30	0	189	45	27
1993	126	50	50	35	261	40	40
1994	141	52	68	0	261	37	48
1995	117	38	55	2	212	32	47
1996	99	44	56	24	223	44	57
1997	107	36	49	12	204	34	46
1998	117	36	55	2	210	31	47
1999	89	34	54	0	177	38	61
2000	75	28	63	0	166	37	84
2001	83	41	56	0	180	49	68
2002	83	40	38	0	161	48	46
2003	110	62	40	0	212	56	36
2004	99	37	42	0	189	37	42
2005	112	41	36	2	191	37	32
2006	83	32	39	25	179	39	47
2007	106	47	63	47	263	44	59
2008	106	31	80	53	270	29	76

Table 1. Classification surveys for the Thompson Falls population, Hunting District 121, 1981-2008.

in Hunting District 121 (Table 1). The total number of sheep observed has varied from 161 to 432 with lamb: ewe and ram: ewe ratios ranging from 29:100 to 75:100 and 27:100 to 130:100, respectively.

Recreation Provided: The Thompson Falls bighorn sheep herd has provided numerous hunter days for hundreds of sportsmen and women with a unique hunting opportunity. This population has offered legal hunting of sheep since 1968 when five permits for adult rams were issued. A small number of half-curl ram licenses were initiated in 1985 and discontinued in 1991. Ewe-only licenses were introduced in the early 1980s and provided hunters with the opportunity to harvest ewe sheep up to the year 2000 when, because of a declining sheep population, they were eliminated. Table 2 shows the number of licenses issued, success rate, harvest, and hunter days since 1986.

In addition to hunting recreation, the Thompson Falls bighorn sheep herd is one of the most highly watchable herds in the state. With MT Highway 200 running the length of the southern boundary, sheep provide tourists and locals with a tremendous amount of viewing and photography opportunities. The highly popular sheep-viewing site is located about seven to eight miles east of Thompson Falls and provides an ideal area to pull off and view sheep in their natural setting. Also available are

Table 2. Number and types of licenses and resulting harvest for bighorn sheep in the Thompson Falls population, Hunting District 121, 1986-2006.

	Number Licenses		Total	%				Hunter
Year	Ram, 1/2 Curl, Ewe	Hunters	Harvest	Success	Rams	1/2 Curl	Ewes	Days
1986	15,15,60	84	74	88	14	14	46	427
1987	15,15,40	67	55	82	15	11	29	274
1988	15,15,20	47	35	74	14	9	12	341
1989	15,15,20	49	41	84	15	9	17	188
1990	15,5,20	38	34	89	15	4	15	178
1991	14,0,5	19	19	100	14	0	5	150
1992	10,0,8	18	16	89	10	0	6	102
1993	13,0,5	11	11	100	7	0	4	85
1994	7,0,5	27	27	100	7	0	20	142
1995	7,0,20	26	22	85	7	0	15	108
1996	8,0,20	26	24	92	8	0	16	151
1997	8,0,20	23	23	100	8	0	15	133
1998	9,0,15	22	21	95	9	0	12	124
1999	9,0,10	18	17	94	8	0	9	103
2000	9,0,0	9	9	100	9	0	0	99
2001	9,0,0	9	9	100	9	0	0	46
2002	9,0,0	9	9	100	9	0	0	122
2003	9,0,0	9	9	100	9	0	0	119
2004	9,0,0	9	9	100	9	0	0	87
2005	9,0,0	9	9	100	9	0	0	94
2006	10,0,0	10	10	100	10	0	0	91

several displays and informational signs that describe sheep behavior, horn growth, habitat, and nutritional requirements. Two wildlife management areas, Roundhorn and Mount Silcox, and the Bighorn Sheep Viewing Site, are located along the highway and provide visitors an opportunity to hike or mountain bike into sheep habitat and possible additional wildlife viewing areas. These WMAs provide big game winter range and are closed to the public from December 1 through May 15 of each year. Increasing public demands on the WMAs may require additional restrictions on public use of the area to allow bighorn sheep and other wildlife some solitude during critical portions of the year.

Current Annual Bighorn Sheep Harvest: Since 1998, nine or ten either-sex licenses have been issued annually for sheep in the Thompson Falls herd. Additionally, five ewe-only licenses were initiated for the 2008 hunting season. Table 2 shows the harvest record since 1986. The Thompson Falls herd is one of the top hunting districts in the state for producing trophy class rams (Table 3). Hunter success continues to be excellent with 90-100% success for adult rams. The success rate for ewe harvest is expected to be between 75-100%.

Accomplishments: Some small-scale prescribed burning projects on national forest lands within the sheep range have been directed at enhancing bighorn sheep habitat. USFS habitat enhancement projects are coordinated with FWP. Efforts to continue these types of enhancement projects will continue on the Lolo National Forest. FWP has purchased the 1,552-acre Mount Silcox WMA, the 50-acre Sheep Viewing Site, and the 27-acre Roundhorn WMA. All three areas provide critical habitat needs for the Thompson Falls bighorn sheep herd while providing access to adjacent national forest lands. Weed management activities, hayfield maintenance, and some small salvage timber harvest projects have occurred on the three WMAs to improve forage production for bighorn sheep and other wildlife.

		Horn Length		Base Circumference		Harvest
HD	Age	Right	Left	Right	Left	Date
2006						
121	4 1/2	33 1/8	33 1/4	16	16	11/19/2006
	6 1/2	**39 3/4**	**39 7/8**	**15 3/4**	**15 3/4**	**9/25/2006**
	6 1/2	**41**	**39 1/4**	**16 1/8**	**16 1/4**	**10/18/2006**
	6 1/2	33 1/2	34	15 1/4	15 1/4	11/11/2006
	7 1/2	**41 3/4**	**41 1/8**	**15 1/4**	**15 3/8**	**11/4/2006**
	7 1/2	37	36 1/4	14 1/4	14 3/8	11/18/2006
	7 1/2	37	39 1/2	15 1/4	15 1/4	11/2/2006
	8 1/2	38 1/4	38 1/2	15 1/4	15 1/2	11/18/2006
	9 1/2	38	35 1/2	14 1/2	14 3/4	11/17/2006
	9 1/2	**38**	**39**	**16**	**16**	**10/28/2006**
Avg.	7.4					
2007						
121	6 1/2	33 3/4	34 7/8	14 1/2	14 1/2	10/27/2007
	7 1/2	34 3/4	37 1/4	15 1/2	15 1/2	9/15/2007
	7 1/2	**41 1/4**	**40 1/2**	**16**	**16**	**10/25/2007**
	7 1/2	**38**	**38 3/4**	**16 3/8**	**16 1/2**	**11/5/2007**
	7 1/2	37	37 3/8	16	16 3/8	11/6/2007
	7 1/2	**40**	**41**	**16 1/2**	**16 1/2**	**11/13/2007**
	8 1/2	**41 7/8**	**41 1/2**	**15 3/4**	**15 5/8**	**10/31/2007**
	8 1/2	**39 1/2**	**38 1/8**	**15 7/8**	**15 3/4**	**11/15/2007**
	8 1/2	35 3/8	36 3/4	14 3/8	14 3/8	11/17/2007
	8 1/2	37 1/8	39 1/8	15 3/8	15 3/8	11/19/2007
Avg.	7.8					
	Bold = Estimated minimum Boone and Crockett score of at least 180 points.					

Table 3. Horn measurements, age, and harvest dates for bighorn rams, Hunting District 121, 2006-2007.

Management Challenges: Sheep mortalities from vehicles traveling on MT Highway 200 are the number one challenge facing managers responsible for the Thompson Falls sheep herd. Since 1985, a total of 389 sheep have been documented as killed from collisions with either trains or vehicles (Table 4). The largest mortality, 86%, is from vehicles, with most of those occurring on two one-mile-long sections of highway between Weeksville Creek and the Thompson River. These sections are marked with warning signs and yellow flashing lights; in addition, four newly installed reader boards, with a message alerting drivers to potential hazards ahead, have been in use on the two worst sections. Unfortunately, drivers continue to pay little attention to the message and drive inattentive to their surroundings; 2008 was the worst mortality year on record.

Sheep are attracted to the highway in the winter because of a salt-based liquid deicer that is applied to clear the surface of ice and snow and provide better traction during winter travel. During the spring, sheep congregate adjacent to the highway because of the freshly sprouted green vegetation. Sheep can be found on or along the highway from November through May of each year. Scheduled realignment of the highway may provide some relief by increasing the sight distance around existing curves. FWP will continue to work with the Montana Department of Transportation to find a non-salt-based deicer, educate and notify the public of the existing danger, and possibly look into

Table 4. Recorded bighorn sheep mortality by trains and vehicles for the Thompson Falls population, Hunting District 121, 1985-2008.

Year	Ewes	Lambs	Rams	Unknown	Total
1985	2		2		4
1986			1		1
1987	4	1	1		6
1988	1			3	4
1989	4	3		4	11
1990	7	1	5	1	14
1991	16	11	7		34
1992	14	4	6	1	25
1993	14	2	7		23
1994	15	3	6		24
1995	6	4	1		11
1996	8	3	2		13
1997	10	3	5		18
1998	16	4	4		24
1999	7	7	4		18
2000	10	5	5		20
2001	3			1	4
2002	6	2	3	2	13
2003	11	2	2		15
2004	6	2	8	4	20
2005	6	1			7
2006	14	9	4		27
2007	9	2	4		15
2008	21	7	8	2	38
Total	210	76	85	18	389
Avg.	8.8	3.2	3.5		16.2

reducing the speed limit in the sections that receive the most mortality.

Habitat deterioration through fire suppression continues to be a problem on the Thompson Falls bighorn sheep range. Compared with sheep habitats in other regions of the state, sheep ranges in northwest Montana are represented by heavily timbered shrub-dominated communities with very little grassland vegetation types available. Historically, wildfire prevailed on the landscape and maintained fire-based vegetation communities of ponderosa pine and bunchgrasses over much of the sheep range. With the advent of effective fire suppression by the USFS over the past 50 years, sheep forage such as bunchgrasses and certain shrubs are being replaced by Douglas fir trees through encroachment onto open foraging sites or under the ponderosa pine canopy. This has resulted in gradual habitat deterioration for bighorn sheep.

Disease issues related to contact between bighorns and domestic sheep is not an apparent problem for the Thompson Falls bighorn sheep. There are no grazing allotments for domestic sheep or other livestock anywhere near this herd. However, bighorns from the Thompson Falls herd sometimes take excursions off the sheep range, especially during the rut, and may come in contact with domestic sheep or goats on hobby farms scattered throughout the area.

Noxious weed infestation by species such as spotted knapweed, St. John's Wort, leafy spurge, Dalmatian toadflax, and other weeds continue to expand on sheep winter and spring habitat. These weeds are costly to control and continue to choke out native forage for bighorn sheep. Efforts to control these and other noxious weeds

are ongoing on the three properties that FWP has purchased. Methods currently in use include hand-pulling, biological control, and herbicide spraying. Control of noxious weeds on other public and private lands is very limited.

Population Monitoring: Annual helicopter surveys of the Thompson Falls bighorn sheep population have been conducted since 1981. These surveys are completed during the spring grass green-up period in early to mid-April (Table 1). Surveys are done to count and classify ewes, lambs, and rams. Rams are further classified into three categories: yearling rams, sub-adult rams (typically three- to five-year-olds) and adult rams (six years of age and older). The heavily timbered nature of this sheep range provides considerable cover for sheep to avoid observation, and precludes total population counts during these short aerial surveys. A very simple mark-recapture sightability assessment was conducted on a population of sheep north of Thompson Falls in the mid-1980s. Information from that trial indicated that spring helicopter surveys were able to detect approximately 65-75% of the sheep on the range. These surveys should continue as the primary population trend monitoring effort for these sheep.

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district indicates a high level of support for FWP's management direction. Both hunters and non-hunters enjoy viewing bighorn sheep in this area.

Management Goal

The Thompson Falls bighorn sheep herd is managed to maintain a limited-entry hunt that offers a relatively large number of permits while maintaining a tradition of producing trophy class rams. The goal is to keep sheep population numbers consistent with available habitat and within the limits of social and landowner tolerance while maintaining a healthy population. Presently this level is at a spring observed population of between 225 to 275 sheep.

Habitat Objectives

Encourage the continued improvement of year-round habitat and control of noxious weeds so that both the quantity and quality of bighorn sheep forage is increased.

Habitat Management Strategies

Continue cooperation with the USFS in identifying areas in need of prescribed burning and noxious weed spraying.

Game Damage Strategies

Game damage complaints related to the Thompson Falls bighorn sheep herd have decreased in the past several years. When game damage complaints occur, department response will be consistent with FWP's program direction including the requirement of reasonable hunting access.

Access Strategies

Continue to improve access across private lands that are currently closed. Access in general is not an issue in this hunting district.

Population Objectives

1) Maintain the number of bighorn sheep observed during spring aerial surveys within 10% of 250 sheep (225 to 275).

2) Maintain spring classification ratios of at least 30 lambs: 100 ewes.

3) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys of at least 50 rams: 100 ewes, with at least 30% of the rams having a ¾-curl.

4) Maintain the average age of 7½ years for rams harvested on either-sex licenses.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 121 is located in the Northwest Montane ecological region (see discussion of ecological regions in Chapter 1), which includes much of northwest Montana. This bighorn population is relatively stable, is characterized as having moderate lamb production with good recruitment rates, is at population objective, and has a moderate ram to ewe ratio. Bighorn numbers are currently being managed to maintain population objectives while providing for a conservative harvest of the ram segment. The population objective of 250

(± 10%) observed bighorn sheep was derived by considering the ability of public lands to provide forage for wintering bighorn sheep.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment. In Hunting District 121, licenses are issued under the following prescriptions (Table 5):

Standard Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 10% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's observed lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 10% of the population objective and lamb recruitment is between 30 and 40 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 15% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment

Table 5. Summary of regulation types under different population criteria for ewe harvest and population management.

NORTHWEST MONTANE	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	± 10% of 250	Between 30-40	Limited Entry Ewes	Up to 10% of Ewes
Restrictive Regulation	More than 10% below 250	Less than 30	Fewer than 5 ewe licenses	Less than 5% of ewes
Liberal Regulation	Greater than 10% above 250	Greater than 40	Limited Entry Ewes or translocate if > 25 sheep including rams are available	Up to 15% of Ewes

Table 6. Summary of potential ram harvest under different population parameters and criteria.

NORTHWEST MONTANE	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has	
		Population Size	Ram: 100 Ewe ratio
Standard Regulation	Up to 20% of the total of sub-adult and adult rams	± 10% of 250	40-60:100
Liberal Regulation	Up to 25% of the total of sub-adult and adult rams	Greater than 10% above 250	> 60:100

of one-half the previous year's observed lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 10% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 20% of the total number of sub-adult and adult rams observed during spring surveys.

The Standard Regulation will be recommended if the population is within objective (+ 10% of 250), there are 40 to 60 rams: 100 ewes, and the age of rams harvested the previous two years averaged six to seven years old.

Liberal Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 25% of the total number of sub-adult and adult rams observed during spring surveys.

The Liberal Regulation will be recommended if: The population is more than 10% above the objective of 250, there are more than 60 rams: 100 ewes, and the age of rams harvested the previous two years averaged greater than seven years old.

Clark Fork Cut-Off
(St. Regis Cut-Off)
(Hunting District 122)

Description: The St. Regis Cut-Off bighorn sheep herd occupies approximately 30 square miles from Sesame Creek in the southwest to Kennedy Creek in the north. The Clark Fork River borders the area to the south and on the east side of the range. The habitat generally consists of steep, rugged cliff and timbered forest terrain with scattered openings. The lower-elevation areas are composed of rock outcrops, open forested slopes with grassy benches, and steep scree slopes.

Approximately 90% of the habitat is located on land managed by the Lolo National Forest. The remaining 10% consists of land owned by small individual private landowners.

Bighorn sheep from the Cut-Off herd have a very limited migration that consists mostly of an elevational migration to higher, timbered habitat during the summer months. This migration typically takes place around the end of April through the middle of May and reverses back to lower winter habitat above the Clark Fork River during October.

Public Access: A large portion of the bighorn sheep habitat is in a roadless area. There are primitive low-standard roads in Dunn's Draw, Patrick Creek, and Fourteen Mile Creek. MT Highway 135 also crosses portions of the southern edge of the area. There is a Forest Service road along the ridge to Pat's Knob in the upper-elevation area of the unit. Access is gained by these roads, a trail in Fourteen Mile Creek, or by crossing the Clark Fork River via boat or canoe.

Bighorn Sheep Population: Sheep were reintroduced into the area in 1979 with a transplant of 41 sheep and a supplemental transplant of five bighorns in 1981, all from Wildhorse Island. By the mid-1990s, the herd had grown to about 140 animals. The population appears to be peaking again in 2008 with an estimated population of 175 to 190 sheep. Since 1981, spring helicopter classification surveys of bighorn sheep have been conducted in Hunting District 122 (Figure 1 and Table 1). The total number of sheep observed has varied from 55 to 141 with lamb: ewe and ram: ewe ratios ranging from 20:100 to 66:100 and 38:100 to 159:100, respectively.

Recreation Provided: The St. Regis Cut-Off bighorn sheep herd has provided numerous hunter days for hundreds of sportsmen and women with a unique hunting opportunity. This population has provided legal hunting of sheep since 1986 when one adult ram license was issued along with 10 ewe-only licenses. Ewe-only licenses have been issued for the past 22 years. Table 2 shows the number of permits issued, success rate, harvest, and hunter days since 1986.

Current Annual Bighorn Sheep Harvest: Since 1995, five or six either-sex licenses have been issued annually for sheep in the Cut-Off herd. Additionally, ewe-only licenses have varied from two to eight the past several years but will be increased to 10 for the 2008 hunting season. Table 2 shows the harvest record since

Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the St. Regis Cut-Off population, Hunting District 122, 1981-2008.

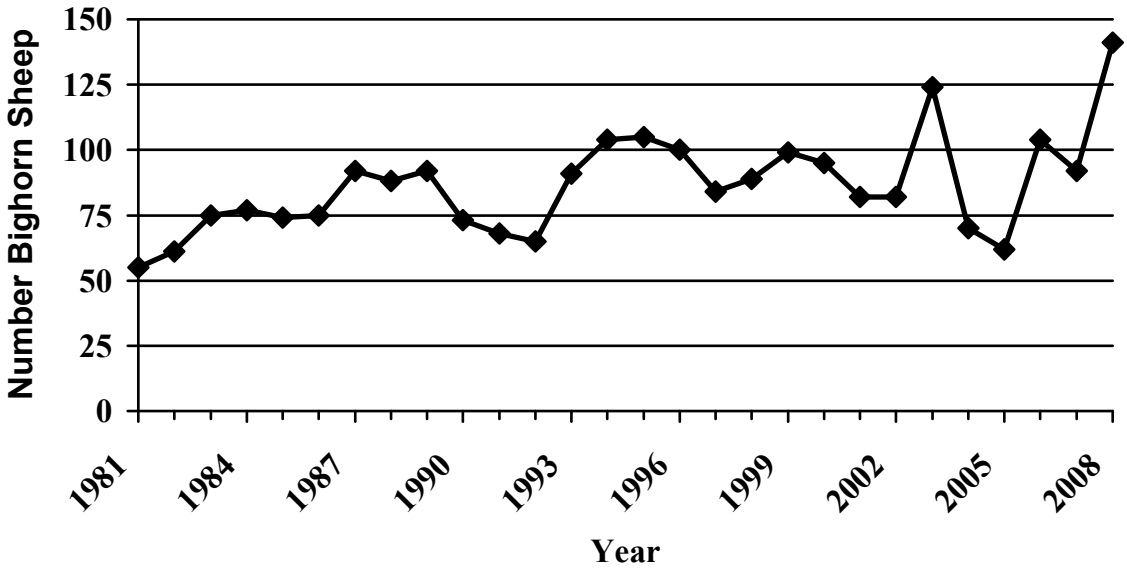


Table 1. Classification data from aerial surveys for the St. Regis Cut-Off population, Hunting District 122, 1981-2008.

Year	Ewes	Lambs	Rams	Uncl.	Total Sheep	Lambs: 100 Ewes	Rams: 100 Ewes
1981	29	13	13	0	55	45	45
1982	33	14	14	0	61	42	42
1983	32	16	12	15	75	50	38
1984	28	15	18	16	77	54	64
1985	37	11	25	1	74	30	68
1986	41	14	20	0	75	34	49
1987	37	24	29	2	92	65	78
1988	29	19	40	0	88	66	138
1989	32	9	51	0	92	28	159
1990	32	10	31	0	73	31	97
1991	38	10	20	0	68	26	53
1992	29	14	22	0	65	48	76
1993	38	18	35	0	91	47	92
1994	51	21	32	0	104	41	63
1995	52	18	35	0	105	35	67
1996	49	18	33	0	100	37	67
1997	48	15	21	0	84	31	44
1998	41	21	27	0	89	51	66
1999	44	19	36	0	99	43	82
2000	44	20	31	0	95	46	71
2001	41	9	32	0	82	22	78
2002	39	14	29	0	82	36	74
2003	56	21	47	0	124	38	84
2004	34	10	26	0	70	29	76
2005	35	7	17	3	62	20	49
2006	44	23	37	0	104	52	84
2007	35	19	37	1	92	54	106
2008	66	22	53	0	141	33	80

Year	Permits Ram/Ewe	Hunters	Total Harvest	% Success	Rams	Ewes	Hunter Days	Hunter Effort
1986	1,10	11	8	73	1	7	59	7.4
1987	2,10	12	12	100	2	10	41	3.4
1988	4,10	14	13	93	4	9	56	4.3
1989	5,10	13	9	69	5	4	88	9.8
1990	6,5	11	10	91	6	4	87	8.7
1991	4,1	5	5	100	4	1	33	6.6
1992	4,1	5	5	100	4	1	90	18
1993	4,1	4	4	100	4	0	63	15.8
1994	4,10	13	12	92	4	8	71	5.9
1995	5,10	15	15	100	5	10	66	4.4
1996	5,10	14	13	93	5	8	118	9.1
1997	5,10	15	13	87	5	8	96	7.4
1998	5,10	15	13	87	5	8	103	7.9
1999	5,10	13	10	77	4	6	109	10.9
2000	5,10	15	12	80	5	7	59	4.9
2001	5,5	10	9	90	5	4	71	7.9
2002	5,2	7	7	100	5	2	91	13
2003	6,8	13	11	85	6	5	159	14.5
2004	6,8	12	9	75	6	3	104	11.6
2005	6,4	9	8	89	6	2	102	12.8
2006	6,4	10	7	70	6	1	90	12.9
2007	6,4	6	6	100	6	0	65	10.8

Table 2. The number and types of licenses and resulting harvest for bighorn sheep in the St. Regis Cut-Off population, Hunting District 122, 1986-2007.

1986. The St. Regis Cut-Off herd is one of the top hunting districts in the state for producing trophy class rams (Table 3). Hunter success continues to be excellent with 90-100% success for adult rams. The success rate for ewe harvest is between 75-100%.

Accomplishments: Some small-scale prescribed burning projects on national forest lands within the sheep range have been directed at enhancing bighorn sheep habitat. U.S. Forest Service (USFS) habitat enhancement projects are coordinated with FWP. These projects remove encroaching conifers and rejuvenate shrub and grass species that provide important forage for sheep. Efforts to continue these types of enhancement projects are important to the overall management of the habitat for FWP and the Lolo National Forest.

Management Challenges: This population experiences some sheep mortality from vehicles traveling on MT Highway 200 as well as some mortality from train collisions. Efforts will be made to try and monitor this mortality and to take steps necessary to reduce this problem if it escalates.

Sheep are attracted to the highway in the winter because of a salt-based liquid deicer that is applied to clear the surface of ice and snow and provide better traction during winter travel. During the spring, sheep congregate adjacent to the highway because of the freshly sprouted green vegetation. Sheep can be found on or along the highway from November through May of each year. FWP will continue to work with the Montana Department of Transportation to find a non-salt-based deicer, educate and notify the public of the existing danger, and possibly look into reducing the speed limit in the sections that receive the most mortality.

Habitat deterioration through fire suppression continues to be a problem on the St. Regis Cut-Off bighorn sheep range. Compared with sheep habitats in other regions of the state, sheep ranges in northwest Montana are represented by heavily timbered shrub-dominated communities with very little grassland vegetation types available. Historically, wildfire prevailed on the landscape and maintained fire-based vegetation communities of ponderosa pine and bunchgrasses over much of the sheep range.

Table 3. Horn measurements, age, and harvest dates for bighorn rams in Hunting District 122, 2005-2007.

		Horn Length		Base Circumference		Harvest Date
HD	Age	Right	Left	Right	Left	
2005						
122	**5 1/2**	**39**	**39**	**16 1/2**	**17**	**11/12/2005**
	5 1/2	34	35 1/4	17 1/4	16 7/8	11/24/2005
	7 1/2	**40**	**39**	**16 1/2**	**16 1/2**	**10/13/2005**
	7 1/2	38 1/4	34 5/8	15 5/8	15 3/4	11/11/2005
	7 1/2	35	34	16 1/2	16 1/2	11/12/2005
	7 1/2	35 1/4	35 1/8	16 1/4	16 3/8	11/16/2005
Avg.	6.8					
2006						
122	6 1/2	37 3/8	36 1/8	15 3/4	15 5/8	10/29/2006
	6 1/2	**37 3/4**	**38 1/2**	**17**	**17**	**11/6/2006**
	6 1/2	36 1/2	35	15	15	11/18/2006
	7 1/2	**39**	**37 1/2**	**16 5/8**	**16 1/2**	**11/10/2006**
	8 1/2	**42 1/2**	**41 1/4**	**16 1/4**	**16 3/8**	**11/1/2006**
	10 1/2	36 1/4	36 3/8	15 1/4	15 1/2	11/19/2006
Avg.	7.7					
2007						
122	**5 1/2**	**35 7/8**	**40 3/8**	**16 5/8**	**16 5/8**	**11/2/2007**
	6 1/2	35 5/8	34 1/8	15 1/4	15 3/8	10/30/2007
	6 1/2	33 7/8	35	16	16 1/2	11/11/2007
	6 1/2	36 3/8	34 7/8	15 7/8	16 1/2	11/14/2007
	7 1/2	**41 3/8**	**40 3/8**	**15 1/8**	**14 7/8**	**10/30/2007**
	8 1/2	**41 1/8**	**40**	**16 1/4**	**16 1/4**	**11/1/2007**
Avg.	6.8					
	Bold = Estimated minimum Boone and Crockett score of at least 180 points.					

Table 4. Summary of regulation types under different population criteria for ewe harvest and population management.

NORTHWEST MONTANE	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	± 10% of 115	Between 30-40	Limited Entry Ewes	Up to 10% of Ewes
Restrictive Regulation	More than 10% below 115	Less than 30	Fewer than 5 ewe licenses	Less than 5% of ewes
Liberal Regulation	Greater than 10% above 115	Greater than 40	Limited Entry Ewes or translocate if > 25 sheep including rams are available	Up to 15% of Ewes

NORTHWEST MONTANE	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has	
		Population Size	Ram: 100 Ewe ratio
Standard Regulation	Up to 20% of the total number of sub-adult and adult rams	± 10% of 115	40-60:100
Liberal Regulation	Up to 25 % of the total number of sub-adult and adult rams	Greater than 10% above 115	> 60:100

Table 5. Summary of potential ram harvest under different population parameters and criteria.

With the advent of effective fire suppression by the USFS over the past 50 years, sheep forage such as bunchgrasses and certain shrubs are being replaced by Douglas fir trees through encroachment onto open foraging sites or under the ponderosa pine canopy. This has resulted in gradual habitat deterioration for bighorn sheep.

Disease issues related to contact between bighorns and domestic sheep is not an apparent problem for the Cut-Off bighorn sheep. There are no grazing allotments for domestic sheep or other livestock on adjacent national forest lands. However, bighorns from the Cut-Off population sometimes take excursions off the sheep range, especially during the rut, and may come in contact with domestic sheep or goats on hobby farms scattered throughout the area. A recently discovered band of domestic sheep and goats located immediately next to occupied winter range poses a very real and serious disease threat to this herd. FWP will continue to work with the private landowner and attempt to rectify this situation.

Noxious weed infestation by species such as spotted knapweed, St. John's Wort, leafy spurge, Dalmatian toadflax, and other weeds continue to expand on sheep winter and spring habitat. These weeds are costly and difficult to control and continue to choke out native forage used by bighorn sheep. Efforts to control these and other noxious weeds will be discussed with area land managers, but the outcome is not promising because of the difficult terrain and cost involved. Control of noxious weeds on other public and private lands is very limited.

Population Monitoring: Annual helicopter surveys of the St. Regis Cut-Off bighorn sheep population have been conducted since 1981. These surveys are completed during the spring grass green-up period in early to mid-April (Table 1). Surveys are done to count and classify ewes, lambs, and rams. Rams are further classified into three categories: yearling rams, sub-adult rams (typically three to five-year-olds), and adult rams (six years of age and older). The heavily timbered nature of this sheep range provides considerable cover for sheep to avoid observation, and precludes total population counts during these short aerial surveys. A very simple mark-recapture sightability assessment was conducted on a population of sheep around Libby in the mid-1980s. Information from that trial indicated that spring helicopter surveys were able to detect approximately 65-75% of the sheep on the range. These surveys should continue as the primary population trend monitoring effort for these sheep.

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district indicates a high level of support for FWP's management direction. Both hunters and non-hunters enjoy viewing bighorn sheep in this area.

Management Goal

The St. Regis Cut-off bighorn sheep herd is managed to maintain a limited-entry hunt that offers a relatively large number of permits while maintaining a tradition of producing trophy class rams. The goal is to keep sheep population numbers consistent with available habitat and within the limits of social and landowner tolerance while maintaining a healthy population. Presently this level is at a spring observed population of between 100 to 125 sheep.

Habitat Objectives

Encourage the continued improvement of year-round habitat and control of noxious weeds so that both the quantity and quality of bighorn sheep forage is increased.

Habitat Management Strategies

Continue cooperation with the USFS in identifying areas in need of prescribed burning and noxious weed spraying.

Game Damage Strategies

Game damage complaints related to the St. Regis Cut-off bighorn sheep herd have been few. When game damage complaints occur, department response will be consistent with FWP's program direction including the requirement of reasonable hunting access.

Access Strategies

Continue to improve access across private lands that are currently closed. Access in general is not an issue in this hunting district.

Population Objectives

1) Maintain the number of bighorn sheep observed during spring aerial surveys within 10% of 115 sheep (103 to 127).

2) Maintain spring classification ratios of at least 30 lambs: 100 ewes.

3) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys of at least 60 rams: 100 ewes, with at least 30% of the rams having a ¾-curl.

4) Maintain the average age of 7½ for rams harvested on either-sex licenses.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 122 is located in the Northwest Montane ecological region (see discussion of ecological regions in Chapter 1) which includes much of northwest Montana. This bighorn population is relatively stable, is characterized as having moderate lamb production with good recruitment rates, is at population objective, and has a relatively high ram to ewe ratio. Bighorn numbers are currently being managed to maintain population objectives while providing for a conservative harvest of the ram segment. The population objective of 115 (± 10%) observed bighorn sheep was derived by considering the ability of public lands to provide forage for wintering bighorn sheep.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment. In Hunting District 122 licenses are issued under the following prescriptions (Table 4):

Standard Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 10% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's observed lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 10% of the population objective and lamb recruitment is between 30 and 40 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 15% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's observed lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 10% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 20% of the total number of sub-adult and adult rams observed during spring surveys.

The Standard Regulation will be recommended if: The population was within objective (+ 10% of 115), there were 40 to 60 rams: 100 ewes, and the age of rams harvested the previous two years averaged 6 to 7 years old.

Liberal Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 25% of the total number of sub-adult and adult rams observed during spring surveys.

The Liberal Regulation will be recommended if: The population was more than 10% above the objective of 115, there were more than 60 rams: 100 ewes, and the age of rams harvested the previous two years averaged greater than seven years old.

CABINET MOUNTAINS
(Berray Mountain)
(Hunting District 123)

Description: Bighorn sheep were introduced into this Bull River herd in two separate transplants in 1969 and 1975. The first transplant, in January 1969, consisted of 23 sheep (four rams and 19 ewes) from Wildhorse Island. The second transplant, in March 1975, added 33 sheep from the combined herds of the Sun River (three rams and 28 ewes) and two young rams from Wildhorse Island. The release site for both transplants was on Berray Mountain.

Since this introduction, bighorn sheep have increased and dispersed into the higher elevations and cirque basins of the Cabinet Mountains Wilderness Area for summer range, and established wintering areas on Berray Mountain and along the Middle Fork of the Bull River.

The Berray Mountain bighorn sheep herd occupies approximately 50 square miles of habitat. The summer habitat consists of very rugged and steep terrain with large, rocky outcrops and rugged cliffs in the Ibex, Bighorn, Chippewa, Leigh, Snowshoe, and Cherry Creeks areas of the Cabinet Mountains Wilderness. The lower-elevation winter range is composed of rock outcrops and open forested slopes with grassy benches, and steep scree slopes.

The entire bighorn habitat is located on land managed by the Kootenai National Forest.

Bighorn sheep from the Berray Mountain herd have a limited migration that consists mostly of an elevational migration to summer habitat in the Cabinet Mountains Wilderness. This migration typically takes place around the end of April through the middle of May and reverses back to lower winter habitat on Berray Mountain or lower slopes along the Middle Fork of the Bull River during October.

Public Access: A large portion of the bighorn sheep habitat is located in roadless or designated wilderness areas. MT Highway 56 borders the south and west sides along Berray Mountain. Forest Service roads in the East Fork and South Fork of the Bull River area provide access to trailheads that lead into the Cabinet Mountains Wilderness. Trails into the wilderness are limited and very rugged. Rigorous and sudden-changing weather conditions can limit hunting opportunities in the wilderness area.

Bighorn Sheep Population: Sheep were first introduced into the area in 1969 with a transplant of 23 sheep from Wildhorse Island, with a supplemental transplant of 33 bighorns in 1975. The population peaked in the early to mid-1990s at around 150 sheep. The population decreased dramatically from effects of the extreme winter of 1996 to 97 to around 90 animals. Since then the population has stabilized at around 100 to 110 bighorns bighorns based on 75 to 105 animals actually observed. Spring helicopter classification surveys have been conducted since 1979 on the Berray Mountain bighorn sheep herd in Hunting District 123 (Figure 1). The total number of sheep observed has varied from 20 to 129 with lamb: ewe and ram: ewe ratios ranging from 20:100 to 72:100 and 13:100 to 120:100, respectively (Table 1).

Recreation Provided: The Berray Mountain bighorn sheep herd has provided numerous hunter days for hundreds of sportsmen and women with a unique wilderness hunting experience that is both demanding and challenging. This population has provided legal hunting of sheep since 1977 when three adult rams licenses were issued. Ewe-only licenses have been issued since 1983. Table 2 shows the number of licenses issued, success rate, harvest, and hunter days since 1977.

Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Cabinet Mountains population, Hunting District 123, 1979-2008.

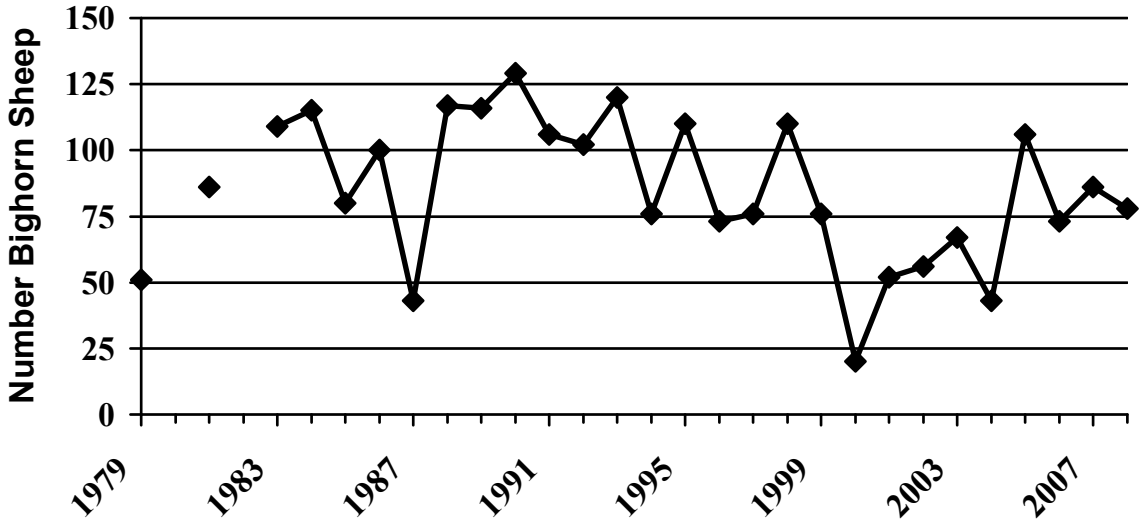


Table 1. Classification data from area surveys for the Cabinet Mountains population, Hunting District 123, 1979-2008.

Year	Ewes	Lambs	Rams	Uncl.	Total Sheep	Lambs: 100 Ewes	Rams: 100 Ewes
1979	14	8	16	13	51	57	114
1980	No Survey						
1981	40	19	27	0	86	48	68
1982	No Survey						
1983	36	15	21	37	109	42	58
1984	40	21	33	21	115	53	83
1985	45	10	25	0	80	22	56
1986	43	26	24	7	100	60	56
1987	15	7	18	3	43	47	120
1988	45	23	46	3	117	51	102
1989	47	34	31	4	116	72	66
1990	68	26	35	0	129	38	51
1991	49	21	36	0	106	43	73
1992	45	18	39	0	102	40	87
1993	64	25	31	0	120	39	48
1994	51	29	26	2	108	57	51
1995	38	24	40	18	120	63	105
1996	37	12	27	0	76	32	73
1997	68	18	24	0	110	27	35
1998	38	23	23	0	73	32	61
1999	43	25	8	0	76	58	19
2000	15	3	2	0	20	20	13
2001	25	11	13	3	52	44	52
2002	26	10	20	0	56	39	77
2003	38	14	15	0	67	37	40
2004	19	9	15	0	43	47	79
2005	57	24	20	5	106	42	35
2006	44	18	11	0	73	41	25
2007	50	17	19	0	86	34	38
2008	53	15	10	0	78	28	19

Year	Number Licenses Ram/Ewe	Hunters	Total Harvest	% Success	Rams	Ewes	Hunter Days	Hunter Effort
1977	3,0	3	2	67	2	0	unk.	n/a
1978	3,0	3	3	100	3	0	unk.	n/a
1979	3,0	3	2	67	2	0	unk.	n/a
1980	3,0	3	2	67	2	0	unk.	n/a
1981	3,0	3	3	100	3	0	unk.	n/a
1982	2,0	2	2	100	2	0	unk.	n/a
1983	5,8	10	7	70	4	3	unk.	n/a
1984	5,8	8	7	88	5	2	unk.	n/a
1985	5,10	13	12	92	5	7	unk.	n/a
1986	5,20	25	15	60	4	11	106	7.1
1987	5,5	9	9	100	5	4	58	6.4
1988	5,5	9	9	100	5	4	36	4
1989	8,5*	12	9	75	6	3	117	13
1990	8,10	18	12	67	6	6	99	8.3
1991	8,10	17	12	71	6	6	99	8.3
1992	8,10	18	15	83	8	7	74	4.9
1993	8,10	17	13	76	8	5	100	7.7
1994	8,10	15	14	93	8	6	79	5.6
1995	8,10	14	11	79	7	4	114	10.4
1996	8,10	16	6	38	4	2	107	17.8
1997	6,10	16	11	69	3	8	210	19.1
1998	4,7	11	4	36	3	1	82	20.5
1999	4,7	9	4	44	3	1	39	9.8
2000	4,1	5	4	80	3	1	40	10.0
2001	4,1	4	3	75	3	0	64	21.3
2002	4,1	5	4	80	3	1	69	17.3
2003	4,1	4	4	100	4	0	41	10.3
2004	4,1	4	3	75	3	0	50	16.7
2005	4,1	5	5	100	4	1	35	7.0
2006	4,0	4	4	100	4	0	60	15.0
2007	4,1	5	4	80	3	1	87	21.8
* wilderness only either-sex permits initiated.								

Table 2. Number and types of licenses and resulting harvest for bighorn sheep in the Cabinet Mountains population, Hunting District 123, 1977-2007.

Current Annual Bighorn Sheep Harvest: Since 1998, four either-sex licenses have been issued annually for sheep in the Berray Mountain herd. Additionally, one ewe-only license has been issued since 2000. Table 2 shows the harvest record since 1977. The Berray Mountain herd does not typically produce trophy class rams, but if you harvest a ram in this area you will have earned it. It is maybe the most difficult place in Montana to harvest a ram. Hunter success is good with 75-100% success on adult rams. The success rate for ewe harvest is between 50-80%.

Accomplishments: Some small-scale prescribed burning projects on Berray Mountain conducted by the Kootenai National Forest have been completed to enhance bighorn sheep habitat. U.S. Forest Service (USFS) habitat enhancement projects are coordinated with FWP. These projects remove encroaching conifers and rejuvenate shrub and grass species that provide important forage for sheep. Efforts to continue these types of enhancement projects are important to the overall management of the habitat for FWP and the Kootenai National Forest.

Management Challenges: This population experiences some sheep mortality from vehicles traveling on MT Highway 56. Efforts will be made to try and monitor this mortality and to take steps necessary to reduce this problem if it escalates.

Sheep are attracted to the highway in the winter because of a salt-based liquid deicer that is applied to clear the surface of ice and snow and provide better traction during winter travel. During the spring, sheep congregate adjacent to the highway because of the freshly sprouted green vegetation. Sheep can be found on or along the highway from November through May of each year. FWP will continue to work with the Montana Department of Transportation to find a non-salt-based deicer, educate and notify the public of the existing danger, and possibly look into reducing the speed limit in the sections that receive the most mortality.

Habitat deterioration through fire suppression continues to be a problem on the Berray Mountain bighorn sheep range. Compared with sheep habitats in other regions of the state, sheep ranges in northwest Montana are represented by heavily timbered shrub-dominated communities with very little grassland vegetation types available. Historically, wildfire prevailed on the landscape and maintained fire-based vegetation communities of ponderosa pine and bunchgrasses over much of the sheep range. With the advent of effective fire suppression by the USFS over the past 50 years, sheep forage such as bunchgrasses and certain shrubs are being replaced by Douglas fir trees through encroachment onto open foraging sites or under the ponderosa pine canopy. This has resulted in gradual habitat deterioration for bighorn sheep.

Disease issues related to contact between bighorns and domestic sheep is not an apparent problem for the Berray Mountain bighorn sheep. There are no grazing allotments for domestic sheep or other livestock anywhere near this herd. However, bighorns from this herd sometimes take excursions off the sheep range, especially during the rut, and may come in contact with domestic sheep or goats on hobby farms scattered throughout the area.

Noxious weed infestation by species such as spotted knapweed, St. John's Wort, leafy spurge, Dalmatian toadflax, and other weeds continue to expand on sheep winter and spring habitat. These weeds are costly and difficult to control and continue to choke out native forage used by bighorn sheep. Efforts to control these and other noxious weeds will be discussed with area land managers, but the outcome is not promising because of the difficult terrain and cost involved. Control of noxious weeds on other public and private lands is very limited.

Because bighorn rams use heavy timber as cover, it is becoming increasingly more difficult to locate and classify rams during the annual spring survey. Recent sightings of large ram bands along with ewe and lamb groups during late June mountain goat surveys in the Cabinet Mountains Wilderness may provide an opportunity to improve the counting and classifying of the Berray Mountain sheep herd.

Population Monitoring: Annual helicopter surveys of the Berray Mountain bighorn

Table 3. Horn measurements, age, and harvest dates for bighorn rams in Hunting District 123, 2006-2007.

HD	Age	Horn Length		Base Circumference		Harvest Date
		Right	Left	Right	Left	
2005						
123	6 1/2	34 1/2	34	17	17	9/19/2005
	6 1/2	35 1/4	36 1/8	16 5/8	16 3/4	9/20/2005
	7 1/2	39	37	15	15 1/4	11/15/2005
	12 1/2	**44**	**43 3/4**	**15 1/2**	**15 1/2**	**10/21/2005**
Avg.	8.3					
2006						
123	4 1/2	34 1/2	34 1/8	15 1/2	15 3/4	9/15/2006
	5 1/2	35 1/4	36 3/8	15 1/2	15 3/8	9/28/2006
	5 1/2	33	33 1/4	15 3/8	15 1/2	11/24/2006
	6 1/2	33 3/4	32	15	15 1/2	11/18/2006
Avg.	5.5					
2007						
123	5 1/2	34 7/8	35 1/2	14 1/4	14 1/2	11/24/2007
	6 1/2	38	36 1/2	15 1/2	15 1/2	11/24/2007
	7 1/2	38 5/8	33 1/4	14 5/8	14 5/8	11/23/2007
Avg.	6.5					
Bold = Estimated Boone and Crockett score of a minimum of 180 points.						

sheep population have been conducted since 1979. These surveys are completed during the spring grass green-up period in early to mid-April (Table 1). Surveys are done to count and classify ewes, lambs, and rams. Rams are further classified into three categories: yearling rams, sub-adult rams (typically three- to five-year-olds), and adult rams (six years of age and older). The heavily timbered nature of this sheep range provides considerable cover for sheep to avoid observation, and precludes total population counts during these short aerial surveys. A very simple mark-recapture sightability assessment was conducted on a population of sheep around Libby in the mid-1980s. Information from that trial indicated that spring helicopter surveys were able to detect approximately 65-75% of the sheep on the range. These surveys should continue as the primary population trend monitoring effort, but consideration should be made to move the surveys to late June to improve the counting and classifying of this sheep herd.

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district indicates a high level of support for FWP's management direction. Both hunters and non-hunters enjoy viewing bighorn sheep in this area.

Management Goal

The Berray Mountain bighorn sheep herd is managed to maintain a limited-entry hunt that offers a rugged, demanding, and challenging hunting experience in the remote Cabinet Mountains Wilderness. The goal is to keep sheep population numbers consistent with available habitat and within the limits of social and landowner tolerance while maintaining a healthy population. Presently this level is at a spring observed population of between 90 to 120 sheep.

Habitat Objectives

Encourage the continued improvement of year-round habitat and control of noxious weeds so that both the quantity and quality of bighorn sheep forage is increased.

Habitat Management Strategies

Continue cooperation with the USFS in identifying areas in need of prescribed burning and noxious weed spraying.

Game Damage Strategies

Game damage complaints related to the Berray Mountain bighorn sheep herd have been few. When game damage complaints occur, department response will be consistent with FWP's program direction including the requirement of reasonable hunting access.

Access Strategies

Continue to improve access across private lands that are currently closed. Access in general is not an issue in this hunting district.

Population Objectives

1) Maintain the number of bighorn sheep observed during spring aerial surveys within 10% of 105 sheep (95 to 115).

2) Maintain spring classification ratios of at least 30 lambs: 100 ewes.

3) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys of at least 50 rams: 100 ewes, with at least 30% of the rams having a ¾-curl.

4) Maintain the average age of 6½ years for rams harvested on either-sex licenses.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 123 is located in the Northwest Montane Ecological Region (see discussion of ecological regions in Chapter 1), which includes much of northwest Montana. This bighorn population is relatively stable, is characterized as having moderate lamb production, is slightly below population objective, and has a moderate ram to ewe ratio. Bighorn numbers are currently being managed to allow an increase in numbers while providing for a conservative harvest of the ram segment. The population objective of 105 (± 10%) observed bighorn sheep was derived by considering the ability of public lands to provide forage for wintering bighorn sheep.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment. In Hunting District 123, licenses are issued under the following prescriptions (Table 4):

Standard Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 10% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's observed lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 10% of the population objective and lamb recruitment is between 30 and 40 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 15% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's observed lambs,

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 10% above the population objective and lamb recruitment is greater than 40 lambs: 100 Ewes.

Rams:

Standard Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 20% of the total number of rams observed during spring surveys.

The Standard Regulation will be recommended if: The population is within objective (+ 10% of 105), there are 40 to 60 rams: 100 ewes, and the age of rams harvested the previous two years averaged six to seven years old.

Liberal Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 25% of the total number of rams observed during spring surveys.

The Liberal Regulation will be recommended if: The population is more than 10% above the objective of 105, there were more than 60 rams: 100 ewes, and the age of rams harvested the previous two years averaged greater than seven years old.

Table 4. Summary of regulation types under different population criteria for ewe harvest and population management.

NORTHWEST MONTANE	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	± 10% of 105	Between 30-40	Limited Entry Ewes	Up to 10% of Ewes
Restrictive Regulation	More than 10% below 105	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Greater than 10% above 105	Greater than 40	Limited Entry Ewes or translocate if > 25 sheep including rams are available	Up to 15% of Ewes

NORTHWEST MONTANE	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has	
		Population Size	Ram: 100 Ewe ratio
Standard Regulation	Up to 20% of the total rams	± 10% of 105	40-60:100
Liberal Regulation	Up to 25 % of the total rams	Greater than 10% above 105	> 60:100

Table 5. Summary of potential ram harvest under different population parameters and criteria.

PARADISE
(Hunting District 124)

Description: The Paradise bighorn sheep herd occupies approximately 20 square miles from Knowles Creek on the east to Henry Creek on the west. The Clark Fork River borders the area to the south of the range. An additional 25 to 30 square miles of habitat is located on the Flathead Indian Reservation from the reservation boundary at Little Money Creek east to Perma. The Confederated Salish and Kootenai Tribes (CSKT) manage the bighorn sheep residing in this area.

The habitat generally consists of steep, rugged cliff and timbered forest terrain with scattered openings. The lower-elevation areas are composed of rock outcrops, open forested slopes with grassy benches, and steep scree slopes. Approximately 60% of the habitat is located on land managed by either the Lolo National Forest or the Montana Department of Natural Resources and Conservation (DNRC). The remaining 40% consists of large parcels of land owned by timber companies and smaller pieces owned by individual private landowners.

Bighorn sheep from the Paradise herd have a very limited migration that consists mostly of an elevational migration to higher timbered habitat during the summer months. This migration typically takes place around the end of April through the middle of May and reverses back to lower winter habitat above the Clark Fork River during October.

Public Access: There are two maintained Forest Service roads that provide some vehicle access to this district. The Henry Peak road is located on the west portion of the range and is open to motorized traffic through October 14 of each year, at which time the road closes to all but nonmotorized traffic. The second road is located in upper Knowles Creek and is accessed through the Flathead Reservation. Access to areas west of the town of Paradise can be difficult since most private landowners residing along MT Highway 200 restrict access, and areas east of Paradise are constrained by private land and the Clark Fork River. There is a FWP-owned fishing access site at Robertson Creek, across from Knowles Creek. This site provides boat or canoe access to cross the Clark Fork River, which allows access to the lower reaches of Knowles Creek. However, you must travel about one mile downstream to gain access to land administered by the Lolo National Forest.

Bighorn Sheep Population: The bighorn sheep in Hunting District 124 are the result of a 1979 transplant of 14 Wildhorse Island sheep, nine ewes and five rams, by the CSKT into the Little Money Creek drainage on the Flathead Reservation. By 1994, this jointly managed herd had grown to an estimated population of 640 animals. This population was systematically decreased through a combination trapping and ewe harvest but appears to have peaked again in 2007 with an estimated population of 670 sheep. Since 1989, spring helicopter classification surveys of bighorn sheep have been conducted in Hunting District 124 (Figure 1 and Table 1). The total number of sheep observed in the population, which includes sheep observed on the Flathead Reservation, is shown in Figure 2 and Table 2. The overall observed population has varied from 93 to 501 sheep while those within Hunting District 124 have varied from 64 to 263 sheep. The lamb: ewe and ram: ewe ratios range from 11:100 to 67:100 and 46:100 to 144:100, respectively.

Recreation Provided: The Paradise bighorn sheep herd has provided numerous hunter days for hundreds of sportsmen and women with a unique hunting opportunity. This population has provided legal hunting of sheep since 1992 when four adult ram permits and five ewe-only

Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Paradise population, Hunting District 124, 1989-2008.

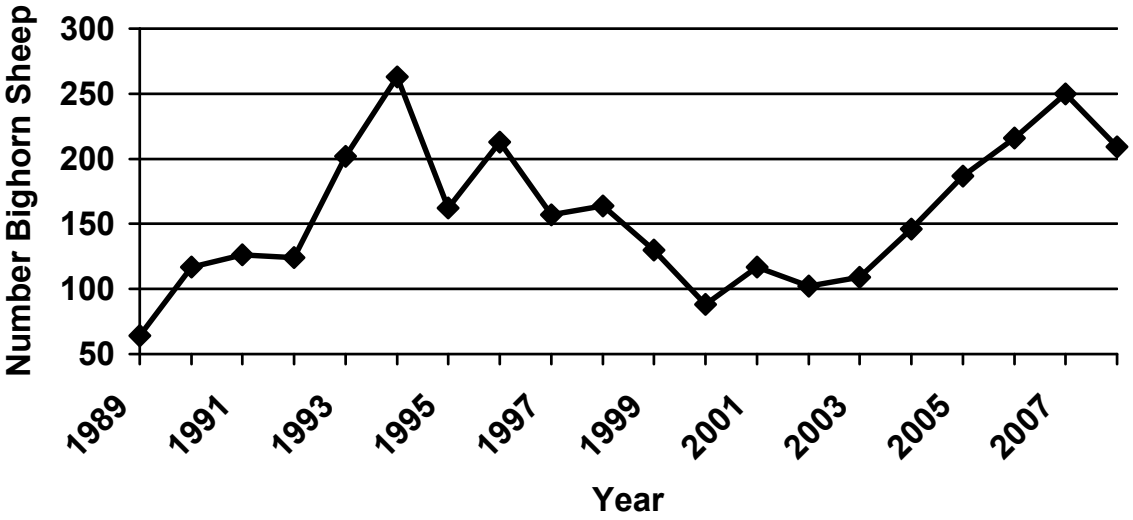


Table 1. Classification data from aerial surveys for the Paradise population not including the Flathead Reservation, Hunting District 124, 1989-2008.

Year	Ewes	Lambs	Rams	Uncl.	Total	Lambs: 100 Ewes	Rams: 100 Ewes
1989	27	10	27	0	64	37	100
1990	47	12	58	0	117	26	123
1991	60	18	48	0	126	30	80
1992	60	29	35	0	124	48	58
1993	86	37	79	0	202	43	92
1994	97	42	119	5	263	43	123
1995	33	22	107	0	162	67	324
1996	73	35	105	0	213	48	144
1997	52	15	90	0	157	29	173
1998	70	25	69	0	164	36	99
1999	62	25	43	0	130	40	69
2000	22	8	58	0	88	36	264
2001	55	31	31	0	117	56	56
2002	34	11	57	0	102	32	168
2003	41	24	44	0	109	59	107
2004	63	17	66	0	146	27	105
2005	96	25	66	0	187	26	69
2006	93	24	96	3	216	26	103
2007	94	31	125	0	250	33	133
2008	108	34	65	2	209	32	60

permits were issued. Ewe-only permits have been issued as many as 60 for the 1994 season but typically are between 5 to 20 permits. Table 3 shows the number of permits issued, success rate, harvest, and hunter days since 1992.

Current Annual Bighorn Sheep Harvest: Ten either-sex permits have been issued annually, since 2005, for sheep in the Paradise herd. Additionally, ewe-only permits have varied from 5 to 20 for the past several years. Table 3 shows the harvest record since 1992. The Paradise herd

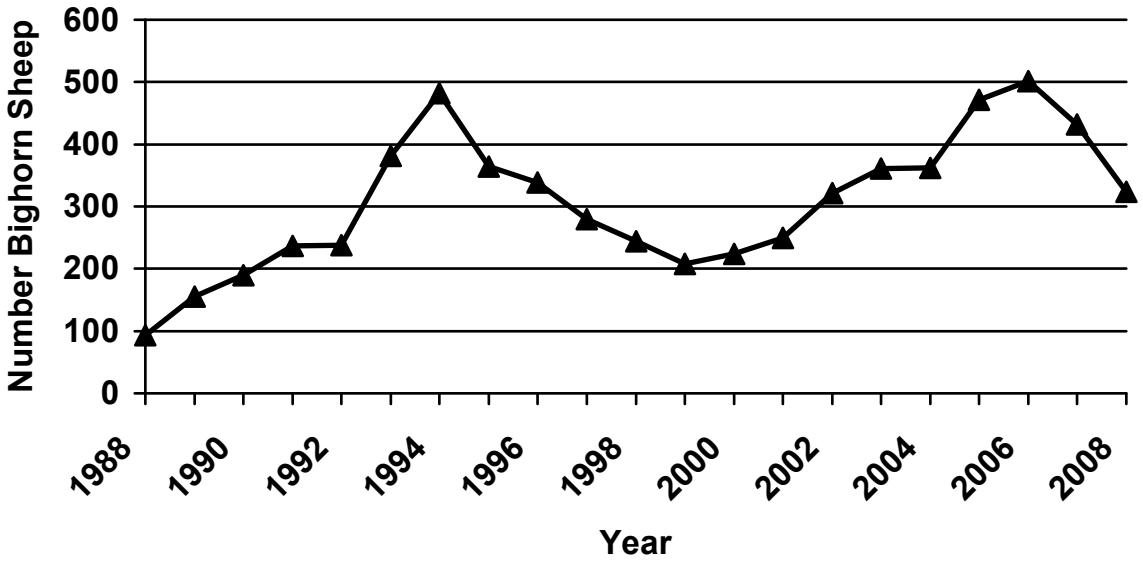


Figure 2. Total number of bighorn sheep observed during aerial trend surveys, Perma to Paradise including the Flathead Reservation, 1988-2008.

Year	Ewes	Lambs	Rams	Uncl.	Total Sheep	Lambs: 100 Ewes	Rams: 100 Ewes
1988	47	5	35	6	93	11	74
1989	87	28	40	0	155	32	46
1990	89	24	77	0	190	27	87
1991	127	45	65	0	237	35	51
1992	104	44	90	0	238	42	87
1993	184	74	123	0	381	40	67
1994	201	91	174	16	482	45	87
1995	133	71	160	0	364	53	120
1996	117	53	169	0	339	45	144
1997	104	37	139	0	280	36	134
1998	113	40	91	0	244	35	81
1999	102	42	64	0	208	41	63
2000	107	32	85	0	224	30	79
2001	121	63	66	0	250	52	55
2002	156	57	98	0	321	37	69
2003	187	75	99	0	361	40	53
2004	189	55	118	0	362	29	62
2005	245	81	145	0	471	33	59
2006	247	83	168	3	501	34	68
2007	176	69	175	12	432	39	99
2008	149	51	122	2	324	34	82

Table 2. Classification surveys for the Perma to Paradise area including the Flathead Reservation, 1988-2008.

is one of the top hunting districts in the state for producing trophy class rams (Table 4). Hunter success continues to be excellent with 90-100% success for adult rams. The success rate for ewe harvest is between 75-100%.

Accomplishments: A forest fire in the fall of 2000 burned approximately 50% of the sheep habitat located on the Lolo National Forest and Confederated Salish and Kootenai lands. This fire replaced habitat enhancement projects scheduled by the Lolo National Forest.

Table 3. The number and types of licenses and resulting harvest for bighorn sheep in the Paradise population, Hunting District 124, 1992-2007.

Year	Number Licenses Ram/Ewe	Hunters	Total Harvest	% Success	Rams	Ewes	Hunter Days	Hunter Effort
1992	4,5	8	8	100	4	4	54	6.8
1993	6,30	31	28	90	6	22	197	7
1994	12,60	68	58	85	12	46	316	5.4
1995	22,10	31	28	90	21	7	241	8.6
1996	22,10	31	28	90	21	7	184	6.6
1997	22,10	32	29	91	22	7	200	6.9
1998	13,10	22	21	96	13	8	172	8.2
1999	6,2	8	6	75	5	1	60	10
2000	6,2	8	8	100	6	2	113	14.1
2001	6,5	11	8	73	6	2	66	8.2
2002	7,5	11	9	82	7	2	67	7.4
2003	7,5	11	10	91	6	4	74	7.4
2004	8,10	17	15	88	8	7	118	7.9
2005	10,20	27	22	81	10	12	193	8.8
2006	10,19	28	27	96	10	17	192	7.1
2007	10,20	25	22	88	10	12	132	6

Habitat enhancement projects, like small prescribed burns, remove encroaching conifers and rejuvenate shrub and grass species that provide important forage for sheep. All U.S. Forest Service (USFS) projects are coordinated with FWP. Efforts to continue these types of enhancement projects are important with the overall management of the habitat for FWP and the Lolo National Forest.

Noxious weeds located in Knowles Creek have been aerial and backpack sprayed on two separate occasions in the past 10 years. Both projects were conducted by the Lolo National Forest and coordinated with FWP. Both parties and funding received from the Montana Chapter of the Foundation for North American Wild Sheep paid for the projects.

Management Challenges: Habitat deterioration through fire suppression continues to be a problem on the Paradise bighorn sheep range. Compared with sheep habitats in other regions of the state, sheep ranges in northwest Montana are represented by heavily timbered shrub-dominated communities with very little grassland vegetation types available. Historically, wildfire prevailed on the landscape and maintained fire-based vegetation communities of ponderosa pine and bunchgrasses over much of the sheep range. With the advent of effective fire suppression by the USFS over the past 50 years, sheep forage such as bunchgrasses and certain shrubs are being replaced by Douglas fir trees through encroachment onto open foraging sites or under the ponderosa pine canopy. This has resulted in gradual habitat deterioration for bighorn sheep.

Disease issues related to contact between bighorns and domestic sheep is not an apparent problem for the Paradise bighorn sheep. There are no grazing allotments for domestic sheep or other livestock anywhere near this herd. However, bighorns from this herd sometimes take excursions off the sheep range, especially during the rut, and may come in contact with domestic sheep or goats on hobby farms scattered throughout the area.

Noxious weed infestation by species such as spotted knapweed, St. John's Wort, leafy spurge, Dalmatian toadflax and other weeds continue to expand on sheep winter and spring habitat. These weeds are costly and difficult to control and continue to choke out native forage used by bighorn sheep. Efforts to control these and other noxious weeds will be discussed with area land managers, but the outcome is not promising because of the difficult terrain and cost involved. Control of noxious weeds on other public and private lands is very limited.

Although this population is managed and coordinated very effectively between biologists from both FWP and CSKT, the department has little control on management decisions made by the Confederated Salish and Kootenai Tribal Council. Decisions by this council on bighorn sheep residing within the reservation could have

HD	Age	Horn Length		Base Circumference		Harvest Date
		Right	Left	Right	Left	
2005						
	3 1/2	27	27 1/2	14	14	11/7/2005
	3 1/2	31 1/4	27 1/8	15	15	11/11/2005
	4 1/2	33 3/8	30 1/2	15 3/8	15 1/2	9/15/2005
	5 1/2	36	33 1/2	16 1/8	16 1/8	11/4/2005
	5 1/2	**35**	**35**	**17 3/4**	**17 1/2**	**11/10/2005**
	6 1/2	**37 1/2**	**38 1/2**	**16**	**16**	**11/5/2005**
	7 1/2	34 1/2	35	14 3/4	14 5/8	10/29/2005
	7 1/2	**38 1/2**	**37 1/2**	**16 1/4**	**16 1/4**	**11/9/2005**
	8 1/2	35 1/4	35	15 7/8	16	9/24/2005
	9 1/2	31	32 3/8	14 1/4	14 1/4	9/29/2005
Avg.	6.2					
2006						
	4 1/2	32 7/8	31 3/8	15 7/8	15 7/8	9/25/2006
	5 1/2	36 7/8	39	15 1/2	15 1/2	10/5/2006
	5 1/2	**37 1/8**	**37**	**17 1/2**	**17 5/8**	**10/23/2006**
	5 1/2	34	34 1/4	16	16	10/28/2006
	6 1/2	35 1/2	34	15 1/4	15 3/4	10/25/2006
	7 1/2	39 3/4	35	14 3/4	14 3/8	10/5/2006
	7 1/2	35 3/4	35 5/8	14 1/4	14 1/4	11/4/2006
	7 1/2	**35 1/2**	**35**	**16 1/2**	**16 1/2**	**11/15/2006**
	7 1/2	37 3/4	36 1/4	15 1/2	15 3/8	11/20/2006
	8 1/2	39	37	14 1/4	14 1/4	10/29/2006
Avg.	6.6					
2007						
	4 1/2	28 1/4	29 3/8	14 1/8	14 1/2	11/11/2007
	5 1/2	**41**	**41 1/4**	**16**	**16**	**9/25/2007**
	5 1/2	35	37	15 3/4	16	10/14/2007
	5 1/2	34 5/8	34	15 1/8	15	10/29/2007
	6 1/2	**39 1/4**	**40 3/4**	**16 1/2**	**16 1/8**	**11/15/2007**
	7 1/2	**38**	**39**	**15 3/8**	**15 1/2**	**10/17/2007**
	7 1/2	**39 1/4**	**37 1/4**	**16**	**15 3/4**	**11/13/2007**
	7 1/2	35 1/8	36 3/8	15 3/8	15 3/8	11/15/2007
	8 1/2	34 1/2	37 1/8	16 1/2	16 1/4	10/27/2007
	9 1/2	34 3/4	35 7/8	14 1/4	14 1/4	11/23/2007
Avg.	6.8					
Bold = Estimated Boone and Crockett score of a minimum of 180 points.						

Table 4. Horn measurements, age, and harvest dates for bighorn rams in Hunting District 124, 2005-2007.

far-reaching effects on bighorn sheep managed outside of the reservation boundary by FWP. Efforts to maintain the relationship between biologists and decision makers from both parties are crucial to the overall management of this herd.

Population Monitoring: Annual helicopter surveys, jointly funded by FWP and CSKT, on the Paradise bighorn sheep population have been conducted since 1988. These surveys are completed during the spring grass green-up period in early to mid-April. Surveys are conducted to count and classify ewes, lambs, and rams. Rams are further classified into three categories: yearling rams, sub-adult rams (typically three- five-year-olds), and adult rams (six years of age and older). The heavily timbered nature of this sheep range provides considerable cover for sheep to avoid observation, and precludes total population counts during these short aerial surveys. A very simple mark-recapture sightability assessment was conducted on a population of sheep around

Libby in the mid-1980s. Information from that trial indicated that spring helicopter surveys were able to detect approximately 65-75% of the sheep on the range. These surveys should continue as the primary population trend monitoring effort for these sheep.

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district indicates a high level of support for FWP's management direction. Both hunters and non-hunters enjoy viewing bighorn sheep in this area.

Management Goal

The Paradise bighorn sheep herd is managed to maintain a limited-entry hunt that offers a relatively large number of permits while maintaining a tradition of producing trophy class rams. The goal is to keep sheep population numbers consistent with available habitat and within the limits of social and landowner tolerance while maintaining a healthy population. Presently this level is at a spring observed population of between 300 to 350 sheep.

Habitat Objectives

Encourage the continued improvement of year-round habitat and control of noxious weeds so that both the quantity and quality of bighorn sheep forage is increased.

Habitat Management Strategies

Continue cooperation with the USFS in identifying areas in need of prescribed burning and noxious weed spraying.

Game Damage Strategies

Game damage complaints related to the Paradise bighorn sheep herd have been few. When game damage complaints occur, department response will be consistent with FWP's program direction including the requirement of reasonable hunting access.

Access Strategies

Continue to improve access across private lands that are currently closed. Access in general is not an issue in this hunting district.

Population Objectives

1) Maintain the number of bighorn sheep observed during spring aerial surveys within 10% of 325 sheep (292 to 358).

2) Maintain spring classification ratios of at least 30 lambs: 100 ewes.

3) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys of at least 60 rams: 100 ewes.

4) Maintain the average age of 6½ for rams harvested on either-sex licenses.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 124 is located in the Northwest Montane Ecological Region (see discussion of ecological regions in Chapter 1), which includes much of northwest Montana. This bighorn population is above objective, is characterized as having moderate lamb production with good recruitment rates, and has a relatively high ram to ewe ratio. Bighorn numbers are currently being managed to stabilize numbers while providing for a sustainable harvest of the ewe and ram segment. The population objective of 325 (± 10%) observed bighorn sheep was derived by considering the ability of private/public lands to provide forage for wintering bighorn sheep.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment. In Hunting District 124, licenses are issued under the following prescriptions (Table 5):

Standard Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 10% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous years observed lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 10% of the population objective and lamb recruitment is between 30 and 40 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 15% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's observed lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 10% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 20% of the total number of sub-adult and adult rams observed, outside of the Flathead Reservation, during spring surveys.

The Standard Regulation will be recommended if: The population is within objective (+ 10% of 325), there are 40 to 60 rams: 100 ewes, and the age of rams harvested the previous two years averaged six to seven years old.

NORTHWEST MONTANE	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	± 10% of 325	Between 30-40	Limited Entry Ewes	Up to 10% of Ewes
Restrictive Regulation	More than 10% below 325	Less than 30	Fewer than 5 ewe licenses	Less than 5% of ewes
Liberal Regulation	Greater than 10% above 325	Greater than 40	Limited Entry Ewes or translocate if > 25 sheep including rams are available	Up to 15% of Ewes

Table 5. Summary of Regulation types under different population criteria for ewe harvest and population management.

NORTHWEST MONTANE	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has	
		Population Size	Ram: 100 Ewe ratio
Standard Regulation	Up to 20% of the total number of sub-adult and adult rams	± 10% of 325	40-60:100
Liberal Regulation	Up to 25% of the total number of sub-adult and adult rams	Greater than 10% above 325	> 60:100

Table 6. Summary of potential ram harvest under different population parameters and criteria.

Liberal Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 25% of the total number of sub-adult and adult rams observed, outside of the Flathead Reservation, during spring surveys.

The Liberal Regulation will be recommended if: The population is more than 10% above the objective of 325, there are more than 60 rams: 100 ewes, and the age of rams harvested the previous two years averaged greater than seven years old.

WILDHORSE ISLAND

Description: The Wildhorse Island bighorn sheep herd is located on the 2,200-acre Wildhorse Island in the southwest corner of Flathead Lake approximately 10 miles northwest of Polson. The island lies within the exterior boundary of the Flathead Indian Reservation but is owned by the State of Montana and operated as a state park.

Initial transplants to the island in December 1917 consisted of six bighorn sheep (one adult ram, two ewes, and three lambs [two females]). This initial effort was unsuccessful. Bighorn sheep were successfully introduced to the island in 1939. This transplant was by a private landowner who captured a yearling ewe and a yearling ram and transported them to Wildhorse Island. These sheep were originally thought to have come from the Sun River herd, but recently discovered FWP transplanting records indicate these sheep came from a native herd on the south end of the Mission Mountains, east of Ravalli, in the Jocko River drainage. In 1947, the Montana Fish and Game Department released six additional sheep onto the island. In 1953 it was estimated that about 100 bighorn sheep, at least 200 mule deer, and around 100 horses inhabited Wildhorse Island. The sheep on the island are a non-hunted population.

The island habitat generally consists of rolling grasslands interspersed with ponderosa pine and Douglas fir trees. There are some steep, rugged cliffs that provide escape and lambing habitat, and the northern portion of the island is heavily timbered with conifers. Bighorn sheep from the Wildhorse Island herd are isolated to the island except on the rare occasion when Flathead Lake freezes during the coldest months of winter. This frozen landscape allows sheep to walk from the island to the mainland. Even when conditions are right, this migration is still a very rare event. The last time Flathead Lake froze in the vicinity of Wildhorse Island was in 1988.

Public Access: Wildhorse Island is a state park and is open to the public year-round. Access is via boat with several rustic access points around the island. Limited walking trails are found on the island. Some of the shoreline is privately owned with several cabins located along the perimeter of the island.

Bighorn Sheep Populations: Sheep were introduced onto the island in 1939 with the release of two sheep from the Mission Mountains. Additionally, six sheep from the Sun River were released in 1947 and two rams from the Ural Tweed herd were released in 1987. By 1953, the population had grown to an estimated 100 animals. Forty sheep were relocated from the island in 1954, and there were reports of sheep dying in 1960. Poor habitat conditions were being noted during the 1960s. By the early 1970s, severe habitat deterioration was being reported, which resulted in the planned removal of 100 sheep in the fall/winter of 1978. Since late 1999, the population has steadily increased to more than 140 sheep (Figure 1 and Table 1). A transplanting operation relocated 38 bighorns in January 2008 to help lower the population to the recommended 100 to 120 sheep and augment an existing population in northwest Montana.

Sheep from Wildhorse Island are used as transplant stock to help establish new populations in Montana and other western states.

Recreation Provided: The bighorn sheep located on Wildhorse Island provide a wonderful opportunity to view and photograph bighorns in a beautiful and natural setting. These sheep are accustomed to and comfortable with seeing people, affording and an opportunity for visitors to see these magnificent animals at close range.

Current Annual Bighorn Sheep Harvest: This is a non-hunted bighorn sheep herd.

Accomplishments: Several small-scale thinning projects that reduce the density of 20- to 30-year-old pine tree stands have been completed in the past several years. These thinning projects help to prevent future outbreaks of the western bark beetle. Habitat

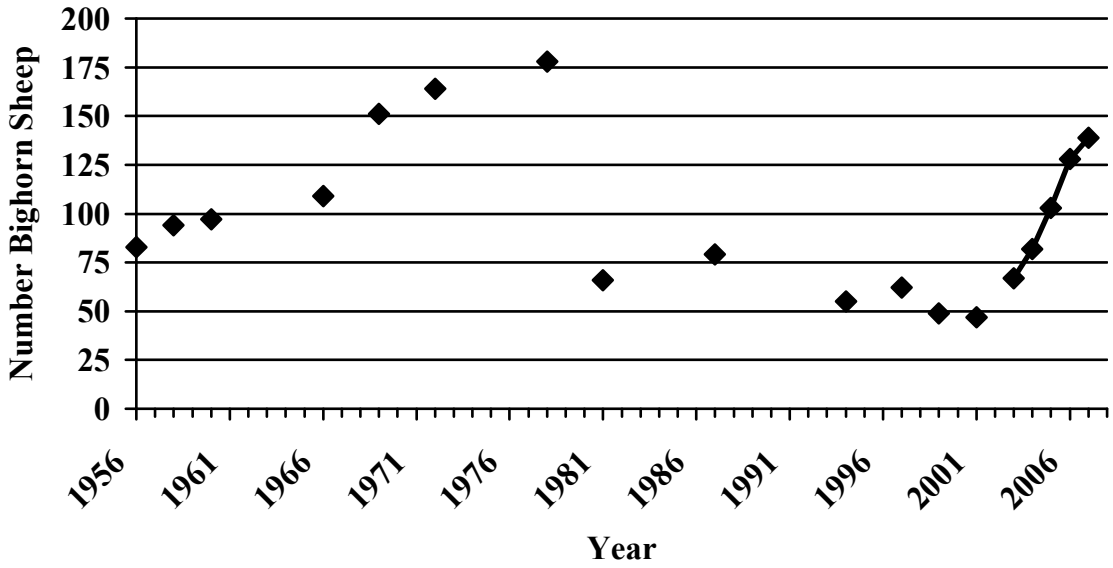


Figure 1. Total number of bighorn sheep observed during trend surveys on Wildhorse Island, 1956-2008

Year	Ewes	Lambs	Rams	Uncl.	Total	Lambs: 100 Ewes	Rams: 100 Ewes
1956			25	58	83	n/a	n/a
1958	19	12	41	22	94	63	216
1960				97	97	n/a	n/a
1966				109	109	n/a	n/a
1969				151	151	n/a	n/a
1972			49	115	164	n/a	n/a
1978	76	25	77	0	178	33	101
1981	19	13	34	0	66	68	179
1987	39	17	23	0	79	44	59
1994	12	6	37	0	55	50	308
1997	13	5	32	0	50	38	246
1997	11	0	51	0	62	0	464
1999	16	4	29	0	49	25	181
1999	15	4	19	0	38	27	127
2001	14	4	29	0	47	29	207
2003	20	5	26	16	67	25	130
2004	29	13	37	3	82	45	128
2005	57	15	31	0	103	26	54
2007	65	20	43	0	128	31	66
2008	62	19	58	0	139	31	94

Table 1. Total number and classification of bighorn sheep on Wildhorse Island, 1956- 2008.

enhancement projects, like small prescribed burns to remove encroaching conifers and rejuvenate shrub and grass species that provide important forage for sheep, may be planned in the future. Efforts to continue these types of enhancement projects are important to the overall management of the habitat for bighorn sheep and other animals on Wildhorse Island.

Management Challenges: Habitat deterioration through fire suppression continues to be a problem on Wildhorse Island. Historically, wildfire prevailed on the landscape and maintained fire-based vegetation communities of ponderosa pine and bunchgrasses over much of the island. With the advent of effective fire suppression, sheep

forage such as bunchgrasses and certain shrubs are being replaced by Douglas fir trees through encroachment onto open foraging sites or under the ponderosa pine canopy. This has resulted in gradual habitat deterioration for bighorn sheep.

Additionally, drought conditions over the past 10 years have contributed to weakened vitality in many stands of ponderosa pine trees, subjecting them to increased risk of western bark beetle infestations.

Disease issues related to contact between bighorns and domestic sheep is not a problem for the Wildhorse Island bighorn sheep herd. There are no domestic grazing allotments allowed on the island.

Noxious weed infestation by species such as spotted knapweed, St. John's Wort, leafy spurge, Dalmatian toadflax and other weeds continue to expand on sheep habitat. These weeds are costly and difficult to control and continue to choke out native forage used by bighorn sheep. Efforts to control these and other noxious weeds will be discussed with area land managers, but the outcome is not promising because of the difficult terrain and cost involved.

Population Monitoring: Helicopter surveys of the Wildhorse Island bighorn sheep population have been conducted since the late 1970s. These surveys are completed during the winter or in early spring during the grass green-up period in early to mid-April. Surveys are done to count and classify ewes, lambs, and rams. Rams are further classified into three categories: yearling rams, sub-adult rams (typically three- to five-year-olds), and adult rams (six years of age and older). Portions of the island are heavily timbered, which provides considerable cover for sheep to avoid observation, and precludes total population counts during these short aerial surveys. These surveys should continue, as time and money allow, as the primary population trend monitoring effort for these sheep.

Summary of Public Comment
Public comments related to the bighorn sheep population and its management on Wildhorse Island indicates a high level of support for FWP's management direction. The public enjoys viewing this highly visible bighorn sheep herd.

Management Goal
The Wildhorse Island bighorn sheep herd is managed to maintain a healthy population of between 100 to 120 animals depending on available forage.

Habitat Objectives
Encourage the continued improvement of year-round habitat and control of noxious weeds so that both the quantity and quality of bighorn sheep forage is increased.

Habitat Management Strategies
Continue cooperation with the Montana Department of Natural Resources and Conservation (DNRC) and the Confederated Salish and Kootenai Tribe (CSKT) in identifying areas in need of prescribed burning, thinning, and noxious weed spraying.

Access Strategies
Access is very good since the island is managed as a state park.

Population Objectives

1) Maintain the number of bighorn sheep observed during post-season aerial surveys within 10% of 110 sheep (99 to 121).

2) Maintain spring classification ratios of at least 25 lambs: 100 ewes.

3) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys of at least 60 rams: 100 ewes.

Population Management Strategies
When the population reaches 130 to 140 bighorns, efforts should be made to trap and relocate excess animals. Wildhorse Island sheep are an excellent source of transplant stock to augment existing populations or to establish new sheep herds in Montana and other western states.

Prescriptive Harvest Management
This is a non-hunted population.

GRAVE CREEK RANGE
(Petty Creek)
(Hunting District 203)

Description: The Grave Creek Range (Hunting District 203) lies directly west of Missoula and contains approximately 419 square miles. The Lolo National Forest administers the majority (about 65%) of the hunting district, and both The Nature Conservancy (TNC) and Plum Creek Timber Company (PCT) own approximately 10% each. The quality and quantity of winter range forage here is declining. Grasslands are subject to weed infestations and conifer encroachment, and shrubfields that were created by the wildfires in the early 1900s are decadent and degraded by conifer reproduction.

Approximately 30 square miles (7%) of the hunting district are occupied by bighorn sheep during some portion of the year. Eighty percent of the occupied range is on public lands. The bighorn sheep population is commonly referred to as the "Petty Creek herd," because its range is limited mostly to suitable habitats in the Petty Creek drainage.

Public Access: Hunting opportunities include motorized hunting on the periphery and walk-in hunting in the interior of this herd's range. There is ample access to the majority of the unit, especially since TNC and PCT allow public access on their lands. Although access to public land is still good, private acquisition and development of former PCT lands has reduced public access during the last 10 years.

Bighorn Sheep Populations: In 1968, FWP established this population with a release of 16 bighorns from the Sun River in Petty Creek. In 1985, four adult rams captured on the National Bison Range were released in Petty Creek. Between 1978 and 1983, senior thesis students at the University of Montana, Len Kopec and Gary Fralick conducted the first field investigations of this herd, describing seasonal movements, habitat conditions, and basic demographics. The first helicopter survey was conducted in 1984, when 63 sheep were counted. That same year, the first hunting season (two either-sex licenses) was established.

The number of bighorn sheep counted during helicopter surveys in Hunting District 203 has ranged from 63 (1984) to 151 (2007) (Figure 1 and Table 1). A previous peak of 149 bighorns was counted in 1993. The 1996-97 winter was so severe that the population declined to below 100 counted sheep. In spite of greatly reduced harvests, numbers remained low and exhibited poor lamb production until 2003.

Recruitment is often 40 to 50 lambs: 100 ewes, recorded during early April surveys. But: during the years immediately following the 1996-97 winter, only 20 to 30 lambs: 100 ewes were observed. The number of rams (yearlings, sub-adults, and adults) typically is 65-90% of ewes counted during surveys. Adult rams (>3/4-curl) numbered 31 in April 2007 (Table 1).

Recreation Provided: Hunting of bighorn sheep was initiated in the fall of 1984 with the

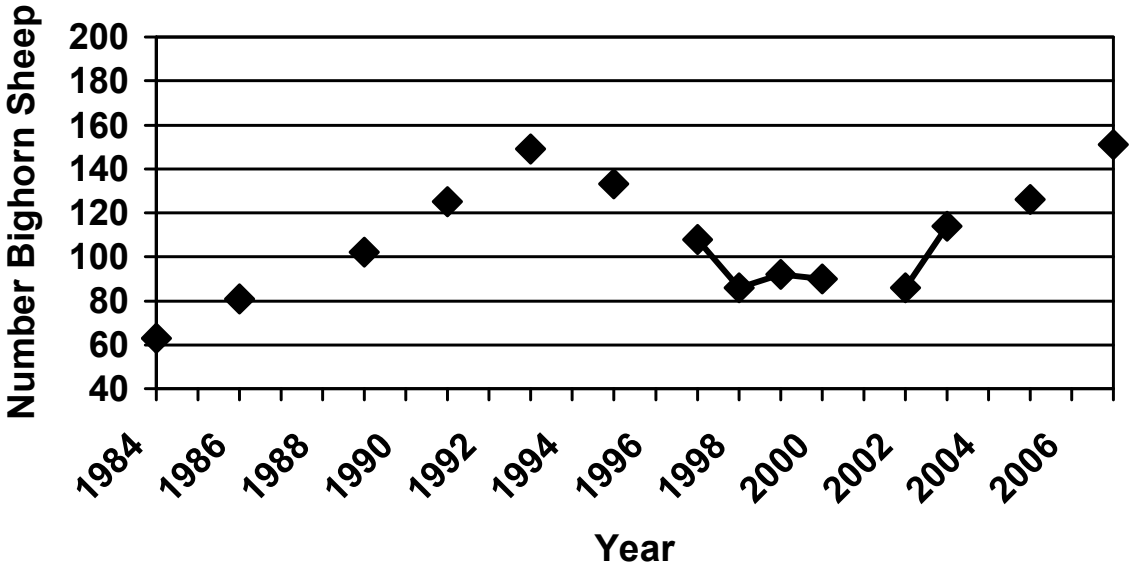


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Grave Creek Range population, Hunting District 203, 1984-2007.

Table 1. Spring helicopter surveys of bighorn sheep in Hunting District 203, 1984–2007.

Year	Ewes	Lambs	Yrlg Rams	Subad Rams	Adult Rams	Unclass	Total
1984	21	10	8	8	10	6	63
1986	37	28	8	5	3	0	81
1989	45	21	11	8	20	0	105
1991	49	22	8	16	25	5	125
1993	66	26	5	18	34	0	149
1995	56	33	7	9	28	0	133
1997	45	9	2	24	28	0	108
1998	38	14	2	10	22	0	86
1999	44	14	4	9	21	0	92
2000	43	19	6	7	15	0	90
2002	41	18	6	6	15	0	86
2003	53	22	11	10	18	0	114
2005	63	19	4	15	25	0	126
2007	31	12	7	12	31	58	151

issuance of two either-sex licenses. The first adult ewe permits were issued in 1988. As the population increased, the number of licenses was increased. Many of the bighorn sheep are nonmigratory and use habitats near the Petty Creek Road. Consequently, sheep are a locally popular wildlife viewing opportunity.

Current Annual Bighorn Sheep Harvest: Since the initial 1984 season, permitted harvests have risen and fallen in response to changing numbers of sheep (Table 2). Since 1990, limited-entry harvests have been prescribed to maintain a population of 120 to 150 counted bighorns. By 1993, five either-sex and 10 adult ewe permits were issued in an attempt to curb further population growth. However, when the 1996-97 winter reduced the herd, permits and harvests were greatly reduced to allow recovery. By 2007, after counting historically high numbers of sheep, FWP again issued five either-sex and 10 adult ewe licenses. During most years, 100% of the licenses are filled. Hunters typically harvest one or more Boone and Crockett–size rams each year.

Accomplishments: This population of bighorn sheep is well established in all suitable habitats and appears to be sustainable at 100 to 150 counted sheep. Linkage with other populations is unknown, but it is generally believed that genetic interchange with other populations is limited or non-existent. Nevertheless, young rams and/or ewes occasionally are seen outside of Petty Creek, near Alberton, in Lolo Creek, in Albert Creek and in Fish Creek, indicative that surplus animals are migrating in search of new habitats or other bighorn populations.

The Lolo National Forest, with funding from the Foundation for North American Wild Sheep, has done some prescribed burning and weed treatment of bighorn winter range in Petty Creek.

In 2008 and 2009, TNC purchased 39,423 acres within the hunting district from PCT as part of the Montana Legacy Project. These lands include a large percentage of occupied bighorn sheep habitat in Petty Creek. TNC's land management goals include preserving vital wildlife habitat, as well as conserving traditional access for hunting.

Management Challenges:

1) Maintaining separation of wild sheep and domestic sheep and goats to avoid transmission of disease to bighorns. Rural subdivisions in the Petty Creek area have resulted in numerous small bands of livestock, including domestic sheep and goats. In 1996, with the owner's permission, FWP exterminated a small band of feral Barbary sheep and young bighorn rams in Lolo Creek. In 2001, FWP for the first time recommended covenants restricting occupancy by domestic sheep on proposed subdivisions in Petty Creek. To date, Missoula County has adopted such covenants in three subdivisions, but enforcement is typically left to homeowners.

2) Human development on winter range areas and on migratory routes is common in this area. Salting for bighorns is common and leads to degradation of nearby forage plants and potentially increases the risk of disease transmission. A proposal to pave

Year	Number Either-Sex Licenses	Ram Harvest	Number Ewe Licenses	Ewe Harvest
1984	2	2	-	-
1985	2	2	-	-
1986	2	2	-	-
1987	2	2	-	-
1988	2	2	5	5
1989	2	2	5	5
1990	2	2	5	5
1991	2	2	5	5
1992	2	2	5	3
1993	5	5	10	9
1994	5	5	10	9
1995	5	5	10	8
1996	5	5	10	9
1997	5	5	2	2
1998	5	5	2	2
1999	5	5	2	0
2000	2	2	2	2
2001	2	2	2	2
2002	2	2	2	2
2003	2	2	2	1
2004	2	2	2	2
2005	3	3	5	5
2006	3	3	5	5
2007	5	(5)	10	(10)

Table 2. Number and types of licenses issued and subsequent harvest, Hunting District 203, 1984-2007.

the Petty Creek Road likely will lead to not only road-kill losses, but also to more rural subdivisions and habitat loss in the area.

3) Weed infestations and conifer encroachment are degrading forage production on summer and winter ranges.

4) Illegal ATV use is common in the area. This activity potentially displaces sheep from preferred habitats, contributes to weed infestations, and aggravates nonmotorized sportsmen using the area.

5) Sale of PCT land parcels has reduced hunter access to important sheep habitats. Although TNC purchased some of those lands, additional sales and subsequent rural developments would further diminish public access and habitat quality.

6) Genetic isolation of this herd is probable, because no other sheep populations occur close to Petty Creek. Not only are other populations distant from Petty Creek, but they are also separated by major highways and rivers.

Population Monitoring: This bighorn population is surveyed biennially from a helicopter. Surveys are conducted over the entire winter/spring range in April, during spring green-up. Bighorns are counted and classified by age and sex. Based on horn development, rams are assigned to yearling, sub-adult (1/2 to 3/4-curl), or adult (greater than 3/4-curl) classifications. To monitor trends in lungworm loads in this population, pellet groups are collected in several locations every few years and sent to the Veterinary Research Laboratory at Montana State University in Bozeman.

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district indicates a high level of support for the current season structure. Both hunters and non-hunters enjoy seeing bighorn sheep in this area.

Management Goal

Manage for a healthy and productive bighorn sheep population with a diverse age structure of rams at current numbers. Cooperate with public land management agencies and private individuals in the management of bighorn habitats. Maintain good opportunity for bighorn sheep hunters to harvest sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain approximately 20,000 acres of occupied bighorn sheep habitat for the benefit of bighorns, other wildlife species, and other agency mandated uses.

2. Encourage improvement of habitat conditions on publicly owned winter ranges (primarily USFS) so that vegetation conditions on these winter ranges provide adequate forage for bighorns and other wildlife during the winter period.

3. Encourage maintenance and improvement of habitat conditions on public lands (USFS) so that bighorns continue to utilize these lands during summer and fall rather than moving onto private lands.

4. Prevent over-utilization of forage by limiting the population to less than 140, through public hunting and the capture and removal of sheep.

Habitat Management Strategies

1) Continue to cooperate with the USFS on prescribed burning and weed treatment projects to make sheep habitats more productive.

2) Work with the USFS to limit motorized use and access of the area to minimize displacement of sheep from preferred habitats and to limit weed infestations on the range.

3) Continue to work with private landowners and Missoula County to limit the use of domestic sheep and goats in the area.

Game Damage Strategies

Specific game damage problems have not occurred to date and are not anticipated. Bighorn numbers can be managed through public hunting and trapping and removal as they approach or exceed objectives.

Access Strategies

Based on the current distribution of bighorns during the hunting season, lack of hunter access to these sheep has not been a significant issue. FWP must continue to work with the USFS to protect access to public lands. Additionally, FWP may be able to work with private landowners to preserve access for hunters to sheep habitats. Where sheep use private land during the hunting season, landowners either personally allow hunter access or are enrolled in FWP's Block Management Program.

Population Objectives

1) Maintain the number of bighorn sheep observed during post-winter aerial surveys within 10% of 130 sheep (117 to 143).

2) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys of at least 60 rams: 100 ewes with at least 30% of the rams having a ¾-curl.

Population Management Strategies

Bighorn numbers are currently being managed primarily through ewe harvest, a modest harvest of the ram segment, and natural mortality. Another option for managing this population is the use of these sheep as transplant stock for initiating or augmenting other populations. To prevent genetic isolation, limited transplants from other populations might be helpful, particularly during population lows. The population objective of 130 (± 10%) observed bighorn sheep was derived from these considerations: 1) the ability of public lands to provide forage for the wintering bighorn population, and 2) the understanding that catastrophic disease-caused die-offs, exhibited in many other sheep populations, are often density dependent occurrences.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed through limited-entry harvest of the female segment. In Hunting District 203, licenses are issued under the following prescriptions (Table 3):

Standard Regulation: A limited number of adult ewe licenses issued would be up to 20% of the number of ewes going into the fall season.

NORTHWEST MONTANE	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	± 10% of 130	Greater than 35	5 or more adult ewe licenses	Up to 20% of Ewes
Restricitve Regulation	More than 10% below 130	Less than 35	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Greater than 10% above 130	Greater than 35	5 or more adult ewe licenses **OR** translocate if > 25 sheep including rams are available	More than 20% of Ewes

Table 3. Summary of Regulation types under different population criteria for ewe harvest and population management.

The number of ewes going into the fall season would be based on the number of ewes observed during the biennial survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 10% of the population objective and lamb recruitment is above 35 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is less than 35 lambs: 100 ewes,

OR if available, the Petty Creek herd might be augmented by a transplant of ewes and young rams from another range.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the biennial survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 10% above the population objective and lamb recruitment is greater than 35 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry either-sex licenses with the number of either-sex licenses issued being up to 20% of the ¾-curl rams in the population.

The Standard Regulation will be recommended if: The population is within objective (+ 10% of 130), there are 50 to 100 rams: 100 ewes, and 30% of the rams are at least ¾-curl (Table 4).

NORTHWEST MONTANE	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of Rams with ≥ ¾-curl
Standard Regulation	Up to 20% of the ¾-curl rams	± 10% of 130	50-100	≥ 30
Restrictive Regulation	Up to 10% of the ¾-curl rams	More than 10% below 130	< 50	< 30
Liberal Regulation	More than 20% of the ¾-curl rams	Greater than 10% above 130	> 100	≥ 30

Table 4. Summary of potential ram harvest under different population parameters and criteria.

Restrictive Regulation: Limited-entry either-sex licenses with the number issued being up to 10% of the ¾-curl rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 10% below the population objective of 130, there are less than 50 rams: 100 ewes and less than 40 lambs: 100 ewes and less than 30% of the rams are at least ¾-curl.

Liberal Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being more than 20% of the ¾-curl rams in the population.

The Liberal Regulation will be recommended if: The population is more than 10% above the objective of 130, there are more than 100 rams: 100 ewes, and more than 30% of the rams are at least ¾-curl.

JOHN LONG RANGE

(Lower Rock Creek) (Hunting District 210)

Description: The Lower Rock Creek bighorn herd is located approximately 20 miles southeast of Missoula in the foothills above the lower reaches of Rock Creek and its tributaries. A satellite herd has become established in the Bearmouth area; this herd is not currently hunted. Both the Lower Rock Creek and Bearmouth herd are stable in size and distribution.

The 188mi^2 bighorn sheep Hunting District 210 is 78% U.S. Forest Service (USFS) – Lolo and Beaverhead-Deerlodge National Forests (NF), 20% private, 1% Bureau of Land Management (BLM), and 1% Department of Natural Resources and Conservation (DNRC). The predominant land manager, in both occupied and unoccupied sheep habitat within the district, is the USFS, mostly the Lolo NF. Hunting District 210 is bounded by Interstate 90 to the north, Harvey Creek to the east, Ranch Creek to the south, and the Sapphire Divide to the west. Lower Rock Creek (Hunting District 210) is a third smaller than Upper Rock Creek (Hunting District 216) and has a correspondingly smaller bighorn sheep herd.

Bighorn sheep occupy 37% of the district (45,001 acres; 70mi^2) during some part of the year. Summer/fall habitat makes up 21% (25,293 acres; 39mi^2) of the total hunting district, with an additional 16% (19,708 acres; 31mi^2) used year-round, including during the critical winter period. Of the occupied habitat, 71%, totaling 50mi^2, is managed by the Lolo NF (none of the occupied habitat is managed by the Beaverhead-Deerlodge NF), 24% by private landowners, 3% by the DNRC, and 2% by BLM. The majority of occupied general and winter habitat is on or near Babcock Mountain, Spring and Brewster Creeks, and along the bottom of the valley. The Lolo NF and private landowners own the key lands for sheep in Lower Rock Creek.

The Rock Creek herd winters on grassy faces above Spring and Brewster Creeks and on Babcock Mountain, with rams also using the ridge north of Gilbert Creek. Late fall and spring are spent on these areas as well as on the valley bottom. Lambing occurs on rocky cliffs above Rock Creek and Spring Creek. In the summer, rams and some ewe groups move upslope several miles, while other ewe groups remain on pastures and in subdivisions along Rock Creek.

The Bearmouth herd is located in the south-central Garnet Range between Wallace Creek and Little Bear Creek north of Interstate 90. The core of their range, Dry and Cramer Creeks, is 10 miles upstream of the confluence of the Clark Fork River and Rock Creek. They use about 10,500 acres (J. Kolbe, pers. comm.) of corporate timberland (60%), private property (25%), and DNRC lands (15%).

The Bearmouth and Rock Creek herds have a well-documented interchange of individuals, and presumably genes. Connectivity with the Upper Rock Creek herd is known. Given the wide ranging explorations of rams in particular, and exploratory movements of bighorn in general, it is plausible to consider a regional metapopulation composed of both Rock Creek and Bearmouth herds (Hunting Districts 210 and 216), Lower Blackfoot (Hunting District 283), Skalkaho (Hunting District 261), the East Fork (Hunting District 270) and West Fork (Hunting District 250) of the Bitterroot, Lost Creek (Hunting District 213), and Garrison (Hunting District 212). Grave Creek Range (Hunting District 203) is isolated due to the separation imposed by the Missoula metropolitan area, Interstate 90 and U.S. Highway 93, and the Clark Fork River. While movements of individuals between distant populations (e.g., Garrison to the West Fork) are not likely on an annual basis (or ever), genetic exchange across generations is likely between neighboring herds and possible between distant herds.

Public Access: There is good public access to the Lower Rock Creek herd. Bighorn habitat occurs on Lolo NF lands, accessible from Forest Service roads, or on private lands in the valley that are visible from Rock Creek Road. The Lolo NF maintains a public viewing area specifically for bighorn. Hunting access on the valley bottom is generally unavailable, but hunting is not appropriate in this densely populated and subdivided landscape anyway. The primary threat to accessing the herd for observation or hunting would be if public access to national forest right-of-ways were curtailed. Given the high profile of this herd and frequent use of public lands by recreational users, this is unlikely.

Bighorn Sheep Populations: The Lower Rock Creek bighorn herd is a reintroduced herd founded by the translocation of 25 sheep (five yearling rams, 16 ewes, and four male lambs) from Wildhorse Island in 1979 to Babcock Mountain and Spring Creek. An additional transplant in 1987 of 28 (18 ewes, seven lambs, three rams) sheep from the Lost Creek herd to Ranch Creek helped to further establish the herd. The Wildhorse and Lost Creek herds were both established, in part, by transplants from the Sun River herd, and as a result, Lower Rock Creek bighorns are descendents of Rocky Mountain Front bighorns.

Berwick (1968) and others (Aderhold 1972; FWP 1975) noted that evidence suggests that bighorns were abundant throughout the Rock Creek drainage prior to extensive settlement and exploitation of the area. After the discovery of silver deposits in Granite County in 1864, market hunting, competition with domestic livestock, and possibly disease-related die-offs resulted in near extirpation of the species from the drainage, as well as the loss of bighorns from the Flint Creek Valley. In 1905, only five bighorns were observed on winter ranges, and these were in Upper Rock Creek. Thereafter, bighorn sheep were absent from Lower Rock Creek until the transplant in 1979.

The population grew from the initial transplant to 44 in 1983 and to a peak of 268 observed bighorn in 1996 (Figure 1 and Table 1). Concerned about the impact of a large population on range and herd health, managers moved aggressively to reduce the population in 1997. In total, 75 sheep were removed, with 50 (35 ewes, five lambs, and 10 rams) for transplants and 10 rams and 15 ewes harvested by hunters. The population did not climb to over 200 individuals again until 2008 when 201 bighorns were observed during an aerial survey.

Lamb production has been moderate with a mean of 36 lambs: 100 ewes and a range of 19 to 65 lambs: 100 ewes observed in the last 25 years (Table 1). Ram to ewe ratios have been widely variable (mean 79, range 19 to 131), more likely due to sampling error than a result of varying harvest. Ram groups can be difficult to find in Hunting District 210, and the loss of a single group can result in 25 fewer rams observed. License levels have not been as variable as the total number of rams observed. For example, from 1995 to 2002, 10 either-sex licenses were issued each year, yet total rams observed varied from 16 to 87 (Table 2).

Several rams were observed in the Bearmouth area beginning in the early 1980s, following the 1979 transplant of bighorn sheep into nearby Lower Rock Creek. In 1987, one radio-collared ewe from the Rock Creek transplant moved north across the Clark Fork River and established a home range in the Garnet Mountains between Wallace Creek and

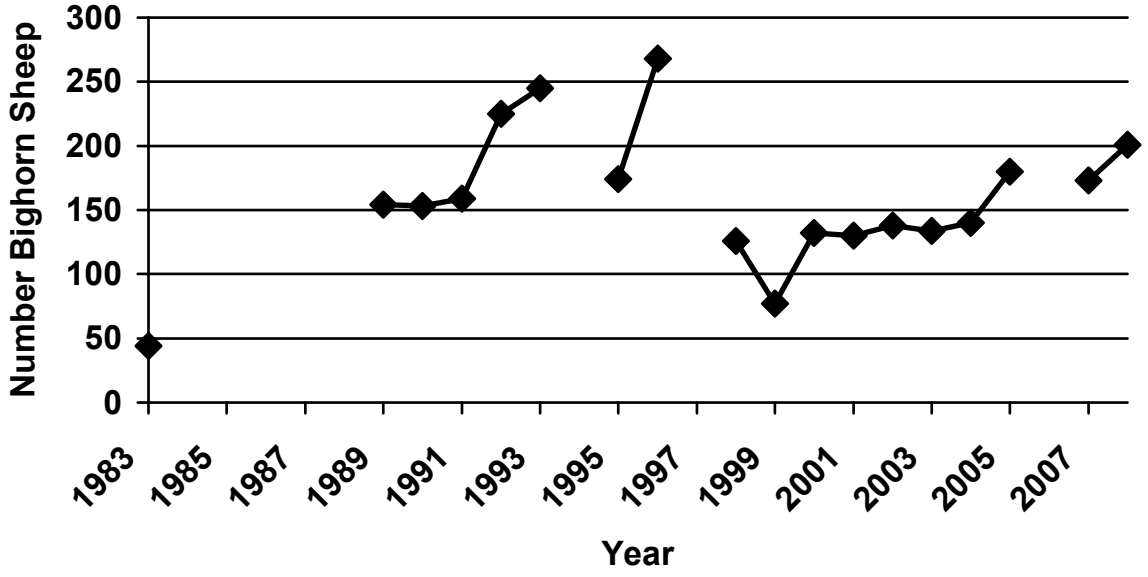


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Lower Rock Creek population, Hunting District 210, 1983-2008.

Table 1. Classification data from surveys of bighorn sheep in lower Rock Creek, Hunting District 210, 1983-2008.

Year	Month	Method	Rams		Ewes and Lambs			Total		Rams/ 100 Ewes	Lambs/ 100 Ewes
			3/4+	Total	Ewes	Lambs	Total	Uncl	Sheep		
1983	March	Copter	2	13	20	11	31	0	44	65	55
1989	April	Copter	14	34	100	19	119	1	154	34	19
1990	April	Copter	18	58	54	30	84	0	142	107	56
1990	June	Copter	16	42	80	31	121	0	153	53	39
1991	April	Copter	9+	53	85	21	106	0	159	62	25
1992	March	Copter	40	52	91	40	131	42	225	57	44
1993	April	Copter	29	91	94	30	124	30	245	97	32
1995	May	Copter	58	84	64	11	75	0	174	131	17
1996	April	Citabria	---	66+	---	---	---	202	268	---	---
1998	March	Copter	64	87	33	6	39	0	126	---	20
1998	April	Citibria	---	82	48-	---	48-	0	130	170	---
1999	March	Copter	26	28	40	9	49	0	77	70	22
2000	April	Copter	36	48	61	23	84	0	132	79	38
2001	June	Ground	0	16	83	31	114	0	130	19	37
2002	May	Copter	34	48	69	21	90	0	138	70	30
2003	April	Copter	22	40	65	29	94	0	134	62	45
2004	April	Ground	19	29	48	31	79	32	140	60	65
2005	April	Copter	41	73	84	23	107	0	180	87	27
2007	March	Copter	8	63	33	10	43	67	173	---	30
2008	April	Copter	28+	73	64	28	92	36	201	114	44

Van Curan Gulch. Sightings of this collared ewe and other sheep continued until reports of 12 to 15 sheep became common.

DeCesare (2002) began a graduate research project on this herd in 2001 and estimated that the Bearmouth herd consisted of at least 17 individuals. Regular movements of Bearmouth rams to and from Rock Creek were documented, and several rams from Rock Creek appeared in Bearmouth during the course of the study. Reliable sightings of up to 28 individuals have been reported as recently as 2007, but FWP does not regularly monitor this herd.

Bighorn sheep have been removed for transplant from Lower Rock Creek twice. In 1997, 50 bighorn were captured, with 30 released on the main Boulder River in FWP Region 5 and 20 in the Tendoys in Region 3. In 2007, 15 bighorns (13 ewes and two yearling rams) were captured by net-gunning and transported to and released along the Green River in Utah to supplement a prior introduction. Translocation has been an effective population management tool.

Recreation Provided: The Lower Rock Creek herd provides hunting and wildlife viewing opportunities. During 2007, hunters spent 20 days pursuing rams and seven days hunting ewes in Hunting District 210. From 2004 to 2007, an average of 38 days a year were spent by ram hunters in Hunting District 210. While 38 days is not many, most hunters consider their time spent hunting and watching wild sheep to be some of the most treasured days of their lives. The odds of drawing a ram license in Montana are slim, and in 2007 the chance of drawing in Hunting District 210 was on par with statewide odds at less than 1%. Similar numbers of hunters put in for nearby districts: Hunting District 203 (463 applicants), Hunting District 210 (481 applicants), and Hunting District 216 (474 applicants). The Lower Rock Creek herd is very visible to residents and recreational users and provides a watchable wildlife population close to Missoula. The Bearmouth herd is not currently hunted, but its proximity to Interstate 90 allows for easy viewing opportunities.

Current Annual Bighorn Sheep Harvest: The first hunting season in Hunting District 210 was in 1986, when a 3.5-year-old ram was harvested. License numbers for rams have ranged from one to 10. In total, 128 adult rams

Date	Method	No. of Ram/ES Licenses	No. of Rams Killed	No. of Ewe Licenses	No. of Ewes Killed	Other Ewes	Other Lambs	Other Rams	Release Area
1986	Hunting	1	1	0	0				
1987	Hunting	2	2	0	0				
1988	Hunting	2	2	0	0				
1989	Hunting	2	2	9	8				
1990	Hunting	5	5	15	12				
1991	Hunting	5	5	15	13				
1992	Hunting	7	7	30	27				
1993	Hunting	3	3	30	27				
1994	Hunting	5	5	30	24				
1995	Hunting	10	10	15	12				
1996	Hunting	10	8	30	24				
Feb 1997	Trap/ Transplant					20	0	5	Boulder River
Feb 1997	Trap & Transplant					15		5	Tendoys
Feb 1997	Trap						5		WA State Univ
1997	Hunting	10	10	15	12				
1998	Hunting	10	10	1	1				
1999	Hunting	10	10	0	0				
2000	Hunting	10	9	0	0				
2001	Hunting	10	10	0	0				
2002	Hunting	10	10	0	0				
2003	Hunting	4	3	0	0				
2004	Hunting	4	4	0	0				
2005	Hunting	4	4	0	0				
2006	Hunting	4	4	8	8				
2007	Trap & Transplant					13		2	Green River, UT
2007	Hunting	4	4	10	6				

Table 2. Bighorn sheep removals in Lower Rock Creek, Hunting District 210, Region 2 of Montana Fish, Wildlife & Parks, 1986-2008.

have been harvested from this population and 12 yearling rams removed for transplants since 1986 (Table 2). Ewe licenses have ranged from zero to 30 with 174 ewes harvested and 48 transplanted. For the 2008 hunting season, there were 10 either-sex licenses and one ewe license available by special drawing.

The mean age of rams harvested in Hunting District 210 from 1990 to 2007 is 6.5 years (range 2.5 to 11.5 years). The highest mean age of rams taken in was 9.5 years in 2003. Although license numbers were reduced after 2003, the mean age of harvested rams has since declined (2004: 8, 2005: 6, 2006: 7, 2007: 8). More than 28 rams with a ¾-curl or better were observed during the 2008 aerial survey. Many of these rams were full-curl, and we expect that the mean age of harvested rams in 2008 will remain above the long-term average.

In 2002, the FWP Commission asked Region 2 to consider shortening the sheep season because of a perception that too many older rams were being taken in the rut close to Rock Creek Road. This was a controversial issue, hunters were overwhelmingly against this proposal and the season was left in place with fewer permits available in 2003.

Accomplishments: The Lower Rock Creek sheep herd is an example of a successful reintroduction of bighorn sheep to their native habitat. After a 75-year absence, the herd was reestablished in 1979. Transplants also resulted in the unintentional establishment of the Bearmouth population. Close cooperation between state and federal agencies, private industry and landowners, and sportsmen resulted in two successful introductions. A

program of active habitat management by the USFS, Lolo NF in cooperation with FWP has resulted in grassland enhancement, via slashing and burning, on thousands of acres of core habitat since 1986. Individuals from Rock Creek have been used to establish herds elsewhere.

Management Challenges:

1) Maintaining separation of wild sheep and domestic sheep and goats to avoid transmission of disease to bighorns. A large domestic sheep herd is pastured directly adjacent to the core of the Bearmouth herd's range; domestics and bighorns regularly intermingle throughout the year. Juxtaposition of this herd to domestic sheep is the primary threat to the Bearmouth herd's long-term survival. Similarly, the frequency of interchange with the nearby Rock Creek herd extends this threat to Upper and Lower Rock Creek.

2) Weed management throughout the two herds' range is ongoing and important to continue. Efforts to enhance and maintain grassland foothills habitat using integrated weed management and prescribed burning will benefit bighorns.

3) Lower Rock Creek is highly developed and becoming more so. Numerous issues arise because of the proximity of the herd to human developments. Road-kill, harassment and injury of sheep by domestic dogs, and complaints by landowners about bighorn sheep damage to their lawns and fields will continue to present a management challenge.

Population Monitoring: The Lower Rock Creek bighorn herd has been surveyed via ground and air since its establishment. Citizen participation in population counts and herd monitoring has provided supplemental data and engendered public support for the herd. Bighorns are counted and classified by age and sex, with rams classified based on horn development as Class I, II, III, or IV (Geist 1971).

Summary of Public Comment

Outfitters, ranchers, hunters, wildlife watchers, and the general public all have an interest in Rock Creek bighorn sheep. Numerous trophy rams taken in the drainage have helped Rock Creek to become one of the best-known sheep herds in Montana. License levels for Rock Creek bighorns are watched closely, with a correspondingly high level of public input. Conflicts between hunters and private landowners and between bighorns and homeowners are a frequent source of concern. Constituents pay close attention to this herd and management actions within Rock Creek.

Management Goal

Manage for a healthy and productive bighorn sheep population with a goal of producing trophy class rams. Maintain and enhance bighorn sheep habitat on a landscape scale. Coordinate closely with the Lolo NF, the BLM and private landowners to control weeds, enhance grassland communities, and minimize the risk of contact with domestic sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain over 70mi^2 (45,001 acres) of occupied bighorn sheep habitat for the benefit of bighorns and other wildlife species.

2) Encourage public and private landowners to manage their properties to maximize the quality and quantity of forage on native grasslands. Explore options to cost-share habitat improvements like weed control, prescribed burning, and, where appropriate, removal of conifers from grasslands.

3) Prevent over-utilization of forage on winter range by limiting the population through public hunting and the capture and removal of sheep.

Habitat Management Strategies

1) Work with private landowners and state, federal, and county governments to limit the use of domestic sheep and goats in the area. Coordinate with the Missoula and Granite County Weed Boards, Montana State University Agricultural Extension, Montana Stock Growers Association, the BLM, and the USFS to minimize impacts to bighorns and maximize improvements to sheep range.

2) Work with private landowners; state, federal, and county governments; and conservation organizations including Five Valleys Land Trust, the Foundation for North American Wild Sheep, the Rocky Mountain Elk Foundation, Safari Club International, and others to conserve important bighorn habitat on private lands through the use of conservation easements or fee title acquisition.

3. Work with landowners to identify and accomplish habitat improvements on important bighorn sheep habitats. Also, it is important to ensure that projects developed to benefit bighorns do in fact have positive results.

Game Damage Strategies

As Lower Rock Creek has been subdivided, complaints about bighorn damage to alfalfa fields have shifted to complaints about sheep impacts to lawns. Public hunting access is not realistic or safe on many of these properties.

Access Strategies

Maintain and enhance existing public access to state and federal lands. Pursue strategic purchases to ensure continued access to public and private lands in bighorn habitats.

Population Objectives

1) Maintain the number of bighorn sheep observed during spring aerial surveys within 20% of 200 sheep (160 to 240).

2) Maintain a ram: ewe ratio observed during spring aerial surveys of 40 rams: 100 ewes with at least 50% of the rams as Class III and IV (approximately ¾-curl or greater).

Population Management Strategies

The Hunting District 210 population objective of 200 (± 20%) observed bighorn sheep is based on: 1) available forage on winter ranges, 2) maintaining range quality, 3) knowledge that catastrophic disease-related die-offs can be density dependent, and 4) minimizing conflicts with private landowners. Population management is occurring through hunter harvest of ewes and rams, natural mortality, and removal of sheep for translocation to other locales.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed through natural mortality, limited-entry harvest of ewes, and, when appropriate, removal of animals for translocation. Ewe bighorn sheep licenses in Hunting District 210 will be issued under the following prescriptions (Table 3):

Standard Regulation: A limited number of adult ewe licenses issued would be up to 15% of the number of ewes going into the fall season. A rough estimate of the number of ewes in the fall will be derived from the number of ewes observed during the annual survey, assuming a 5% mortality of adults, and addind recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is between 160 and 240 and lamb recruitment is over 30 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is less than 160 and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	160-240	Over 30	Limited Entry Adult Ewes	Up to 15% of Ewes
Restrictive Regulation	Less than 160	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Over 240	Over 40	Limited Entry Ewes **OR** translocate	Up to 20% of Ewes

Table 3. Summary of regulation types under different population criteria for ewe harvest and population management.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 240 and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry either-sex licenses with the number of either-sex licenses issued being up to 15% of the Class III and IV rams in the population.

The Standard Regulation will be recommended if: The population is within 20% of objective (160 to 240), there are 40 to 60 rams: 100 ewes, and over 50% of the rams are Class III and IV (Table 4).

Restrictive Regulation: Limited-entry either-sex licenses with the number issued being up to 10% of the Class III and IV rams in the population.

The Restrictive Regulation will be recommended if: The population is below 160 bighorns, there are less than 40 rams: 100 ewes, and less than 50% of the rams are Class III and IV.

Liberal Regulation: Limited-entry either-sex licenses with the number of licenses issued being up to 20% of the Class III and IV rams in the population.

The Liberal Regulation will be recommended if: The population is over 240 bighorns; there are more than 60 rams: 100 ewes, and more than 50% of the rams are Class III and IV.

GARRISON (Hunting District 212)

Description: The Garrison herd occupies bighorn sheep Hunting District 212 and is named after the town of Garrison, which lies a mile east of the herd's range. Although the hunting district includes much of the northern portion of the Flint Creek Range, the core range for this herd is centered on private lands two miles southwest of the junction of U.S. Highway 12 and Interstate 90. The hunting district is made up of approximately 304mi^2 of private, state, and federally owned lands. Most of the district, 173mi^2 (57%), is privately owned. Government agencies manage the rest with the Beaverhead-Deerlodge National Forest managing 102mi^2 (34%), Montana Department of Natural Resources and Conservation (DNRC) (11mi^2), the Bureau of Land Management (BLM) (8mi^2), the Montana State Prison (8mi^2), and the National Park Service (2 mi^2). The district is bounded by MT Highway 1 to the west and Interstate 90 to the north and east; to the south it crosses the Flint Creek Range along a roughly east to west line from Deer Lodge to Philipsburg.

Table 4. Summary of potential ram harvest under different population scenarios.

MOUNTAIN-FOOTHILLS	Number of Ram Licenses	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of rams Class III & IV
Standard Regulation	Up to 15% of Class III & IV rams	160-240	40-60	> 50
Restrictive Regulation Prescription 2	Up to 10% of Class III & IV rams	<160	< 40	< 50
Liberal Regulation	Up to 20% of Class III & IV rams	>240	> 60	> 50

Bighorn sheep occupy about a third, 62mi^2, of this area in the northeastern corner of the district and in the northern end of the Flint Creek Range. The herd is atypical because their primary range is on a small island, 3,840 acres, of privately owned foothills habitat. This core range is separated from U.S. Forest Service– managed mountainous habitat by three miles of open intermountain grasslands and gradual benches that descend from the Flint

Creek Range north toward the Clark Fork River. Residents of Gold Creek have reported a small band of bighorns living near Warm Springs Creek in deer/elk Hunting District 291, eight miles northwest of Garrison. Although this satellite herd has not been verified by FWP employees, recovery of the skull of an 11-year-old ram nearby demonstrates that rams have been exploring habitats north of Interstate 90 in the Garnet Range.

While some ram groups and a few ewes utilize high-elevation habitats in the mountains, the bulk of the population lives year-round on about 6mi² of intermountain grasslands, dry Douglas fir forests, and cliffs above the Clark Fork River. Winter range and lambing habitat are entirely within this area. Additional information is needed on habitats used by ram bands in the summer and fall. Radio-marked rams have been found 18 miles to the west near Boulder Creek (above the town of Maxville), and rams and ewes have been sighted 16 miles to the southwest at Powell Mine. These sightings demonstrate that bighorns are making long exploratory movements into the Flint Creek Range.

Public Access: Hunting access in the Garrison herd's primary range is very limited. With the exception of a section of DNRC property, which is under consideration for land banking (sale to a private party), all of the 3,840 acres are privately owned by four private landowners. It has been challenging to get hunters onto these private lands, and without better access it will be difficult to provide hunting opportunities or manage bighorn populations. Public access to Forest Service land in the North Flints is excellent, but the sheep are few and scattered over a 100mi² landscape.

Bighorn Sheep Populations: The Garrison herd was established by bighorn sheep colonizing new habitat and presumably originated from the Lost Creek herd (25 miles to the south). The first report of bighorns at Garrison was in the early 1980s when Lyn Nielson, FWP biologist, sighted one ram, one ewe, and one lamb. Ultimately, the herd grew to occupy the northeast foothills of the Flint Creek Range. The first comprehensive population surveys were conducted when Nick DeCesare's masters research ("Movement and Resource Selection of Recolonizing Bighorn Sheep in Western Montana," University of Montana, 2002) was initiated.

DeCesare radio-marked seven ewes and one ram from the Garrison population and conducted surveys documenting herd size, composition, and location. In 2001, DeCesare counted a total of 55 bighorn sheep in the population; in 2002, he counted 74 bighorns (Figure 1 and Table 1). Ninety-four bighorns were observed during an aerial survey conducted by FWP in 2004 and 118 during a ground-based survey in 2005.

Total observed bighorn sheep increased from 2001 to 2005, but decreased in 2006 and 2008. We suspect that this reduction is a byproduct of aerial surveys rather than a sign of a population decline. Aerial surveys for this herd have been relatively ineffective because the sheep run into the cliffs and timber prior to observation or classification. As a result, lamb: ewe and ram: ewe ratios are not available for 2004, 2006, or 2008.

Ground-based surveys show a population with good lamb production and half as many rams as ewes. The ram: ewe ratios are likely biased low due to the fact that some ram bands migrate into the Flints for summer and fall. Hunting pressure on this herd has been light,

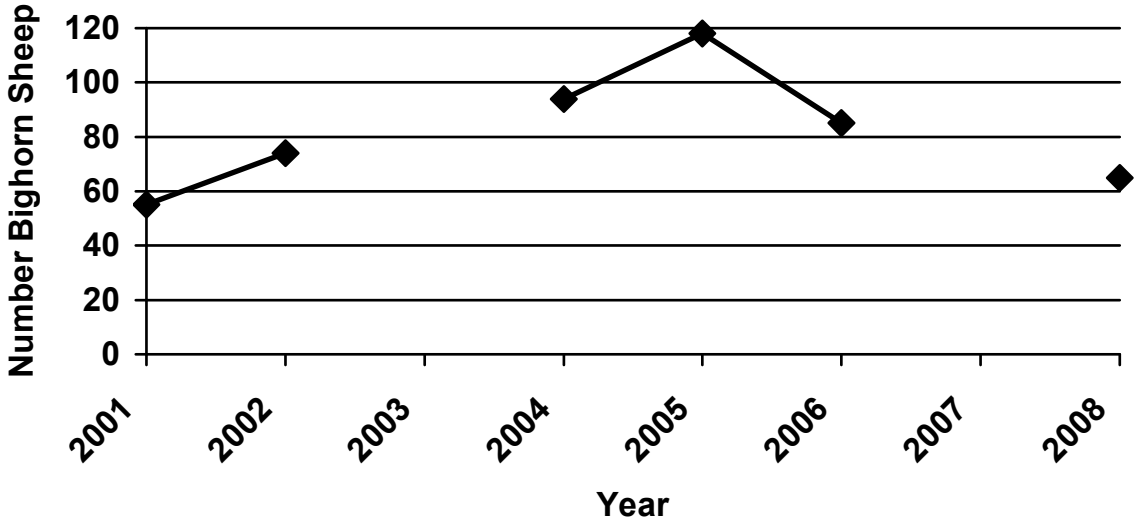


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Garrison population, Hunting District 212, 2001–2008.

Table 1. Counts and classifications from ground and aerial surveys for the Garrison population, Hunting District 212, 2001–2008.

Date	Total	Ewes	Lambs		Rams						Per 100 ewes	
				Unc	I	II	III	IV	Unc	Tot	Lambs	Rams
Sept. 2001	55	27	12	0	-	-	-	-	16	16	44	59
Aug. 2002	74	34	20	-	-	-	-	-	20	20	59	59
Apr. 25, 2004[1]	94	3	2	51	-	1	2	1	34	38	-	-
Aug. 8, 2005	118	55	33	-	-	-	-	-	30	30	60	55
Mar. 23, 2006[1]	85	8	4	45	2	4	3	1	18	28	-	-
Apr. 30, 2008[1]	65	44	12	-	2	1	2	1	3	9	-	-

[1]Aerial bighorn surveys

with only four rams harvested since the season was opened in 2004. This herd has the potential to grow and disperse widely from the Garrison area into the Flints to the south or Garnets to the north.

No bighorns have been removed from this population for translocation. The proximity of this herd to the interstate highway and difficulty obtaining hunting access make it a candidate for future capture and removal operations.

Recreation Provided: Because the sheep mostly occupy private lands and a hunting season has only been in place for four years, the Garrison herd is not well known. The most hunters to put in for this district were 110 in 2004. Despite difficulty obtaining access, all four hunters were able to harvest a ram. From 2004 to 2007, hunters have spent 32 days (average eight, range one to 23) pursuing bighorn rams in Hunting District 212.

Current Annual Bighorn Sheep Harvest: Bighorn sheep Hunting District 212 opened in 2004, and one either-sex permit has been available every year since. Hunter success harvesting a ram has been 100%, and all rams harvested have exceeded a 185-point Boone and Crockett score. Harvested rams have been at least 8.5 years old with the oldest being 11.5 years old.

Accomplishments: The Garrison herd is an example of a naturally colonizing bighorn sheep population. FWP has been successful in monitoring this population and initiating a hunting season.

Management Challenges:

1) Maintaining separation of wild sheep and domestic sheep and goats to avoid transmission of disease to bighorns. The increasing use of domestic sheep to manage weeds, the "sheep on wheels" program, is of concern to bighorn managers. In the Deer Lodge Valley, the use of domestic sheep for weed control is on the upsurge, with thousands of domestic sheep brought into the valley annually. The program is active on private lands, and proposals to use domestic sheep for weed control on public lands are under review. Domestic sheep are found five miles to the north of the Garrison herd and within two miles of the reported satellite herd.
2) The development of a large, high-end subdivision directly adjacent to the Garrison herd presents numerous problems including potential stress to wintering and lambing sheep, loss of landscape connectivity, game damage complaints, direct and indirect losses of habitat, and further limits to public access. FWP is committed to working with adjoining landowners to minimize adverse impacts. The department has been successful in directing placement of a 5,695-acre conservation easement adjacent to and within the herd's core habitat.
3) Weed management throughout the herd's range is necessary. Efforts to enhance and maintain grassland foothills habitat will benefit bighorns.

Population Monitoring: The Garrison herd has been surveyed using a super-cub airplane or helicopter, in March or April, and using a systematic ground-based survey in the summer. Depending on available funding and time, these methods can be used interchangeably in the future. Bighorns are counted and classified by age and sex, with rams classified based on horn development as Class I, II, III, or IV.

Summary of Public Comment

Public awareness of and comment on management of the Garrison herd is limited.

Hunters and local residents appreciate this population. There is concern among sportsmen that private landowners are precluding a more generous hunting season.

Management Goal

Manage for a healthy and productive bighorn sheep population with a diverse age structure of rams. There is an opportunity for an increase in sheep numbers and distribution on public lands in adjoining mountain ranges. Cooperation with neighboring private landholders is especially important to minimize impacts to habitat, minimize the risk of contact with domestic sheep, and maximize opportunities for bighorn sheep hunters to harvest sheep and for FWP to manage the population.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain over 62mi² square miles (39,680 acres) of occupied bighorn sheep habitat for the benefit of bighorns and other wildlife species. Conserve landscape integrity and connectivity by precluding subdivision of critical habitats.

2) Encourage private landowners to manage their properties to maximize the quality and quantity of forage on native grasslands. Explore options to cost-share habitat improvements like weed control, prescribed burning, and where appropriate, removal of conifers from grasslands.

3) Prevent over-utilization of forage on core range by limiting the population, when necessary, through public hunting and the capture and removal of sheep.

Habitat Management Strategies

1 Work with private landowners and state, federal, and county governments to limit the use of domestic sheep and goats in the area. Coordination with the Powell County Weed Board, Montana State University Agricultural Extension Service, Montana Wool Growers Association, and the Montana Stock Growers Association is necessary to minimize impacts to bighorns.

2) Work with landowners to identify and accomplish habitat improvements on important bighorn habitats.

3) Continue to work with private landowners; state, federal, and county governments; and conservation organizations including Five Valleys Land Trust, The Foundation for North American Wild Sheep, the Rocky Mountain Elk Foundation, Safari Club International, and others to conserve important bighorn habitat on private lands through the use of conservation easements or fee title acquisition.

Game Damage Strategies

In the past, there have not been any game damage complaints related to the Garrison herd. We anticipate that with the construction of a golf course and large development adjacent to and within the herd's range, game damage complaints may occur. If so, department response will be consistent with FWP's program direction including the requirement of reasonable hunting access to the herd. Capture and removal operations may be appropriate to reduce herd numbers if necessary.

Access Strategies

Maintain and enhance existing public access to state and federal lands. Work with private landowners with holdings within the core range to assure reasonable and adequate hunting access to the Garrison herd. Maintain FWP access to complete surveys, disease and range monitoring, and capture operations.

Population Objectives

1)Maintain the number of bighorn sheep observed during spring aerial surveys within 20% of 125 bighorn sheep (100 to 150);

2)Maintain a ram: ewe ratio observed during spring aerial surveys of at least 40 rams: 100 ewes with at least 40% of the rams as Class III and IV (approximately ¾-curl or greater).

Population Management Strategies

The population objective of 125 (± 20%) observed bighorn sheep is based on 1) the limited size of currently utilized core range, 2) limited access to the population, and 3) our understanding that catastrophic disease-caused die-offs are often density dependent. If the Garrison herd were to substantially expand their range, via satellite herds or other expansion, a higher population objective would be appropriate.

Currently, population management is occurring through natural mortality. Harvest of one ram a year has not had an impact on population size. As the herd grows, ewe harvest

or removal of bighorns via transplant may be necessary. Access is critical to manage the Garrison herd and to allow hunter opportunity. All prescriptions for harvest management (below) are predicated on sufficient access to accommodate the prescribed harvest.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed through natural mortality and, if feasible, limited-entry harvest of ewes. Adequate access and landowner acceptance is necessary to implement ewe harvest in Hunting District 212. If access is available, bighorn sheep licenses in Hunting District 212 will be issued under the following prescriptions (Table 2):

Standard Regulation: A limited number of adult ewe licenses issued would be up to 15% of the number of ewes going into the fall season. An estimate of the number of ewes in the fall will be derived from the number of ewes observed during the annual survey, assuming a 5% mortality of adults, and adding a recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is between 100 and 150 and lamb recruitment is over 30 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is less than 100 and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 150 and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry either-sex licenses with the number of either-sex licenses issued being up to 15% of the Class III and IV rams in the population (approximately ¾-curl and greater).

The Standard Regulation will be recommended if: The population is within 20% of objective (100 to150), there are 40 to 60 rams: 100 ewes, and over 40% of the rams are Class III and IV (Table 3).

Restrictive Regulation: Limited-entry either-sex licenses with the number issued being up to 10% of the Class III and IV rams in the population.

The Restrictive Regulation will be recommended if: The population is below 100 bighorns, there are less than 40 rams: 100 ewes, and less than 40% of the rams are Class III and IV.

Liberal Regulation: Limited-entry either-sex licenses with the number of licenses issued being more than 20% of the Class III and IV rams in the population.

The Liberal Regulation will be recommended if: The population is over 150 bighorns; there are more than 60 rams: 100 ewes, and more than 40% of the rams are Class III and IV.

Table 2. Summary of regulation types under different population criteria for ewe harvest and population management.

MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	100-150	Over 30	Limited Entry Adult Ewes	Up to 15% of Ewes
Restrictive Regulation	Less than 100	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Over 150	Over 40	Limited Entry Ewes **OR** translocate	Up to 20% of Ewes

MOUNTAIN-FOOTHILLS	Number of Ram Licenses	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of rams Class III & IV
Standard Regulation	Up to 15% of Class III & IV rams	100-150	40-60	> 40
Restrictive Regulation	Up to 10% of Class III & IV rams	<100	< 40	< 40
Liberal Regulation	Up to 20% of Class III & IV rams	>150	> 60	> 40

Table 3. Summary of potential ram harvest under different population scenarios.

LOST CREEK
(Hunting District 213)

Description: The Lost Creek bighorn herd resides immediately west of Anaconda and as a result is often referred to as the "Anaconda herd." Occupied habitat includes foothills in the Flint Creek Range near Lost Creek, valley bottom winter range in Anaconda's West Valley, and high alpine ridges and cirques in the Anaconda-Pintler Range. The herd has rebounded from a pneumonia-induced die-off in 1991 and is increasing in size and distribution. In 2002, Hunting District 213 was expanded south of MT Highway 1 to reflect the herd's increased use of Garrity Mountain and the Anaconda-Pintler Mountains.

Ownership of the approximately 411mi^2 Hunting District 213 is 55% private, 39% federal (Beaverhead-Deerlodge National Forest [NF]), and 6% state (mostly FWP and Montana Department of Natural Resources and Conservation [DNRC]). District boundaries include privately owned lands that are not sheep habitat. The district is defined by the East Fork of Rock Creek to the west, the Continental Divide to the south, Interstate 90 to the east, and Racetrack Creek to the north.

A third of the district (133mi^2), is used by bighorns and most of the sheep habitat is in public onwership. Fifty-four percent of all occupied habitat, totaling 71mi^2, is managed by the Beaverhead-Deerlodge NF. Occupied general and winter core habitat is centered on Stucky Ridge, which runs northwest of Anaconda toward Olsen Mountain, parallel to Lost Creek to the north and MT Highway 1 to the south. This core habitat makes up 11% (46mi^2) of the entire district, with another 21% (87mi^2) occupied seasonally. The majority (63%, 29mi^2) of year-round habitat is in public ownership with 6,572 acres of bighorn habitat owned by FWP. The Blue-eyed Nellie, Garrity Mountain, and Lost Creek Wildlife Management Areas (WMA) provide important habitat for Anaconda-area bighorn sheep.

The topography and vegetation in the area are well suited to bighorns. Native grasslands are found on the foothills, ridges, and saddles, abundant cliffs and rocky terrain provide escape cover, and high-elevation habitats provide nutritious forage in the summer. In the winter, bighorns concentrate in the West Valley between Olsen Gulch and Blue-eyed Nellie Gulch and in Lost Creek near Timber Gulch. The Blue-eyed Nellie and Garrity Mountain WMAs offer critical winter range. Lambing occurs throughout the primary range of the Lost Creek herd and is concentrated on lower elevations. Traditional summer range is at the heads of Lost, Olsen, Foster, and Warm Springs Creeks.

Bighorn are expanding their summer range and can be found along the Continental Divide 9 miles south of Stucky Ridge. Bands of sheep are frequently reported in mountain goat habitat above Lake of the Isles, in Nelson Basin, and near Miller Lake. Rams have been observed over 20 miles southwest of Stucky Ridge, near Cougar Creek, at the headwaters of the Rock Creek drainage. Anaconda rams have been pioneering westward, and rams from Upper Rock Creek have been exploring north.

Pioneering sheep from the Lost Creek herd were the likely founders of the Garrison herd. Population connectivity throughout the Upper Clark Fork between the Lost Creek, Garrison, and Upper and Lower Rock Creek herds is possible.

Public Access: There is excellent public access to the Lost Creek herd. Abundant public lands, close proximity to Anaconda and MT Highway 1, and numerous Forest Service roads allow the public to observe and hunt bighorn with ease. Anaconda bighorn habitat and public access have benefited from numerous land transactions that have brought private lands into public ownership. The U.S. Forest Service (USFS) completed the 14,000-acre Lost Creek exchange in 1994. The Garrity Mountain WMA, at 9,200

acres, was purchased from RY Timber in 2000 using funds from the Natural Resource Damage program, and the 23,300-acre USFS "Watershed Property" was purchased in 2001. The 162-acre Blue-eyed Nellie WMA protects critical winter range in Anaconda's West Valley and provides access to Blue-eyed Nellie and Tin Can Gulches.

Bighorn Sheep Populations: The Lost Creek herd was established in 1967, with help from the Anaconda Sportsmen's Club, when 25 bighorn sheep (20 ewes, five rams) were transplanted to Olsen and Foster Creeks from the Sun River herd near Choteau, Montana. The transplant was successful; the population grew to 50 in 1971 and to 80 in 1974. Two bighorns from Thompson Falls supplemented the population in 1985. The herd grew rapidly, and by 1989 the bighorn population was over 361 sheep (Figure 1 and Table 1). Over 150 sheep (mostly ewes and lambs) were captured and removed for transplant within Montana during a five-year period, 1986 to 1991, yet the population continued to grow.

On September 15, 1991, a hunter in Lost Creek found a sick ram. The ram died in transit to Anaconda and was taken to the State Veterinary Lab in Bozeman for an autopsy, which determined that pneumonia was the cause of death. Subsequently, dead and sick sheep were found throughout the range of the herd, and lung samples from 19 bighorns were submitted to the lab on September 9, 1991. *Pasteurella hemolytica* was cultured and determined to be the major cause of the die-off. The disease outbreak lasted for about 10 weeks and the population plummeted. Only 80 head were observed during a partial aerial survey on December 12, 1991, and 144 sheep were observed during a full survey in 1992. Mortality from the die-off was over 50%. Total observed sheep numbers continued to decline until 1999. Since 2000, the population has grown steadily, and the herd is now over 300 head. Lamb production in the Lost Creek herd from 1978 to 2008 has been consistently strong (mean = 45, range = 13 to 73). Only in 1994, three years after the die-off, was a lamb: ewe ratio of less than 30 lambs: 100 ewes observed. The capture and removal of large numbers of ewes in the late 1980s resulted in more rams in the population than ewes. Ram to ewe ratios have varied from 44 to 112 rams: 100 ewes. Class III and IV rams made up more than half of the ram population every year except 1978. Rapid horn growth and large numbers of older rams characterize this population.

As the Lost Creek herd increased in the late 1980s, an aggressive transplant program was initiated to reduce the population and develop bighorn herds in other areas. In total, over 160 bighorns were captured for transplant using a drive net at Blue-eyed Nellie and Smith Gulches in February 1986, 1988, and 1991. Records are incomplete, but it is known that in 1991 alone, 60 sheep were captured and relocated with about half going to the Boulder area and the rest released near Quake Lake. These captures were composed mostly of ewes and lambs and resulted in a sex ratio biased toward males. Transplants from the Lost Creek herd ceased in 1991 after the die-off. The Lost Creek herd has rebounded and should again be considered as a source for transplants.

Recreation Provided: Good public access and consistently large rams have made the Lost Creek herd popular with sportsmen. In

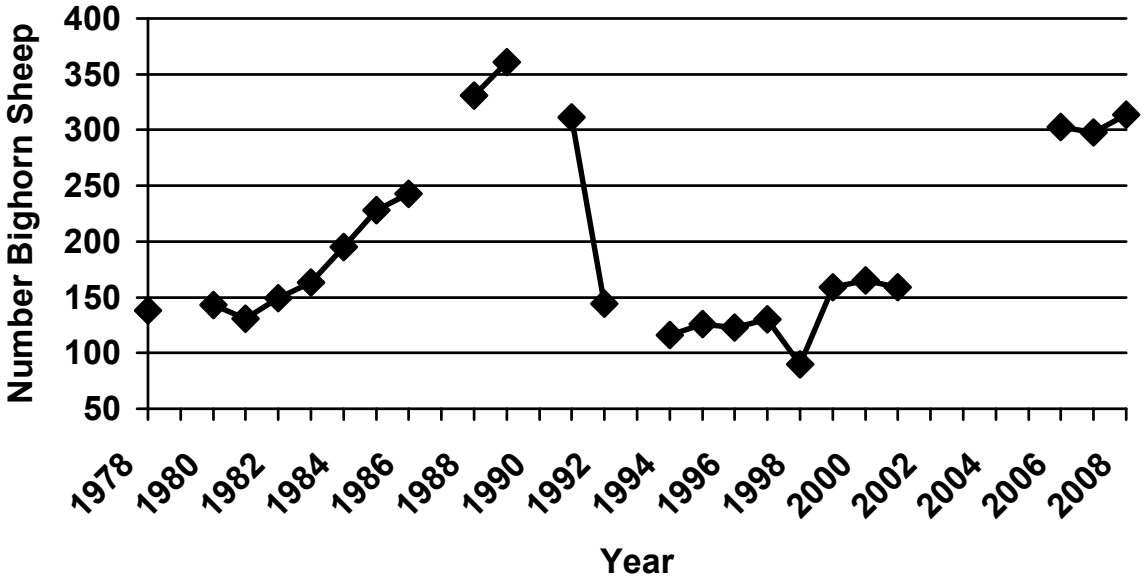


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Lost Creek population, Hunting District 213, 1978-2008.

	Rams (degree of horn curl)			Ewes and Lambs				Total	Rams/	Lambs/
Year	3/4+	¼-1/2	Total	Ewes	Lambs	Total	Uncl.	Sheep	100 Ewes	100 Ewes
1978	12	35	47	45	33	78		138	104	73
1980	27	15	42	70	31	101	----	143	60	44
1981	34	7	41	67	23	90	----	131	61	34
1982	22	27	49	73	27	100	----	149	67	37
1983	32	38	70	62	31	93	----	163	112	50
1984	58	30	88	3	0	107	----	195	----	----
1985	65	34	99	90	39	129	----	228	110	43
1986	59	47	106	101	36	137	----	243	105	36
1988	55	68	123	150	58	208	----	331	104	39
1989	90	59	149	147	65	212	----	361	101	44
1991	97	64	161	64	32	106	44	311	----	50
1992	23	21	44	72	28	100	----	144	44	39
1994	42	12	54	55	7	62	----	116	87	13
1995	45	4	49	6	3	43	34	126	----	----
1996	49	0	49	24	11	35	39	123	----	46
1997	41	4	45	51	18	69	16	130	88	35
1998	16	4	20	48	22	70	----	90	42	46
1999	43	10	53	53	31	84	22	159	100	58
2000	38	23	61	38	22	60	44	165	----	58
2001	41	21	62	64	33	97	----	159	97	53
2006	32	33	72	125	53	178	53	303	58	42
2007	31	33	80	56	8	64	153	298	----	----
2008	39	28	70	62	39	101	143	314	----	62

Table 1. Classification data from aerial surveys for the Lost Creek population, Hunting District 213, 1978-2008.

2007, Hunting District 213 was the seventh most popular district to put in for a ram license statewide, with 1,186 hunters applying for a license. Hunters spent 102 days hunting bighorn rams and 46 days hunting ewes in Hunting District 213 during 2007. The herd's proximity to Anaconda and ease of observation from MT Highway 1, North Cable Road, and the Blue-eyed Nellie WMA make it an important watchable wildlife opportunity. Local residents frequently drive out to observe the sheep.

Current Annual Bighorn Sheep Harvest: Eight either-sex and 20 ewe licenses were available by special drawing for fall 2008. Liberal opportunities are currently in place to limit the population. Bighorn hunting was initiated in the Anaconda herd in 1973 when five (¾-curl) licenses were issued; the following year five ewe licenses were added. Ram licenses have ranged from three to 18 (just before and after the die-off) with six licenses issued being typical. Ewe licenses were eliminated after the die-off in 1991 and reinitiated in 2004, when five were available; ewe licenses were increased to 20 in 2007. Nearly all ram and ewe hunters are successful harvesting a bighorn sheep in Hunting District 213.

The mean age of rams harvested in Hunting District 213 from 1990 to 2008 is 6.6 years (range 4 to 10). Mean age of harvested rams has been climbing over the last few years from seven years, in 2004, to nine years, in 2007. This significant gain reflects the large number of older rams in the Anaconda herd as well as increased hunter effort. Harvest of Boone and Crockett–class rams from this population is common.

Accomplishments: The transplant of bighorn sheep to Anaconda in 1967 has been an extraordinary success. This herd occupies all suitable habitat within the hunting district, founded the Garrison herd, and continues to pioneer new habitats. It is a rare example of a bighorn population that survived a die-off, recovered, and is expanding. Extensive sheep habitat, much of it publicly owned, has allowed this population to thrive. Numerous land purchases in the Anaconda area have benefited bighorn and other wildlife.

Since 1994, a total of 46,500 acres of land within the herd's range have been acquired by either the USFS or FWP. The 14,000-acre Lost Creek land exchange transferred ownership of most of the core sheep habitat to the

Beaverhead-Deerlodge NF. The purchase of the Garrity Mountain WMA in 2000 and the "Watershed Property" in 2001 also brought extensive habitat for sheep, elk, mule deer, and other species into public ownership. A series of small purchases of critical winter range have built the Blue-eyed Nellie WMA complex. Funding from the annual auction of a bighorn sheep license as well as from the Foundation for North American Wild Sheep, the Five Valleys Chapter of the Safari Club, and the Anaconda Sportsmen's Club enabled FWP to add 156 acres to the Blue-eyed Nellie WMA in 2006. The Jamison addition, another 295 acres closed in April 2009.

A broad constituency of local residents, state and national sporting groups, conservation groups, and agency cooperators has enabled FWP to successfully manage the Lost Creek herd and its habitat.

Management Challenges:

1) Maintaining separation of wild sheep and domestic sheep and goats to avoid transmission of disease to bighorns. The increasing use of domestic sheep to manage weeds, the "sheep on wheels" program, as well as sheep kept as pets or on hobby farms, is of concern to bighorn managers. In the Deer Lodge Valley, the use of domestic sheep for weed control is on the upsurge, with thousands of domestic sheep brought into the valley annually. The program is active on private lands, and proposals to use domestic sheep for weed control on public lands are under consideration. A few domestic sheep are present in Anaconda's West Valley in year-round habitat, and several thousand are being used for weed control in the Racetrack drainage.

2) The development of subdivisions within the core range of the Lost Creek herd presents numerous problems including potential stress to wintering and lambing sheep, direct mortality from dogs and fences, loss of landscape connectivity, game damage complaints, direct and indirect losses of habitat, and further limits to public access. Subdivision of key bighorn habitat is occurring at a rapid pace in Lost Creek, along Stucky Ridge, and in the West Valley.

3) Weed management throughout the herd's range is necessary. Knapweed infestations are especially severe on private and public lands in Lost Creek and on Stucky Ridge. Efforts to enhance and maintain grassland foothills habitat will benefit bighorns.

Population Monitoring: The Lost Creek herd has been surveyed using a helicopter, in March or April, with occasional classifications conducted on the ground. Bighorns are counted and classified by age and sex, with rams classified based on horn development as Class I, II, III, or IV.

Summary of Public Comment

There is a great deal of public interest and local pride in the Lost Creek herd. Citizens are supportive of habitat acquisitions and are deeply concerned about the threat poised by domestic sheep living within the herd's range. Also, road-kill of bighorns crossing and eating salt on MT Highway 1 is of concern to residents. Numerous individuals have suggested that a crossing structure be put in place, off-highway salting be implemented in an attempt to move sheep, or that highway crossing signs be installed. Ewe licenses are popular in the Anaconda community.

Management Goal

Manage for a healthy and productive bighorn sheep population with a diverse age structure of rams. Maintain and enhance bighorn sheep habitat on over 138mi^2 of habitat connecting the Flint Creek and Anaconda-Pintler Mountain Ranges. Minimize risk of contact between bighorn and domestic sheep. Coordination with the Beaverhead-Deerlodge NF, DNRC, and private landowners is essential to control weeds, enhance grassland communities, and minimize the risk of contact with domestic sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain over 138mi^2 square miles (85,055 acres) of occupied bighorn sheep habitat for the benefit of bighorns and other wildlife species. Conserve landscape integrity and connectivity by precluding subdivision of critical habitats.

2) Encourage public and private landowners to manage their properties to maximize the quality and quantity of forage on native grasslands. Explore options to cost-share habitat improvements like weed control, prescribed burning, and, where appropriate, removal of conifers from grasslands.

3) Prevent over-utilization of forage on winter range by limiting the population through public hunting and capture and removal of sheep.

Habitat Management Strategies

1) Continue to work with private landowners; state, federal, and county governments; and conservation organizations including Five Valleys Land Trust, the Foundation for North American Wild Sheep, the Rocky Mountain Elk Foundation, Safari Club International, and others to conserve important bighorn habitat on private lands through the use of conservation easements or fee title acquisition.

2) Work with landowners to identify and accomplish habitat improvements on important bighorn habitats.

3) Work with private landowners and state, federal, and county governments to limit the use of domestic sheep and goats in the area. Coordination with the Anaconda-Deerlodge and Powell County Weed Boards, Montana State University Agricultural Extension, Montana Stock Growers Association, DNRC, and the USFS is necessary to minimize impacts to bighorns.

Game Damage Strategies

Game damage complaints related to the Lost Creek bighorn herd have been few. When game damage complaints occur, department response will be consistent with FWP's program direction including the requirement of reasonable hunting access.

Access Strategies

Maintain and enhance existing public access to state and federal lands. Pursue strategic purchases to ensure continued access to public lands in occupied bighorn habitat.

Population Objectives

1) Maintain the number of bighorn sheep observed during spring aerial surveys within 20% of 250 sheep (200 to 300).

2) Maintain a ram: ewe ratio observed during spring aerial surveys of at least 40 rams: 100 ewes with at least 40% of the rams as Class III and IV (approximately ¾-curl or greater).

Population Management Strategies

The Hunting District 213 population objective of 250 (± 20%) observed bighorn sheep is based on: 1) available forage on winter ranges, 2) maintaining range quality, and 3) understanding that catastrophic disease-related die-offs are often density dependent.

Currently, population management is occurring through hunter harvest of ewes and rams as well as natural mortality. An increase in the population objective for the Lost Creek herd may be warranted because of the herd's significant and ongoing range expansion.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed through natural mortality and limited-entry harvest of ewes. Ewe bighorn sheep licenses in Hunting District 213 will be issued under the following prescriptions (Table 2):

Standard Regulation: A limited number of adult ewe licenses issued would be up to 15% of the number of ewes going into the fall season. A rough estimate of the number of ewes in the fall will be derived from the number of ewes observed during the annual survey, assuming a 5% mortality of adults, and adding a recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is between 200 and 300 and lamb recruitment is over 30 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	200-300	Over 30	Limited Entry Adult Ewes	Up to 15% of Ewes
Restrictive Regulation	Less than 200	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Over 300	Over 40	Limited Entry Ewes **OR** translocate	Up to 20% of Ewes

Table 2. Summary of regulation types under different population criteria for ewe harvest and population management.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is less than 200 and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 300 and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry either-sex licenses with the number of either-sex licenses issued being up to 15% of the Class III and IV rams in the population.

The Standard Regulation will be recommended if: The population is within 20% of objective (200 to 300), there are 40 to 60 rams: 100 ewes, and over 40% of the rams are Class III and IV (Table 3).

Restrictive Regulation: Limited-entry either-sex licenses with the number issued being up to 10% of the Class III and IV rams in the population.

The Restrictive Regulation will be recommended if: The population is below 200 bighorns, there are less than 40 rams: 100 ewes, and less than 40% of the rams are Class III and IV.

Liberal Regulation: Limited-entry either-sex licenses with the number of licenses issued being up to 20% of the Class III and IV rams in the population.

The Liberal Regulation will be recommended if: The population is over 300 bighorns, there are more than 60 rams: 100 ewes, and more than 40% of the rams are Class III and IV.

WEST ROCK CREEK – QUIGG PEAK

(Upper Rock Creek) (Hunting District 216)

Description: The Upper Rock Creek bighorn herd is located 10 miles west of Philipsburg along the main stem of Rock Creek. Occupied habitat lies primarily on the east side of Upper Rock Creek, south to the Little Hogback, and north to the confluence of the East and West Forks of Rock Creek. Bighorn sheep use habitats from the creek bottom to intermountain grassland slopes to the timbered ridges between Rock Creek and Upper Willow Creek. The population is increasing, and bighorns have been exploring lands upstream above the confluence of the East and West Forks of Rock Creek.

Ownership of the 304mi^2 Hunting District 216 is 19% private, 75% U.S. Forest Service (USFS) (Beaverhead-Deerlodge and Lolo National Forests; [NF], 5% Bureau of Land Management (BLM), and 1% Montana Department of Natural Resources and Conservation (DNRC). Although federal lands make up the majority of the district, much of the winter range is on privately owned cliffs, draws, and bowls above Rock Creek. Hunting district boundaries are roughly MT Highway 38 to the

Table 3. Summary of potential ram harvest under different population scenarios.

MOUNTAIN-FOOTHILLS	Number of Ram Licenses	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of rams Class III & IV
Standard Regulation	Up to 15% of Class III & IV rams	200-300	40-60	> 40
Restrictive Regulation	Up to 10% of Class III & IV rams	<200	< 40	< 40
Liberal Regulation	Up to 20% of Class III & IV rams	>300	> 60	> 40

south, the Sapphire Divide and Rock Creek to the west, Ranch Creek to the north, and Upper Willow Creek to the east.

Thirty percent of the district (89mi^2) is used by bighorns during some part of the year. Fifty-six percent of this occupied habitat, totaling 50mi^2, is managed by either the Beaverhead-Deerlodge NF or Lolo NF. Occupied general and winter core habitat lies mostly between the Little Hogback and Jimmy Lee Gulch. This core habitat makes up 18% (56mi^2) of the entire district, with another 11% (33mi^2) of the district occupied only seasonally. While the preponderance of the seasonal habitat (87%, 28mi^2) is managed by the USFS, most (61%, 34mi^2) of the year-round habitat is managed by private landowners or the BLM. DNRC lands are heavily forested and are not occupied by bighorn sheep.

Bighorns thrive in Rock Creek. Habitat exists along a 3,500-foot elevational gradient from the creek to cliffs, grasslands, and forests below and along Sandstone Ridge. Most of the critical winter range is concentrated on several ranches and extensive BLM lands between Windlass and Jimmy Lee Gulches. Lambing occurs on cliffs above Rock Creek where ewes have ready access to water, forage on adjoining grasslands, and escape terrain. Summer range is typically within five miles of winter range and upslope.

Bighorn sheep are exploring habitats upstream, where some landowners are thinning forests to encourage their use. Rams from Upper Rock Creek may encounter wandering rams from the Anaconda herd in the headwaters of Rock Creek. While this interaction has not been documented, only a dozen miles separate known sightings of sheep from either population. Connectivity with bighorns from Lower Rock Creek is known. Population connectivity throughout the Upper Clark Fork between the Lost Creek, Garrison, and Upper and Lower Rock Creek herds is feasible.

Public Access: Public hunting and viewing access to the Upper Rock Creek herd is good, but declining. Several key points of access are on private lands. Access is declining as lands appreciate in value and transition from agricultural to recreational use. Existing county and forest road networks, as well as the Rock Creek corridor, allow hunters to access sheep and the public to view bighorns while driving, hiking, or floating.

Bighorn Sheep Populations: The Upper Rock Creek bighorn herd is a native population that was supplemented by the addition of 31 sheep (21 ewes, 10 rams) from the Sun River herd in 1975. Intensive research was conducted on this population in the late 1960s and early 1970s by Berwick (1968), Cooperrider (1969), and Aderhold (1972). These researchers attempted to determine the cause of a major population die-off in 1967. They gathered all available information on the herd's history, habitat use, interaction with other species, and general ecological data. Butts (1980) examined the success of and characteristics of the herd following the 1975 addition of sheep from Sun River. Population data from their research follows; additional in-depth information is available in their publications.

Reports from early explorers suggest that bighorn sheep were abundant throughout the Rock Creek drainage prior to extensive settlement and exploitation of the area. After the discovery of silver deposits in Granite County in 1864, market hunting, competition with domestic livestock, and possibly disease-related die-offs resulted in near extirpation of the species from the drainage. By 1905, only five bighorns were observed on winter ranges (Berwick 1968). Following the silver bust, regulation of and ultimately a ban on hunting bighorn sheep, the species began to recover. About 200 bighorns were thought to be in Upper Rock Creek before the die-off in 1967. Following the die-off (likely *Pasterella spp*. induced), only 15 were observed on winter ranges. Typical of a disease-mediated die-off, lamb production was very low for years following the event. However, by 1981, the population had rebuilt itself to 128 observed sheep (Figure 1 and Table 1). The herd has continued to grow, with intermittent declines, over the last quarter century, and a high of 347 bighorns were observed during a spring survey flight in 2007 (Table 2).

Data on lamb production in Upper Rock Creek is available beginning in 1990 (Table 2). An average of almost half of all ewes had lambs in this period (mean 43, range 27 to 58). Ram to ewe ratios have been extremely variable from 14 to 275 rams: 100 ewes. This variability is the result of changing hunting regulations and is accentuated by year-to-year variations in the visibility of rams. Class III and IV rams were dominant in the population until 2003, when a sustained high rate of harvest from the 1990s and early 2000s caught up with the population.

Bighorns were removed from Upper Rock Creek in 1984 – one to an unknown location (likely Thompson Falls), 1987 – 10 to Boulder River (Park County) and 27 to Bonner (Missoula County), and 1996 – 20 to the Beartooth Wildlife Management Area (Cascade County) and 25 to the Elkhorns (Jefferson County). In total, 83 bighorns have

Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Upper Rock Creek population, Hunting District 216, 1981-2008.

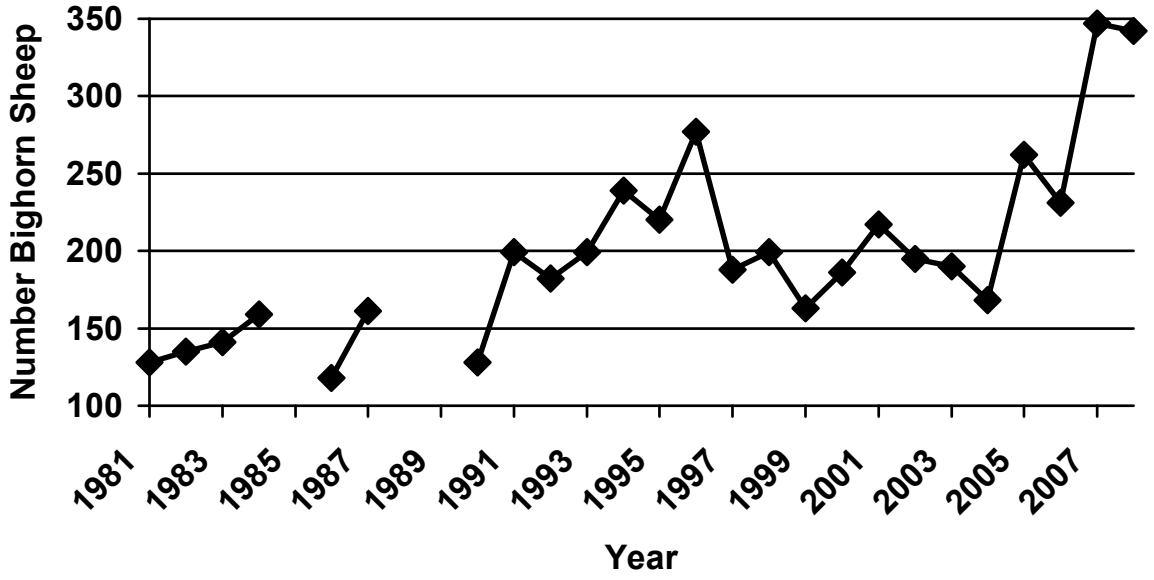


Table 1. Total population counts for the Upper Rock Creek population, Hunting District 216; 1981-1987.

Year	Total bighorn
1981	128
1982	135
1983	141
1984	159
1986	118
1987	161

been removed from Hunting District 216 to supplement or establish populations elsewhere in Montana. Despite increases in ewe permits, the bighorn population is stable to increasing and should again be considered as a source for transplants.

Recreation Provided: Like many hunting districts, the odds of drawing a ram license in Hunting District 216 are less than 1%, and hunters who do draw usually harvest a ram. In 2007, hunters spent 17 days pursuing rams and 41 days hunting ewes in Hunting District 216. Generally, sheep hunters spend more time in the district, but in 2007 there were only four ram: mits, and each hunter spent an average of only 4.2 days hunting. Total public time spent watching bighorns is far in excess of hunter days, yet is difficult to quantify. Many floaters and fishermen on Rock Creek as well as travelers, landowners, and locals enjoy watching these bighorn sheep.

Current Annual Bighorn Sheep Harvest: In Upper Rock Creek, eight either-sex and 20 ewe licenses were available by special drawing for fall 2008. Liberal ewe harvest opportunities are currently in place to manage the population, and additional ewe licenses or removals may be warranted in the future. Although bighorns were harvested earlier in the century, the first hunting season recorded in Pittman-Robertson Reports is 1979 when one license was filled. Subsequently, ram license numbers have ranged from one to 16 with over eight licenses issued annually being common. Ewe licenses were initiated in 1980, and the number issued has ranged from five to 40 with an average of 15 licenses being issued annually. The mean age of rams harvested in Hunting District 216 from 1979 to 2007 is 6.1 years (range 1.5 to 11.5). The greatest number of older rams taken in Hunting District 216 was in 1992 when a remarkable eight rams over nine years old were taken. The harvest of 112 rams in the following decade reduced the mean age of harvested rams from 7.4 years in 1992 to 4.9 years in 2003. As license numbers were reduced during the last five years, the mean age of harvested rams has risen to its long-term average of six years.

Accomplishments: The Upper Rock Creek sheep population has been resilient. The herd recovered from near elimination in the early 20th century, in 1967, and during other undocumented die-offs. The herd is at a record high, and individual sheep are exploring new habitats. Most suitable habitat within the hunting district is occupied. Extensive quality sheep habitat has allowed this population to recover from declines.

A broad constituency of local residents, state and national sporting groups, conservation groups, and agency cooperators has enabled FWP to successfully manage the Upper Rock Creek herd and its habitat.

Year	Date	Rams (degree of horn curl)				Ewes and Lambs			Uncl	Total Sheep	Rams/ 100 Ewes	Lambs/ 100 Ewes
		3/4+	1/2-3/4	<1/4-1/2	Total	Ewes	Lambs	Total				
1990	13-Jan	49	21	5	75	37	16	53	0	128	203	43
1991	10-Jan	55	18	13	86	75	38	113	0	199	115	51
1992	10-Mar	62	10	6	78	82	22	104	0	182	95	27
1993	4-Jan	48	16	15	79	76	44	120	0	199	104	58
1994	1-Mar	68	12	0	80	122	37	159	0	239	66	30
1995	1-Jan	65	14	12	91	85	44	129	0	220	107	52
1996	10-Jan	93	25	10	128	100	49	149	0	277	128	49
1997	1-Jan	33	8	16	57	86	45	131	0	188	66	52
1998	4-Jan	56	14	3	73	86	40	126	0	199	85	47
1999	7-May	54	8	2	64	70	29	99	0	163	91	41
2000	21-Apr	84	10	5	99	36	13	49	38	186	275	36
2001	10-Apr	62	13	12	87	76	26	102	28	217	115	34
2002	16-Jan	34	0	0	0	0	0	0	161	195	N/A	N/A
2003	7-Jan	23	14	20	60	89	41	130	0	190	67	46
2004	31-Mar	15	16	5	36	87	45	132	0	168	41	51
2005	11-Mar	13	21	25	59	100	28	128	75	262	59	28
2006	31-Mar	5	12	5	22	155	52	207	2	231	14	34
2007	30-Mar	31	36	31	103	73	40	113	131	347	N/A	55
2008	4-Apr	33	33	16	82	153	64	217	43	342	54	42

Table 2. Classification data from aerial surveys in the Upper Rock Creek population, Hunting District 216, 1990-2008.

Management Challenges:

1) Maintaining separation of wild sheep and domestic sheep and goats to avoid transmission of disease to bighorns. The increasing use of domestic sheep to manage weeds, the "sheep on wheels" program, as well as sheep kept on hobby farms or as pets, is a threat to wild sheep. In Upper Rock Creek, specifically, no domestic sheep are known, but their use for weed control, as commercial livestock, and as pets is expanding in Granite County. Weed boards and some agencies are encouraging the expanded use of domestic sheep and goats.

2) Habitat for the Upper Rock Creek herd is secure at this time, due to large federal holdings and the continued use of private lands for ranching. Private land conservation is essential to prevent future habitat loss. Recent sales of ranches in the area to recreational users may diminish bighorn habitat and public access.

3) Weed management throughout the herd's range is ongoing and important to continue. Efforts to enhance and maintain grassland foothills habitat using targeted weed control and prescribed burning will benefit bighorns.

Population Monitoring: The Upper Rock Creek bighorn herd is surveyed using a helicopter, during winter conditions in January, March or April. An unbroken 19-year data stream exists for Hunting District 216. Bighorns are counted and classified by age and sex, with rams classified based on horn development as Class I, II, III, or IV (Geist 1971).

Summary of Public Comment

Outfitters, ranchers, hunters, wildlife watchers, and the general public all have an interest in Rock Creek bighorn sheep. Numerous trophy

rams taken in the drainage, including a world record scoring 204 7/8 Boone and Crockett, have helped Rock Creek to become one of the best-known sheep herds in Montana. Permit levels for Rock Creek are watched closely with a correspondingly high level of public input. Access is the predominant concern for the public. Constituents pay close attention to this herd and management actions within Rock Creek.

Management Goal

Manage for a healthy and productive bighorn sheep population with a goal of producing trophy class rams. Maintain and enhance bighorn sheep habitat on a landscape scale. Close coordination with the Beaverhead-Deerlodge and Lolo NF, the BLM, and private landowners is essential to control weeds, enhance grassland communities, and minimize the risk of contact with domestic sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain over 89mi² square miles (56,681 acres) of occupied bighorn sheep habitat for the benefit of bighorns and other wildlife species. Conserve landscape connectivity by precluding subdivision of critical habitats.

2) Encourage public and private landowners to manage their properties to maximize the quality and quantity of forage on native grasslands. Explore options to cost-share habitat improvements like weed control, prescribed burning, and, where appropriate, removal of conifers from grasslands.

3) Prevent over-utilization of forage on winter range by limiting the population, through public hunting and the capture and removal of sheep.

Habitat Management Strategies

1) Work with private landowners; and state, federal, and county governments to limit the use of domestic sheep and goats in the area. Coordination with the Granite County Weed Board, Montana State University Agricultural Extension, Montana Stock Growers Association, the BLM and the USFS is necessary to minimize impacts to bighorn and maximize improvements to sheep range.

2) Work with private landowners; state, federal, and county governments; and conservation organizations including Five Valleys Land Trust, the Foundation for North American Wild Sheep, the Rocky Mountain Elk Foundation, Safari Club International, and others to conserve important bighorn habitat on private lands through the use of conservation easements or fee title acquisition.

3) Work with landowners to identify and accomplish habitat improvements on important bighorn habitats. Also, it is important to ensure that projects prescribed to benefit bighorn do in fact have positive results.

Game Damage Strategies

Game damage complaints related to the Upper Rock Creek bighorn herd have been few. When game damage complaints occur, department response will be consistent with FWP's program direction including the requirement of reasonable hunting access.

Access Strategies

Maintain and enhance existing public access to state and federal lands. Pursue strategic purchases to ensure continued access to public and private lands in bighorn habitat.

Population Objectives

1) Maintain the number of bighorn sheep observed during spring aerial surveys within 20% of 300 sheep (240 to 360).

2) Maintain a ram: ewe ratio observed during spring aerial surveys of 40 rams: per 100 ewes with at least 50% of the rams as Class III and IV (approximately ¾-curl or greater).

Population Management Strategies

The Hunting District 216 population objective of 300 (± 20%) observed bighorn sheep is based on: 1) available forage on winter ranges, 2) maintaining range quality, 3) understanding that catastrophic disease-related die-offs are often density dependent, and 4) a desire to maintain a robust and sustainable population.

Population management is occurring through hunter harvest of ewes and rams as well as natural mortality. The most recent capture and removal operation was in 1996 when 45 sheep were removed.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed through natural mortality, limited-entry harvest

of ewes, and, when appropriate, removal of animals for translocation. Ewe bighorn sheep licenses in Hunting District 216 will be issued under the following prescriptions (Table 3):

MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	240-360	Over 30	Limited Entry Adult Ewes	Up to 15% of Ewes
Restrictive Regulation	Less than 240	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Over 360	Over 40	Limited Entry Ewes **OR** translocate	Up to 20% of Ewes

Table 3. Summary of regulation types under different population criteria for ewe harvest and population management.

Standard Regulation: A limited number of adult ewe licenses will be issued with the number of licenses issued being up to 15% of the number of ewes going into the fall season. A rough estimate of the number of ewes in the fall will be derived from number of ewes observed during the annual survey, assuming a 5% mortality of adults, and adding a recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is between 240 and 360 and lamb recruitment is over 30 lambs: 100 ewe.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is less than 240 and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs, **OR** if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 360 and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry either-sex licenses with the number of either-sex licenses issued being up to 15% of the Class III and IV rams in the population.

The Standard Regulation will be recommended if: The population is within 20% of objective (240 to 360), there are 40 to 60 rams: 100 ewes, and over 50% of the rams are Class III and IV (Table 4).

Restrictive Regulation: Limited-entry either-sex licenses with the number issued being up to 10% of the Class III and IV rams in the population.

The Restrictive Regulation will be recommended if: The population is below 200 bighorn, there are less than 40 rams: 100 ewes, and less than 50% of the rams are Class III and IV.

Liberal Regulation: Limited-entry either-sex licenses with the number of licenses issued being up to 20% of the Class III and IV rams in the population.

MOUNTAIN-FOOTHILLS	Number of Ram Licenses	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of rams Class III & IV
Standard Regulation	Up to 15% of Class III & IV rams	240-360	40-60	> 50
Restrictive Regulation	Up to 10% of Class III & IV rams	<240	< 40	< 50
Liberal Regulation	Up to 20% of Class III & IV rams	>360	> 60	> 50

Table 4. Summary of potential ram harvest under different population scenarios.

The Liberal Regulation will be recommended if: The population is over 300 bighorns; there are more than 60 rams: 100 ewes, and more than 50% of the rams are Class III and IV.

WEST FORK BITTEROOT
(Hunting District 250)

Description: Bighorn sheep Hunting District 250 is immediately southwest of Darby. The area includes the West Fork of the Bitterroot River and the region west of U.S. Highway 93 draining into Camp Creek and the East Fork of the Bitterroot River. The entire hunting district is about 707mi^2 with 94%, or 662 square miles, managed by the Bitterrooot National Forest. The Montana Department of Natural Resources and Conservation (DNRC) manages 1%, 6mi^2, and the remaining 5%, 37mi^2, are private lands.

Bighorn sheep occupy about 190mi^2 of the hunting district. There are two herd units within Hunting District 250. The Nez Perce, or Watchtower, subunit occupies about 112 mi^2 of the hunting district and is the only fully native bighorn population left in the Bitterroot Valley. The Painted Rocks subunit occupies about 77mi^2 of this hunting district. There is limited information regarding the mixing of these two populations. There is sufficient evidence of mixing, however limited, to not claim these subunits as separate populations.

About 98% of the occupied sheep habitat in Hunting District 250 is public land. Almost 90% of the occupied sheep habitat within the Watchtower subunit is wilderness. Only 4mi^2 are considered winter range. The lack of winter range is a major limitation to the possible expansion or growth of this subunit. The occupied sheep habitat within the Painted Rocks subunit is almost exclusively public land. Thirteen square miles are considered winter range.

The majority of bighorn sheep that inhabit the Watchtower area move into Idaho, along the Selway River, during the winter months. Few are found on the limited winter ranges in Montana. Eighteen bighorns were observed along the lower elevations of Watchtower and Sheephead Creeks in 2002. Winter range surveys in Idaho from 1978 to 1984 found from 58 to 109 sheep along the Selway winter ranges. Winter range surveys in 1994 and 1995 found 38 and 45 sheep, respectively, wintering along Idaho's Selway River.

Although historical observations of sheep in the Painted Rocks area were occasional, recent occupation by sheep occurred as a result of reintroductions in 1990, 1991, and 2004. FWP reintroduced 38 sheep from the Sun River herd in March 1990. An additional release of 28 bighorns from the Anaconda herd occurred in Feburary 1991. This subunit suffered from several years of poor lamb survival. That situation prompted FWP to augment the existing herd with 10 sheep from the Sun River in February 2004.

The bulk of the Painted Rocks sheep winter along the rocky, south-facing bunchgrass slopes north of Painted Rocks Reservoir. This winter range is complicated by a mature ponderosa pine overstory that dominates much of the landscape in addition to infestations of spotted knapweed. Mature ponderosa pines are highly resistant to stand-replacing fires. The noxious weed infestations are difficult to access due to the steep and rocky terrain. Other habitat manipulation techniques will be required to reclaim the native bunchgrass habitat in the Painted Rocks winter range.

Summer ranges for the Watchtower bighorns occur near the upper elevations of Watchtower and Sheephead Creeks and along the Montana-Idaho divide toward Nez Perce Pass. Some are found as far east as the Little West Fork Creek. The Painted Rocks sheep tend to stay fairly close to the cliffs and open slopes north of Painted Rocks Reservior.

Public Access: The majority of lands within this hunting district are public lands. Motorized and nonmotorized access is excellent throughout most of this area. Major trailheads occur in Watchtower and Sheephead Creeks. Road access along Painted Rocks Reservoir and the Nez Perce Road allow sufficient access to most of the public lands within the hunting district. These areas also host significant hunting opportunities for other big game species and upland game birds.

Bighorn Sheep Population: Bighorns in the Watchtower portion of the hunting district are native sheep. However, most of these sheep move to winter ranges near Idaho's Selway River and are therefore only temporary residents of Montana.

Although bighorns made occasional appearances in the Painted Rocks area, there is no substantiated information that a native population maintained a persistent presence in

that area. The Painted Rocks sheep began to occupy the area consistently because of three transplanting operations, which included; in 1990, 38 sheep from the Sun River, in 1991, 28 sheep from Lost Creek and in 2004, 10 sheep from the Sun River.

Aerial surveys in Hunting District 250 were not flown in 2007-08. However, Figure 1 and Table 1 provide the survey results for the Painted Rocks portion of the hunting district. The most current survey information for the Watchtower portion of the hunting district located 18 sheep during a late winter/early spring flight in 2002. Recent survey efforts included flights on a three-year rotation.

As is often the case, ram observations are highly variable during spring aerial surveys. Neither the rams nor lambs: 100 ewes ratio observed during winter or spring surveys since 2003 are particularly exceptional. These population characteristics are considered marginal compared to other bighorn sheep populations in Montana.

Recreation Provided: Both subunits of this population provide watchable wildlife opportunities for local residents, including residents of the greater Bitterroot Valley. The bighorns wintering near Painted Rocks are more visible, and there are simply a greater number of sheep in this subunit compared to the Watchtower subunit. Interest in hunting sheep

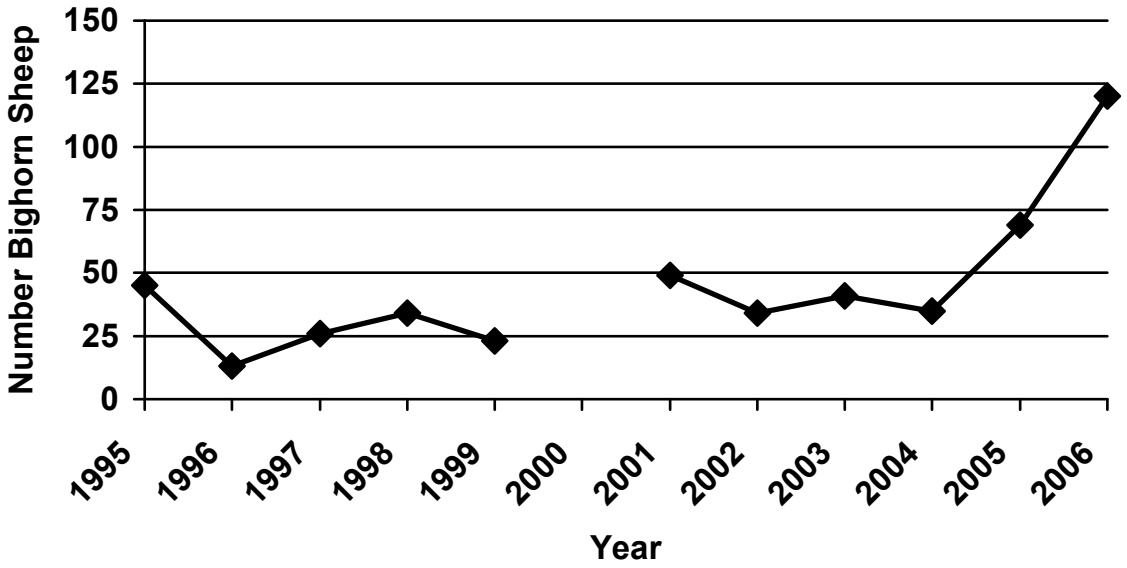


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the West Fork Bitterroot population, Hunting District 250, 1995-2006.

					Rams						Per 100 ewes	
Year	Date	Total	Ewes	Lambs	Ylg	I	II	III	IV	Total	Rams	Lambs
1995		45	26	12			4	2	1	7	27	46
1996		13	6	4			2	1		3	50	67
1997		26	18	3			2	1	2	5	28	17
1998		34	15	7			8	1	3	12	80	47
1999		23	8	6			2	4	3	9	113	75
2001		49	25	13			5	3	3	11	44	52
2002	18-Apr	34	25	2		1	1	4	1	7	28	8
2003	2-Jan	41	22	12		3	4			7	32	64
2003	16-Apr	41	28	12	1					1	4	43
2004	6-Jan	45	27	10	0	5	1	2	0	8	30	37
2004	17-Apr	35	23	8		1	1	2		4	17	35
2005	12-Jan	59	34	14		7	0	2	2	11	32	41
2005	21-Mar	69	45	17		7				7	16	38
2006	5-Jan	120	68	21		5	10	13	3	31	46	31

Table 1. Bighorn sheep counts and classifications in the Painted Rocks area, Hunting District 250, 1995-2006.

in this hunting district is fairly high. In 2007, 97 hunters applied for two either-sex licenses valid in the Painted Rocks portion of Hunting District 250, and 21 hunters applied for one legal ram license in the Watchtower portion of this district.

Current Annual Bighorn Sheep Harvest: Presently, two either-sex licenses are available for the Painted Rocks portion of the hunting district 250. Hunter success for these permits is over 95%. Although these licenses are an either-sex opportunity, hunters typically harvest rams. In comparison, hunter success for the single legal ram license available in the Watchtower portion of the district runs about 45%.

Between the years 1968 and 1989, five either-sex licenses were available district wide, and the average harvest during those years was 1.9 sheep. Two either-sex licenses were issued for each of the years 1990 to 1993 with a hunter success of 62% and an average of 1.25 sheep harvested per year.

Accomplishments: This population of bighorn sheep is well established in all suitable habitats in the hunting district.

Management Challenges:

1) Maintaining separation of wild sheep and domestic sheep and goats to avoid transmission of disease to bighorns. There are domestic sheep within eight miles of the Painted Rocks subunit. Although the domestic sheep occur on private lands, they are essentially free roaming and easily drift onto adjoining U.S. Forest Service (USFS) lands.

2) Weeds are a ubiquitous problem, and conifer encroachment is occurring in some areas of bighorn range.

3) Maintaining or expanding winter range opportunities for bighorns, especially in the Watchtower/Sheephead drainages. Stimulating shrub and grass production and removing coniferous overstory are key elements to winter range improvement in this area.

4) Monitoring these subunits on a more consistent basis.

Population Monitoring: This bighorn population is surveyed on winter range from a helicopter on an irregular basis. These aerial surveys occur in early spring. Bighorns are counted and classified by age and sex. Rams are classified based on horn development as yearling or Class I, II, III, or IV (Geist 1971).

Summary Of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district indicates a high level of support for FWP's management direction. Both hunters and non-hunters enjoy seeing bighorn sheep in this area.

Management Goal

Protect the unique and endemic subunit of sheep in the Watchtower/Sheephead drainages. This subunit does not have the ability to expand to any significant degree. It is important to manage these sheep accordingly and work toward improving and expanding winter range opportunities in this area.

Manage for a healthy and productive bighorn sheep population with a diverse age structure of rams. There may be some opportunity for an increase in sheep numbers. Maintain the limited opportunity for bighorn sheep hunters to harvest sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain about 190 square miles of occupied bighorn sheep habitat for the benefit of bighorns, other wildlife species, and other agency-mandated uses.

2) Encourage improvement of habitat conditions, particularly weed management, on publicly owned winter ranges (primarily USFS) so that vegetation conditions on these ranges provide adequate forage for bighorns and other wildlife during the winter.

3) Encourage maintenance and improvement of habitat conditions on public lands (USFS).

Habitat Management Strategies

1) Cooperate with the USFS on prescribed burning and weed treatment projects to make sheep habitats more productive.

2) Where identified as necessary, work with the USFS to limit motorized use, particularly off-trail OHVs and motorcycles, in the area.

3) Continue to work with private landowners and Ravalli County to limit the use of domestic sheep and goats in the area.

Game Damage Strategies

At present there are no game damage complaints related to bighorn sheep in Hunting District 250. If game damage problems develop, they will be addressed on a case-by-case basis consistent with FWP's Game Damage Program. If it is determined that a population reduction is necessary, it could be accomplished through hunting and sheep capture for transplanting.

Access Strategies

Maintain the current level of public access on public lands. However, to maintain habitat security and protect habitat, FWP should work with the USFS and DNRC to limit use of OHVs and motorcycles where necessary.

Population Objectives

The consistency of observing adult rams, especially during spring green-up surveys, varies greatly between years. Oftentimes, discretion by the managing biologist regarding survey conditions is important when interpreting survey results.

Watchtower/Sheephead Subunit:

The difficulty with this subunit is being able to classify enough sheep to provide an accurate rams and lambs: 100 ewe ratio. One option is to attempt to survey these sheep during the rut (post-hunting season) in an effort to obtain a more accurate estimate of sheep available to hunters during the hunting season, and classify enough sheep to provide a more accurate ram and lamb: 100 ewe ratio.

An achievable population goal, contingent on habitat improvements on winter ranges, would be 45 to 60 sheep. However, current population goals for this subunit include:

1) Maintain the number of bighorn sheep observed during "good" post-winter aerial surveys within 20% of 20 sheep (16 to 24). Work with Idaho Fish and Game to address more frequent survey efforts on winter ranges along the Selway River and work with the USFS to expand winter range.

2) Maintain a rams: 100 ewe ratio observed during "good" post-season aerial surveys of at least 40 rams: 100 ewes with at least 40% of the rams as Class III and IV (approximately ¾-curl or greater).

3) Maintain a minimum 35 lambs: 100 ewes.

Painted Rocks Subunit:

1) Maintain the number of bighorn sheep observed during "good" post-winter aerial surveys within 20% of 120 sheep (96 to 144).

2) Maintain 50 rams: 100 ewes with a minimum of 40% of the rams Class III or larger.
3) Maintain lamb production at a minimum of 35 lambs: 100 ewes over a three-consecutive year average.

Population Management Strategies

FWP will work with the USFS to improve and expand winter ranges for both herd subunits. Also, the primary population management activity will be hunting for either-sex sheep in the Painted Rocks area and legal ram opportunities in the Watchtower/Sheephead area.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed statewide through limited-entry harvest of ewes and capture operations. Due to the relatively small populations in both the Watchtower/Sheephead and Painted Rocks subunits and because bighorn numbers in both subunits appear to be naturally regulated, ewe harvest is not recommended at this time. Should this situation change, appropriate strategies to manage bighorn numbers will be explored and recommended.

Watchtower/Sheephead Subunit:

Rams: Because of the limited number of bighorns in this subunit this subunit is hunted conservatively with legal ram licenses issued for up 20% of the Class III and IV rams (approximately ¾-curl and greater) observed during survey efforts. Generally, this has resulted in issuing one license.

Painted Rocks Subunit:

Rams: Limited-entry either-sex licenses with the number of either-sex licenses issued being up to 20% of the Class III and IV rams (approximately ¾-curl and greater) observed during survey efforts.

SKALKAHO
(Hunting District 261)

Description: Bighorn sheep Hunting District 261 lies east and southeast of Hamilton. It is about 540mi^2 with most of it, 52% or 280 mi^2, administered by the Bitterrooot National Forest. Other public lands include 14mi^2 (3%) owned by the Montana Department of Natural Resources and Conservation (DNRC) and the relatively small (3.4mi^2) Calf Creek Wildlife Management Area (WMA) owned by FWP. The remaining 54% of the hunting district, some 292mi^2, is privately owned.

Bighorn sheep occupy about 82mi^2 of the hunting district, mostly in Skalkaho Creek (hence these sheep are commonly called the "Skalkaho herd") but also in Sleeping Child and Gird Creeks. Sixty-five percent (53mi^2) of the herd's range is public land and 8% (6.3mi^2) is private land protected by a conservation easement held by the Rocky Mountain Elk Foundation. Within the occupied area are five smaller areas totaling 26 mi^2 (32% of occupied range) of lower-elevation, steep, rocky, cliff-type habitat that sheep favor year-round and concentrate on in winter. Sheep have occasionally been seen outside the "normal" range described above, most notably on Deer Mountain east of Darby. In 2002, a three-year-old radio-collared bighorn ram from the Skalkaho area was followed to Whiskey Gulch, in bighorn sheep Hunting District 270. This was about 10 miles southeast of Darby and about 15 miles south of its "normal" range, where it stayed for a while before returning. This ram was later destroyed because it had been near a small herd of domestic sheep at the mouth of Whisky Gulch.

The quality and quantity of winter range forage is good due to a 2000 forest fire that burned much of the area. Weeds, especially spotted knapweed, are widespread, and conifer encroachment is occurring on those areas not affected by fire.

Public Access: Access via Forest Service roads to the majority of the hunting district is very good. The area occupied by bighorn sheep within this hunting district is also popular for hunting other kinds of wildlife including deer, elk, mountain lions, bears and upland birds.

Bighorn Sheep Populations: The Skalkaho area is historical bighorn habitat, but sheep had not been observed there more recently until 1973, one year after a reintroduction into the East Fork of the Bitterroot east of Sula, when two ewes were seen. In 1988, three sheep were observed: a ram, a ewe, and a lamb. By 1999, there were about 36 sheep, and the herd was supplemented with 27 animals from the Sun River herd in early 2000. Currently, it is estimated there are about 130 bighorns in the herd (Figure 1 and Table 1). As of 2008, this is a fairly "young" and growing population. It has not been necessary to institute the harvest of ewes or to capture sheep to reduce the population. However, these steps may be necessary in the future to control herd size. Starting in 2000, Nicholas DeCesare used

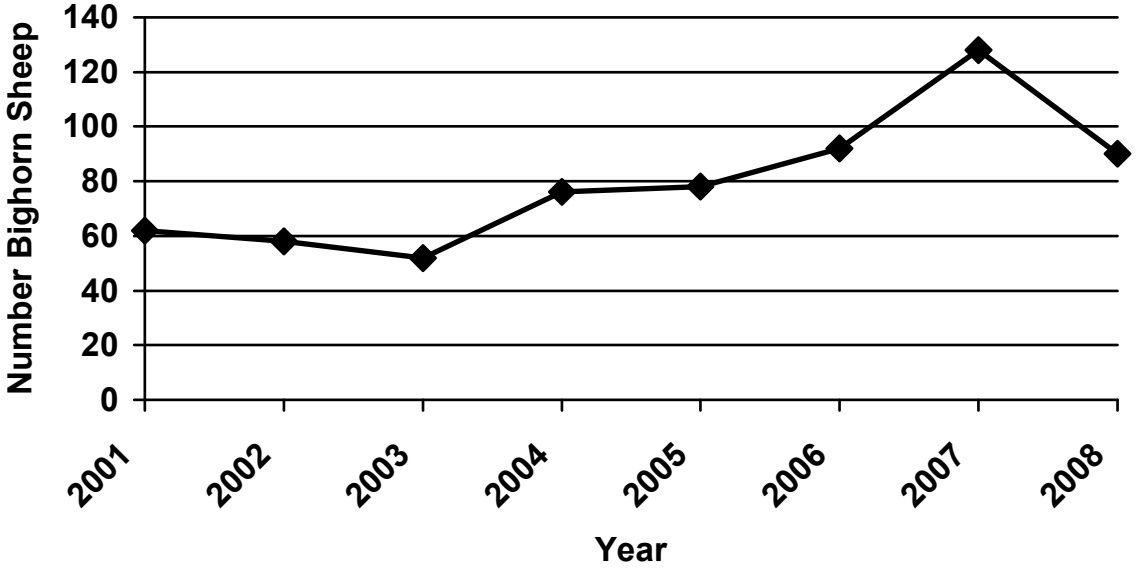


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Skalkaho population, Hunting District 261, 2001-2008.

Date	Total	Ewes	Lambs	Rams						Per 100 ewes	
				Ylg	I	II	III	IV	Tot	Uncl	Lambs	Rams
01 Aug 2001[1]	49	19	9		4	9	5	3	21		47	111
Sept 2001	62	27	11						24		41	89
26 Dec 2001	30	12	6		2	3	3	2	10	2	50	83
Aug 2002	58	25	8						25		32	100
15 & 16 Apr 2003	52	27	2	2		7	8	6	23		7	85
5 Jan 2004	82	41	19		2	4	7	9	22		46	54
16 Apr 2004	76	34	14		5	10	4	9	28		41	82
4 Aug 2004[1]	27	15	10	1					1		67	7
12 Jan 2005	59	34	14		7	0	2	2	11		41	32
20 Mar 2005	78	49	14		3	5	2	4	15	1	29	31
4 Jan 2006	74	12	6		3	2	1	2	8	48	50	67
21 Mar 2006												
28 Mar 2006	92	50	11	2	3	8	8	10	31		22	62
5 Jan 2007	128	69	24		9	4	9	13	35		35	51
2 Apr 2007	99	62	14		6	0	0	2	8	15	23	24
2 Jan 2008	90	51	18	0	8	6	2	2	18	3	35	35

[1]Ground survey

Table 1. Helicopter counts and classifications in the Skalkaho population, Hunting District 261, 2001–2007.

nine radio-collared sheep from this population as part of his master's degree project that evaluated distribution, movements, and habitat selection. His findings are reported in his 2002 thesis "Movement and Resource Selection of Recolonizing Bighorn Sheep in Western Montana" (University of Montana, Missoula).

During good years, recruitment may be 40 to 50 lambs: 100 ewes seen during spring surveys, but lamb: ewe ratios have often been below 35:100. The number of rams seen during surveys has varied widely suggesting that sightability of rams, particularly adult ram groups, can be low and is unreliable in these habitats.

In 2001, seven bighorns were captured and radio-collared in Skalkaho Creek to augment the two that had been collared when transplanted in 2000 as part of the aforementioned graduate project. Two other sheep in the population were already wearing radio collars, having been so equipped when translocated to the area in 2000. No bighorns have been captured and removed from the Skalkaho herd.

Recreation Provided: This population is a popular watchable wildlife opportunity enjoyed by hundreds of people because it is close to Hamilton and the sheep are often seen along the Skalkaho Highway, MT Highway 38. Hunting is also a popular recreational pursuit enjoyed by the lucky people who draw a bighorn license. Currently, there are about 50 to 60 hunter days per year associated with the Skalkaho herd.

Current Annual Bighorn Sheep Harvest: Hunting began in 2000 with one either-sex license and is now at five either-sex licenses. Hunter success has been 100% from 2000 to 2007. In recent years, it has not been uncommon for a Boone and Crockett–size ram to be harvested in Hunting District 261. In 2007, the largest ram ever harvested in the Bitterroot Valley came out of this hunting district, an 8½-year-old that scored 193 2/8.

Accomplishments: This population of bighorn sheep is well established in all suitable habitats in the hunting district.

Management Challenges:

1) Maintaining separation of wild sheep and domestic sheep and goats to avoid transmission of disease to bighorns. There are two large domestic sheep producers within a few miles of the bighorn range: one less than 1½ miles to the east across Sleeping Child Creek and the other about 2½ miles to the east across the Bitterroot River. Additionally, there are a number of hobby producers of domestic sheep in the Bitterroot Valley including the one mentioned earlier in Whiskey Gulch about 15 miles south of the "normal" bighorn range in Hunting District 261. In June of 2004, a private individual released an unknown number (believed to be about 35) of domestic churro sheep on USFS land in Daly Creek within the range

of the Skalkaho bighorn sheep herd. Forest Service and FWP personnel rounded up most of these, and an additional 13 were killed by FWP staff over the next few months. This incident illustrates some of the problems that can accompany a growing human population and the spread of "hobby" ranches. Although not employed in the Bitterroot Valley yet, the increasing use of domestic sheep to manage weeds, colloquially known as the "sheep on wheels" program, is of concern to bighorn managers.

2) Loss of wildlife habitat is occurring in this hunting district; housing developments on bighorn range areas and along migratory routes are common. Road-kills on the Skalkaho Highway, MT Highway 38, number about two to four annually.

3. Weeds are a ubiquitous problem, and conifer encroachment is occurring in some areas of bighorn range.

Population Monitoring: This bighorn population is surveyed on winter range from a helicopter while surveying mule deer in the same area. Consequently, it usually gets counted twice a year: once in late December or early January and again during spring green-up in April. Bighorns are counted and classified by age and sex. Rams are classified based on horn development as yearling or Class I, II, III, or IV (Geist 1971).

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district indicates a high level of support for FWP's management direction. Both hunters and non-hunters enjoy seeing bighorn sheep in this area.

Management Goal

Manage for a healthy and productive bighorn sheep population with a diverse age structure of rams. There may be some opportunity for an increase in sheep numbers. Cooperate with public land management agencies and private individuals in the management of bighorn habitats. Maintain good opportunity for bighorn sheep hunters to harvest sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain about 82mi^2 (52,500 acres) of occupied bighorn sheep habitat for the benefit of bighorns, other wildlife species, and other agency-mandated uses.

2) Encourage improvement of habitat conditions, particularly weed management, on publicly owned winter ranges (primarily USFS) so that vegetation conditions on these ranges provide adequate forage for bighorns and other wildlife during the winter.

3) Encourage maintenance and improvement of habitat conditions on public lands (USFS) so that bighorns continue to utilize these lands during summer and fall rather than moving onto private land. Prevent over-utilization of forage by limiting the population, when necessary, through public hunting and capture and removal of sheep.

Habitat Management Strategies

1) Cooperate with the USFS on prescribed burning and weed treatment projects to make sheep habitats more productive.

2) Where identified as necessary, work with the USFS to limit motorized use, particularly off-trail OHVs and motorcycles, in the area to minimize displacement of sheep from preferred habitats and to limit the spread of weeds.

3) Continue to work with private landowners and Ravalli County to limit the use of domestic sheep and goats in the area.

4) Continue to work with private landowners, Ravalli County, particularly the Ravalli County Open Lands Board, and organizations like the Foundation for North American Wild Sheep, the Rocky Mountain Elk Foundation, Safari Club International, the Ravalli County Fish & Wildlife Association, and others to conserve important bighorn habitat on private lands through the use of conservation easements or fee title acquisition.

Game Damage Strategies

At present there are few game damage complaints related to bighorn sheep in Hunting District 261. If game damage problems develop, they will be addressed on a case-by-case basis consistent with Montana FWP's Game Damage Program. If it is determined that a population reduction is necessary, it could be accomplished through hunting and sheep capture for transplanting.

Access Strategies

Maintain the current level of public access on public lands. However, to maintain habitat security and protect habitat, FWP should work with the USFS and DNRC to limit use of OHVs and motorcycles where necessary.

Population Objectives

When considering the following population objectives, it must be kept in mind that the observability of these sheep, particularly the adult ram groups, varies considerably. Consequently, much must be left to the discretion of the managing biologist as to whether he/she has made a "good" count on any particular flight.

1) Maintain the number of bighorn sheep observed during "good" post-winter aerial surveys within 20% of 120 sheep (96 to 144).

2) Maintain a ram: 100 ewe ratio observed during "good" post-season aerial surveys of at least 60 rams: 100 ewes with at least 40 % of the rams as Class III and IV (approximately ¾-curl or greater).

Population Management Strategies

The population objective of 120 (± 20 %) observed bighorn sheep is largely based on: 1) the ability of public and private lands to provide habitat for wintering bighorns, 2) vehicular/bighorn collisions on the Skalkaho Highway, and particularly, 3) the understanding that catastrophic disease-caused die-offs are often density dependent occurrences.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed through limited-entry harvest of ewes. The following prescriptions are recommended guidance provided no other extenuating circumstances arise, such as gross habitat changes, disease outbreak, or a groundswell of public sentiment or change in department direction. In general, bighorn sheep licenses in Hunting District 261 are issued under the following prescriptions (Table 2):

Standard Regulation: A limited number of adult ewe licenses – up to 20% of the number of ewes going into the fall season. A suggested model to determine the number of ewes going into the fall season would be the number of ewes observed during the annual survey, assuming a 5% mortality of adults, and adding a recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is between 96 and 144 and lamb recruitment is above 35 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is less than 96 and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	96-144	Above 30	Limited Entry Adult Ewes	Up to 20% of Ewes
Restrictive Regulation	<96	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	>144	> 40	Limited Entry Ewes **OR** translocate if > 25 sheep including rams are available	More than 20% of Ewes

Table 2. Summary of regulation types under different population criteria for ewe harvest and population management.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 144 and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry either-sex licenses with the number of either-sex licenses issued being up to 20% of the Class III and IV rams in the population (approximately ¾-curl and greater).

The Standard Regulation will be recommended if: The population is within objective (+ 20% of 120), there are more than 30 rams: 100 ewes, and 30% of the rams are Class III and IV (Table 3).

Restrictive Regulation: Limited-entry either-sex licenses with the number issued being up to 10% of the Class III and IV rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 20% below the population objective of 120, there are less than 30 rams: 100 ewes, less than 30 lambs: 100 ewes, and less than 30% of the rams are Class III and IV.

Liberal Regulation: Limited-entry either-sex licenses with the number of licenses issued being more than 20% of the Class III and IV rams in the population.

The Liberal Regulation will be recommended if: The population is more than 20% above the objective of 120, there are more than 80 rams: 100 ewes, and more than 30% of the rams are Class III and IV.

Table 3. Summary of potential ram harvest under different population scenarios.

MOUNTAIN-FOOTHILLS	Number of Ram Licenses	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of rams Class III & IV
Standard Regulation	Up to 20% of Class III & IV rams	96-144	>30	≥ 30
Restrictive Regulation	Up to 10% of Class III & IV rams	<96	< 30	< 30
Liberal Regulation	More than 20 % of Class III & IV rams	>144	> 80	≥ 30

EAST FORK BITTERROOT (Hunting District 270)

Description: Bighorn sheep Hunting District 270 is about 5 miles southeast of Darby. It is about 326mi² with 85%, or 277mi², managed by the Bitterroot National Forest. The Montana Department of Natural Resources and Conservation (DNRC) manages 6%, or 20mi², and the remaining 9%, or 29mi², is privately owned.

Bighorn sheep occupy about 121mi² of the hunting district, mostly in the East Fork of the Bitterroot; hence these sheep are commonly called the "East Fork herd". Eighty-four percent (102mi²) of the herd's range is public land (94mi² U.S. Forest Service (USFS) and 8mi² DNRC). Within the occupied area are three smaller areas totaling 34 mi² (28% of occupied range) of lower-elevation, relatively steep, often rocky habitat that sheep favor year-round and concentrate on in winter. Sheep have occasionally been seen outside the "normal" range described above, most notably on Deer Mountain east of Darby.

There are two major areas of winter range. The Sula Peak portion includes the southwest-facing slopes from Sula Peak to Robbins Gulch, with most sheep found from Sula Peak to just north of Spring Gulch. After the rut, there is some tendency for mature ram groups to be found north of Spring Gulch while ewe and lamb groups are south. The Bunch Gulch winter range includes the area from the open slopes west of Bunch Gulch to those east of Jennings Camp Creek. Following the rut here, groups of mature rams, often 40 to 50 together, gravitate to the open south-facing ridges from Guide Creek to east of Jennings Camp Creek. Ewe and

lamb groups are generally found east of Guide Creek.

Most of the ewes and lambs and some smaller rams remain on or near their winter range for the rest of the year. Most of the mature rams, however, migrate to the area around Fish, Faith, Hope, and Charity Lakes in summer and wander as far northwest from there as the Rooster Comb.

The quality and quantity of winter range forage is good due to a 2000 forest fire that burned much of the area. Weeds, especially spotted knapweed, are widespread, and conifer encroachment is occurring on those areas not affected by fire.

Public Access: Access via Forest Service roads to the majority of the hunting district is very good. The area occupied by bighorn sheep within this hunting district is also very popular for hunting other wildlife species, most notably elk, but also deer, mountain lions, bears, and upland birds.

Bighorn Sheep Populations: The East Fork herd was reintroduced into historical bighorn habitat on January 20, 1972, with 19 sheep released into Tolan Creek and an additional 16 released in Bunch Gulch on March 3, for a total release of 35.

Population data for the years 1980 to 1993 found in FWP annual progress reports is often confusing, with different numbers sometimes being presented for the same year and season. In reconstructing the population history presented in Figure 1 and Table 1, where numbers did not agree, the greater of the two for a given year was used. From the original reintroduction of 35 sheep, the population currently stands at around 200 to 250.

During good years, recruitment may be 40 to 50 lambs: 100 ewes seen during spring surveys, but lamb: ewe ratios have often been below 35:100. The number of rams seen during surveys has varied widely suggesting that sightability of rams, particularly adult ram groups, can be low and is unreliable in these habitats.

Over the years, the East Fork herd has been periodically reduced by trapping sheep for transplant or research. Records for trapping episodes before 2002 are not readily available, but since then some 77 sheep have been removed (Table 3). During the 2002 effort, one ewe tested positive for *Brucella ovis*, a brucellosis bacterium affecting sheep. However, it was later determined to be a false positive. The 15 sheep trapped on February 26, 2004, were sent to the USDA National Wildlife Research Center in Fort Collins, Colorado, for research on *B. ovis*. One of these sheep died shortly after arriving there, most likely from shipping stress.

Contagious ecthyma, or sore mouth, has been found in the East Fork herd. Scabs were noted on one adult ewe during both the 2002 and 2004 trapping operations. In 2002, the ewe was released, but the one captured in 2004 was euthanized. All 14 of the surviving sheep sent to Fort Collins in 2004 eventually manifested the disease. It is unknown how many of these were infected before capture.

Recreation Provided: This population is a popular watchable wildlife opportunity enjoyed by hundreds of people because it is close to Hamilton and the sheep are often seen along U.S. Highway 93, a busy highway connecting Missoula, Montana and Salmon, Idaho. Hunting is also a popular recreational

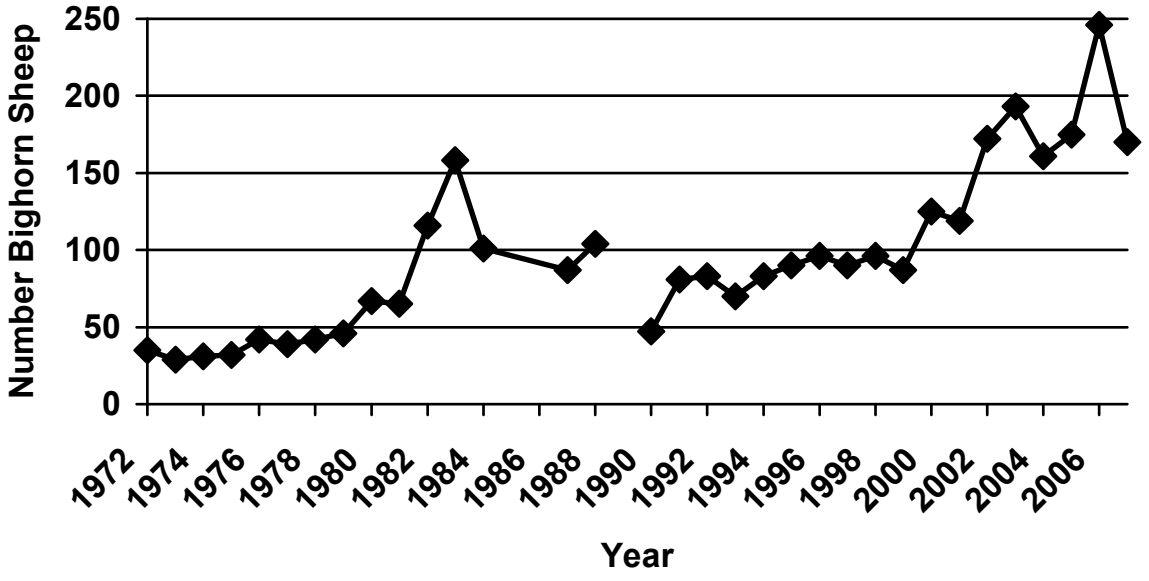


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the East Fork Bitterroot population, Hunting District 270, 1972-2007.

Table 1. Spring counts and classifications in the East Fork Bitterroot population, Hunting District 270, 1972-2001.

Year	Total	Ewes	Lambs	Rams				Per 100 ewes	
				<½ Curl	>½ Curl	Total	Uncl	Lambs	Rams
1972	35[1]	20	7			8		35	40
1973	29						29		
1974	31	9	2			9	11	22	100
1975	32	19	3			10		16	53
1976	42	21	6			15		29	71
1977	39	21	7			11		33	52
1978	42					10	32		
1979	46					13	33		
1980	67	29	20	10	8	18		69	62
1981	65	33	11	3	13	16	5	33	48
1982	116	71	25	11	9	20		35	28
1983	158	91	39	10	18	28		43	31
1984	101	41	17	15	28	43		41	105
1985	77	43	6	8	20	28		14	65
1986	129	70	29	4	26	30		41	43
1987	87	26	9	29	10	39	13	35	150
1988	104	62	14	18	10	28		23	45
1989									
1990	47	38	0	7	2	9		0	24
1991	81	57	10	8	6	14		18	25
1992	83	57	10			16		18	28
1993	70	44	2	6	18	24		5	55
1994	83	45	19	7	12	19		42	42
1995	126	73	28	13	12	25		38	34
1996	96	59	13	9	15	24		22	41
1997	90	48	20	13	9	22		42	49
1998	96	58	20	10	8	18		34	31
1999	87	52	19	3	13	16		37	31
2000	125	85	21	6	13	19		25	22
2001	119	66	22	15	16	31		33	47

[1]Original reintroduction release

Table 2. Spring helicopter counts and classifications in the East Fork population, Hunting District 270, 2002-2007.

Date	Total	Ewes	Lambs	Rams							Per 100 ewes		
				Ylg	I	II	III	IV	Uncl	Tot	Uncl	Lambs	Rams
18 Apr 2002	172	85	22		7	25	18	15	0	65	0	26	76
16 Apr 2003	193	109	22	5	5	9	24	19	0	62	0	20	57
17 Apr 2004	161	75	30		2	11	23	19	2	57	0	40	76
21 Mar 2005	175	73	34		15	13	19	15	6	68	0	47	93
30 Mar 2006	246	110	38	9	13	21	22	24	0	58	9	35	81
2 Apr 2007	170	57	18		20	27	22	16	6	91	4	32	160

			Lambs			Rams	
Date	Total	Ewes	Male	Female		Yearling	Adult
Feb. 13&14, 2002	37	28	3	3		2	1
Feb. 26, 2004	15	10	2	2		1	0
Jan. 28, 2007	25	25	0	0		0	0

Table 3. Bighorn sheep captured and moved from the East Fork population, 2002–2007.

pursuit enjoyed by the lucky people who draw a bighorn license. In recent years, there have been between 73 and 143 hunter days per year associated with the East Fork herd.

Current Annual Bighorn Sheep Harvest: Hunting was first allowed in 1976 with three legal-ram permits being issued. In recent years there have been 6 to 8 either-sex and 10 to 20 adult ewe licenses issued. Success rates are often 100% or very close to it.

Accomplishments: This population of bighorn sheep is well established in all suitable habitats in the hunting district.

Management Challenges:

1) Maintain separation of wild sheep and domestic sheep and goats to avoid transmission of disease to bighorns. Two large domestic sheep producers are about 15 miles north of this bighorn range. Additionally, there are a number of hobby producers of domestic sheep in the Bitterroot Valley including one within bighorn range in Whiskey Gulch. Although not employed in the Bitterroot Valley yet, the increasing use of domestic sheep to manage weeds, colloquially known as the "sheep on wheels" program, is of concern to bighorn managers.

2) Loss of bighorn habitat to development does happen in this hunting district, but is minimized somewhat because of the amount of national forest land. However, some lower-elevation sheep ranges along the East Fork of the Bitterroot are seeing an increase in houses. Road-kills along the East Fork Highway and U.S. Highway 93 number about four to eight annually.

3) Weeds are a ubiquitous problem, and conifer encroachment is occurring in some areas of bighorn range.

Population Monitoring: This bighorn population is surveyed on winter range from a helicopter during spring green-up in April. Bighorns are counted and classified by age and sex. Rams are classified based on horn development as yearling or Class I, II, III, or IV (Geist 1971).

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district indicates a high level of support for FWP's management direction. Both hunters and non-hunters enjoy seeing bighorn sheep in this area.

Management Goal

Manage for a healthy and productive bighorn sheep population with a diverse age structure of rams. There may be some opportunity for an increase in sheep numbers. Cooperate with public land management agencies and private individuals in the management of bighorn habitats. Maintain good opportunity for bighorn sheep hunters to harvest sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain about 121mi^2 (77,440 acres) of occupied bighorn sheep habitat for the benefit of bighorns, other wildlife species, and other agency-mandated uses.

2) Encourage improvement of habitat conditions, particularly weed management, on publicly owned winter ranges (primarily USFS) so that vegetation conditions on these ranges provide adequate forage for bighorns and other wildlife during the winter.

3) Encourage maintenance and improvement of habitat conditions on public lands (USFS) so that bighorns continue to utilize these lands during summer and fall rather than moving onto private land. Prevent over-utilization of forage by limiting the population, when necessary, through public hunting and capture and removal of sheep.

Habitat Management Strategies

1) Cooperate with the USFS on prescribed burning and weed treatment projects to make sheep habitats more productive.

2) Where identified as necessary, work with the USFS to limit motorized use, particularly off-trail OHVs and motorcycles, in the area to minimize displacement of sheep from preferred habitats and to limit the spread of weeds.

3) Continue to work with private landowners and Ravalli County to limit the use of domestic sheep and goats in the area.

4) Continue to work with private landowners, Ravalli County, particularly the Ravalli County Open Lands Board, and organizations like the Foundation for North American Wild Sheep, the Rocky Mountain Elk Foundation, Safari Club International, the Ravalli County Fish & Wildlife Association, and others to conserve important bighorn habitat on private lands through the use of conservation easements or fee title acquisition.

Game Damage Strategies

At present there are few game damage complaints related to bighorn sheep in this hunting district. If game damage problems develop, they will be addressed on a case-by-case basis consistent with Montana FWP's Game Damage Program. If it is determined that a population reduction is necessary, it could be accomplished through hunting and sheep capture for transplanting.

Access Strategies

Maintain the current level of public access on public lands. However, to maintain habitat security and protect habitat, FWP should work with the USFS and DNRC to limit use of OHVs and motorcycles where necessary. Of particular concern in this regard is the summer range used by rams in the "Chain of Lakes" area near Faith, Hope, and Charity Lakes.

Population Objectives

When considering the following population objectives, it must be kept in mind that the observability of these sheep, particularly the adult ram groups, varies considerably. Consequently, much must be left to the discretion of the managing biologist as to whether he/she has made a "good" count on any particular flight.

1) Maintain the number of bighorn sheep observed during "good" post-winter aerial surveys within 20% of 200 sheep (160 to 240).

2. Maintain a ram: 100 ewe ratio observed during "good" post-season aerial surveys of at least 60 rams: 100 ewes with at least 40% of the rams as Class III and IV (approximately ¾-curl or greater).

Population Management Strategies

The population objective of 200 (± 20%) observed bighorn sheep is largely based on: 1) the ability of public and private lands to provide habitat for wintering bighorns, 2) vehicular/bighorn collisions on the East Fork Highway and U.S. Highway 93, and particularly, 3) the understanding that catastrophic disease-caused die-offs are often density dependent occurrences.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed through limited-entry harvest of ewes. The following prescriptions are recommended guidance provided no other extenuating circumstances arise, such as gross habitat changes, disease outbreak, or a groundswell of public sentiment or change in department direction. In general, bighorn sheep licenses in Hunting District 270 are issued under the following prescriptions (Table 4):

Standard Regulation: A limited number of adult ewe licenses issued would be up to 20% of the number of ewes going into the fall season. A suggested model to determine the number of ewes going into the fall season would be the number of ewes observed during the annual survey, assuming a 5% mortality of adults, and add a recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is between 160 and 240 and lamb recruitment is above 35 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is less than 160 and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 240 and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry either-sex or legal ram licenses with the number of either-sex licenses issued being up to 20% of the Class III and IV rams in the population (approximately ¾-curl and greater).

The Standard Regulation will be recommended if: The population is within objective (+ 20% of 200), there are more than 30 rams: 100 ewes, and 30% of the rams are Class III and IV (Table 5).

Restrictive Regulation: Limited-entry either-sex or legal ram licenses with the number issued being up to 10% of the Class III and IV rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 20% below the population objective of 200, there are less than 30 rams: 100 ewes, less than 30 lambs: 100 ewes; and less than 30% of the rams are Class III and IV.

Liberal Regulation: Limited-entry either-sex or legal ram licenses with the number of licenses issued being more than 20% of the Class III and IV rams in the population.

The Liberal Regulation will be recommended if: The population is more than 20% above the objective of 200, there are more than 80 rams: 100 ewes, and more than 30% of the rams are Class III and IV.

MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	160-240	Above 30	Limited Entry Adult Ewes	Up to 20% of Ewes
Restrictive Regulation	<160	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	>240	> 40	Limited Entry Ewes **OR** translocate if > 25 sheep including rams are available	More than 20% of Ewes

Table 4. Summary of regulation types under different population criteria for ewe harvest and population management.

MOUNTAIN-FOOTHILLS	Number of Ram Licenses	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of rams Class III & IV
Standard Regulation	Up to 20% of Class III & IV rams	160-240	>30	≥ 30
Restrictive Regulation	Up to 10% of Class III & IV rams	<160	< 30	< 30
Liberal Regulation	More than 20 % of Class III & IV rams	>240	> 80	≥ 30

Table 5. Summary of potential ram harvest under different population scenarios.

LOWER BLACKFOOT
(Bonner)
(Hunting District 283)

Description: The Lower Blackfoot (Hunting District 283) lies directly northeast of Missoula and contains approximately 360mi^2. Plum Creek Timber Company (PCT) owns approximately 24%, the U.S. Forest Service (USFS) – Lolo National Forest (NF) administers about 37%, and the State of Montana administers 5% of the hunting district. The remaining is privately owned. The quality and quantity of winter range forage here is declining. Grasslands are subject to weed infestations and conifer encroachment. Shrubfields, created by the wildfires in the early 1900s, are decadent and degraded by conifer reproduction.

Approximately 25mi^2 (7%) of the hunting district are occupied by bighorn sheep during some portion of the year. Forty-five percent of the occupied range is on public lands. Sheep commonly graze in residential lots in the West Riverside community. The bighorn sheep population is commonly referred to as the "Bonner herd" because it is generally limited to suitable habitats in the lower Blackfoot River drainage near the town of Bonner.

Public Access: Access is very limited to the majority of the unit. Private acquisition and development of private lands at lower elevations and road closures on PCT lands during the last 15 years have greatly reduced public access. Most hunting is accomplished through walking in at a few access points.

Bighorn Sheep Populations: FWP established this population by initially releasing 14 bighorns from Upper Rock Creek in 1987 on Woody Mountain. Another 30 sheep from the Sun River were released in 1990. The first helicopter survey was conducted in 1991, when 35 sheep were counted. The number of bighorn sheep counted during helicopter surveys in Hunting District 283 has ranged from 35 (1991) to 128 (2007) (Figure 1 and Table 1).

During good years, recruitment may be 40 to 55 lambs: 100 ewes recorded during early April surveys. But lamb: ewe ratios have often been below 35:100 and in 1998, following the 1996-97 winter, only 13 lambs: 100 ewes were observed. The number of observed rams has ranged between 4% and 61% of the number of ewes seen during surveys. From year to year, a great amount of variation occurs in numbers of adult rams (>3/4-curl) seen during helicopter surveys, suggesting that sightability of adult rams in particular is low and unreliable in these habitats.

Because of the lack of hunting access that might otherwise control this population and because of the numerous complaints from residents in West Riverside, FWP repeatedly has trapped and removed sheep for starting or augmenting other herds. The 1996 to 97 winter was so severe that more than 30 sheep were forced to temporarily live in the Big Pine Trailer Court until FWP trapped and successfully translocated 31 of them to the Elkhorn Mountains. In 2007, another 27 sheep were captured and moved to Utah.

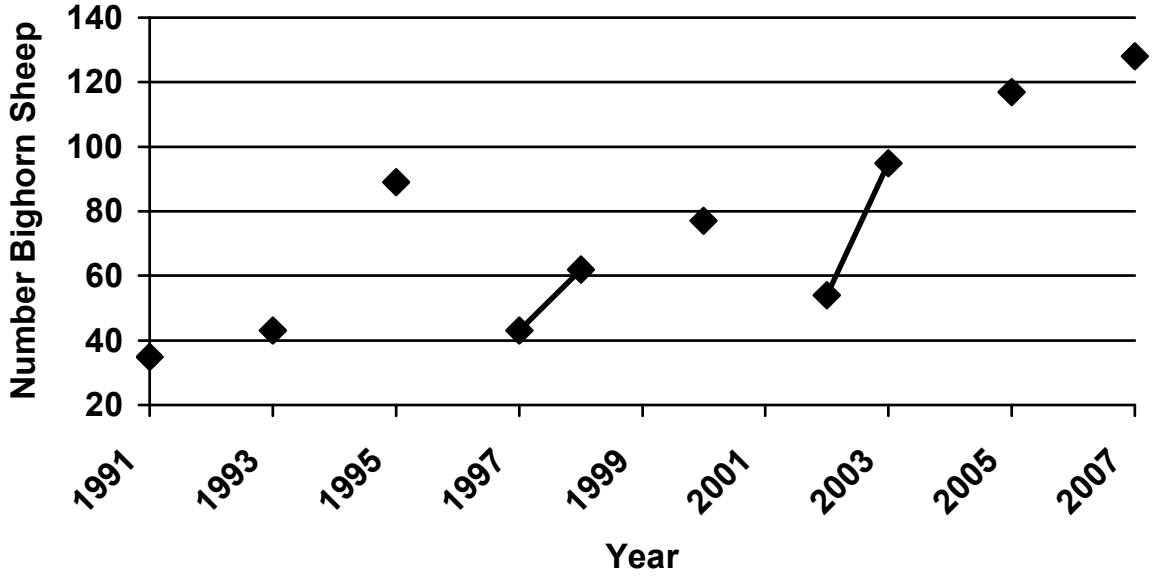


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Lower Blackfoot population, Hunting District 283, 1991-2007.

Year	Ewes	Lambs	Yrlg Rams	Subad Rams	Adult Rams	Unclass	Total
1991	18	6	4	4	3	0	35
1993	27	6	2	5	3	0	43
1995	47	23	8	4	7	0	89
1997	27	9	2	3	2	0	43
1998	48	6	2	3	3	0	62
2000	46	15	6	5	5	0	77
2002	37	13	4	0	0	0	54
2003	49	24	12	2	8	0	95
2005	52	26	7	11	21	0	117
2007[1]	76	41	7	3	1	0	128

[1] 2007 Survey followed capture and removal of 27 sheep in January 2007.

Table 1. Spring helicopter surveys in Lower Blackfoot population in Hunting District 283, Spring 1991-2007.

Recreation Provided: Hunting of bighorn sheep was initiated in the fall of 1996 with the issuance of two either-sex and five adult ewe licenses. Following the 1996-97 winter, licenses were reduced to allow for population recovery. As the population increased, the number of licenses was increased. This population is a popular watchable wildlife opportunity because of its proximity to Missoula and Bonner and MT Highway 200.

Current Annual Bighorn Sheep Harvest: Since the initial 1996 season, permitted harvests have generally risen and fallen in response to changing numbers of sheep (Table 2). Since 1996, permitted harvests have been prescribed to maintain a population of about 100 bighorns counted during spring surveys. Out of consideration for homeowners, season dates were short (September 15 through October 31) from 1996 through 2001. However, the low success rates prompted FWP to extend the season in 2002. In spite of limited access, hunter success is nearly 100% during most years. Hunters typically harvest one or more Boone and Crockett–size rams each year.

Accomplishments: This population of bighorn sheep is well established in all suitable habitats. In addition to the core population that inhabits the area north of Bonner and the Blackfoot River, a subpopulation of approximately 30 (not surveyed) occupies a portion of the Rattlesnake Wilderness and National Recreation Area. Another subpopulation of approximately 30 (not surveyed and not hunted) occupies the area south of the Blackfoot River between Bonner and LaFrey Creek in Hunting District 292. During cold winters, sheep often cross an iced-over Blackfoot River, which separates Hunting District 283 from Hunting District 292. Occasionally, bands of young rams and/or ewes are seen on Mount Jumbo and near Johnsrud Park in Missoula, suggesting that surplus animals are immigrating in search of new habitats or other bighorn populations.

In 2008 and 2009, TNC purchased 12,305 acres within the hunting district from PCT as part of the Montana Legacy Project. In 2009, TNC turned 5,169 acres over to the Lolo NF. The majority of those lands include important occupied bighorn sheep winter habitat northeast of Bonner.

Year	Number Either-Sex Licenses	Ram Harvest	Number Ewe Licenses	Ewe Harvest
1996	2	2	5	4
1997	1	1	2	1
1998	1	1	2	1
1999	1	0	2	0
2000	1	0	2	2
2001	1	1	2	2
2002	1	1	2	2
2003	1	1	4	4
2004	1	1	4	4
2005	3	3	5	5
2006	3	3	5	5
2007	5	(5)	10	(10)

Table 2. Number and types of licenses issued and subsequent harvest, Hunting District 283, 1996-2007.

Management Challenges:

1) Maintaining separation of wild sheep and domestic sheep and goats to avoid transmission of disease to bighorns. Rural subdivisions in the East Missoula and Bonner areas have resulted in small bands of livestock including domestic sheep and goats. In 2000, Missoula's decision to manage weeds with domestic sheep grazing led to protocols for reporting bighorn sheep on Mount Jumbo by domestic sheepherders. To date, two yearling bighorn rams have been shot and removed from Mount Jumbo. Also, Missoula County has adopted covenants prohibiting domestic sheep in two subdivisions, but enforcement is typically left to homeowners.

2) Loss of wildlife habitat is occurring in this hunting district; human development on winter range areas and along migratory routes is common. Salting for bighorns is common and leads to degradation of nearby forage plants and potentially increases the risk of disease transmission. Road-kills on MT Highway 200 number five to 10 annually.

3) Weed infestations and conifer encroachment are degrading forage production on summer and winter ranges.

4) PCT's sales of parcels have reduced hunter access to important sheep habitats. Additional land sales and subsequent rural developments in the Gold Creek area are expected to further diminish public access.

5) Damage complaints from homeowners in the West Riverside area are chronic occurrences. In addition to depredation of gardens and ornamental plants, residents often voice fears of possibly being injured by wild sheep.

Population Monitoring: This bighorn population is surveyed biennially from a helicopter. Surveys are conducted in April, during spring green-up. Typically, only the winter/spring range from Mitauer Creek to Wishard Ridge is surveyed. Bighorns are counted and classified by age and sex. Based on horn development, rams are assigned to yearling, sub-adult (1/2- to 3/4-curl) or adult (3/4+ curl) classifications. To monitor trends in lungworm loads in this population, pellet groups are collected in several locations every few years and sent to the Veterinary Research Laboratory at Montana State University in Bozeman.

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in this hunting district indicates a high level of support for the current season structure. Both hunters and non-hunters enjoyed seeing bighorn sheep in this area.

Management Goal

Manage for a healthy and productive bighorn sheep population with a diverse age structure of rams at current numbers. Cooperate with public land management agencies and private individuals in the management of bighorn habitats. Maintain good opportunity for bighorn sheep hunters to harvest sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain approximately 20,000 acres of occupied bighorn sheep habitat for the benefit of bighorns, other wildlife species, and other agency-mandated uses.

2) Encourage improvement of habitat conditions on publicly owned winter ranges (primarily USFS) so that vegetation conditions on these ranges provide adequate forage for bighorns and other wildlife during the winter.

3) Encourage maintenance and improvement of habitat conditions on public lands (USFS) so that bighorns continue to utilize these lands during summer and fall rather than moving onto private lands.

4) Prevent over-utilization of forage by limiting the population to less than 110 through public hunting and capture and removal of sheep.

Habitat Management Strategies

1. Continue to cooperate with the USFS on prescribed burning and weed treatment projects to make sheep habitats more productive.

2. Work with the USFS to limit motorized use and access of the area to minimize displacement of sheep from preferred

habitats and to limit weed infestations on the range.

3. Continue to work with private landowners and Missoula County to limit the use of domestic sheep and goats in the area.

Game Damage Strategies

Damage complaints from West Riverside residents are chronic. Public hunting to limit this population has not been efficacious and may be less so in the future. Bighorn numbers, however, can be managed through a combination of hunting and trapping and removal as they approach or exceed objectives.

Access Strategies

Lack of hunter access is a significant issue. FWP must continue to work with PCT and Stimson Lumber Co. to protect access to public lands.

Population Objectives

1) Maintain the number of bighorn sheep observed during post-winter aerial surveys within 10% of 100 sheep (90 to 110).

2) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys of at least 60 rams: 100 ewes with at least 30% of the rams having a ¾-curl.

Population Management Strategies

Bighorn numbers are currently being managed through hunter harvests of ewes and rams and through capture and removal projects. The population objective of 100 (± 10%) observed bighorn sheep was derived by considering: 1) the ability of public and private lands to provide forage for the wintering bighorn population, 2) conflicts with residential developments, 3) vehicular/bighorn collisions, and 4) the understanding that catastrophic disease-caused die-offs, exhibited in many other sheep populations, are often density dependent occurrences.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed through limited-entry harvest of the female segment. In Hunting District 283, licenses are issued under the following prescriptions (Table 3):

Standard Regulation: A limited number of adult ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the biennial survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 10% of the population objective and lamb recruitment is above 35 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is less than 35 lambs: 100 ewes.

MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	± 10% of 100	Above 35	Limited Entry Adult Ewes	Up to 20% of Ewes
Restrictive Regulation	More than 10% below 100	Less than 35	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Greater than 10% above 100	Greater than 40	Limited Entry Ewes **OR** translocate if > 25 sheep including rams are available	More than 20% of Ewes

Table 3. Summary of regulation types under different population criteria for ewe harvest and population management.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the biennial survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 10% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry either-sex licenses with the number of either-sex licenses issued being up to 20% of the ¾-curl rams in the population.

The Standard Regulation will be recommended if: The population is within objective (+ 10% of 100), there are more than 30 rams: 100 ewes, and 30% of the rams are at least ¾-curl (Table 4).

Restrictive Regulation: Limited-entry either-sex licenses with the number issued being up to 10% of the ¾-curl rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 10% below the population objective of 100, there are less than 30 rams: 100 ewes and less than 40 lambs: 100 ewes, and less than 30% of the rams are at least ¾-curl.

Liberal Regulation: Limited-entry either-sex licenses with the number of either-sex licenses issued being more than 20% of the ¾-curl rams in the population.

The Liberal Regulation will be recommended if: The population is more than 10% above the objective of 100, there are more than 100 rams: 100 ewes, and more than 30% of the rams are at least ¾-curl.

GALLATIN – YELLOWSTONE, SOUTH ABSAROKA, HYALITE, SOUTH YELLOWSTONE

(Upper Yellowstone Complex) (Hunting Districts 300, 303, 304, 305 and Mill Creek Non-Hunted Population)

Description: The Upper Yellowstone sheep management complex (Hunting Districts 300, 303, 304, and 305 and the Mill Creek non-hunted sheep population) is located in the Southern Mountains ecological region and contains approximately 1,350mi^2 in the Upper Yellowstone and Upper Gallatin River drainages north of Yellowstone National Park (YNP). This sheep population is comprised of several small, interconnected subpopulations, some of which occupy additional habitat inside YNP. Sheep movements across national park and state boundaries impact sheep management decisions, hunting regulations, and survey strategies (see below).

Bighorn sheep currently occupy less than 10% of this large area. Sheep habitat in the Upper Yellowstone drainage is a mosaic of foothills grassland, forest, alpine ridges and basins, and rugged rocky canyons and cliffs at elevations of 5,500 to 10,500 feet. Because most sheep in this complex occur in small, scattered

Table 4. Summary of potential ram harvest under different population parameters and criteria.

MOUNTAIN-FOOTHILLS	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of Rams with ≥ ¾-curl
Standard Regulation	Up to 20% of the ¾-curl rams	± 10% of 100	>30	≥ 30
Restrictive Regulation	Up to 10% of the ¾-curl rams	More than 10% below 100	< 30	< 30
Liberal Regulation	Up to 20 % of the ¾-curl rams	Greater than 10% above 100	> 100	≥ 30

subpopulations and migrate considerable distances between seasonal habitats, their exact home range boundaries are not completely known. However, with the exception of a few small winter range areas in private ownership, the majority of occupied bighorn sheep habitat in this area is in public ownership, managed by the U.S. Forest Service (USFS) – Gallatin National Forest (NF) and the National Park Service (NPS) – Yellowstone National Park (YNP).

Public Access: In general there is good public access to all hunted and non-hunted sheep populations in this complex. Public access to bighorn sheep north of YNP is largely provided by the Gallatin NF and varies between subpopulations. In some cases, sheep hunting occurs a short distance from open Forest Service or county roads (Hunting Districts 303 and 305) or via a system of backcountry trails (Hunting Districts 300 and 304). Trail distances to hunt sheep in Hunting Districts 300 and 304 may range from 6 to 12 miles. The non-hunted Mill Creek bighorn sheep subpopulation can be viewed during the winter and spring from public roads at the mouth of the Mill Creek canyon and sporadically during the rest of the year from Forest Service roads and backcountry trails in the Mill Creek and Emigrant Creek drainages. During the winter and spring, sheep in Hunting Districts 300 and 303 are often visible from U.S. Highway 89 and adjacent county roads from the Point of Rocks south to Gardiner. Sheep on the east side of the Yellowstone River (Hunting District 303 and Mill Creek) move seasonally in and out of the Absaroka-Beartooth Wilderness Area. Inside YNP, sheep can be viewed seasonally from roads in several areas (e.g., Mount Everts/Gardiner River, Mount Washburn, Tower Falls/Junction Butte, Druid Peak) and from backcountry trails.

Bighorn Sheep Populations: There are nine distinct bighorn sheep subpopulations in the Upper Yellowstone Bighorn Sheep Complex. Population data for these bighorns has been collected and analyzed over time based on these population units (Figures 1-5 and Tables 1-9).

All bighorns in the Upper Yellowstone, with the exception of a 1985 transplant in Mill Creek, are "native" bighorn sheep. Between January 15 and March 27, 1985, 20 bighorn sheep were released on winter range at the mouth of Mill Creek canyon. Thirteen sheep (three rams, eight ewes, two lambs) came from a nearby native Upper Yellowstone subpopulation (Cinnabar Mountain near Corwin Springs) while seven ewes were "nonnative" sheep transplanted from Thompson Falls, in northwest Montana.

Hunted bighorn sheep subpopulations are monitored annually by spring helicopter surveys, and the non-hunted Mill Creek sheep population is monitored by annual ground counts throughout the winter and early spring. From 1995 to 2008, the total number of sheep counted during helicopter surveys on small, scattered winter ranges in Hunting Districts 300, 303, 304, 305, and adjacent YNP has ranged from 134 to 353 (mean=204). The Mill Creek sheep subpopulation is surveyed several times from the ground between January and April on its winter range, and in the last six years, 13 to 27 sheep have been observed (mean=21 sheep).

From 1995 to 2008, recruitment for the hunted and YNP subpopulations has been relatively low, ranging from 7 to 34 lambs: 100 ewes (mean=24) with an observed ram

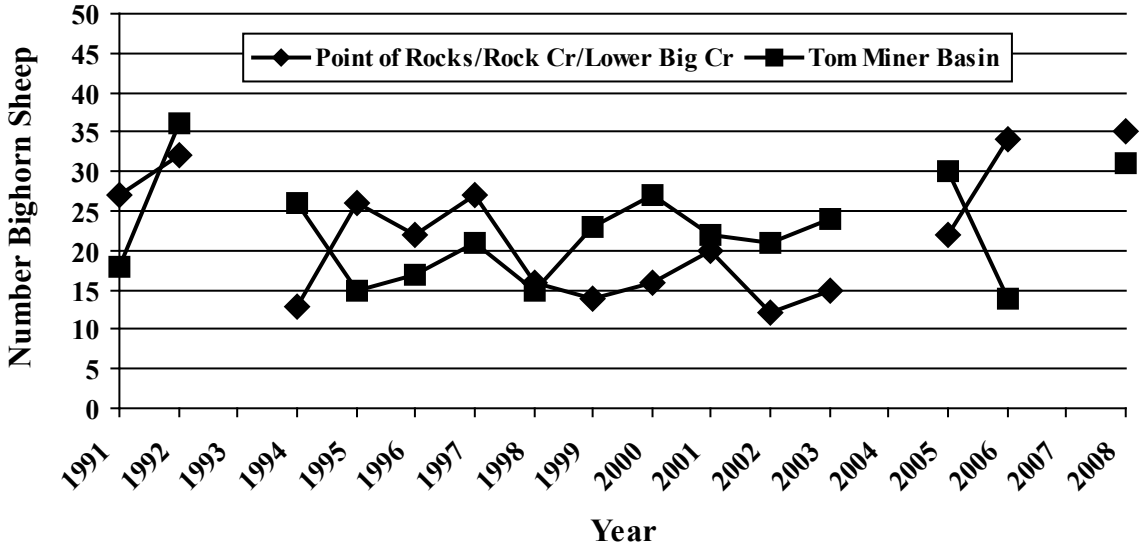


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in Hunting Districts 300 and 304, 1997-2008.

Table 1. Classification data from aerial surveys in the Tom Miner Basin population segment, Hunting District 300, 1991-2008.

Year	Total	Rams	Ewes	Lambs
1991	18	2	14	2
1992	36	13	18	5
1994	26	6	16	4
1995	15	3	10	2
1996	17	1	13	3
1997	21	2	9	0
1998	15	1	12	2
1999	23	2	14	7
2000	27	7	15	5
2001	22	7	12	4
2002	21	3	14	4
2003	24	9	12	3
2005	30	6	15	9
2006	14	1	9	4
2008	31	8	18	5

to ewe ratio of 44 to 86 rams: 100 ewes (mean=63). Recruitment in the small non-hunted subpopulation in Mill Creek, from 2002 to 2007, has ranged from 1 to 5 lambs per year (mean=2.7) produced by 5 to 8 ewes per year (mean=7.2). The number of rams observed in the Mill Creek subpopulation has ranged from 6 to 14 rams per year (mean=11).

Observations and harvest of marked Mill Creek sheep following the transplant indicates connectivity between Mill Creek sheep and bighorns in Hunting District 303, 15 to 20 miles to the south.

The movement of sheep across YNP boundaries complicates monitoring and setting harvest prescriptions. While it is clear that portions of some YNP subpopulations move into Hunting Districts 300, 303, and 305 during the hunting season and contribute to rams that are available to hunters, other YNP subpopulations may or may not be part of the "huntable" sheep population, or their movements may vary from year to year. Many of the scattered subpopulations are biologically/genetically connected, but their exposure to potential harvest is not clearly understood. It must be remembered that not all sheep surveyed between Point of Rocks and Soda Butte Creek are subject to hunting, and we do not know for sure which ones are. Because the "huntable" bighorn subpopulations are quite small (probably less than 50 sheep in each hunting district), management flexibility and harvest prescription options are limited. In general, sheep management has been and will probably continue to be conservative, with an allowable harvest of only a few adult rams each year. Unless population size and recruitment increase significantly, increasing harvest quotas and/or harvesting females in the Upper Yellowstone complex is unlikely.

Regarding the small non-hunted Mill Creek population, large fires of 2006 and 2007 converted 30,000+ acres of forest into much more open habitats, including high-elevation ridges and drainage divides. This natural habitat conversion may benefit bighorns and potentially support larger numbers in the future.

Wildlife diseases can have profound impacts on bighorn sheep populations, and in some places the occurrence of disease can periodically remove large numbers of sheep and influence population management decisions. In 1981-82, an epizootic event of chlamydial-caused infectious keratoconjunctivitis, or "pink-eye," killed hundreds of bighorn sheep (approximately 60% of an estimated 500 bighorns) in the Upper Yellowstone complex inside and along the northern border of YNP. Based on aerial surveys, bighorn sheep populations between Cinnabar Mountain (outside YNP) and Soda Butte Creek (inside YNP) have never recovered to population levels observed prior to the "pink-eye" die-off. In spring 2008, 287 sheep were observed in roughly the same area where 487 sheep were observed in spring 1981. The most recent count is 200, or 41% fewer sheep than the pre-die-off sheep count of 1981; however, it should be noted that bighorn numbers were at record high levels just prior to the die-off.

In recent history, there has been no evidence of an all-age pneumonia/lungworm complex bighorn sheep die-off in the Upper Yellowstone area. All-age pneumonia-related die-offs have occurred in several southwest Montana sheep populations in the last 20 years. There has, however, been some evidence of chronic "lamb pneumonia" mortality in bighorn sheep in the Gardiner Basin in the mid-to late 1990s to include finding dead lambs in late summer and

Year	Total	Rams	Ewes	Lambs
1991	27	12	11	4
1992	32	17	12	3
1994	13	9	4	0
1995	26	5	18	3
1996	22	7	12	3
1997	27	14	13	0
1998	16	8	7	1
1999	14	9	4	1
2000	16	10	4	2
2001	20	14	5	1
2002	12	12	0	0
2003	15	8	4	3
2005	22	14	6	2
2006	34	11	22	1
2008	35	12	17	6

Table 2. Classification data from aerial surveys in the Point of Rocks, Rock Creek, and Lower Big Creek population segments, Hunting Districts 300 and 304, 1991-2008.

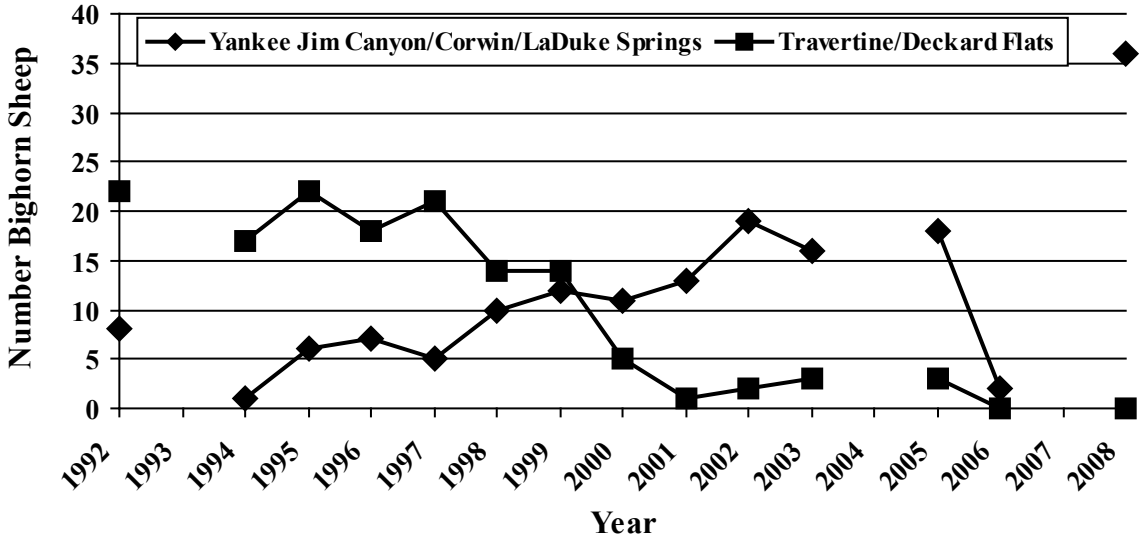


Figure 2. Total number of bighorn sheep observed during aerial trend surveys in Hunting District 303, 1992-2008.

Year	Total	Rams	Ewes	Lambs
1992	8	1	5	2
1994	1	0	1	0
1995	6	6	0	0
1996	7	4	2	1
1997	5	1	4	0
1998	10	0	8	2
1999	12	0	9	3
2000	11	0	11	0
2001	13	1	12	0
2002	19	0	14	5
2003	16	3	11	2
2005	18	3	11	4
2006	2	0	1	1
2008	36	8	23	5

Table 3. Classification data from aerial surveys in the Yankee Jim Canyon, Corwin, and LaDuke Springs population segments, Hunting District 303, 1992-2008.

Table 4. Classification data from aerial surveys in the Travertine and Deckard Flats population segments, Hunting District 303, 1992-2008.

Year	Total	Rams	Ewes	Lambs
1992	22	6	13	3
1994	17	1	15	1
1995	22	2	17	3
1996	18	1	13	4
1997	21	7	12	2
1998	14	7	7	0
1999	14	6	8	0
2000	5	4	1	0
2001	1	1	0	0
2002	2	0	2	0
2003	3	2	1	0
2005	3	3	0	0
2006	0	0	0	0
2008	0	0	0	0

Figure 3. Total number of bighorn sheep observed during aerial trend surveys in Hunting District 305, 1992-2008.

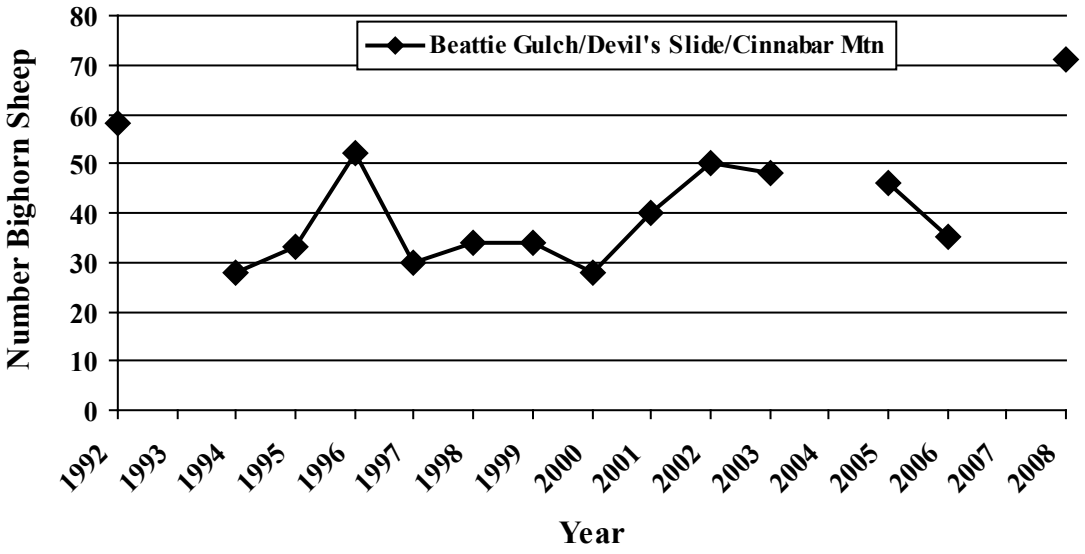


Table 5. Classification data from aerial surveys in the Beattie Gulch, Devil's Slide, and Cinnabar Mountain population segments, Hunting District 305, 1992-2008.

Year	Total	Rams	Ewes	Lambs
1992	58	25	24	9
1994	28	4	21	3
1995	33	11	19	3
1996	52	26	20	6
1997	30	12	16	2
1998	34	13	18	3
1999	34	12	16	6
2000	28	5	16	7
2001	40	12	22	6
2002	50	17	23	9
2003	48	17	25	6
2005	46	11	27	11
2006	35	11	19	5
2008	71	21	37	13

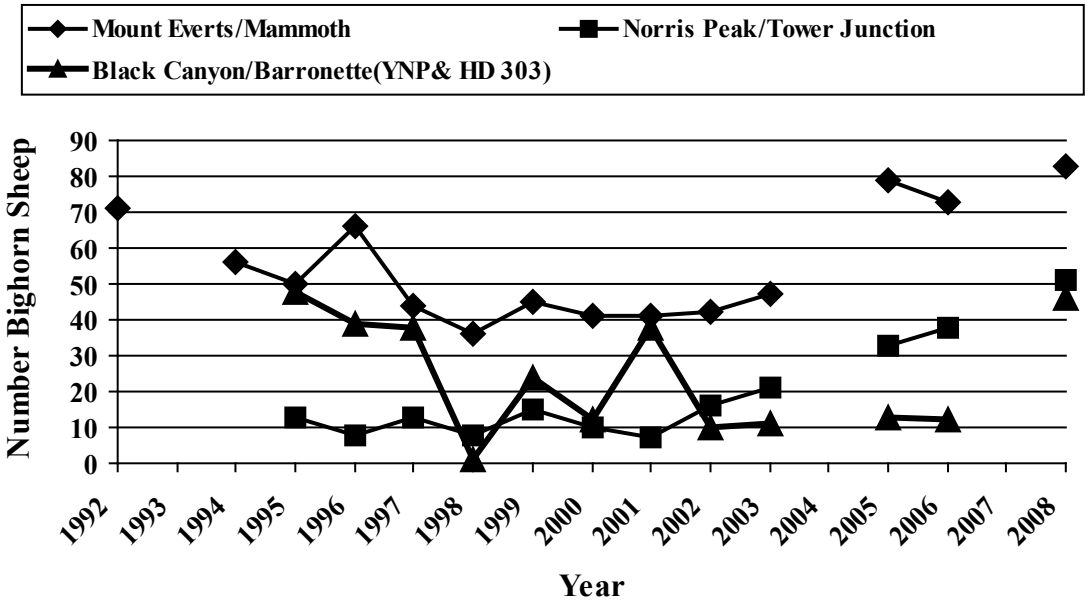


Figure 4. Total number of bighorn sheep observed during aerial trend surveys in Yellowstone National Park and portion of Hunting District 303, 1992-2008.

Year	Total	Rams	Ewes	Lambs
1992	71	30	34	7
1994	56	17	32	5
1995	50	23	21	6
1996	66	26	35	5
1997	44	26	17	1
1998	36	19	17	0
1999	45	16	23	6
2000	41	17	20	4
2001	41	16	25	0
2002	42	13	25	4
2003	47	13	25	9
2005	79	25	44	10
2006	73	24	43	6
2008	83	39	35	9

Table 6. Classification data from aerial surveys in the Mount Everts and Mammoth population segments, Yellowstone National Park, 1992-2008.

Year	Total	Rams	Ewes	Lambs
1995	48	18	24	6
1996	39	8	29	2
1997	38	22	14	2
1998	1	1	0	0
1999	24	10	11	3
2000	12	8	4	0
2001	38	2	26	9
2002	10	2	6	2
2003	11	2	7	2
2005	13	1	9	3
2006	12	6	5	1
2008	46	10	27	9

Table 7. Classification data from aerial surveys in the Black Canyon and Barronette population segments, Yellowstone National Park and Hunting District 303, 1995-2008.

Table 8. Classification data from aerial surveys in the Norris Peak and Tower Junction population segments, Yellowstone National Park, 1995-2008.

Year	Total	Rams	Ewes	Lambs
1995	13	8	3	2
1996	8	6	2	0
1997	13	5	8	0
1998	8	1	7	0
1999	15	6	6	3
2000	10	2	4	4
2001	7	4	1	2
2002	16	5	8	3
2003	21	12	5	4
2005	33	2	22	9
2006	38	1	25	12
2008	51	15	28	8

Figure 5. Total number of bighorn sheep observed during ground surveys in the non-hunted Mill Creek population, 2002-2007.

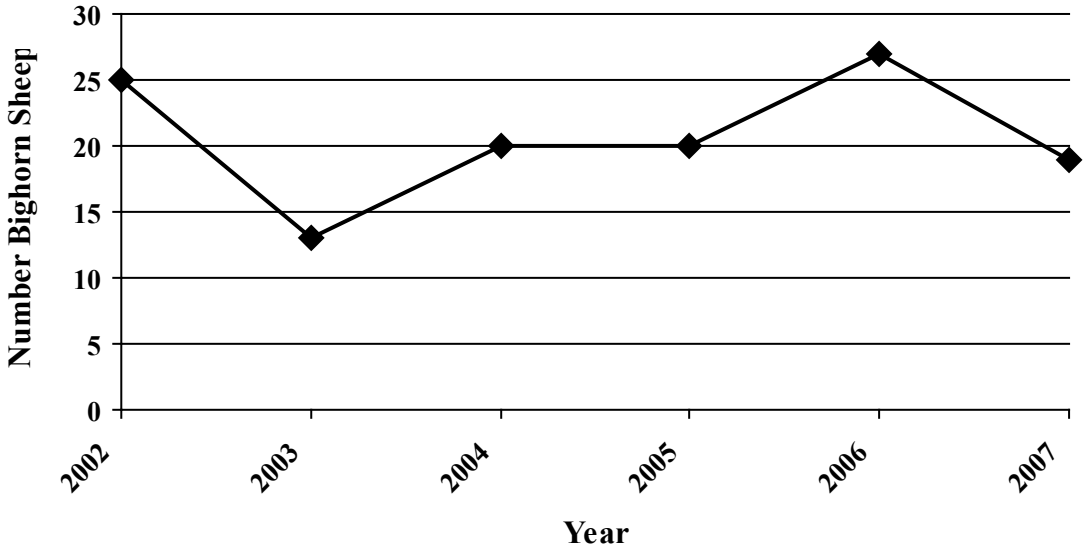


Table 9. Classification data from ground surveys in the non-hunted Mill Creek population segment, 2002-2007.

Year	Total	Rams	Ewes	Lambs
2002	25	14	7-8	3-4
2003	13	6	5	2
2004	20	12	6	2
2005	20	10	8	2
2006	27	14	8	5
2007	19	10	8	1

early fall and diagnosing pneumonia as a cause of death. Lamb recruitment from Soda Butte Creek to Point of Rocks between 1995 and 1998 was chronically low, ranging from 7 to 22 lambs: 100 ewes (mean=15 lambs: 100 ewes). Lamb recruitment in the last five years has been higher, ranging from 24 to 34 lambs: 100 ewes (mean=30 lambs: 100 ewes).

Recreation Provided: Bighorn sheep hunting occurs under two season types in the Upper Yellowstone bighorn sheep complex. Since 1978, sheep hunting in Hunting Districts 300 and 303 has occurred under some form of an unlimited access season. Over time the boundaries, harvest quotas, season dates, and season length have been adjusted, but the number of hunters has not been regulated. Since the late 1980s, season adjustments in Hunting District 300 creating an earlier, shorter season (September 1 to 10) and setting a quota of two adult rams were made to reduce the chance of over-harvesting rams. For a few years in the 1980s, a limited-draw sheep season offering two to five legal ram licenses occurred in both Hunting Districts 300 and 303 after the unlimited season (Tables 10 and 11). The unique unlimited access season type, which provides a sheep license to all hunters who apply, is currently offered in only five hunting districts in Montana (Hunting Districts 300, 303, 500, 501, and 502). Montana is the only state in the country to offer unlimited access sheep hunting. The odds of being selected to hunt in Hunting Districts 300 and 303 are 100%. Since 1978, 3,572 unlimited access sheep hunting licenses have been issued in Hunting Districts 300 and 303, contributing significantly to the statewide sheep hunting opportunity in Montana.

Hunting districts that have successfully maintained long-term unlimited sheep hunting seasons often share common characteristics: 1) populations are relatively small (often less than 75 to 100 sheep) with small numbers of legal rams, 2) the probability of finding and harvesting a legal ram is very low due to low numbers, reduced availability during the hunting season due to proximity to national park boundaries, short early season structure, conservative harvest quotas, small numbers of sheep dispersed over large, rugged areas, or a combination of factors, 3) the areas do not produce high-scoring trophy rams regardless of age, and 4) over time, hunter expectations have grown to match reality, i.e., hunters through research or personal experience know that the chances of harvesting or even seeing a legal ram are very small indeed (probably less than 5%). As a result of the challenges involved in the unlimited areas, the number of hunters is typically low; in 2007, 35 and 23 hunters applied for Hunting Districts 300 and 303, respectively.

Both Hunting Districts 304 and 305 have the traditional limited access sheep season, which in this case limits hunting opportunity to one hunter per year per hunting district and provides the opportunity to harvest one legal ram/year in each hunting district. Limited access sheep hunting began in Hunting District 304 in 1992 and in Hunting District 305 in 2001. Prior to 2001, Hunting District 305 was included within the boundaries of the unlimited access Hunting District 300 (see below). Hunting District 305 was created as the result of a public land purchase that made bighorn sheep easily accessible to hunters during the rut. The increased vulnerability of sheep to human harvest rendered the unlimited season regulation inappropriate for this area.

Hunters in Hunting Districts 304 and 305 are randomly selected from a pool of hunters who apply for a specific hunting district. Beginning in 2001, bighorn hunters may pay an additional $2.00 fee to accumulate bonus points that increase their chances of being selected. Each bonus point equates to one more chance of being drawn. Since limited sheep seasons began in Hunting District 304, 52 to 104 hunters per year (mean=72) have applied for one available license; in Hunting District 305, 63 to 94 hunters per year (mean=76) have applied for a single license (Tables 12 and 13). The odds of being selected to hunt have averaged 1.4% for Hunting District 304 and 1.3% for Hunting District 305. Since 1992, only 24 hunters have hunted sheep in Hunting District 304 and 305.

The objective of the 1985 Mill Creek sheep transplant was to reestablish a bighorn population in Mill Creek with hopes of providing public sheep viewing opportunities and possibly new hunting opportunities, if sheep numbers increased sufficiently. While the project has achieved its objective of reestablishing bighorns and providing public viewing opportunities, it has not met the original criteria for a sustainable sheep hunting season, which is an observable population of 100 sheep. Recent surveys are counting only a few more sheep now than were released into the area in 1985.

Current Annual Bighorn Sheep Harvest: Legally harvested sheep in Hunting Districts 300, 303, and 305 must meet Montana's "legal ram" ¾-curl definition. In Hunting District 304, hunters may legally harvest either-sex bighorn sheep. In reality, sheep hunters in Hunting District 304 harvest adult rams meeting the legal ram ¾-curl definition. In the last 30 years under the unlimited sheep seasons, 73 rams have been

Table 10. Number of licenses issued and legal ram quota and harvest, Hunting District 300, 1978-2007.

Year	Number Licenses	Legal Ram Quota	Legal Ram Harvest
1978	146	5	4
1979	154	5	2
1980[1]	126	6(5)	2(4)
1981[1]	206	5(3)	6(3)
1982	183	5	3
1983[1]	181	5(3)	6(2)
1984[1]	193	5(2)	3(2)
1985[1]	84	3(2)	3(2)
1986[1]	102	3(2)	3(2)
1987	83	3	3
1988	45	3	4
1989	78	3	5
1990	52	2	6
1991	48	0	2
1992	53	0	2
1993	71	0	4
1994	63	0	6
1995	41	0	0
1996	52	0	1
1997	61	0	0
1998	31	1	3
1999	43	2	0
2000	21	2	0
2001	24	2	0
2002	26	2	0
2003	40	2	1
2004	37	2	2
2005	30	2	1
2006	27	2	1
2007	35	2	0
Totals	2336		73(15)

[1] Indicates years in which there was a limited drawing sheep season following the unlimited access season in Hunting Districts 300 and 303; 2-5 limited drawing sheep licenses were issued each of these years. The additional limited licenses and harvest appears in ( ).

Year	Number Licenses	Legal Ram Quota	Legal Ram Harvest
1978	123	5	0
1979	131	5	2
1980[1]	65	5(5)	5(5)
1981[1]	120	3(2)	3(1)
1982	51	3	1
1983	34	2	1
1984	57	2	1
1985	41	2	2
1986[1]	34	2(2)	2(2)
1987	34	2	3
1988	19	2	1
1989	30	2	1
1990	23	2	0
1991	22	2	2
1992	36	2	2
1993	43	2	2
1994	25	2	1
1995	22	2	3
1996	27	2	2
1997	30	2	3
1998	33	2	1
1999	25	2	2
2000	35	2	1
2001	33	2	4
2002	39	2	1
2003	22	2	0
2004	23	2	0
2005	14	2	3
2006	22	2	3
2007	23	2	3
Totals	1236		55(8)

Table 11. Number of licenses issued and legal ram quota and harvest, Hunting District 303, 1978-2007.

[1] Indicates years in which there was a limited drawing sheep season following the unlimited access season in Hunting Districts 300 and 303; 2-5 limited drawing sheep licenses were issued each of these years. The additional limited licenses and harvest appears in ( ).

harvested in Hunting District 300 and 55 have been harvested in Hunting District 303 (Table 10 and 11). An additional 15 rams in Hunting District 300 and eight rams in Hunting District 303 were harvested under a limited access season in the 1980s. An average of 2.4 rams per year were harvested in Hunting District 300 and 1.8 rams per year were harvested in Hunting District 303 under unlimited seasons. With regard to harvest quotas, Hunting District 300 had designated harvest quotas of one to six rams for 23 out of 30 years and Hunting District 303 had quotas of two to five rams every year (Table/Figure 2). Harvest quotas in Hunting District 300 were exceeded six out of 23 years (26%) and seven out of 30 years (23%) in Hunting District 303. Since 1992, when limited access sheep hunting began in Hunting District 304, five rams have been harvested (mean=0.31 ram per year) (Table 12). Since 2000, seven rams have been harvested in Hunting District 305 (0.88 ram per year) (Table 13). One measure of long-term hunter success is the ratio (or percentage) of the number of sheep harvested verses the number of licenses issued over time. Hunter success in the unlimited sheep areas has been 3.1% in Hunting District 300 and 4.4% in Hunting District 303, while success rates in the limited draw areas has been 31.3% in Hunting District 304 and 87.5% in Hunting District 305.

Accomplishments: The following bighorn sheep–related projects have been accomplished in the Upper Yellowstone in recent years: 1) Removal of bighorn sheep from Corwin Springs Bison Quarantine Facility: In 2006 and 2007, FWP removed and released nearby approximately 10 bighorn sheep from inside the fenced Bison Quarantine Facility at Corwin Springs. For years sheep would move into and out of this fenced commercial elk farm owned by Welch Brogan. Sheep had access to the upper pasture where fencing intersected rocky cliffs. During the transition to a bison quarantine facility, the upper pasture has been re-fenced to eliminate bighorn sheep from entering the facility. 2) Domestic sheep allotment buyout/retirement: In 2005, the National Wildlife Federation, with support from FWP and other interest groups, was successful in negotiating a buyout and subsequent retirement of the 74,000-acre Ash Mountain and Iron Mountain Forest Service domestic sheep grazing allotment in the Absaroka-Beartooth Wilderness Area north of YNP. Retiring this grazing allotment has eliminated the potentially negative effects of domestic sheep on wildlife habitat and disease transmission to bighorn sheep. 3) Habitat management plan for privately owned sheep winter range: In 2005, FWP wrote a management plan to protect and enhance bighorn sheep winter range on a portion of the 360 Ranch at the mouth of Mill Creek. Recommendations to the owner included a deferred grazing system for 400 acres of lower pasture, eliminating all livestock grazing from high elevation slopes, and replacing old fencing with new "take down/fall down" fencing in areas of wildlife movement. 4) Lungworm medication project: In the winters of 2003 and 2004, FWP in cooperation with the GNF conducted a bighorn sheep lungworm medication project at 12 bait stations in the Gardiner Basin to help reduce lungworm levels in sheep, particularly lambs, to improve recruitment. Salt blocks and alfalfa-based pellets containing Fenbenazole (a medication used to kill lungworms) were provided to bighorn sheep for a period of several weeks. At least 30 to 40 sheep used the bait stations. During the first year, fecal analysis indicated the lungworm levels (shedding) were reduced in sheep at the bait stations. 5) Graduate student sheep studies; During the mid-to late 1990s, the Northern Yellowstone Cooperative Wildlife Working Group (NYCWWG) supported and funded two MSU masters thesis projects in the Upper Yellowstone that marked bighorn sheep with radio-telemetry collars. Graduate students studied sheep in the Mount Everts and Tom Miner/Point of Rocks area. Both studies contributed significantly to understanding local sheep movements and ecology.

Management Challenges: 1) Value and importance of maintaining a genetically "native" sheep population: To our knowledge, the Upper Yellowstone bighorn complex has not experienced all-age pneumonia/lungworm-related die-offs, which have occurred in other southwest Montana populations. Whether this is related to being a genetically "native" sheep population is unknown, but may be worthy of future consideration. Augmenting existing sheep populations through transplanting is a common management technique; however, there may be some risk of introducing sheep that are more susceptible to disease die-offs. In the Upper Yellowstone, a single transplant of seven ewes in 1985 from Thompson Falls is the only documented source of "nonnative" sheep into the area. Whether or not to introduce additional nonnative sheep is a management issue. 2) Difficulty in accurately surveying small populations on certain winter ranges. Some bighorn subpopulations are so small that they are difficult to consistently find and survey (e.g., Yankee Jim Canyon – LaDuke Hotsprings, Travertine – Deckard Flats, Black

Year	Number Licenses	Number of Applicants	Ram Harvest
1992	1	52	0
1993	1	56	0
1994	1	54	0
1995	1	63	0
1996	1	49	0
1997	1	65	0
1998	1	76	0
1999	1	69	1
2000	1	74	0
2001	1	79	0
2002	1	76	0
2003	1	74	1
2004	1	104	0
2005	1	97	1
2006	1	84	1
2007	1	83	1
Totals	16/1155		5

Table 12. Number of either-sex licenses issued and ram harvest, Hunting District 304, 1992-2007.

Year	Number Licenses Issued for Legal Ram	Number of Applicants	Ram Harvest
2000	1	67	1
2001	1	63	1
2002	1	72	0
2003	1	76	1
2004	1	85	1
2005	1	73	1
2006	1	79	1
2007	1	94	1
Totals	8/609		7

Table 13. Number of legal ram licenses issued and ram harvest, Hunting District 305, 2000-2007.

Canyon – Barronette Peak). Not finding even a small number of sheep can have a significant effect on survey results. The observability factor becomes a greater issue when sheep numbers are low. 3) Interpreting trends and changes in sheep numbers in certain subpopulations; It is challenging to accurately interpret survey results and it has been difficult to explain trends in some small subpopulations that have declined (e.g., Travertine – Deckard Flats; Hellroaring Slopes). FWP is concerned about declining numbers in these areas but are unsure if the sheep have experienced actual population declines or if they have dispersed to other areas. In some cases increased predator activity in an area (wolf dens) has been implicated, but with little real data. We have also noted that the timing of spring green-up, which triggers when we survey, is changing. Green-up conditions are occurring sooner, and we may need to adjust our survey accordingly to make sure we count sheep before they leave winter ranges (the 2007 survey was cancelled due to early green-up). 4) Maintaining the presence of all individual subpopulations. Biologically and genetically, it is important to maintain as many small subpopulations as possible, each having established its own unique seasonal home ranges and migration routes. If a subpopulation vanishes it may be extremely difficult to reestablish a group of sheep with similar migratory habits.

Population Monitoring: Currently, the hunted bighorn sheep subpopulations in Hunting Districts 300, 303, 304, and 305 and adjacent

YNP subpopulations are monitored by spring helicopter surveys, and the non-hunted Mill Creek sheep population is monitored by ground counts on its winter range. Systematic spring helicopter surveys began on a trial basis in a portion of Hunting District 300 in 1991. By 1995, the survey area was expanded to include all major sheep winter ranges in the Gardiner Basin and into YNP, from Mammoth Hot Springs to the Upper Lamar Valley. Monitoring bighorn sheep from Point of Rocks through the Gardiner Basin and into YNP is funded by the interagency NYCWWG. Cooperators include NPS, NF, FWP, and the USGS-Biological Resource Division. The Mill Creek sheep subpopulation is surveyed from the ground on its winter range several times between January and April. Fixed-wing surveys have been tried on the Mill Creek winter range, but due to the small number of sheep involved and the timbered habitat, aerial surveys were largely unsuccessful. Helicopter surveys would likely be more effective; however, the high cost of sampling a small number of sheep that are not hunted is a factor to consider.

Summary of Public Comment

Public comments related to the bighorn sheep population and its management in the Upper Yellowstone complex indicate strong continuing support for maintaining the unlimited access sheep hunting opportunity in Hunting Districts 300 and 303 and maintaining a limited access hunting opportunity in Hunting Districts 304 and 305. Both hunters and non-hunters enjoy seeing bighorn sheep in the Upper Yellowstone and support having healthy bighorn populations wherever they occur.

Management Goal

Manage for a healthy, sustainable, interconnected native bighorn sheep population composed of several small subpopulations in the Upper Yellowstone complex. Strive to preserve the unique unlimited access sheep hunting opportunity in Hunting Districts 300 and 303 and the conservative limited access hunting opportunity in Hunting Districts 304 and 305. Recognize and maintain the opportunity to readily view bighorn sheep in the Upper Yellowstone drainage both outside and inside YNP.

Habitat Objectives

1) Encourage maintenance and improvement of habitat conditions on publicly owned (USFS, YNP) bighorn sheep summer and winter ranges so that these habitats provide adequate forage for bighorns and other wildlife.

2) As opportunities arise, develop cooperative programs or provide technical advice that encourages private land managers to protect or enhance bighorn sheep habitats found within their ownership.

3) When and where appropriate (road development, rural subdivision planning), emphasize the negative effects of habitat fragmentation on bighorn sheep and other wildlife and provide guidance on important areas that should be maintained intact if possible.

Habitat Management Strategies

1) Comment on USFS, BLM, DNRC and NPS projects that could potentially affect wildlife habitats that include bighorn sheep. Through this process we can positively influence a wide variety of activities (grazing, burning, logging, road building) in terms of maintaining or enhancing habitat for wildlife including bighorn sheep.

2) Acquire or protect bighorn sheep habitat through involvement with other agencies and nongovernment organizations in public and private land exchanges, acquisitions and conservation easements.

3) Continue to participate in and support long-term noxious weed control on public and private lands, particularly as they apply to bighorn sheep winter range areas.

Game Damage Strategies

Bighorn sheep–related game damage problems and conflicts with livestock have not occurred in the Upper Yellowstone and are not currently anticipated to occur. Sheep numbers on private land are small enough not to create concerns from livestock producers at this time.

Access Strategies

FWP identified the area between Big Creek and West Pine Creek in the Gallatin Range as an area where improved access to the Gallatin NF is desirable for improving hunter access and increasing wildlife harvest, to include improved foot and horseback access to bighorn sheep in Hunting District 304. This access need has been discussed for several years with the Gallatin NF and public land access groups, and appears in

the Statewide Elk Plan and other documents. The Gallatin NF succeeded in securing a new access point in north Dry Creek as the result of a 1999 land trade/purchase.

Population Objectives

Population objectives in the Upper Yellowstone complex are strongly influenced by the small size and dispersed nature of several individual interconnected bighorn sheep subpopulations. The current population size and distribution are likely due to limited habitat availability, rigorous environmental factors, a predator-rich environment, and regional isolation from other sheep populations. Most subpopulations exist within a small population range of less than 15 to 40 sheep and appear to be regulated by natural factors other than human harvest. Given that sheep hunting seasons have been conservative for the past 30 years and populations remain relatively small and stable, FWP population objectives are:

1) Maintain a total observed Upper Yellowstone bighorn sheep population at or above recent survey counts of 200 to 230 sheep.
2) Maintain the presence of all individual bighorn subpopulations that currently exist in the Upper Yellowstone complex.

3) Support enough sheep (at current or higher levels) in the hunted subpopulations to maintain unlimited access hunting seasons in Hunting Districts 300 and 303 and the conservative limited access hunting seasons in Hunting Districts 304 and 305.

4) Reevaluate the status of the small non-hunted Mill Creek sheep population in light of major fire-induced habitat changes in Mill Creek. Explore the potential for expanding the size of this subpopulation.

Population Management Strategies

Currently, Upper Yellowstone sheep are managed conservatively through the use of specialized unlimited access and limited access hunting seasons. The harvest of sheep during unlimited seasons is regulated by a shorter season length, an early season that ends prior to the rut, and a mandatory 48-hour harvest reporting requirement combined with a low harvest quota of two legal rams. The harvest in the Upper Yellowstone limited access hunting district is as conservative as it can be with only one license for one legal ram per year. The key to accurately monitoring population size, composition, and trend of individual subpopulations is to continue with consistent annual aerial and ground surveys and improve and expand surveys when possible.

Prescriptive Harvest Management

When possible, FWP management direction for many big game species, including bighorn sheep, is shifting toward a modified Adaptive Harvest Management (AHM) approach. In general this approach provides suggested changes in regulation types, or "prescriptions," based on specific numeric "triggers" related to an observed range in total survey counts, sex ratios, recruitment rates or a combination of these factors. In some cases, time-related criteria are also added; e.g., a certain population range must be observed for two or more years, etc. The various prescription types are often referred to as "restrictive, standard, or liberal" regulation types or packages.

There are several advantages to the AHM approach including increased consistency in management decisions and regulation types, greater accountability and predictability in hunting season changes, increased efforts to systematically collect accurate survey data, and new opportunities to test the effectiveness of different regulations and to make corrective changes. The feasibility of the AHM approach as it applies to bighorn sheep, however, may depend on the size of individual populations and the ability to accurately collect survey data on them. When individual subpopulation counts are less than 50 animals (Hunting Districts 300, 303, 304, and 305) and recruitment may be less than five to ten lambs per year in each area, the range of management options and hunting prescriptions become limited; i.e., there are few opportunities for more liberal prescriptions (increasing the adult ram harvest, harvesting ewes, harvesting yearling rams) for such small populations. Based on the history of these populations, it appears unrealistic to significantly increase their numbers through changes in adult ram-only hunting seasons that are already conservative. In the Upper Yellowstone complex, the general management direction may of necessity be conservative, allowing a harvesting of one to two adult legal rams out of each hunting district, and recognizing that in some years no rams will be harvested in some areas. Until huntable subpopulations increase, there appears little opportunity for more liberal management.

SPANISH PEAKS
(Hunting District 301)

Description: Hunting District 301 lies about 20 miles southwest of Bozeman. The core of the occupied bighorn habitat lies within an established wilderness area managed by the U.S. Forest Service (USFS). Other communities that serve this area include Ennis and Big Sky.

The Spanish Peaks hunting district includes about 676mi^2. About 65% is public land administered by the Gallatin and Beaverhead-Deerlodge National Forests. Additional public lands include the 9,000-acre Bear Trap Canyon Unit managed by the Bureau of Land Management (BLM), about 9,000 acres of state lands managed by the Department of Natural Resources and Conservation (DNRC), and about 3,200 acres managed by FWP. The remaining 30% of landownership in this hunting district is private. The majority of the USFS lands in this hunting district are within the Lee Metcalf Wilderness Area.

The core summer range for these sheep occurs within the 76,000-acre Spanish Peaks Unit of the Lee Metcalf Wilderness Area. The primary winter range occurs adjacent to the Gallatin River between the Big Sky Spur Road and Burnt Creek in the Gallatin Canyon. The primary forage on this winter range includes native bunchgrasses like bluebunch wheatgrass and Idaho fescue.

There are valid reports of bighorns along the Madison River within the Bear Trap Canyon Unit of the Lee Metcalf Wilderness. These reports occur during the spring and summer months. The reports verify bighorn occurrence in groups of two to six sheep.

Habitat within this hunting district ranges from above-timberline, cushion plant communities occurring above 11,000 feet, to mahogany and bitterbrush communities occurring along the Madison within the Bear Trap Canyon Unit below 4,800 feet.

Of the 676mi^2 within the hunting district, about 20% is actually occupied by bighorns. About 85% of the occupied bighorn habitat is public land. Small portions of the winter range, especially along the Gallatin Canyon, are privately owned. Most of these private lands have residential development. Other notable developments within this hunting district include Big Sky and Moonlight Basin Resorts. These resorts not only offer residential development, but also attract thousands of summer tourists and winter skiers. These developments have a direct impact on bighorn winter range along the Gallatin and West Gallatin Rivers and increase traffic along U.S. MT Highway 191. Vehicle collisions are a significant source of mortality for this sheep herd with an average of 8 to 12 sheep annually being hit along this stretch of U.S. MT Highway 191.

Public Access: The Spanish Peaks area provides an excellent diversity of hunting opportunities. Hunters are required to access most of the area primarily by foot or horseback. Access to the public lands is reasonable and limited only by mode of travel, with numerous trailheads located around the periphery of the hunting district. There is also some access to public lands available from public roadways. Access to the private lands is very restricted, although most of the sheep hunting opportunity occurs on public lands. The forest travel plan emphasizes nonmotorized travel through most of this hunting district. The same is true for the BLM-managed lands in the Bear Trap Canyon Unit.

Bighorn Sheep Populations: The number of bighorn sheep observed in this hunting district has been increasing over the past eight years (Figure 1 and Table 1). Successive years of poor lamb survival caused FWP to close this area to sheep hunting in 2001. At that time about 50 sheep survived in this hunting district. As of spring 2008, FWP observed 158 sheep on the winter range during the annual spring aerial survey.

This population is a native sheep herd. The only augmentation attempts on record occurred in 1944, 1947 and 1963. Two rams from the Kootenai Falls herd (Ural Tweed) were released in 1944, two rams from the Sun River herd were transported and released in 1947 and 6 rams from the National Bison Range were released in 1963. Interestingly, this herd has not experienced an all-age die-off common to other sheep herds in Montana.

Observing rams during the spring aerial surveys have always been a challenge. The rams often dispersed off of the winter ranges before the flight took place and were difficult to find. As a result, FWP began flying a rut survey in December 2006 (Table 2). Rams in this area are far more visible during this time of year compared to the spring flight window.

The 2008 spring aerial survey observed the highest total of bighorns since 1980. This count

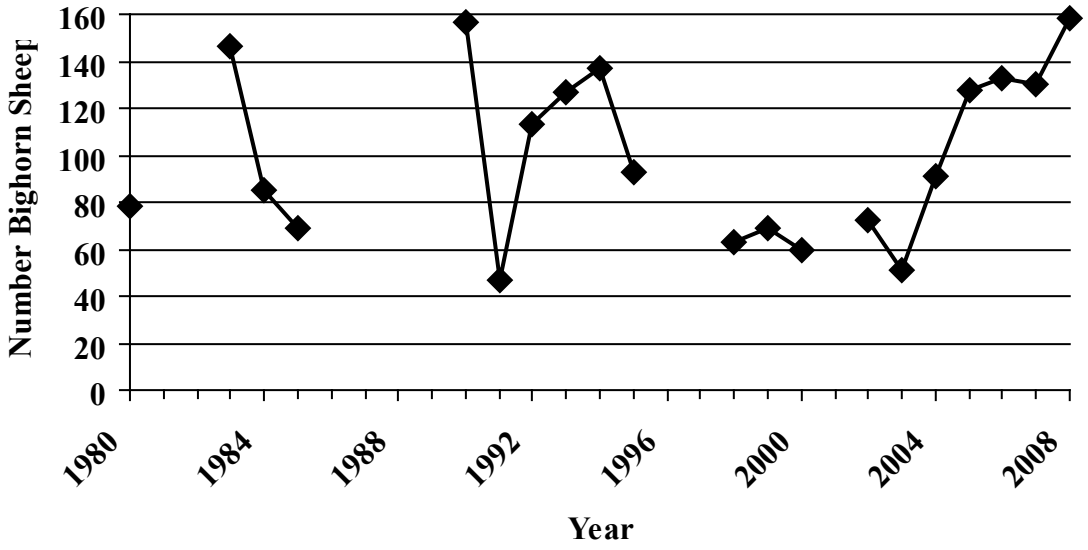


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Spanish Peaks population, Hunting District 301, 1980-2008.

Year	Total	Rams	Ewes	Lambs	Lambs/100 Ewes	Rams/100 Ewes
1980	78					
1983	146	20	73	43	58	27
1984	85	9	60	16	27	15
1985	69					
1990	157					
1991	47					
1992	113					
1993	127 (103 class.)	20	57	26	46	35
1994	137	21	106	10	9	20
1995	93 (51 class.)	18	20	13	65	90
1998	63	9	53	1	17	2
1999	69					
2000	60	13	32	15	47	41
2002	72			13		
2003	51	3	37	11	29	8
2004	91	14	65	12	18	22
2005	128	17	77	34	44	22
2006	133	12	93	28	30	13
2007	130	0	97	33	34	0
2008	158					

Table 1. Classification data from spring aerial surveys for the Spanish Peaks population, Hunting District 301, 1980-2008.

Year	Total	Ewes	Lambs	Rams	¼	½	¾	¾-full	Lambs /100 Ewes	Rams/100 Ewes
2006	145	80	33	32	5	10	3	14	41	41
2007	155	66	46	40	7	9	8	14	70	60

Table 2. Classification data from aerial surveys conducted during the rut for the Spanish Peaks population, Hunting District 301, 2006-2007.

occurred following severe winter conditions throughout the upper Gallatin winter ranges. Presently, rams make up about 25% of the sheep population in the Spanish Peaks.

The Spanish Peaks herd has not been used as a source for capturing and relocating sheep. Typically, this herd has not grown to a level that would support such an effort. However, with it's low parasite loading and relative resistance to disease-induced die-offs, the Spanish Peaks herd would be a healthy candidate for consideration in future capture operations. The fact that many of the sheep winter within the wilderness boundary may prove problematic for helicopter darting or net-gun operations.

Recreation Provided: Since 1977, FWP managed the sheep hunting in this area as an unlimited district for bighorn sheep. This season type meant any applicant who applied for this hunting district was granted a permit to hunt for a "legal" ram. Although the hunting district boundaries changed in 1977 and 1978, Hunting District 301 became the most popular unlimited area to hunt bighorn sheep. The average number of licenses issued between 1978 and 1990 was 144; from 1991 to 1997, hunter numbers averaged 136. The range of hunters applying for licenses over that period of time was 94 to 235. The unlimited sheep season went through a series of season structure changes during this time. Originally, this season type opened in early September and remained open until a quota was reached. The quota fluctuated over the years from four to six legal rams. There was a 48-hour notice on the season closure. In 1991, the season changed to a six-day season with no quota. In 1999, there was an attempt to limit the number of sheep licenses available for Hunting District 301 to 90 licenses. The FWP Commission chose not to approve this proposal. The average harvest from 1978 to 1997 was seven legal rams. The average success rate over that same time period was about 8%. As mentioned previously, the unlimited hunting season for bighorns in Hunting District 301 was closed in 2001. The hunting season for Hunting District 301 reopened in the fall of 2008 with a limited-entry structure and five any-ram licenses were issued.

Current Annual Bighorn Sheep Harvest: The legal hunting season for bighorn sheep closed in this area in 2001. The sheep hunting season reopened in the fall of 2008 with five any-ram licenses. This area is not known for producing rams that score over 180 Boone and Crockett points.

Accomplishments: This sheep herd has fully recovered from a population low of about 50 sheep in 2000. The herd is a well established, native population that occupies most of its suitable habitat within the hunting district.

Management Challenges:

1) Attempting to minimize mortality from vehicle collisions along U.S. Highway 191 and the Big Sky Spur Road is an ongoing challenge. The traffic pattern will only intensify as the large resort areas near the Gallatin Canyon continue to build out. Sheep are attracted to the salt used in sanding the highways during the winter months.

2) Continued loss of habitat due to residential and resort development.

3) Maintaining this sheep herd within the habitat's ability to support it. The winter range portions of this hunting district are confined to the Gallatin Canyon. This area experiences severe winter weather. There is the potential for this sheep population to increase beyond the winter range's ability to support it under severe winter conditions. Long-term survey records indicate this population has no history of ewe hunting, nor any capture and relocation efforts. Both of these elements might be helpful in managing this population in the future.

4) Some of the highest quality sheep habitat is essentially unoccupied. The Bear Trap Canyon Unit of the Lee Metcalf Wilderness Area provides excellent sheep habitat although it is considered disconnected from the currently occupied sheep habitat within the hunting district. However, the Montana State University's "Red Bluff Ranch" is located within four miles of this wilderness area unit. Red Bluff has domestic sheep on its pastures during the spring, summer, and fall months. Unless some agreement could be worked out with the Red Bluff Ranch managers, having wild sheep in the Bear Trap area is not advisable.

5) Minimizing stress and disturbance to sheep from users of public lands during the summer and winter months. The increasing population of residents and visitors to Gallatin County has increased the number of people using the public land backcountry and winter ranges in and around the Gallatin Canyon.

Population Monitoring: This population is monitored annually through helicopter surveys during spring green-up and a late rut survey flown immediately after the general big game season ends. Sheep are classified on both surveys according to sex and horn class in the case of rams. Lambs are classified during these surveys as well.

Summary of Public Comment

Public comments reflect the desire to have a healthy, vibrant bighorn sheep herd in the Spanish Peaks. Public support for hunting these sheep is significant. There is divided support for bringing back the unlimited style hunting season compared to the basic limited permit season structure. Region 3 would like to pursue discussions regarding a third season type that would meet the desires of the unlimited-style hunting season yet protect: 1) the sheep from overharvest of rams, 2) the sensitive nature of the high-elevation plant communities where hunters camp during the hunting season within the Spanish Peaks Wilderness Area, and 3) the quality of hunt and hunting experience.

Management Goal

Continue to manage this sheep herd as a healthy, productive population that exhibits reasonable lamb survival and age diversity in rams. There is very little opportunity to increase sheep numbers in this district. The Bear Trap Canyon Unit offers significant opportunity for additional bighorn sheep in this area; however, there are numerous domestic sheep that occupy adjacent ranch lands. Continue to manage for a high-quality sheep hunting opportunity for hunters.

Habitat Objectives

1) Create partnership opportunities with public and private land managers to protect and preserve habitat presently occupied by bighorn sheep and other wildlife species in this area.

2) Encourage creative and progressive habitat improvement projects, particularly fire management on publicly owned winter ranges.

3) Encourage preservation and improvement of publicly owned bighorn sheep habitat to minimize the dependence on privately owned winter ranges in this area.

4) Encourage and cost-share wildlife-friendly fencing projects in this area.

Habitat Management Strategies

1) The majority of the occupied sheep range in this area is protected under a wilderness designation. Therefore, it is critical to work with the USFS to help manage and protect this area in its wilderness state.

2) Pursue conservation easements and other protective ventures with private landowners along the Gallatin Canyon to protect critical winter ranges for bighorn sheep and other wildlife in this area.

3) Work closely with Montana Department of Transportation regarding any highway improvements and construction along U.S. Highway 191 and occupied bighorn sheep range.

4) Continue to work with and consult with the USFS on fire management proposals for improving and increasing the amount of effective winter range in the Gallatin Canyon. The USFS has had a fairly active fire management plan in place within this sheep herd's winter and spring ranges. The primary goal of these prescribed burns is to lessen the fuel loading and assist in developing buffer zones that would help protect private residences in the area. These burns have been fairly effective at removing some of the conifer encroachment.

Game Damage Strategies

Game damage issues are nonexistent in this area. If they do arise, FWP will follow game damage policies now in place. In addition, FWP can use the legal hunting season to assist in population control by issuing ewe permits or scheduling a trapping and transplanting operation.

Access Strategies

Access is not a limiting factor regarding hunter opportunity in this area. FWP will remain vigilant in supporting current access opportunities for hunting and wildlife viewing.

Population Objectives

1) Maintain the number of bighorn sheep observed during late rut and green-up aerial surveys within 20% of 150 (120 to 180) sheep observed on the winter range.

2)Maintain a ram: 100 ewe ratio observed during late rut surveys of at least 50 rams: 100 ewes with a minimum of 40% of these rams being ¾-curl or larger.

Population Management Strategies

Bighorn numbers are currently being managed through hunter harvests of ewes and rams and through capture and removal projects. The population objective of 150 (± 20%) observed bighorn sheep was derived by considering: 1) the ability of public and private lands to provide forage for the wintering bighorn population, 2) conflicts with residential developments, 3) vehicular/bighorn collisions, and 4) the understanding that catastrophic disease-caused die-offs, exhibited in many other sheep populations, are often density dependent occurrences.

Ewes have not been harvested in this district in the past. In the advent that it may be desirable to harvest ewes in the future either for population management or recreational opportunity, the process has been developed to provide for ewe harvest. Additionally, if the population was sufficient and a potential transplant site existed, translocation of bighorns from this population is also an option.

The hunting season for Hunting District 301 reopened in the fall of 2008 with a limited-entry structure and five-any ram licenses issued. The season structure for the 2009 season will be the same. For the 2010 season, the potential for a new season type that will provide for additional hunter opportunity will be explored during FWP's biennial season setting process, which will begin in December of 2009. The current season structure for rams is depicted below.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed in many hunting districts through limited-entry harvest of the female segment. In Hunting District 301, licenses could be issued under the following prescriptions (Table 3):

Standard Regulation: A limited number of adult ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 20% of the population objective and lamb recruitment is above 35 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 20% below the population objective and lamb recruitment is less than 35 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

Table 3. Summary of regulation types under different population criteria for ewe harvest and population management.

SOUTHERN MOUNTAINS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation_	± 20% of 150	Above 35	Limited Entry Adult Ewes	Up to 20% of Ewes
Restrictive Regulation	More than 20% below 150	Less than 35	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Greater than 20% above 150	Greater than 40	Limited Entry Ewes **OR** translocate if > 25 sheep including rams are available	More than 20% of Ewes

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 20% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry any-ram licenses with the number of licenses issued being up to 35% of the ¾-curl rams in the population.

The Standard Regulation will be recommended if: The population is within objective (+ 20% of 150), there are more than 50 rams: 100 ewes, and 35% of the rams are at least ¾-curl (Table 4).

SOUTHERN MOUNTAINS	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of Rams with ≥ ¾-curl
Standard Regulation	Up to 35% of the ¾-curl rams	± 20% of 150	>50	≥ 35
Restrictive Regulation	Up to 20% of the ¾-curl rams	More than 20% below 150	< 50	< 35

Table 4. Summary of potential ram harvest under different population parameters and criteria.

Restrictive Regulation: Limited-entry any-ram licenses with the number issued being up to 20% of the ¾-curl rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 20% below the population objective of 150, there are less than 50 rams: 100 ewes, and less than 35% of the rams are at least ¾-curl.

HILGARDS
(Hunting District 302)

Description: The Hilgard bighorn sheep hunting district is located about 40 miles south of Bozeman. The hunting district is approximately 557mi² and is bordered by U.S. Highways 191 and 287 on the east and west respectively. The Montana-Idaho border is on the south end of the district, and the Taylor Fork and Indian Creek drainages are to the north. Out of the 557mi², 88mi² involve private lands, 3mi² are managed by the Bureau of Land Management (BLM), 4.5mi² are state lands (of which 1.5mi² are managed by FWP as a portion of the Gallatin Wildlife Management Area [WMA]) and the remaining 461mi² are U.S. Forest Service (USFS) lands.

A significant portion of this district is part of the Taylor Hilgard and Monument Mountain Units of the Lee Metcalf Wilderness Area. Additionally, the Cabin Creek WMA makes up a portion of the public lands within the hunting district. The Beaverhead-Deerlodge and Gallatin National Forests manage these USFS lands.

The primary summer range for these sheep occurs along the higher elevations of the Madison Range and the Cabin Creek WMA. Portions of the upper reaches of tributaries to Taylor Fork also summer small numbers of sheep. The core winter range occurs along the Madison River and the foothills of the Madison Range between Quake Lake and Wolf Creek.

Much of the winter activity is centered along the windswept slopes near Moose and Squaw Creeks and the private/public land complex above U.S. Highway 287 between the Madison Slide and Deadman Creek. Most of the winter range is comprised of native sagebrush and bunchgrass vegetation types interspersed with mesic aspen sites and Douglas fir and lodgepole pine overstory. This winter range is an uncommonly severe site for bighorn sheep. Except for the higher windswept slopes along Moose and Squaw Creeks, much of this area is a deep-snow environment. The windswept areas are relatively small and only have forage capacity to winter small (less than 30 sheep) groups of bighorns. The winter range along U.S. Highway 287 winters about 70 to 100 sheep. However, these sheep become highly vulnerable to severe winters when much of the forage in this area becomes buried in two to four feet of snow into the spring months. In the Henry's Mountains portion of this hunting district, there are few sheep. Attempts to survey them during other flights resulted in no observations. However, snowmobilers using the high-elevation plateaus during the winter months in the

Lionhead Mountain vicinity have observed bighorns wintering in the area.

Approximately 50% of this hunting district is actually occupied by bighorns. Roughly 80% of the occupied habitat occurs on public lands. Key portions of the winter range are privately owned. The winter range that occurs in the Moose/Squaw Creek area is split between the USFS and the Sun Ranch. The Sun Ranch property is under a conservation easement. The private lands near the Madison Slide have minimal residential development. A portion of this winter range occurs on the Oliffe Ranch. This property is also protected under the terms of a conservation easement. Presently, there are no conservation easements on the remaining private lands that include bighorn winter range.

Increasing traffic along U.S. Highway 287 is directly related to the increasing populations of Big Sky, Ennis, and West Yellowstone. Also, increasing numbers of residents and visitors are using U.S. Highway 287, especially during winter and spring months, as an avenue for wildlife viewing. Much of the most critical winter range in this hunting district occurs adjacent to this highway. Sheep/vehicle collisions are common during the winter and spring and have a direct impact on the herd's overall population.

Public Access: Much of the core summer and early fall sheep range is accessible from public lands in the Taylor Fork and Cabin Creek areas. Also, there are public trailheads at Papoose Creek and Indian Creek on the west side of the hunting district, although these access points are indirect ways of accessing the key summer range areas. Most of the habitat sheep occupy during the fall and winter months is bordered at lower elevations by private land. Presently, the Oliffe Ranch is enrolled in FWP's Block Management Program, which provides hunter access to this area. The other private lands are more difficult to find access to the adjoining public lands.

Bighorn Sheep Populations: The number of bighorns observed in this area has been increasing over the past eight years (Figure 1 and Table 1). In 1996-97, a die-off attributed to an outbreak of lungworm/pneumonia caused FWP to close the hunting season in this district.

This hunting district was originally part of Hunting District 301. In 1978, the Taylor Hilgards portion was divided into a separate district (Hunting District 302) and managed as an unlimited hunting district. This hunting district was closed to hunting in 1987 following an all-age die-off. It was reopened in 1991 as a limited-entry area, and then closed again in 1997 following another all-age die-off. Originally a native population, supplemental transplants into this area began in 1988 with 19 sheep from Thompson Falls, in 1989 with 5 sheep from Thompson Falls, in 1989 with 19 sheep from Lost Creek and in 1993 with 26 sheep from Wildhorse Island. Over that time, a total of 69 sheep were captured in FWP Regions 1 and 2 and relocated to the Taylor Hilgards and Henry's Mountains. The Henry's Mountains sheep suffered from a similar all-age die-off in 1996-97. This population is at very low numbers and probably will not recover to any viable numbers without assistance from FWP.

Presently, there are about 105 sheep in this hunting district. Twenty-seven sheep were observed in the Squaw/Moose Creek areas during a 2008 elk survey of Hunting Districts 360 and 362. An additional 79 sheep were observed through ground surveys in the Slide Inn vicinity during the winter of 2008. It is highly doubtful that sheep from these two population segments have much interchange while on winter ranges. These two wintering areas are fairly distinct and isolated by severe winter conditions and snow depths. Population figures and survey data for this area are incomplete and will require additional efforts in the future.

Recreation Provided: Hunting for bighorns in Hunting District 302 is presently closed, but the population has reached the 100 sheep population goal to trigger FWP to propose limited hunting as early as 2010.

Previous to 1978, FWP managed this area as part of Hunting District 301, which had an unlimited hunting regulation at that time. From 1978 to 1986, this area was removed from Hunting District 301 and given a new hunting district designation as Hunting District 302. The area remained an unlimited hunting district until 1987. FWP closed the hunting district from 1987 to 1990 following an all-age die-off, then reopened the hunting district to limited-entry sheep hunting in 1991. FWP closed the hunting district again in 1997 after a second all-age die-off. It has been closed since that time. The last year of legal hunting occurred in 1996 when four either-sex licenses were valid for this hunting district. Hunters harvested four rams with an average days per harvest of 13.

Region 3 would like to propose the reopening of a hunting season for bighorn sheep in Hunting District 302. The proposal might follow very similar protocol as compared with Hunting District 301: calling for an initial limited-entry style season with some energy spent on looking toward creating a new season

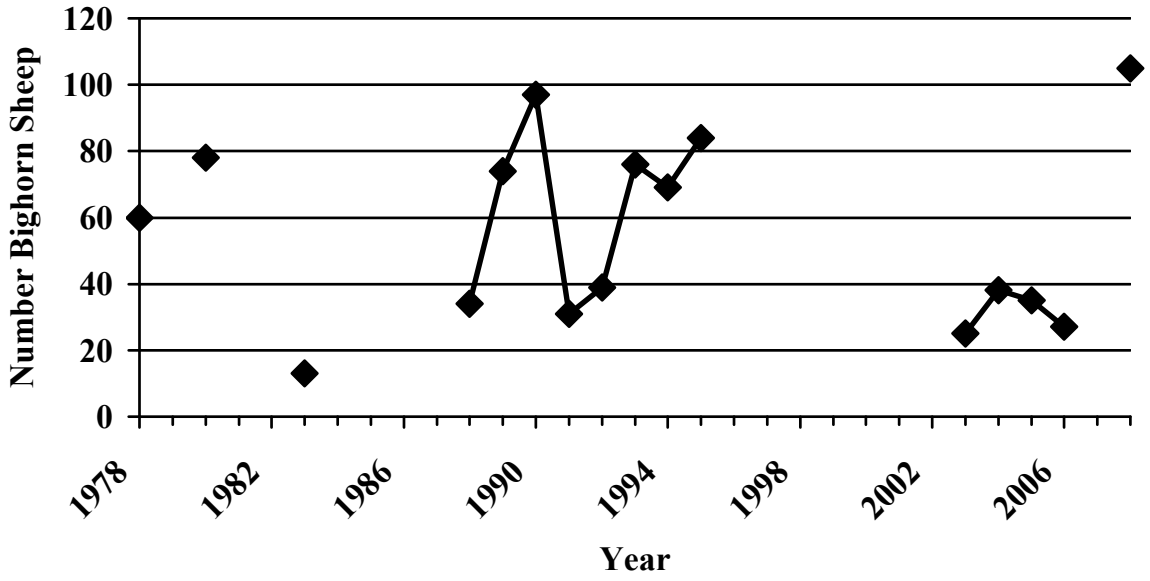


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Hilgards population, Hunting District 302, 1978-2008.

Year	Total	Total Classified	Rams	Ewes	Lambs	Lambs/100 Ewes	Rams/100 Ewes
1978	>60						
1980	78						
1983	13						
1988	34	34	5	13	8	61	38
1989	74	74	16	44	13	29	36
1990	97	97	27	47	23	49	55
1991	31	31	5	18	8	44	28
1992	39	39	12	19	9	47	63
1993	76						
1994	69		12				
1995	84	66	26	25	15	60	104
2003	25	25	12	12	1	8	100
2004	38	38	6	25	7	28	24
2005	35	35	1	34	0	0	3
2006	27	27	13	8	6	75	162
2008	105	105	34	49	22	45	69

Table 1. Classification data from aerial surveys for the Hilgards population, Hunting District 302, 1978-2008.

type that meets the desires of the unlimited-style hunting community.

In addition to hunting, the sheep in this area are highly visible to the general public during the winter and spring months. Wildlife viewing is a very popular pastime for area residents and tourists. This winter range is located along popular commercial wildlife viewing and birding routes.

Current Annual Bighorn Sheep Harvest: This hunting district is presently closed to legal hunting for bighorn sheep.

Accomplishments: This herd has slowly recovered from successive die-offs in the late 1980s and 1990s. It has most recently recovered from a population low of less than 30 sheep to its current population of 105 sheep observed on the winter ranges in 2008. This sheep herd was the subject of two master's degree projects during the mid-1990s.

Management Challenges:

1) Coordinating the management of associated big game species, particularly elk and mountain goats. This sheep herd winters in direct competition with an unusually large number of elk, in addition to mountain goats and mule deer. With winter conditions being fairly severe on bighorn winter range, managing the number of sheep in regard

to the immediate competition from other ungulates is a major challenge.

2) Minimizing mortality from vehicle collisions along U.S. Highway 287.

3) Protecting and conserving private portions of winter range along U.S. Highway 287.

4) Maintaining this sheep herd within the habitat's ability to support it. These sheep winter on a fairly confined winter range. Two major population die-offs occurred when the population approached 100 sheep. The high population combined with severe winter conditions, high numbers of other ungulates and domestic livestock, place a priority to avoid allowing this herd to increase beyond the 100 sheep objective.

5) Avoiding artificial feeding by local residents.

6) Protecting sheep from contact with domestic sheep and goats. There are several weed control programs in the Madison Valley promoting the use of domestic sheep as a weed control tool. It is imperative that FWP continue to keep watch over this program and any actions by private landowners choosing to bring domestic sheep or goats into proximity of this bighorn sheep herd.

7) Monitoring predation on these bighorn sheep from large carnivores, including wolves and mountain lions.

Population Monitoring: This population has not received the monitoring attention afforded other sheep herds in Montana. This herd should be monitored every spring during early green-up. In the past, the herd was monitored at the end of the spring mule deer or late winter elk survey. Those surveys alone were six- to seven-hour surveys, even before the biologist reached the primary sheep winter range. Logistically and physically, that situation was not conducive to surveying under the best conditions. Secondly, much of the winter and early spring range is timbered. Surveying rams in this area might best be accomplished by conducting late rut or early winter ground surveys. Most of the adult rams are highly visible during this time.

In the past five years, sheep were classified according to gender, with rams being classified according to horn growth. Lambs were classified during these surveys as well.

Summary of Public Comment

Beyond the local residents and tourists, this sheep herd is not well known to wildlife enthusiasts in Montana. However, those familiar with this herd desire a healthy, vibrant sheep herd that is managed to minimize further die-off events. Many would appreciate the chance to hunt this area for bighorns. It is not known for, nor probably capable of, producing Boone and Crockett–defined trophy rams. However, the early season hunting opportunities require hunters to access very demanding and wild country. It presents a quality hunting opportunity from a terrain and access aspect.

Management Goal

Continue to manage this sheep herd for optimum health and productivity. Manage for a population that promotes reasonable lamb survival and diversity in age structure in rams. There is very little opportunity to increase sheep numbers in this district. Attempting to manage for a population that exceeds 100 to 120 is probably not in the best interests of this sheep herd.

Habitat Objectives

1. Create partnership opportunities with public and private land managers to protect and preserve habitat presently occupied by bighorn sheep and other wildlife species in this area.

2. Encourage creative and progressive habitat improvement projects, particularly weed and fire management on publicly owned winter ranges.

3. Encourage preservation and improvement of publicly owned bighorn sheep habitat to minimize the dependence on privately owned winter ranges in this area.

4. Encourage and cost-share wildlife-friendly fencing projects in this area.

Habitat Management Strategies

1) The majority of the occupied sheep range in this area is protected under a wilderness designation. Therefore, it is critical to work with the USFS to help manage and protect this area in its wilderness state.

2) Pursue conservation easements and other protective ventures with private landowners along the Slide Inn area to protect critical winter ranges for bighorn sheep and other wildlife in this area.

3) Work closely with Montana Department of Transportation regarding any highway improvements and construction along U.S. Highway 287 and occupied bighorn sheep range.

4) Continue to work with and consult with the USFS on fire management proposals for improving and increasing the amount of effective winter range in the upper Madison Valley.

Game Damage Strategies

Game damage issues may arise in this area. There are incidences of private landowners artificially feeding sheep during the winter. This practice artificially concentrates these sheep into small areas on private lands. FWP will follow game damage policies now in place. In addition, FWP can use the legal hunting season to assist in population control by issuing ewe licenses or scheduling a trapping and transplanting operation.

Access Strategies

Access may be a limiting factor regarding hunter opportunity in this area. FWP will remain vigilant in supporting current access opportunities for hunting and wildlife viewing and work with private landowners to create new opportunities in the immediate future.

Population Objectives

1) Maintain the number of bighorn sheep observed during late rut and green-up aerial surveys within 20% of 100 (80 to 120) sheep observed on the winter range.

2) Maintain a ram: 100 ewe ratio observed during late rut surveys of at least 50 rams: 100 ewes with a minimum of 40% of these rams being ¾-curl or larger.

Population Management Strategies

Bighorn numbers have been traditionally managed through hunter harvest. The population objective of 100 (± 20%) observed bighorn sheep was derived by considering 1) the ability of public and private lands to provide forage for the wintering bighorn population, 2) conflicts with residential developments, 3) vehicular/bighorn collisions, and 4) the understanding that catastrophic disease-caused die-offs, exhibited in many other sheep populations, are often density dependent occurrences.

Bighorn sheep in the district have recovered sufficiently to provide some limited hunting. Reopening this district for the 2010 season will probably be proposed during FWP's biennial season setting process.

Ewes have not been harvested in this district in the past. In the advent that it may be desirable to harvest ewes in the future either for population management or recreational opportunity, the process has been developed to provide for ewe harvest.

Assuming hunting of bighorns in this district will be reopened in 2010, the season structure could follow the format depicted below.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed in many hunting districts through limited-entry harvest of the female segment. In Hunting District 302, licenses could be issued under the following prescriptions (Table 2):

Standard Regulation: A limited number of adult ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 20% of the population objective and lamb recruitment is above 35 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 20% below the population objective and lamb recruitment is less than 35 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 20% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Table 2. Summary of regulation types under different population criteria for ewe harvest and population management.

SOUTHERN MOUNTAINS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation_	± 20% of 150	Above 35	Limited Entry Adult Ewes	Up to 20% of Ewes
Restrictive Regulation	More than 20% below 150	Less than 35	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Greater than 20% above 150	Greater than 40	Limited Entry Ewes **OR** translocate if > 25 sheep including rams are available	More than 20% of Ewes

Rams:

Standard Regulation: Limited-entry any-ram licenses with the number of licenses issued being up to 20% of the ¾-curl rams in the population.

The Standard Regulation will be recommended if: The population is within objective (+ 20% of 100), there are more than 50 rams: 100 ewes, and 35% of the rams are at least ¾-curl (Table 3).

Table 3. Summary of potential ram harvest under different population parameters and criteria.

SOUTHERN MOUNTAINS	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of Rams with ≥ ¾-curl
Standard Regulation	Up to 35% of the ¾-curl rams	± 20% of 100	>50	≥ 35
Restrictive Regulation	Up to 20% of the ¾-curl rams	More than 20% below 100	< 50	< 35

Restrictive Regulation: Limited-entry any-ram licenses with the number issued being up to 10% of the ¾-curl rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 20% below the population objective of 100, there are less than 50 rams: 100 ewes, and less than 35% of the rams are at least ¾-curl.

TENDOY

(Hunting District 315)

Description: Hunting District 315 contains approximately 720mi² with 22% privately owned and 78% managed by the Montana Department of Natural Resources and Conservation (DNRC), Bureau of Land Management (BLM), and the U.S. Forest Service (USFS). Bighorn sheep currently occupy about 20% of the district, or 140mi² , in the Tendoy Mountains, Whitepine Ridge, and the south end of the Beaverhead Mountains. The Beaverhead Mountains population is an interstate population that straddles the Continental Divide, typically summering in Montana and wintering in Idaho Hunting Units 30 and 30A. Occasionally, bighorns are observed in the Lima Peaks. No bighorns have been observed in recent history in either the Italian Peaks or Red Conglomerate Mountains.

Currently occupied bighorn range is comprised of 95% public land and 5% private, with the majority of land administered by the USFS (64%) and BLM (29%). The land is managed for multiple-use with livestock grazing and recreation the dominant land uses. There is some interest in oil and gas exploration and development within the current occupied range. Winter range is scattered over 50mi² of predominantly BLM (53%) and USFS (30%) lands with the balance either DNRC or private lands. The BLM withdrew primary winter range in the Hidden Pasture drainage in the Tendoy Mountains from grazing for the benefit of bighorns and other wildlife.

Public Access: The Tendoys, Beaverheads, and Lima Peaks provide a diversity of hunting experiences. Within the current occupied range, bighorns are generally accessible from county or public roads, or by foot or horseback trails maintained by either the BLM or USFS. The BLM recently implemented a new travel plan while the USFS will undertake travel planning in the near future. User-created trails in the Tendoy Mountains are a major concern as they compromise wildlife security, promote soil erosion, and spread noxious weeds.

Bighorn Sheep Populations: Bighorn sheep in the Tendoy and Beaverhead Mountains are introduced populations on historical bighorn range. Transplant records vary, but the Tendoy herd was started with an initial transplant of about 39 in 1985 and another 14 in 1986 (Table 1). Additional transplants of 19 in 1997 and 30 in 2002 were made following two lungworm-pneumonia die-offs in 1993 and 1999. Idaho Fish and Game transplanted 22 bighorns in 1985 and another 17 in 1988 to start the population in Unit 30A. About 100 bighorns occupy Hunting District 315, with about 70 in the Tendoys and about 30 in the Montana portion of the Beaverhead Mountains (Figure 1 and Tables 2 and 3).

Recreation Provided: Hunting of bighorn sheep was reauthorized in 2005 with the issuance of two either-sex licenses. Bighorn sheep, most notably rams, have been somewhat hard for hunters to find in either the Beaverhead or the Tendoy Mountains early in the season, forcing most hunters to wait until sheep migrate to traditional winter range in the vicinity of Big Sheep Creek in the south end of the Tendoys. This migration occurs in mid-to late October. Since the bighorn season was reauthorized, all sheep hunters were successful and hunted an average of 14 days (range 5 to 20) each before harvesting a sheep. All sheep during this period were harvested out of the resident (Tendoy) population. Hunters have pursued sheep in the Beaverhead Mountains but have not been successful in harvesting from this subpopulation, which generally returns to rut and winter in Idaho.

The mountains of southwest Montana are well known for sport hunting and recreation on a variety of public and private lands. Hunters and recreationists from across Montana and the nation recreate in Beaverhead County. Bighorn sheep in the Tendoy and Beaverhead Mountains are migratory but occupy public lands that make them available for viewing during most months of the year. Popular viewing areas include Big Sheep Creek, Muddy Creek, Morrison Lake, and White Pine Ridge.

Location	Year	No. Released	Composition	Origin
Tendoys	1985	39	13 Rams, 26 Ewes	Lost Creek
	1986	14	13 Rams, 1 Ewe	Thompson Falls
	1997	19		Rock Creek
	2002	30	3 Rams, 27 Ewe	Sun River
Idaho Unit 30 A	1985	22		Lostine Mountains, OR
	1988	17		Morgan Creek (Unit 36B)

Table 1. Bighorn sheep transplant history, composition, and origin, Hunting District 315 1985-2002.

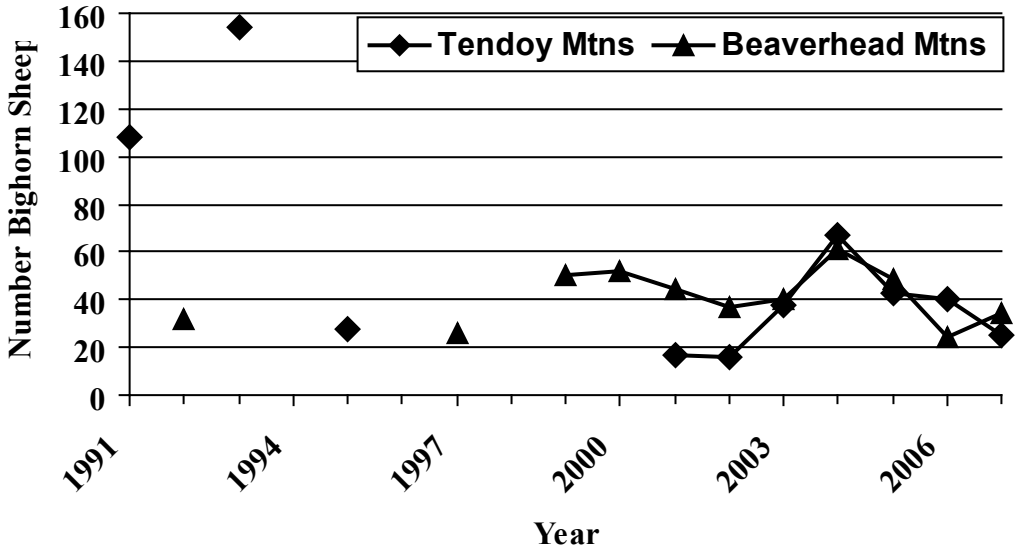


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in Hunting District 315, 1991-2007.

Table 2. Bighorn sheep population parameters in Tendoy Mountains, Hunting District 315 1990-2007.

Year	Total	Lambs	Rams	¾+ Rams
1991	108 (19 Unclassified)	26	32	
1993	154	27	71	44
1995	28	0	12	7
2001	17	3	5	
2002	16	5	2	
2003	38	9	9	
2004	67	13	12	
2005	43 (15 unclassified)	6	2	2
2006	40	6	13	12
2007	25	5	7	6

Table 3. Bighorn sheep population parameters in Beaverhead Mountains, Hunting District 315 1996-2007. Data provided by Idaho Fish and Game from Units 30 and 30A, excepting the 2006 Montana observation. Observations were all made incidental to surveys for other species or reflect incomplete coverage of the bighorn habitat.

Year	Total	Lambs	Rams	¾+ Rams
1992	32	2	11	2
1997	26	5	18	12
1999	50	9	12	4
2000	52	2	24	16
2001	44	9	17	10
2002	37	4	18	10
2002	37	10	9	3
2003	40	8	10	7
2004	61	9	15	11
2005	49	6	18	13
2006	28	1	10	1
2006	24 (Montana)	2	9	9
2007	34	0	8	7

Current Annual Bighorn Sheep Harvest: Bighorn sheep hunting was reauthorized in Hunting District 315 in 2005. The hunt followed five years where no hunting was authorized due to the die-off event in the late 1990s. Two either-sex licenses have been issued annually since 2005 (Table 4). The district was also expanded in 2005 to include the Beaverhead Mountains south of Pass Creek. No harvest has been directed toward the ewe segment of the population since 1993. License levels will likely remain at low levels until the population shows significant growth toward the population objective of 200 bighorns.

Accomplishments: Initial introductions of bighorns into the Tendoy Mountains flourished for almost a decade. However, since 1993 the population has suffered two major pneumonia-lungworm die-off events and a transplant that was largely a failure in 1997. These events led to accusations over the cause of the die-offs and hard feelings over the loss of a cherished wildlife resource and associated hunting and viewing opportunity. The 1990s were a hard decade for sheep management across southwest Montana, and several populations were affected. Fortunately, other areas of the state were not affected, and FWP has been able to readily provide transplant stock to reestablish populations.

The 2002 transplant, comprised of mostly females, has survived and produced sufficient lambs to slowly grow the population despite unusually high lungworm loads in the population. (Lungworm is a native, respiratory tract parasite that may act as a stressor that can lead to pneumonia). Given these factors, the department has decided to not add additional bighorns to this population. The management theory is that additional bighorns may introduce new organisms that promote immunological stress in the existing population. In this regard, the Tendoy hunting district is acting as an experiment in sheep management.

FWP is supporting research through Montana State University to understand the differences between stable and unstable populations across western Montana, including the Tendoy population. This habitat study is focused on the vegetation, environment, and geographic character of sheep habitat.

Year	Either-Sex or Legal Ram Licenses	Ram Harvest	Ewe Licenses	Ewe Harvest
1992	3	3	10	9
1993	5	5	10	7
1994-1995	CLOSED			
1996	2	2	-	-
1997	2	2	-	-
1998	1	1	-	-
1999	1	1	-	-
2000-2004	CLOSED			
2005	2	2	-	-
2006	2	2	-	-
2007	2	2	-	-

Table 4. License and harvest history, Hunting District 315 1992-2007. Legal ram licenses were issued for the period 1992-1999 and either-sex licenses since 2005.

Management Challenges: There are a number of management challenges related to bighorn sheep management in the Tendoys. Overall herd health is the most pressing concern at this time following two independent die-off events in the 1990s. The population is currently declining and is far below historical growth rates in the Tendoys or those observed in other Montana populations. The Tendoy herd currently has high lungworm loads, including the highest load ever documented in Montana. FWP has attempted some treatment for lungworm at bait stations as recently as 2006, but has subsequently decided there is more risk from artificially concentrating sheep than reward from reducing lungworm loads.

Maintaining separation of wild sheep and domestic sheep is a significant issue in the Tendoy district. There are four domestic sheep producers within the district, mostly well removed from occupied bighorn sheep habitat. There is one USFS domestic sheep allotment that poses some risk to wild sheep in one pasture in the Beaverhead Mountains and another allotment in Idaho that will preclude bighorn sheep expansion into the Red Conglomerate Mountains. FWP and the Montana Wild Sheep Foundation have met with one producer to seek amicable solutions to this issue and to discuss the need to remove individual bighorns that come in contact with domestic sheep. To date there has been no management removals of bighorns.

Population Monitoring: Primary winter range in the Tendoys, Deadwood Gulch, and the north side of Garr Canyon is surveyed annually with a helicopter in early January in conjunction with a post-season mule deer flight. This flight covers the majority of the winter range but is not particularly effective at detecting population trends. Bighorns are also observed during annual elk census flights conducted with a fixed-wing aircraft. Bighorns in the Beaverhead Mountains are surveyed incidental to other surveys. Idaho Fish and Game surveys bighorns in the Beaverhead Mountains, either incidental to other surveys or with incomplete coverage. There is a need for a periodic, dedicated helicopter survey in this district, conducted in March or early April. All observed bighorns are classified by age and sex; rams are classified by horn class.

Summary of Public Comment

Public comments are highly supportive of the current season structure in the Tendoys. A few individuals have expressed concern over the lack of Boone and Crockett, or trophy, rams in the district. A few individuals have brought alternatives forward such as a 7/8-curl regulation and distribution of supplemental minerals to promote horn growth. There is general concern regarding the health of the Tendoy herd following the die-off events during the last decade.

Management Goal

Manage for a three-fold increase in the Tendoy (resident) bighorn population with diverse age classes of rams. Cooperate with public land management agencies, the State of Idaho, interested organizations, and private individuals in the management of bighorn habitat. Provide opportunities for bighorn sheep hunting and wildlife viewing.

Habitat Objectives

1) Encourage the maintenance and improvement of habitat conditions on public lands (USFS, BLM, and DNRC) for the benefit of bighorns, other wildlife, and other agency-mandated uses.

Habitat Management Strategies

1) The USFS and BLM are the principal land management agencies for the public land in Hunting District 315. DNRC manages a few key winter range parcels. FWP provides support, distribution of information, and technical assistance to agency habitat management efforts from the planning level to project implementation. Both the USFS and BLM have installed a total of three wildlife guzzlers for the benefit of bighorns. Fences have been modified, or in a few cases removed, wherever possible to accommodate wildlife movement. New fences are being built to allow wildlife passage. FWP maintains a Memorandum of Understanding (MOU) with the USFS on the manipulation of habitat. The MOU is intended to ensure coordination and cooperation between the agencies during the planning, implementation, and evaluation phases of projects that occur in sagebrush, Douglas fir, aspen/willow and mountain mahogany/bitterbrush communities.

2) Interest in oil and gas leasing and exploration has recently occurred within occupied bighorn range on Whitepine Ridge, the Tendoy Mountains, and the Lima Peaks. FWP submitted distribution information and comments in support of either seasonal or year-round no surface occupy stipulations for leases that occur in habitat that is critical to bighorn sheep and other wildlife.

3) Two 500KV powerlines are planned to bisect southwest Montana in the near future. FWP is actively involved in trying to mitigate impacts from these lines on wildlife resources and is cooperating with private landowners, industry, and other agencies to ensure critical habitats are not degraded or fragmented.

Game Damage Strategies

Game damage problems have not occurred to date and are not anticipated at current population levels. There is limited opportunity for bighorns to depredate haystacks or standing crops on or near their primary winter range. Should such problems develop, FWP will respond with fencing, herding, or hazing to mitigate the damage. Should the population approach the objective of 200 individuals and game damage occur, those individuals responsible for the damage could be offered as transplant stock for other herds.

Access Strategies

FWP maintains three Block Management Areas (BMAs) within Hunting District 315, totaling approximately 17,000 acres. Most of the access to bighorns is from public lands administered by the BL and USFS, and these BMAs. FWP continually works with other public land management agencies on travel plans that emphasize access while trying to eliminate user-created, unauthorized trails.

Population Objectives

1) Maintain the number of bighorn sheep observed during post-season aerial surveys within 10% of 200 sheep (180 to 220) within the current winter ranges in Muddy Creek, Big Sheep Creek, Garr Canyon, and Deadwood Gulches.

2) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys of at least 40 rams: 100 ewes with at least 30% of the rams having a ¾-curl.

3) Coordinate survey and harvest management strategies with Idaho on the interstate bighorns in the Beaverhead Mountains.

Population Management Strategies

Hunting District 315 is located in the Mountain Foothills ecological region. The bighorn population has been introduced on historical bighorn sheep range. The initial transplants flourished and were characterized by high lamb production and recruitment and, as a result, rapid population expansion. Two die-off events in the 1990s reduced the bighorn population to as few as 16 observed individuals. Additional transplants in 1997 and 2002 have not resulted in rapid population expansion due to lagging lamb recruitment. Bighorns are currently being managed for population growth with extremely low harvest directed solely at the ram segment. Should the population begin to expand toward the objective of 200, ewe licenses would be issued and/or the population surplus could be offered as transplant stock.

The population objective of 200 (± 10%) observed bighorn sheep was derived by considering the history of the 1984 and 1986 transplants, which may have exceeded 200 for a brief period, and other uses of the land base within the hunting district. Population management strategies will focus on maintaining bighorn numbers consistent with allotment and other land use plans on private, BLM, and USFS administered lands.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment. In Hunting District 315, licenses will be issued under the following prescriptions (Table 5):

Standard Regulation: Limited ewe licenses valid in the Tendoy (resident) portion of the hunting district during the general season for bighorn sheep. The number of ewe licenses issued would be up to 15% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs. Ewe licenses could include the Beaverhead Mountains (interstate population) if the population is within the prescription.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 10% of the population objective and lamb recruitment is between 30 and 40 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is below 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the Tendoy (resident) portion of the hunting district during the general season for bighorn sheep. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs. Ewe licenses could include the Beaverhead Mountains (interstate population) if the population is within the prescription.

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 10% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry either-sex licenses with the number of licenses issued up to 15% of the ¾-curl rams in the population.

The Standard Regulation will be recommended if: The population is within objective (+ 10% of 200), the annual survey showed at least 40 to 60 rams: 100 ewes, and 30% of the rams are at least ¾-curl (Table 6).

Restrictive Regulation: Limited-entry either-sex licenses with the number of licenses issued up to 10% of the ¾-curl rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 10% below the objective of 200, the annual survey showed less than 40 rams: 100 ewes, and less than 30% of the rams are at least ¾-curl.

Liberal Regulation: Limited-entry either-sex licenses with the number of licenses issued up to 20% of the ¾-curl rams in the population.

MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	±10% of 200	Between 30-40	Limited Entry Ewes	Up to 15% of Ewes
Restrictive Regulation	More than 10% below 200	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation_	Greater than 10% above 200	Greater than 40	Limited Entry Ewes or translocate if > 25 sheep including rams are available	Up to 20% of Ewes

Table 5. Summary of regulation types under different population criteria for ewe harvest and population management.

Table 6. Summary of potential ram harvest under different population parameters and criteria.

MOUNTAIN-FOOTHILLS	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of Rams with ≥ ¾ curl
Standard Regulation	Up to 15% of the ¾-curl rams	±10% of 200	40-60:100	≥ 30
Restrictive Regulation	Up to 10% of the ¾-curl rams	More than 10% below 200	< 40:100	< 30
Liberal Regulation_	Up to 20 % of the ¾-curl rams	Greater than 10% above 200	> 60:100	≥ 30

The Liberal Regulation will be recommended if: The population was more than 10% above the objective of 200, the annual survey showed more than 60 rams: 100 ewes, and more than 30% of the rams are at least ¾-curl.

HIGHLAND
(Hunting District 340)

Description: The Highland area (Hunting District 340) located just south of Butte, contains approximately 1,141mi² and includes the Highland Mountains and the northern portion of the East Pioneer Mountains near the town of Melrose. Interstate 15 and the Big Hole River separate the two mountain chains. The district is comprised of shrub grasslands (sagebrush, mountain mahogany, bluebunch wheatgrass, Idaho fescue), coniferous forests, and agricultural lands. Forty-two percent of the district is in private ownership, located primarily at the lower elevations of the district. The majority of private land is in agricultural production, primarily cattle although there are several hobby sheep farms as well. Due to the mineral-rich geology of this area, there are also a significant number of mining claims, active or otherwise, located throughout this district. The other 58% of land in this hunting district is managed by various public land management agencies. The Bureau of Land Management (BLM) administers 231mi² (20%), managed under the Butte Resource Management Plan. Included in the BLM portion of publicly administerrd land is the Humbug Spires Wilderness Study Area, which is managed as a roadless area with no resource extraction. The U.S. Forest Service (USFS) - Beaverhead-Deerlodge National Forest administers 363mi² (32%), while the State of Montana, through the Department of Natural Resources and Conservation (DNRC), administers 62mi² (6%).

Approximately 233mi² of the district (20%) is currently occupied by bighorn sheep during some portion of the year. Sixteen percent of the occupied area is private land and 84% is public land. Bighorn sheep winter range comprises approximately 188mi² of this district (16%); 23% is private land and 77% public, with the majority of public land being administered by the BLM. Based on past and current telemetry data and recent observations, the majority of the bighorn sheep population winters on public lands.

The vegetation within the occupied bighorn sheep range is predominantly rocky terrain interspersed with sagebrush grassland, mountain mahogany, and lodgepole pine and Douglas fir forest.

Public Access: The Highland hunting district provides a diversity of hunting experiences, including motorized hunting along main drainages and walk-in hunting in between drainages. There is ample road access throughout the unit in general, including access to public land specifically. Travel Plan revisions on USFS and BLM lands were implemented in 1995 with the primary objectives being the protection of the soil, water, and vegetation and enhancement of elk security where it was low. Existing, and some new, winter range closures were incorporated into this revision. The Upper Big Hole Travel Plan was again revisited in 2006 during the revision of the Butte Resource Management Plan. Although this plan will not be finalized until 2009, it is expected that additional closures and seasonal restrictions will be implemented on BLM lands within bighorn sheep habitat.

Bighorn Sheep Populations: The original Highland bighorn sheep herd, located in the Highland and East Pioneer mountain ranges, died out in the early 1900s, mainly due to

overharvesting and disease transmission from domestic livestock. In the late 1960s, an effort was made to reestablish this herd through two transplants of bighorn sheep from the Sun River herd (Table 1). Since this original transplant of 53 bighorn sheep, the number of animals counted in the Highlands herd grew steadily until reaching its peak of over 300 observable animals in the early 1990s. During the winter of 1994-95, a die-off occurred, causing as much as 90% mortality and reducing the Highlands bighorn sheep population to less than 100 animals. The die-off was attributed to a pneumonia-lungworm complex.

Month/Year	Source Herd	Number Tranplanted	Release Site
1967	Sun River	22	Camp Creek
1969	Sun River	31	Camp Creek
Dec 2000	Sun River	15	Camp Creek
Feb 2001	Sun River	17	Camp Creek
April 2001	Bonner	3	Soap Gulch
Feb 2002	Sula	14	Camp Creek
Feb 2007	Ruby Mtns	17	Soap Gulch
Jan 2008	Sun River	65	Soap Gulch/Camp Creek

Table 1. History of bighorn sheep transplants to the Highlands population, Hunting District 340, 1967-2008.

Following the die-off, several transplants ensued in an attempt to rebuild this population. During the winter of 2000-01, 32 bighorn sheep were transplanted from the Sun River herd. In the spring of 2001, three sheep were transplanted from the Bonner herd. During winter 2002, 14 sheep were transplanted from the Sula herd, and in 2007, 17 sheep were transplanted from the Ruby Mountains. In January 2008, 65 sheep were transplanted from the Sun River herd. Since 1967, a total of 184 sheep have been released in Hunting District 340.

From 1994 to 1996, two Montana State University graduate research studies plus an additional study were done on the Highlands herd, in cooperation with FWP, BLM, and the Montana Foundation for North American Wild Sheep:

Hoar, K.L., D.E. Worley, and K.E. Aune. 1996. Parasite loads and their relationship to herd health in the Highlands bighorn sheep herd in southwestern Montana. Proceedings of the Bienn. Symp. of the North. Wild Sheep and Goat Council.10: 57-65.

Weigand, J.P. 1994. Range use and interspecific competition of Rocky Mountain bighorn sheep in the Highland Mountains, Montana. MS Thesis. Montana State University, Bozeman. 86pp.

Semmens, W.J. 1996. Seasonal movements and habitat use of the Highland/Pioneer Mountains bighorn sheep herd of southwest Montana. MS Thesis. Montana State University, Bozeman. 103pp.

The results from Hoar's work show that the Highlands bighorn sheep suffered a light lungworm infection in the early 1990s, prior to the die-off. This finding is not uncommon among bighorn sheep herds.

Intensive telemetry work done by Weigand and Semmens in 1994-95 identified three subpopulations of the Highlands herd and described seasonal range distribution and interaction between these subpopulations. As defined by associated ewe-lamb groups and the location of their seasonal home ranges, the subpopulations were described as the East Pioneer, Moose Creek, and Camp Creek population units. Sheep established traditional seasonal ranges in these locations, generally wintering at the lower elevations then moving to higher, south-facing slopes during the spring through fall.

Radio-telemetry data from Weigand's and Semmens's studies showed very little mixing occurred among subgroups during the summer and winter, while some mixing occurred during the spring lambing period. The majority of documented interactions occurred in the fall during the rut. It is worth noting that on numerous occasions, bighorn sheep rams have been observed crossing Interstate 15 between the Highland and East Pioneer mountain ranges.

Since bighorn ram movements have never been monitored via instrumented animals, the extent of ram range is best known from observations made by FWP and the public. Summering rams have been located as far west as Sheriff and Lion Mountains in the East Pioneers and as easterly as Brazil Ridge in the Highlands. Rams have been spotted north of the Big Hole River on the Fleecer Wildlife Management Area and as far south as the Birch Creek drainage, although these sightings have been rare and probably do not indicate commonly used areas but rather random wanderings of a few individuals.

Despite the die-off and transplants, bighorn sheep in the present-day Highlands herd appear to continue to use traditional seasonal ranges, although it is unknown at this time whether three distinct subpopulations still exist.

Prior to the die-off, the Highlands bighorn sheep herd was at an all-time high of over 300 observable animals (Figure 1 and Table 2), and some avid sheep watchers claim there were as many as 400 or more sheep by the late 1980s. It was not uncommon for groups of 50 or more rams to be observed. Since the die-off, total counts of observed bighorn sheep have remained below 50 animals, despite transplant efforts. From 1999 to 2004, no aerial surveys specifically for bighorn sheep were flown and only opportunistic observations were gathered during other big game surveys. Lamb production and recruitment has remained low, contributing to the bottleneck in population growth that the Highlands herd is currently experiencing.

In the late summer following the 2008 transplant, another small die-off event occurred in the Highlands sheep population. This event appeared to be limited primarily to adult ewes from the 2008 transplant that did not migrate off the winter range. Field necropsies suggested that all the sheep were in poor body condition prior to mortality. Lab results showed that pneumonia was the likely cause of death. In all, 11 adult ewes and one adult ram were known to perish in this die-off event. It is inconclusive whether the ram had been from the 2008 transplant.

Concurrent with this die-off event attacking adult sheep, lamb pneumonia continued to claim more than 90% of the lamb crop for 2008. By fall, only a few lambs were observed in the herd. Interestingly, the one group of sheep that have consistently produced and retained lambs for the past two years is a group of ewes from the 2007 transplant that migrated away from the main body of the herd and took up residence approximately 10 miles to the south.

Recreation Provided: Bighorn sheep in the Highlands herd have been one of Montana's best-known and premier wild sheep herds, both for hunting and wildlife watching. Because much of the annual range is within easy access and sight of Interstate 15 and several secondary roads, going out to "watch sheep" has been and continues to be a popular pastime of many local residents and wild sheep fans. Popular areas to view bighorn sheep are the lower extents of Moose Creek, Soap Gulch, and Camp Creek in the Highlands and the Maiden Rock and Canyon Creek areas in the East Pioneer Mountains.

Second only to the Missouri Breaks herd in Montana for trophy status, the Highlands herd at one time was known as one of the best places to harvest a trophy ram. At the height of the population in the mid-1990s just prior to the die-off, as many as 35 either-sex licenses and 35 ewe licenses were being issued. A skull found in the East Pioneers from a Highlands ram that presumably died from natural causes scored 203 5/8 Boone and Crockett points.

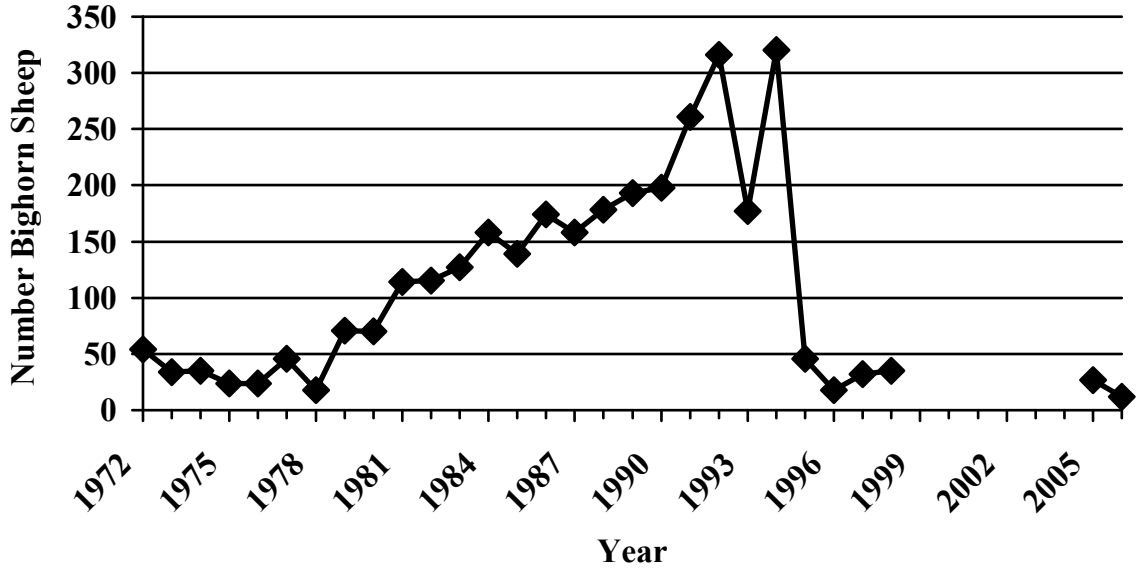


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in Hunting District 340, 1972-2006.

Year	Total	Ewes	Lambs	Rams	Unk	¾+ Rams
2006	12	6	0	6		3
2005	27	6	2	19		5
1999-2004	NA	----	----	----		-----
1998	35	25	6	4		1
1997	32	27	4	1		1
1996	18	18	0	0		0
1995	46	23	6	14	3	2
1994	320	161	41	118		91
1993	177	91	49	37		7
1992	316	182	58	76		47
1991	261	154	61	46		25
1990	198	74	27	97		67
1989	193	98	37	58		30
1988	178	116	29	33		13
1987	158	75	35	48		22
1986	174	98	26	50		37
1985	139	59	39	41		18
1984	158	101	15	42		16
1983	127	62	31	34		15
1982	115	42	19	22		7
1981	114	71	29	14		5
1980	70	41	17	12		1
1979	71	35	28	8		3
1978	18	11	4	3		3
1977	46	25	13	8		2
1976	24	12	7	5		0
1975	24	14	7	3		1
1974	35	-	-	-		-
1973	34	20	10	4		-
1972	54	-	-	4		-

Table 2. Bighorn sheep population parameters before die-off (1972-1994) and after die-off (1995–2006) for Highlands population, Hunting District 340.

Despite the die-off, the Highlands bighorn sheep herd continues to be one of Montana's most important herds and a source of local pride for the residents of the Butte, Anaconda, Whitehall, and Dillon areas.

Current Annual Bighorn Sheep Harvest: In 1994, prior to the die-off, 35 either-sex licenses and 35 ewe licenses were issued for Hunting District 340 (Table 3). As a result of the significant decrease in population size following the die-off, Hunting District 340 was closed to all bighorn sheep hunting in 1995. The district did not reopen until 2002 when one either-sex permit was issued. As a result of a perceived increase in the number of bighorn sheep in the Highlands herd based on opportunistic observations and response to augmentation efforts, the number of either-sex licenses was increased to three in 2005. Annual bighorn sheep aerial surveys resumed in December 2005. Data gathered from the 2005 and 2006 surveys, combined with observations made during concurrent ground surveys, substantiated re-closing Hunting District 340 to all bighorn sheep harvest in 2007 based on the low number of observable sheep (Table 2). Currently, Hunting District 340 remains closed.

Accomplishments: Since the original transplant efforts in the late 1960s, the Highlands bighorn sheep herd has been one of

Table 3. History of license types and number issued in the Highlands Hunting District 340, 1994-2007.

Year	License Type/# Issued	# Harvested/# rams
2007	CLOSED	------
2005-2006	Either-Sex/3	3/3
2002-2004	Either-Sex/1	1/1
1995-2001	CLOSED	------
1994	Either-Sex/35 Ewe/35	35/35 32/0

Montana's most popular herds for both wildlife viewing and harvest opportunity. This herd once held the reputation as being the source of trophy rams, and prior to the die-off a majority of the rams in the population exceeded 180 points (by Boone and Crockett scoring methods) by six years of age.

In order to better understand the seasonal movements and ranges, habitat conditions and requirements, and herd dynamics within the Highlands bighorn population, a Highlands bighorn sheep study was initiated in 1992. A cooperative effort between FWP, BLM, Foundation for North American Wild Sheep, and the Butte Skyline Sportsmen Association, this initiative led to the completion of two masters of science theses from Montana State University, plus one internal report, (see Bighorn Sheep Populations section). These bodies of work have led to a greater understanding of the ecology and population dynamics of this herd.

In 2007, signs were erected on all the main access roads in the Highlands sheep range requesting voluntary reporting of bighorn sheep sightings. In addition, observation cards were made available to the public at local sporting good stores and at the BLM Butte Field Office. To date, this voluntary reporting system has been moderately used and has provided valuable information on the Highlands herd while at the same time generating ownership in the welfare of the herd.

In February 2007, 17 bighorn sheep were transplanted from the Ruby Mountains to the Highlands hunting district. Eight adult ewes were fitted with radio collars prior to release. In January 2008, 65 bighorn sheep were transplanted from the Sun River herd, consisting of 57 adult ewes, three lambs, and five adult rams. Radio collars were placed on 17 ewes while 27 other ewes received individual neckbands. Instrumented sheep are monitored regularly from the ground by FWP biologists and citizen volunteers, including students and teachers from Butte High School.

Management Challenges: There are a number of issues related to bighorn sheep management in this district including increasing the current size of the herd and maintaining an upward trend in population so that the district can be reopened to hunting opportunity; maintaining separation with domestic sheep and goats to prevent disease transmission to bighorn sheep; and the mortality associated with crossing Interstate 15.

Despite efforts to increase the Highlands bighorn sheep herd through several transplants since the mid-1990s die-off, this herd currently is experiencing a bottleneck in population growth. Lamb: ewe ratios generally need to be greater than 50 lambs: 100 ewes in order for the population size to increase. In recent years, lamb recruitment has been negligible, with very few lambs surviving through their first year to offset adult mortality.

Historically, the Highlands bighorn sheep range has overlapped with two small bands of domestic sheep located on private land near Maiden Rock in the East Pioneer Mountains. Semmens (1996) observed bighorn sheep using agricultural areas that supported these domestic sheep bands throughout the year, with the majority of use occurring in the fall. Bighorn sheep have used this overlapping area with domestic sheep for more than 20 years prior to the die-off in the mid-1990s and no problems with diseases had arisen in the past, although die-offs of wild sheep have been linked to domestic sheep and goat interactions in other areas. Presently, several domestic sheep hobby farms operate within proximity of the Highlands wild sheep range. There are no BLM or Forest Service sheep allotments, active or retired, in the Highlands or East Pioneer Mountains. The need to monitor the Highlands herd on a regular basis for domestic sheep interactions and herd health continues to be a management concern.

Interstate 15 cuts through the middle of the Highlands bighorn sheep range, separating the Highlands from the East Pioneer Mountains. Movement of bighorn sheep from one side of

the interstate to the other has been documented. The majority of crossover occurs by rams during the rut, although there has been documentation of ewes crossing the interstate as well. Bighorn sheep have been involved in vehicular collisions in the past while crossing Interstate 15. Any crossings of well-traveled roads carry the risk of mortality to bighorn sheep.

Population Monitoring: To monitor the bighorn population, aerial surveys are conducted annually, generally using a helicopter, in early spring during green-up when sheep are most concentrated. The entire area historically occupied by bighorn sheep during winter is flown, including public and private lands. Bighorns are counted and classified by age and sex and rams are classified by horn class.

Summary of Public Comment

Public comments related to this bighorn sheep population and its management in this hunting district have indicated a high level of support for having bighorn sheep here. Both hunters and non-hunters enjoy seeing bighorn sheep in this area.

Management Goal

Manage for a healthy and productive bighorn sheep herd in balance with available habitat. Cooperate with public land management agencies and private individuals in the management of bighorn sheep habitats. Manage for hunter harvest opportunity of surplus males in a manner that allows for the opportunity to harvest trophy rams.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain approximately 100,000 acres of occupied bighorn sheep habitat (based on telemetry data) for the benefit of bighorns, other wildlife species, and other agency mandated uses.

2) Encourage maintenance and improvement of habitat conditions on publicly owned winter ranges (primarily BLM) so that vegetation conditions on these winter ranges provide adequate forage for bighorns and other wildlife during the winter.

3) Encourage maintenance and improvement of habitat conditions on public lands (USFS and BLM) so that bighorns continue to utilize these lands during summer and fall rather than moving onto private lands.

Habitat Management Strategies

1) The BLM in both the Butte and Dillon Field Offices are implementing forest and grassland/shrubland restoration projects, noxious weed control, and better grazing management to maintain and/or improve wildlife habitats in the Soap Gulch and Camp Creek drainages. To date, approximately 1,000 acres of conifer encroachment in grassland and shrubland habitat has been slashed and burned. Roughly 3,700 acres of additional restoration treatments will occur in the Soap Gulch and Camp Creek drainages and approximately 3,000 acres will be treated in the McCartney Mountain area. No new roads have been or will be built with these treatments.

2) Grazing allotments in the southwest Highlands, including Camp Creek, have been modified to lessen the impacts of grazing on grassland and shrubland communities. These changes include reducing animal unit months, changing seasons of use, and changing the grazing system and/or the allowable use levels.

3) A complete inventory of leafy spurge will be completed by the BLM Butte Field Office. This inventory will be used to develop a strategy to reduce and control the population of spurge. Spraying of noxious weeds will continue in the southwest Highlands.

4) The Upper Big Hole Travel Plan was revisited in 2006 during the revision of the Butte Resource Management Plan. Although this plan will not be finalized until 2009, it is expected that additional closures and seasonal restrictions will be implemented on BLM lands within bighorn sheep habitat.

Game Damage Strategies

Specific game damage problems with the Highlands bighorn sheep have not occurred to date and are not anticipated. In the event that game damage occurs, bighorn sheep numbers can be managed through trapping and transplanting sheep from this area as the population approaches or is at objective.

Access Strategies

The majority of bighorn sheep annual range is located on public land (USFS and BLM). Based on the current distribution of bighorns during the hunting season, lack of hunter access to these sheep is not an issue. FWP will continue to work actively with public land management agencies to maintain sufficient access to the

Highlands bighorn sheep herd. If bighorn sheep shift their range to private land during the hunting season, FWP will work with landowners to allow hunter access.

Population Objectives

As a result of the mid-1990s die-off and chronic lamb pneumonia that has persisted in the herd and is causing extremely low annual recruitment, the reasonable management objective for the Highlands herd is that of a minimum viable population of 125 sheep, sufficient enough to be self-sustaining (Geist 1971).

Reopening the Hunting District

Hunting of bighorn sheep in the Highlands population (Hunting District 340) will be recommended when at least three of the following four criteria have been met for a minimum of three successive years:

1) The population is at least 75 observable sheep.

2) There are at least 30 rams: 100 ewes.

3) More than 30% of the rams are at least ¾-curl.

4) There are at least 30 lambs: 100 ewes.

Monitoring of these sheep will continue at a level sufficient to determine if these criteria are being met. If so, license levels will be based on the number of ¾-curl rams observed during surveys.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 340 is located in the Mountain Foothills ecological region (see discussion of ecological regions in Chapter 1), which includes much of southwest Montana. This bighorn population suffered an all-age die-off event in the mid-1990s; as a result, several transplants into this area have occurred in an effort to rebuild and stabilize this herd. Hunting has been closed since 2007. Hunting may occur again if the conditions listed above are met. If the population exceeds population objective, appropriate Adaptive Harvest Prescriptions will be developed to adequately manage these sheep.

Prescriptive Harvest Management

Ewes: Not applicable at this time.

Rams: Not applicable at this time.

ELKHORN
(Hunting District 380)

Description: The Elkhorn Mountains area (Hunting District 380) contains approximately 1,241mi^2 with 59% privately owned and 41% managed by various public land management agencies. The Elkhorn Mountains are a relatively small and isolated mountain range of about 391mi^2 located about 16 miles southeast of Helena. Approximately 116mi^2 of the district (10%) is currently occupied by bighorn sheep during some portion of the year. Twenty percent of the area occupied by bighorn sheep is private land and 80% is public land. There are approximately 40mi^2 of bighorn sheep winter/year-round range in this unit; 30% is private land and 70% public. Based on past telemetry data and recent observations, approximately 70% of the total bighorn sheep population spend winter on public lands. About 250mi^2 of this productive mosaic of mountain grasslands, forests, and alpine vistas are managed by the U.S. Forest Service (USFS) – Helena and Beaverhead-Deerlodge National Forests. The portion of the range in Forest Service management, by virtue of special Forest Plan direction, is managed as the only Wildlife Management Unit in the National Forest System. According to the 1986 Forest Plan for the Helena National Forest, management goals for big game winter range on forest lands include "Optimize big game winter range" and "Provide for other resources as long as their uses are compatible with maintaining elk winter range".

Additionally, 145mi^2 of foothills, predominated by grassland/shrubland vegetation, are managed by the Bureau of

Land Management (BLM). These adjacent BLM lands are managed under the Headwaters Resource Management Plan (RMP), which provides for multiple use management. Some of the major uses on BLM lands include a utility corridor occupied by the Colstrip 500-KV line, a National Guard training range, and the Graymont lime mine near Townsend. In 2006 and 2007, the BLM acquired two major properties in this unit, the McMaster's and Iron Mask properties. The Iron Mask property is occupied by bighorn sheep and is winter year-round range for approximately 50 bighorns.

Public Access: The Elkhorn Mountains district provides a good diversity of hunting experiences, including motorized hunting on the periphery and walk-in hunting in the interior. There is ample road access to the majority of the unit. Access to public land is relatively good, and in addition, there were a total of 18 Block Management areas involving 25 different landowners in the Elkhorn Mountains in 2008. Travel Plan revisions on USFS and BLM lands were implemented in 1995 with the primary objectives being the protection of the soil, water, and vegetation and enhancement of elk security where it was low. Existing, and some new, winter range closures and game retrieval areas were incorporated into this revision. In the Limestone Hills, which are located on the eastern side of the unit near Townsend, the Montana National Guard has an artillery range. This range is currently on BLM lands, which the National Guard is in the process of trying to withdraw for their use. Approximately 7,000 acres of this area is closed to the public for safety reasons. Approximately 20 bighorn sheep have used this closed area, primarily during the winter period.

Bighorn Sheep Populations: The number of bighorn sheep counted in Hunting District 380 had been steadily increasing since the initial transplant of 25 sheep in 1996 (Figure 1 and Table 1). On January 10, 2008, the Townsend FWP office received a report of a dead bighorn sheep in the Elkhorn Mountains. Field observations confirmed bighorn sheep were dying and a helicopter survey was flown on January 16, 2008, to determine the extent of the die-off. Based on the results of the 2007 bighorn survey and the recruitment of an average lamb crop, there should have been approximately 220 to 230 bighorn sheep on winter ranges. We flew the entire winter range and observed a total of 35 sheep (Table 2). Some sheep could be seen coughing from the helicopter.

FWP normally conducts bighorn surveys in late winter or early spring prior to them moving off of winter range. This survey was flown in conjunction with a mule deer trend survey, which covers a similar area, on April 2, 2008. It appeared from on the ground observations that the die-off was slowing down or perhaps we were running out of sheep left to die. We saw a total of 19 bighorn sheep on this survey (Table 3). The coverage on this survey was good as we refueled in order to fly the extra time and area to get full coverage. The loss of sheep due to this die-off represents approximately 90% of the population and essentially all of the lambs and older rams. On this survey we documented approximately 75 domestic goats running loose on BLM and private lands in Keating Gulch.

The Elkhorn bighorn sheep are from transplants, which began in the winter of 1995-96 (N=25 from upper Rock Creek), supplemented in 1996-97 (N=30 from Milltown) and in 2000 (N=20 from Missouri

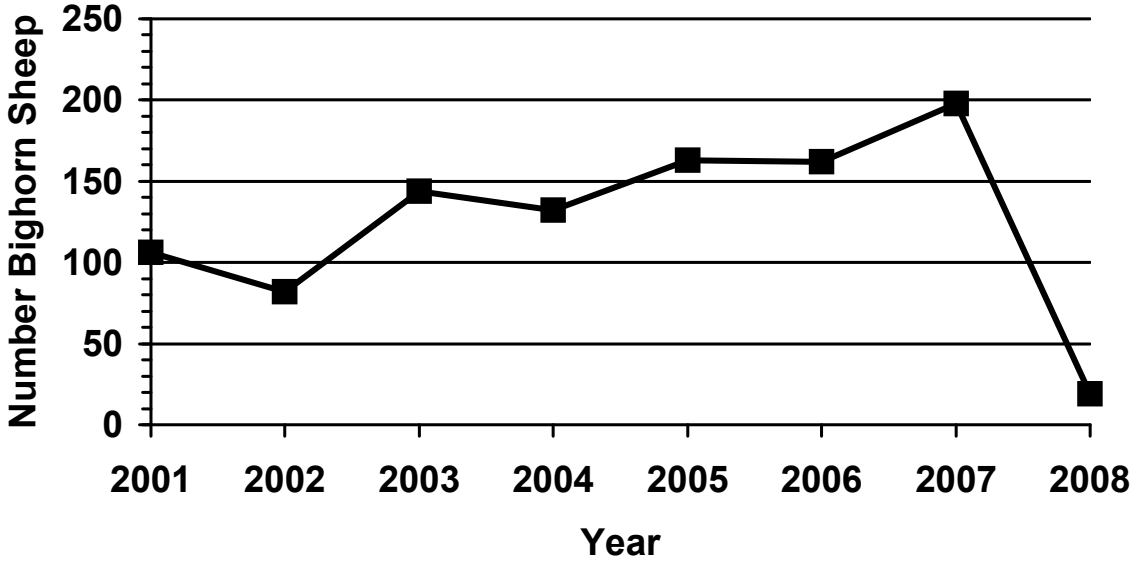


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the Elkhorn population, Hunting District 380, 2001-2007.

Table 1. Bighorn sheep population parameters for the Elkhorn population, Hunting District 380, 2001-2007.

Year	Total	Lambs	Rams	¾+ Rams
2001	106	19	25	
2002	82	31	6	
2003	144	32	35	13
2004	132	29	25	7
2005	163	28	48	15
2006	162	24	54	19
2007	198	27	75	18
2008	19	0	4	0

Table 2. Summary of bighorn sheep observations for Elkhorn population, Hunting District 380, January 16, 2008.

Location	Total	Ewes	Lambs	Rams			
				0-1/4	1/4-1/2	1/2-3/4	3/4+
Shep's Ridge	2	2					
"	2	2					
Cold Springs	1			1			
Crow Creek	1				1		
Sagebrush Gul	3	3					
Crow Creek	2						2
Power Gul	1					1	
Big Mountain	3	3					
"	3	2	1				
Keating Gul	1				1		
"	6	5		1			
Limestone Hills	1	1					
"	3	1	1	1			
"	5	3	1	1			
"	1	1					
Total	35	23	3	4	2	1	2

Table 3. Summary of bighorn sheep observations, Hunting District 380, April 2, 2008.

Location	Total	Ewes	Lambs	Rams			
				0-1/4	1/4-1/2	1/2-3/4	3/4+
Shep's Ridge	5	4		1			
"	2	2					
"	1					1	
Cold Springs	5	5					
Big Mountain	1				1		
South Fk Crow	1					1	
"	2	2					
Rattlesnake Gul	2	2					
Total	19	15		1	1	2	

River Breaks). A total of 75 sheep have been released at two different release sites. Radio collars and individually marked neckbands were placed on a total of 35 and 23 sheep, respectively. Intensive telemetry work has provided seasonal range distribution information for this growing sheep herd.

Sheep have established traditional seasonal ranges, primarily in the Crow and Indian Creek drainages. Approximately one-quarter of the sheep are migratory just prior to lambing and use the heads of the Beaver Creek and McClellan Creek drainages. The distribution information collected from the telemetry work

proved valuable during this survey, as all sheep observed were within traditional wintering areas.

The total count of 198 sheep in 2007 was the highest total count since surveys were initiated. Lamb production was relatively good with a total of 27 lambs observed for a 28.4 lambs: 100 ewes ratio. A total of 75 rams were observed with approximately 76% of these being younger rams or having less than a ¾-curl. Approximately 18 rams were legal rams with a few of these probably scoring greater than 180 (by Boone and Crockett scoring methods). Rams made up 37.9% of the sheep population.

For the 2006 hunting season, the fifth year of hunting these sheep, there were three either-sex licenses issued. The population objective for sheep in the Elkhorn Mountains (Hunting District 380) is for a total of 250 sheep. The production and recruitment of lambs has started picking up the past couple of years, and at the current rate this population objective could be reached in a few years. For the first time, there were three ewe licenses issued for the 2006 season with the objective of implementing a season structure to help manage sheep numbers as the population nears objective. For the 2007 season, there were four either-sex licenses and eight adult ewe licenses issued.

Recreation Provided: Hunting of bighorn sheep in the Elkhorn Mountains was initiated in the fall of 2002 with the issuance of two either-sex licenses. As the population increased, the number of licenses was increased to three either-sex licenses in 2005. As bighorn sheep numbers continued to increase toward the population objective of 250 total sheep, a series of ewe licenses was initiated in 2006 with three licenses being issued. In 2007, the number of either-sex licenses was increased to four and there were eight licenses issued for ewes.

The proximity of the Elkhorn Mountains to population centers, combined with good access by virtue of public ownership of much of the mountain range, has made the area popular for hunting of big game in general and wildlife viewing during all seasons of the year. Most of the bighorn sheep in the Elkhorns are nonmigratory and use habitats near their release site in the southeast portion of the range. A majority of these areas are located on public lands with good access. Popular areas for viewing bighorn sheep include lower portions of the Crow Creek and Indian Creek drainages. The migratory population of these sheep can be observed in the heads of Beaver and McClellan creeks and Casey Peak, and have been observed on Elkhorn and Crow Peaks.

Current Annual Bighorn Sheep Harvest: The bighorn sheep population, in Hunting District 380 is a newly established population and a hunting season was first initiated in 2002 (Table 4). As the population continued to grow, the number and types of licenses issued increased. The population objective for bighorn sheep in this unit is a total of 250 sheep. As the population started approaching this objective, ewe licenses were issued beginning in 2006 in an effort to start managing the total number of sheep. Due to the 2007-08 die-off, the hunting season was closed for the 2008 season.

Accomplishments: This population of bighorn sheep had increased relatively rapidly since the first transplant in 1996. The fall of 2007 was the sixth year that sheep were hunted in this district. At the time of the die-off, FWP was in the second year of beginning to manage the population through the use of ewe licenses, to be within the objective of a total of 250 sheep.

The BLM in 2007 finalized a major land acquisition. The 5,548-acre Iron Mask property on the east slope of the Elkhorn Mountains provides year-round habitat for up to 50 bighorn sheep and winter habitat for approximately 300 elk. This property will likely be managed as a "grass bank," where livestock from other allotments can be moved temporarily to facilitate management actions on those allotments.

In 1992, a Memorandum of Understanding (MOU) (since updated) was developed between the three primary managing agencies in the Elkhorns, the USFS, BLM, and FWP. Shortly thereafter, the agencies completed the Elkhorns

Year	Number Either-Sex Licenses	Ram Harvest	Number Ewe Licenses	Ewe Harvest
2002	2	2	-	-
2003	2	2	-	-
2004	2	2	-	-
2005	3	3	-	-
2006	3	3	3	3
2007	4	4	8	8

Table 4. Number and types of licenses issued and subsequent harvest in the Elkhorns, Hunting District 380, 2002-2007.

Landscape Analysis. This analysis established the historical and existing conditions of the soil, water, vegetation, and wildlife resources in the Elkhorn Mountains. The desired conditions for all the resources were then integrated and compared with existing conditions to establish general, mountain range–wide management direction. Projects completed include a comprehensive Elkhorn Travel Plan, reintroduction of bighorn sheep, the revision of allotment management plans, vegetation treatments that reflect the landscape analysis in much of the mountain range, rehabilitation of historic mine sites, a mountain range–wide "fire plan," bighorn sheep habitat enhancements, westslope cutthroat trout restoration, a comprehensive recreation and travel map, and signing and interpretive projects.

In 1998, FWP acquired a conservation easement on the 1,600-acre Hahn Ranch in Kimber Gulch along the east slope of the Elkhorns. This important property is adjacent to USFS and BLM-managed lands and is important seasonal range for a variety of animals including bighorn sheep.

Management of the Elkhorns historically has been and continues to be controversial. Primary issues are the relationship between wildlife and management activities such as vegetation treatments, travel management, mining, grazing, timber harvest, and recreational uses. The number of elk and their management also is an ongoing controversial issue. In early 2002, to address some of these issues, the agencies, along with other sponsoring partners, formed a working group comprised of individuals from a variety of interests. This diverse group attended several facilitated meetings that primarily addressed conflicts with elk and livestock management. The product of these meetings was a list of recommendations from the working group to the sponsoring agencies on how to address this issue, including information needs, habitat management strategies, and educational efforts. Beginning in 2004, the working group facilitated a contracted vegetation study focusing on the relationship between livestock grazing and elk use of the mountain range. Results from this study and recommendations based on the results were presented to the three managing agencies in the summer of 2007. The working group has been very supportive of protecting wildlife habitat and played a key role in the BLM acquiring the Iron Mask property.

Management Challenges: The primary challenge to reestablishing this bighorn population to former levels will be resolving the potential for contact between domestic sheep and goats and bighorn sheep. When bighorn sheep were first transplanted into the Elkhorns during the winter of 1995-96, BLM guidelines formulated in 1992 were used, which identified a buffer of six miles between habitat that bighorn sheep would potentially use and domestic sheep distribution. These guidelines were the only ones available at that time, and the buffer distance was thought to be adequate. For several years the distance was adequate, but as the bighorn sheep population grew, their distribution increased and contact with domestic animals occurred.

Loss of wildlife habitat continues to occur in this unit. Primarily through human development on winter range areas. Mining, specifically mining occurring in the Limestone Hills on BLM lands is resulting in substantial loss of year-round and winter habitat for bighorn sheep as well as mule deer. While the mine has implemented reclamation efforts, these have been inadequate to offset the loss of wildlife habitat from their operation.

Also in the Limestone Hills adjacent to the mining operation, is a National Guard training area. While this area is currently on public land (BLM) the Guard is pursuing withdrawal of the property to ultimately gain ownership and management responsibility. While the Guard has shown sensitivity to wildlife and wildlife issues on their training area, the cumulative impacts to wildlife of having an active mine and a military training area will likely have a long-term negative effect on wildlife that use this area.

Management of bighorn sheep habitat on public lands has been an issue at times in this district. Lack of coordination on specific projects has resulted in management actions that have questionable value to bighorn sheep based on the scientific literature and documented seasonal distribution and habitat use of bighorns. Some projects were probably detrimental to other big game and wildlife species in general. Closer coordination on projects needs to occur between managing agencies, and specific objectives for managing wildlife habitats on public lands need to be developed.

Bighorn sheep use of private land is at times an issue. While the major landowners in this unit who have bighorns on their property periodically signed off on this transplant, it is imperative that we continue to work with them and make every effort to ensure we keep this population of sheep within the stated objective that was promised to the landowners and public when the analysis was done for these introduced bighorns.

Population Monitoring: To monitor the bighorn population, aerial surveys are conducted annually, generally using a helicopter,

in late winter to early spring. About one-third of these sheep are migratory and start moving off of winter range areas around the middle of April. To get a total count for population trends, the survey has to be conducted prior to then. The entire area occupied by bighorns during winter is flown, including public and private lands. Bighorns are counted and classified by age and sex and rams are classified by horn class.

Summary of Public Comment

Public comments related to this bighorn sheep population and its management in this hunting district have indicated a high level of support for having bighorn sheep here. Both hunters and non-hunters enjoy seeing bighorn sheep in this area.

Management Goal

The primary goal is to ultimately reestablish this population to its former abundance. This will require making sure there is effective separation between bighorn sheep and domestic sheep and goats in this area.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain approximately 80,000 acres of occupied bighorn sheep habitat (based on telemetry data) for the benefit of bighorns, other wildlife species, and other agency mandated uses.

2) Encourage maintenance and improvement of habitat conditions on publicly owned winter ranges (primarily USFS) so that vegetation conditions on these winter ranges provide adequate forage for bighorns and other wildlife during the winter.

3) Encourage maintenance and improvement of habitat conditions on public lands (USFS and BLM) so that bighorns continue to utilize these lands during summer and fall rather than moving onto private lands.

Habitat Management Strategies

1) FWP has worked in cooperation with the USFS and BLM in developing a Landscape Analysis for all public land in this mountain range. This analysis determined the existing condition of soil, water, and vegetation and developed specific projects to improve, maintain, or enhance these resources. Additionally, the agencies, along with the Rocky Mountain Elk Foundation as a partner, are pursuing land exchanges, acquisitions, and conservation easements to acquire or protect important wildlife habitat. Allotment management plans have been revised where needed to enhance vegetation on these sites for wintering wildlife. Some vegetation manipulation through prescribed burning has also been implemented to make these winter ranges more attractive to wintering wildlife.

2) A major effort by the agencies has been underway the past couple of years to control noxious weeds. This will continue and has recently expanded to include adjacent private lands. Much of this effort has been directed at areas of bighorn winter range.

3) A number of recommendations related to habitat made by the Elkhorn Working Group are being evaluated by the agencies and may be implemented in the near future. Some of these involve vegetation monitoring, which would help direct future management direction and decisions.

Game Damage Strategies

Specific game damage problems have not occurred to date and are not anticipated. Bighorn sheep do have the potential for causing conflict with the mining operation in the Limestone Hills. When sheep were being introduced in this mountain range, one of the release sites was a few miles from the mining operation. An MOA was written in conjunction with the mine, stating that if sheep became a conflict with the mining operation, FWP would haze or herd the sheep off of the area. Additionally, bighorn numbers can be managed through trapping and moving sheep from this area as they approach or are at objective.

Access Strategies

FWP has actively pursued new Block Management Areas (BMAs) on private land. In 2007, there were 18 BMAs totaling over 100,000 acres in Hunting District 380. Based on the current distribution of bighorns during the hunting season, lack of hunter access to these sheep has not been an issue. Where sheep use private land during the hunting season, the landowners either allow hunter access on their own or are enrolled in FWP's Block Management Program.

Population Objectives

The population objective for these sheep prior to the die-off was for a total of 250 bighorns, which was being approached at that time. As a result of the die-off and anticipated poor lamb production and recruitment, the objective is being revised. A reasonable objective is that of a minimum viable population of 125 sheep, sufficient enough to be self-sustaining (Geist 1971).

Reopening the Hunting District

Hunting of bighorn sheep in the Elkhorn Mountains (Hunting District 380) will be recommended when at least three of the following four criteria have been met for a minimum of three successive years:

1) The population is at least 75 observable sheep.

2) There are at least 30 rams: 100 ewes.

3) More than 30% of the rams are at least ¾-curl.

4) There are at least 30 lambs: 100 ewes.

Monitoring of these sheep will continue at a level sufficient to determine if these criteria are being met. If so, license levels will be based on the number of ¾-curl rams observed during surveys.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 380 is located in the Mountain Foothills ecological region (see discussion of ecological regions in Chapter 1), which includes much of southwest Montana. This bighorn population is a relatively recently established population that went through a major die-off (90+%), and hunting was closed. Hunting may occur again if the conditions listed above are met. If the population exceeds population objective, appropriate Adaptive Harvest Prescriptions will be developed to adequately manage these sheep.

Currently, the most important strategy for this population is to work with domestic sheep producers and other interested parties in this district to ensure that there is effective separation between domestic animals and bighorn sheep to prevent potential disease transmission, which will help this population recover.

Prescriptive Harvest Management

Ewes: Not applicable at this time.

Rams: Not applicable at this time

SLEEPING GIANT

(Hunting District 381)

Description: Hunting District 381 (Sleeping Giant) begins about eight miles north of Helena and is 533mi² in area. The Sleeping Giant is at the southeastern end of the Lewis and Clark Range of the Rocky Mountains and is adjacent to the Big Belt Mountains. The majority of the district is privately owned (77%) and the remaining land is managed by various public land management agencies. There are three large ranches with FWP conservation easements, six properties enrolled in Block Management within Hunting District 381. The district encompasses approximately 41mi² of Bureau of Land Management (BLM) land. Nearly 19mi² of these BLM lands are designated as an Area of Critical Environmental Concern with management objectives to preserve resource values, provide primitive recreational opportunities, and promote wildlife and habitat values.

Based on telemetry data collected from 1992 to 2003, bighorn sheep occupy a minimum of 75mi² of the Sleeping Giant area(14%) year-round, and during winter, sheep occupy about 40mi². Sixty-seven percent of the total area occupied by bighorn sheep is private land and 33% is public land. Ownership of bighorn sheep winter range within Sleeping Giant is 56% private land and 44% public. These core use areas include BLM lands but do not include private lands with FWP conservation easements or Block Mangement Areas within the district at large.

Seasonal use areas overlap and are not distinct. Sheep do not appear to migrate to specific seasonal use areas except during late summer when sheep do spend some time at higher elevations. Movements of marked animals indicate that sheep readily cross the Missouri River at two areas, one known as

Ming Bar and the other as Oxbow Bend. Sheep move bidirectionally between Hunting District 381 on the west side of the river and Hunting District 455 on the east side (Beartooth Wildlife Management Area, Beartooth bighorn herd; FWP Region 4). Some sheep permanently dispersed to the Birdtail Hills west of Cascade in Region 4. As recently as 2008, bighorns were observed on the Roberts Mountain ridge, which is between the Sleeping Giant and the Continental Divide. According to long time ranchers in that area, Roberts Mountain was historically occupied by bighorns. It is likely that sheep move between the Sleeping Giant herd and the Continental Divide, but movements are probably infrequent as the connecting habitat between these areas does not appear to be suitable for bighorn sheep.

The area occupied by sheep is a mosaic of forests and grasslands. Forests are predominantly Douglas fir, but ponderosa, limber, and lodgepole pines are also present (Rau 1991). Past fire and logging activities provide additional diversity to conifer stands within the core use area. Native bunch grasses are the dominant herbaceous cover throughout the area. Grasslands are characterized by bluebunch wheatgrass, rough and Idaho fescue, and needle and thread grass, and common shrubs include mountain maple, skunkbush sumac, chokecherry, and mountain big sagebrush (Rau 1991). Natural mineral licks are present. Cliff and rock outcrop terrain are common and encompass several thousand acres in five major drainages. Most suitable habitat is between 5,000 to 6,000 feet in elevation.

Public Access: A substantial amount of both public and private lands within Hunting District 381 is accessible to the public. There are 60mi^2 of Montana State Trust lands. There are several large ranches with FWP conservation easements and six properties enrolled in Block Management within this district. Together, these provide about 140 square miles of hunting opportunity on private land within the district. However, the core use areas for sheep do not overlap with these easements or Block Management areas. Core use areas do overlap with approximately 41 square miles of BLM lands and border about 30 miles of the Missouri River. Further, other private landowners have also allowed access for bighorn sheep hunting.

Road access is extensive throughout the district. Interstate 15 bisects the southern portion of the district, and U.S. Highway 287 is the eastern boundary of the district to the north. The Recreation Road along Prickly Pear Creek parallels Interstate 15. MT Highways 279 and 200 form the majority of the western boundary. The Woodsiding Gulch Road provides access to the Sheep Creek-Spring Gulch ridge. The best access to core use areas on BLM lands is from the Missouri River. Walk-in access to core use areas on BLM lands includes the river, Interstate 15, and the Woodsiding Gulch road and Recreation Road.

Bighorn Sheep Population: Bighorn sheep may have been endemic to the Sleeping Giant area, and evidence in support of this includes photographs of a bighorn ram killed on the nearby Carey Hilger Ranch in the 1930s (G. Joslin, personal communication). However, the herd was decimated in the late 1800s as Helena's human population expanded. In 1968, 32 sheep from the Sun River herd were reintroduced. Additionally, sheep emigrated to and immigrated from the Beartooth herd on the east side of the Missouri River (Hunting District 455). Sheep numbers declined in the mid 1980s, which was coincident with an outbreak of viral pneumonia that spread throughout all bighorn herds along the Continental Divide from Alberta south to the Beartooth Wildlife Management Area. By 1988, no bighorns were observed in the Sleeping Giant area. In 1989, the BLM requested that FWP consider reintroducing sheep to the area again. In 1990, as part of the sheep-reintroduction agreement, 14 feral horses were removed. In 1992 and 1993 respectively, 35 sheep from Melrose (Hunting District 340) and 32 sheep from Wildhorse Island (Hunting District 340) were reintroduced.

Of the 67 animals released in 1992 and 1993, 45 were uniquely marked (including 28 neckbands, eight radio collars, and seven colored ear tags; 59 females: eight males). Three uniquely marked ewes were never relocated. Two radio-marked ewes immediately and permanently dispersed to the Birdtail Hills west of Cascade in Region 4, and by fall 2001 approximately 23 sheep were observed in that area (B. Knudson, personal communication).

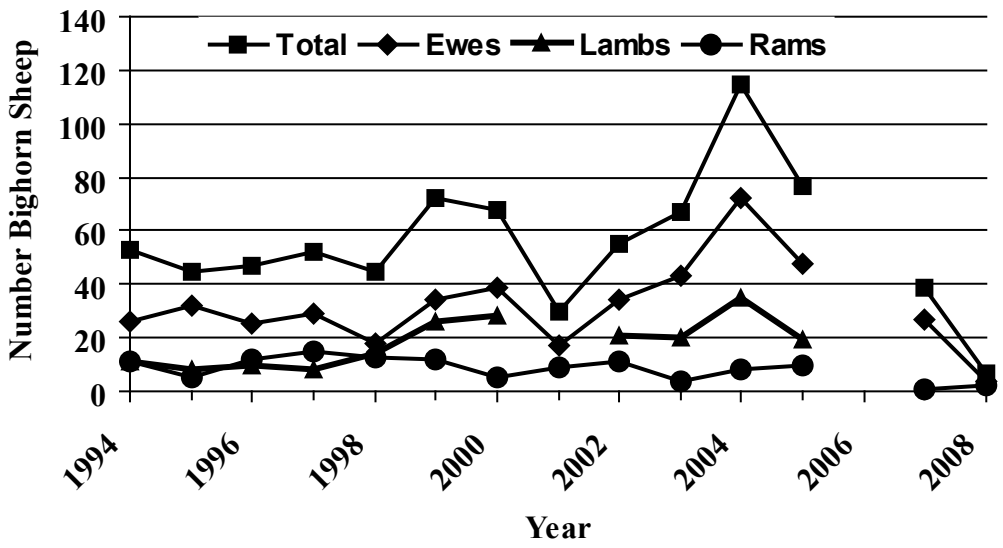
It is important to note that aerial surveys of bighorn sheep in the Sleeping Giant area were conducted at different times of year to document seasonal distribution of this reestablished herd (Table 1). Some spring surveys were conducted pre- and some post-production, and some surveys were conducted in fall and winter, which would be expected to result in more variability in the numbers observed between years due to lamb presence or absence and sheep distribution and visibility. In the interpretation of the survey results that follow, it is not assumed that observations made at different times of year were comparable for trend analysis. While it is likely that stress and disease contributed to the number of deaths and the subsequent decline

Table 1. Summary of aerial survey data for bighorn sheep including number observed and ratio of lambs and rams per 100 ewes in the Sleeping Giant population, Hunting District 381 1994–2008.

Date	Number Observed										Ratios (per 100 ewes)	
	Total	Ewe	Lamb <6 mo	Lamb >6 mo	Ram					Total unclassified	Lamb	Ram
					1/4	1/2	3/4	Full	Unclassified			
Jul-94	53	26	11	-	-	2	3	1	5	5	42	42
Jun-95	45	32	8	-	-	-	-	-	5	-	25	16
Jun-96	47	25	10	-	2	5	2	-	3	-	40	48
Jun-97	52[1]	29	8	-	1	-	12	2	-	-	28	52
Jun-98	45	18	14	-	1	2	6	4	-	-	78	72
Jun-99	72	34	26	-	4	3	4	1	-	-	76	35
Jun-00	68	39	21	-	1	-	5	2	-	-	54	21
Jul-00	70	37	28	-	1	-	2	2	-	-	76	14
Dec-01	30	17	-	4	-	3	2	-	4	-	24	53
Jan-02	55[2]	25	-	19	2	5	3	1	-	-	76	44
Sep-02	56[3]	34	21	-	-	1	-	-	-	-	62	3
Jun-03	67	43	20	-	2	1	1	-	-	-	47	9
Jun-04	115	72	35	-	4	2	2	-	-	-	49	11
Sep-05	77	48	19	-	9	1	-	-	-	1	40	21
Apr-07	39	27	-	11	1	-	-	-	-	-	41	4
Apr-08	7	4	-	-	2	-	-	-	-	1	0	50

1 Includes five ewes and two lambs north of the old Hunting District 381 boundary.
2 Includes four ewes, three lambs, and two rams north of the old Hunting District 381 boundary.
3 Includes six sheep north of the old Hunting District 381 boundary.

Figure 1. Number of ewes, lambs, rams, and total bighorn sheep observed during aerial trend surveys in the Sleeping Giant area, Hunting District 381 1994–2008.



in the number of sheep observed in some years, variability in survey date likely contributed to the fluctuations observed as well. Further, when comparing lamb: ewe ratios between years, whether the survey was conducted pre- or post-production and how many months past production the survey was conducted must also be considered. Some lamb: ewe ratios presented in Table 1 approximate yearling: ewe ratios. Finally, emigration and immigration are known to occur, but the degree to which they affect this herd's population dynamics, and subsequent growth, is uncertain.

Within the Sleeping Giant area, the number of sheep observed was relatively stable with low to moderate lamb production from 1994 until 1998 (Figure 1). In 1998, the number of lambs observed in June and September and the lamb: ewe ratio increased, indicating that production had increased (Table 1). Production remained high through 2002. The increase in total number of sheep observed in this case is not indicative of an increase in the recruitment rate, because lamb production was already higher than previous years and would contribute to growth of the herd. Given the high lamb: ewe ratio (more than 50:100 ewes), an increasing trend in the number of ewes and rams would be expected but was not observed from 2000 to 2002 (Figure 1). In December 2001, anglers reported dead sheep. The number of sheep observed during that winter was lower than other years, which could have been a result of survey date or may have represented a decline in the herd. The die-off was likely minor in 2001, because the number of ewes observed between 2000 and 2002 was similar.

In 2003 and 2004 however, lamb: ewe ratios dropped below 50:100. During the same time period, the number of ewes observed increased and more ¼-curl rams were observed, suggesting good recruitment of yearlings in 2004 and 2005.

The number of sheep observed peaked in this area at 115 in 2004. In 2005, the number of ewes observed and the lamb: ewe ratio declined, but the number of ¼-curl rams (yearling rams) increased.

In 2006, 30 bighorn sheep and 102 domestic sheep were sampled to assess disease prevalence (Joslin 2007). Bighorns were captured by helicopter net gunning. After the sampling work, additional domestic sheep and goats were introduced to this area, and contact between domestic and wild sheep did occur on the north end of the district. In the 18 months following the sampling work, 11 bighorns were reported dead, and one of these tested positive for the bacterial pneumonia *Pasteurella multocida*. Another die-off may have been the cause of further decline in the number of sheep observed between 2005 and 2007, but lamb: ewe ratios were the same during that time. No survey was conducted in 2006.

In 2007, more than 65 square miles burned on the east side of the Missouri River, adjacent to the Sleeping Giant herd's core use area. In 2008, only seven bighorn sheep were observed during a spring pre-production survey. (Sheep may have been in heavier cover, and therefore less observable, due to the strong wind that came up during the survey.)

This herd is not stable, and since 2005 it has been declining. There have been biologically significant fluctuations in lamb production, with some years of low to moderate production and some years of high production. Why years of high production have not resulted in an increase in herd size could be related to a number of factors, including emigration, low recruitment, or adult survival. Known causes of adult mortality include road kill, removal, disease, and predation.

At the FWP Commission's recommendation, the first hunting season for bighorn sheep in Hunting District 381 was established in 2002, and this was a reactionary response to the die-off in 2001. One license for an either-sex bighorn sheep is issued annually and is valid from September 15 through November 30. The regulations remained the same through the 2008 hunting season, except that the boundary of Hunting District 381 was expanded in 2007 to accommodate the expansion of the range of the herd to the Rock Creek drainage to the west and the Dearborn River to the north. Hunting may be closed altogether in this district depending on the number of bighorn sheep observed during the pre-production survey in 2009.

Recreation Provided: Year-round recreational use of the Sleeping Giant includes hunting, fishing, photography, and wildlife viewing. There are many big game hunting opportunities in this area due to the availability of public lands and the substantial size of the Block Management areas. Fishing opportunities are good along the Missouri River. Wildlife viewing is featured by a popular boat tour along the Missouri River. Bighorn sheep may be observed from the river and along Interstate 15 near the town of Wolf Creek. Hunting of bighorn sheep in the Sleeping Giant area began in fall 2002. One either-sex license has been issued annually. However, hunting may be closed altogether in this district beginning with the 2009 (see above).

Current Annual Bighorn Sheep Harvest: The first hunting season for bighorn sheep in Hunting District 381 was established in 2002.

The regulations have remained the same to date, except that the boundary of Hunting District 381 was expanded in 2007. Annually, one license for an either-sex bighorn sheep has been issued and has been valid from 15 September through 30 November. Since the harvest season was initiated, one ram has been harvested in each year (2002 to 2008) except for 2007. Ages of harvested rams ranged from 4.5 to 8.5 years old. Successful harvest has taken 7 to 30 days.

Accomplishments: Six properties are enrolled in the Block Management Program in Hunting District 381, and FWP has conservation easements with the Sieben and O'Connell ranches. Combined, these properties total 140mi^2. The easements are designed to maintain and improve wildlife habitat, provide public hunting opportunity, and protect wildlife habitat from development, in perpetuity. Further, these easements provide continuity for wildlife movement across the landscape by connecting the Continental Divide and the Big Belt Mountains through the Sleeping Giant area.

To better understand disease dynamics between wild and domestic sheep, a respiratory study was conducted in 2006 across several areas of Montana with bighorn sheep herds, including the Sleeping Giant. From two ranches in the Sleeping Giant area, baseline blood, throat swab, and fecal samples were collected and screened from 30 wild sheep and 96 domestic sheep. To date, the report for this study is not completed.

Management Challenges: There are a number of challenges to bighorn sheep management in this district. There is a need to understand what factors may be limiting herd growth. The herd has yet to exceed 115 observable sheep during aerial surveys, despite high lamb: ewe ratios, and the number of sheep observed in this population during pre-production surveys was 39 in 2007 and 7 in 2008. Incidentally, 20 bighorns were observed during a survey of elk in the area in February 2009. Factors potentially limiting herd growth include low lamb survival, low recruitment rates, road kill, emigration, and disease transmission between wild sheep and domestic sheep and goats, resulting in lower survival rates.

Interaction between wild sheep and domestic sheep and goats occurs in this area, and is a management concern given the potential for disease transmission. There are at least two substantial domestic sheep ranching operations, one substantial domestic sheep and goat operation, and one smaller domestic sheep operation within the district. Feral goats have also been observed. There are no sheep grazing allotments in this district, but there is a cattle grazing allotment on BLM lands within the Sleeping Giant area. Pneumonia has been documented as the cause of death in some wild sheep in this area. Occasionally, wild and domestic sheep have interacted on the north end of the district, and as a management response, bighorns were killed.

To date, bighorn use of private lands has not been an issue, but maintaining tolerance for bighorns is also a management priority. When bighorns were reintroduced to the Sleeping Giant area in 1992-93, all but one of the landowners in the area consented to the reintroduction, and since that time, the one landowner that did not consent has sold the property. Landowners and sheep growers in the area are cooperative and supportive of the establishment of this bighorn herd. One sheep grower stated that they were willing to adjust domestic sheep operations for the benefit of the bighorns if necessary. To maintain tolerance for bighorn sheep in this area, it is imperative that FWP continue to work with landowners and manage this herd within stated objectives.

Occasionally, bighorn in this district are killed on Interstate 15 in the north end of the district (average two per year), by drowning in the Missouri River, or by poachers.

Classified noxious weeds and other exotic plants are spreading throughout the district, and, if invasion becomes widespread, forage for bighorns might become limited. There is currently no noxious weed control on the BLM lands in the Sleeping Giant area, and noxious weed control on public lands is recommended. Several private landowners do have strategies in place for managing noxious weeds.

Historically, habitat monitoring in the area occupied by bighorn sheep has not been conducted, but is recommended. If any habitat management is proposed by the BLM or the U.S. Forest Service (USFS), interagency coordination is recommended to develop reasonable and appropriate habitat management objectives for bighorns and other wildlife.

Although housing development is predominantly outside areas that sheep are known to use, loss of wildlife habitat continues in this district. Further, motorized use of public lands via USFS and BLM system roads and illegal off-road use are also a concern.

Population Monitoring: To monitor the Sleeping Giant bighorn population, surveys are conducted annually from a helicopter. Initially, some surveys were conducted at different times of year to document seasonal distribution. Bighorns are counted and classified by age and sex, rams are classified by horn class, and

locations are recorded. Previously, surveys were conducted in all seasons, including in the spring both before and after lambing. In the future, efforts will be made to conduct surveys in late winter or early spring prior to lambing to reduce variability in observations due to lambing and potential changes in distribution and observability throughout the year. The entire area known to be occupied by bighorns during winter will be surveyed, including public and private lands.

In addition to trend surveys, investigation of the population demographics of this herd is recommended to help explain what may be limiting herd growth.

Summary of Public Comment

Generally, public sentiment regarding bighorn sheep establishment in the Sleeping Giant area is positive. Landowners and sportspersons are both supportive.

Management Goal

The management goals for this herd are: 1) to manage for a healthy, productive, stable, and sustainable bighorn sheep herd with a diverse age structure of rams, 2) to better understand the population dynamics of this herd, 3) to cooperate with public land management agencies and private individuals in the management of bighorn habitats, and 4) to maintain good opportunity for hunter harvest.

Habitat Objectives

1) Develop and maintain cooperative programs that encourage public and private land managers to maintain a minimum of 75 square miles of occupied bighorn sheep habitat (based on location data) for the benefit of bighorns, other wildlife species, and other agency-mandated uses.

2) Encourage maintenance and improvement of habitat conditions on publicly owned winter ranges (primarily BLM) so that vegetation conditions on these winter ranges provide adequate forage for bighorns and other wildlife during the winter.

3) Encourage maintenance and improvement of habitat conditions on public lands (BLM and USFS) adjacent to the area currently occupied by sheep so that the use area might expand and more bighorn sheep might be sustained within the district.

Habitat Management Strategies

1) There is currently no noxious weed control on the BLM lands in the Sleeping Giant area, and noxious weed monitoring and control on public lands is recommended. Several private landowners do have strategies in place for managing noxious weeds.

2) Habitat monitoring is needed and recommended.

3) Specific habitat treatments have not been implemented, but it is recommended that options for improving or expanding bighorn habitat be considered with land management agencies such as the BLM and the USFS.

Game Damage Strategies

Specific game damage problems have not occurred to date and are not anticipated. Bighorns are occasionally killed on Interstate 15 (current average is two per year), and it may be necessary to address this if the incidence increases. If bighorn sheep exceed population objectives in this district, they could be trapped and relocated to other areas.

Access Strategies

Public access is good in this district because of the cooperation of landowners and the availability of public land. Landowners have granted bighorn sheep hunters permission to hunt and to traverse their lands to access BLM lands. Opportunities for enrolling private land into FWP's Block Management Program or for obtaining conservation easements on private lands will be pursued, if these lands benefit proposed management goals and/or habitat objectives for bighorn sheep or other wildlife.

Population Objectives

The overall objective is to establish a stable herd in the Sleeping Giant area of approximately 125 bighorn sheep, a herd size that should be self-sustaining (Geist 1971). This population objective of 125 (± 10%) observed bighorn sheep was established based on the ability of private and public lands to provide forage for the majority of the wintering bighorn herd and landowner tolerance for the remaining sheep that winter on private lands.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn

populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological zone where they occur. Hunting District 381 is located in the Mountain Foothills ecological zone (see discussion of ecological regions in Chapter 1), which includes much of southwest Montana.

The Sleeping Giant bighorn herd is below population objective, and the observed herd size tends to fluctuate. It is assumed that harvest of one legal ram (at least ¾-curl), or one ewe, annually is not detrimental to this herd, given that 25 sheep in the field is expected to produce one trophy ram annually (Wishart 1978). However, hunting may be closed altogether in this district beginning with the 2009 season depending on the number of bighorn sheep observed during the pre-production survey in 2009. Monitoring migration and standardizing the timing of surveys may better explain the dynamics of this herd. It is recommended that the population dynamics of this herd, and factors that might be influencing these dynamics, be investigated prior to additional transplant. Given the prevalence of domestic sheep and goat producers in this area and the likelihood of mixing between these domestics and wild sheep, sustainable success is dubious. This herd may also be limited by suitable habitat. There is much USFS land near the area occupied by sheep, but these lands are primarily dense forests, which do not provide adequate habitat for bighorn sheep. Habitat improvements may be necessary to meet management objectives.

Prescriptive Harvest Management

Ewes: Not applicable at this time due to small herd size.

Rams: Not applicable at this time due to small herd size.

Reopening the Hunting District:

If hunting of bighorn sheep in the Sleeping Giant area (Hunting District 381) is closed for the 2009 season, reopening will be recommended when at least three of the following four criteria have been met for a minimum of three successive years:

1) The population is at least 75 observable sheep.

2) There are at least 30 rams: 100 ewes.

3) More than 30% of the rams are at least ¾-curl.

4) There are at least 30 lambs: 100 ewes.

Monitoring of these sheep will continue at a level sufficient to determine if these criteria are being met. If so, license levels will be based on the number of ¾-curl rams observed during surveys.

GREENHORN

Description: The Greenhorn Mountains contain approximately 169mi^2 with private land on the west bench and public land in the vast majority of the mountain range. The Greenhorns are a relatively small mountain range located about 3 miles southeast of Alder, Montana. The mountain range is currently occupied by bighorn sheep during the entire year. This productive mosaic of mountain grasslands, forests, and alpine vistas are managed primarily by the U.S. Forest Service (USFS) – Beaverhead-Deerlodge National Forest, and the Bureau of Land Management (BLM). The BLM lands are managed under the Dillon Resource Management Plan.

Public Access: The Greenhorn Mountains provide a good diversity of hunting experiences, including motorized hunting on the periphery and walk-in hunting in the interior. Access to public land is relatively good north of Idaho Creek and south of Greenhorn Creek on the west slope and in the remainder of the area. However, only foot access exists between Idaho and Greenhorn Creeks. Access here is limited by the absence of any public roads and the closure of most of the private land to public access.

Bighorn Sheep Populations: The number of bighorn sheep in the Greenhorn population has been steadily decreasing since the initial transplant of 69 sheep that occurred in February 2003 (N=30 from the Missouri Breaks) and February 2004 (N=39 from the Sun River). Radio collars were placed on 36 sheep.

Telemetry work has provided movement data and range distribution for this sheep population.

A total count of 31 sheep in April 2007 is the latest high observed count available. Lamb production and ram counts have been difficult to determine as so many sheep have been removed from the population by dispatch to avoid contact with domestic sheep or trapping and transplanting, and the few remaining have been so widely dispersed.

The population objective for bighorn sheep in the Greenhorn Mountains is 125 sheep. A large number of sheep have been removed from this population prior to enough time passing to allow for population growth. From the original 69 sheep released, there have been known mortalities of 15 radioed sheep (13 were from unknown causes and 2 were dispatched). There have also been 14 other sheep dispatched for a total of 29 mortalities out of the original 69. In addition, 18 sheep were removed in February 2006, eight of which were from the original 69 and 10 others born since the last transplant in February 2004. Of the 69 sheep originally released, 34 have died or been removed from the population, leaving a maximum of 35 of the original sheep to grow the population. At the current rate of removal, this population is not likely to establish as viable. Even in the absence of further removals, it is not known whether the remaining number of sheep will be sufficient to establish a viable population. Time will tell whether the population becomes viable and will approach the population objective.

Recreation Provided: Hunting of bighorn sheep in the Greenhorn Mountains was one of the objectives of the transplant into the area. Should the population increase sufficiently, following all the recent removals, hunting may yet be achievable for this population. Bighorn sheep may sometimes be viewed near the Ruby Reservoir dam, in the Barton Gulch area, along the Ruby Road near some buffalo jumps near Jack Creek, and at the Ruby River Canyon near Powder Gulch.

Management Challenges: Issues in bighorn sheep management in this area all relate to wild sheep and domestic sheep conflicts. One issue is the potential for transmission of disease between the two species. Another is the potential for wild rams to breed domestic ewes. To date, and to the best of our knowledge, neither of these potentials has come to fruition. There has been sufficient spatial separation between the two species, even without the removal measures listed above, which further reduced potential conflicts.

An Environmental Analysis (EA) was done prior to transplanting sheep into this area. In that EA, provisions were developed to attempt to preclude wild and domestic sheep conflicts. These were outlined in a Memorandum of Understanding (MOU) between FWP, the USFS, BLM, and local sheep producers, and included trapping and dispatch, both of which have been carried out. In addition, local sheep producers were provided with kill permits to dispatch any bighorns with potential to come into proximity to their domestic sheep. To date, the sheep producers have not used these permits.

Another part of the EA completed prior to releasing bighorns in the area was a plan for dealing with sheep that move beyond the Greenhorn Mountains or attempt to establish beyond the Greenhorn Mountains. This included provisions to trap or dispatch, as indicated above, as well as allowing hunting or preparing an amendment to the EA to determine if the population should be allowed to expand. To date, neither of these latter two provisions has been used.

The final challenge would be getting the population to a level sufficient for hunting. Given the extent of removals, the low level of the population at this time, the propensity for management actions, and the population objective, it is not likely that hunting could be expected to occur prior to the population reaching an observed level of at least 125 animals.

Population Monitoring: To monitor the Greenhorn bighorn population, aerial surveys will be conducted annually. The entire area occupied by bighorns during winter will be surveyed, including public and private lands. Bighorns will be counted and classified by age and sex, and rams will be classified by horn class.

Management Goal

Manage for an increasing healthy and productive bighorn sheep population with a diverse age structure of rams. Cooperate with public land management agencies and private individuals in the management of bighorn habitats, and develop opportunity for bighorn sheep hunters to harvest sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain occupied bighorn sheep habitat for the benefit of bighorns, other wildlife species, and other agency-mandated uses.

2) Encourage maintenance and improvement of habitat conditions on publicly owned winter ranges so that vegetation conditions on these winter ranges provide adequate forage for bighorns and other wildlife during the winter.

3) Encourage maintenance and improvement of habitat conditions on public lands so that bighorns continue to utilize these lands during summer and fall rather than moving onto private lands.

Habitat Management Strategies

Prescribed burning or other habitat manipulations are not necessary to improve bighorn sheep habitat in this area. The results from such activities are anticipated to be minimal at best, and consequently, are not proposed at this time. In this area, habitat management strategies will be developed should the bighorn population appear that it may become viable.

Game Damage Strategies

Specific game damage problems have not occurred to date and are not anticipated. However, the EA prepared for reintroducing bighorns to the Greenhorns specified actions to be taken should conflicts on private lands occur. These actions consist of, where possible, hunting and/or translocating sheep back into the Greenhorn Mountains. Hazing, herding, scare guns or dispatch may also be employed as the situation merits.

Access Strategies

Access is only anticipated to be a potential problem in the area between Barton Gulch and Greenhorn Creek. In this area, access strategies will be pursued should the bighorn population appear it may become viable and hunting may become feasible.

Population Objectives

The population objective originally proposed for this population prior to release, which was identified in the EA done for this transplant, was for a total of 200 bighorn sheep. Since the initial transplants of 2003 and 2004, removal of bighorn sheep as a result of agreements made with adjacent domestic sheep producers have precluded these bighorns from expanding numerically. While there may be adequate habitat to support more bighorn sheep a more reasonable and perhaps attainable objective would be for a total of 125 bighorns, which is what is considered a minimum viable population (Geist 1971). The objective would be:

1) Maintain the number of bighorn sheep observed during winter aerial surveys within 20% of 125 sheep (100 to 150) with 30 to 40 lambs: 100 ewes.

2) Maintain a ram: 100 ewe ratio observed during winter aerial surveys of at least 40, with at least 30% of the rams having a ¾-curl.

3) Maintain the average age of 5½ years for rams harvested (should there be hunting) on either-sex licenses.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and objectives for the various populations as well as monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. The Greenhorn Mountains are located in the Mountain Foothills ecological region (see discussion of ecological regions in Chapter 1), which includes much of southwest Montana. This bighorn population is a very recently reintroduced population.

The population objective of 125 (± 20%) observed bighorn sheep was derived by considering both the ability of public lands to provide forage for the majority of the wintering bighorn population and landowner tolerance for the remaining sheep that winter on private lands. Population management strategies will be directed at maintaining bighorn numbers consistent with landowner tolerance as well as maintaining the number of sheep wintering on public lands within carrying capacity.

Prescriptive Harvest Management

Hunting of bighorn sheep in the Greenhorn Mountains will be recommended when at least three of the following four criteria have been met for a minimum of three successive years:

1) The population is at least 75 observable sheep.

2) There are at least 30 rams: 100 ewes.

3) More than 30% of the rams are at least ¾-curl.

4) There are at least 30 lambs: 100 ewes.

Monitoring of these sheep will continue at a level sufficient to determine if these criteria

are met. If so, license levels will be based on the number of ¾-curl rams observed during surveys.

Ewes: Not applicable at this time.

Rams: Harvest would initially be conservative with the number of either-sex licenses recommended equal to approximately 10% of the rams observed during aerial surveys.

DEEP CREEK, CASTLE REEF, GIBSON LAKE NORTH, FORD CREEK (SOUTHERN ROCKY MOUNTAIN FRONT ELK CREEK – TETON RIVER COMPLEX)

(Hunting Districts 421, 422, 423, 424)

Description: The Southern Rocky Mountain Front region, sheep Hunting Districts 421, 422, 423, and 424, represents 1,105mi² with 434mi² (42%) privately owned and the rest managed by several public land management agencies. In Montana, the Rocky Mountain Front extends from Glacier National Park approximatly 155 miles in a southeasterly direction. Roughly 330mi² (30%) of these hunting districts are currently occupied by bighorn sheep during at least some portion of the year. Less than 10% of existing occupied sheep habitat is private land. Just over 450 square miles of this productive mosaic of mountain foothills and grasslands, forests and alpine vistas are managed by the U.S. Forest Service (USFS) – Lewis and Clark National Forest (NF). There are an additional 22mi² of foothills, predominated by grassland/shrubland vegetation, managed by the Bureau of Land Management (BLM). The private land portion of the area is mostly cattle and hay operations with a smaller amount of dryland grain on the eastern perimeter. The Teton and Sun Rivers along with Deep, Willow, Smith, Ford, and Elk Creeks drain eastward through the area from the mountain front and the Continental Divide.

Public Access: Hunting as well as many other forms of outdoor recreation occurs on private and public lands throughout the Southern Rocky Mountain Front Complex. Bighorn sheep hunting access is mostly by foot or horseback on USFS trails. There is further access on BLM and private lands. Very little of the Lewis and Clark NF and adjacent BLM lands are authorized for motorized use. Access to private lands for bighorn hunting varies from limited to no access, with varying amounts of public use depending upon individual landowners. Currently, there are no Block Management areas in the area where bighorns reside. The majority of the bighorns in these hunting districts are available to the public during the hunting season. Most of the bighorn sheep on the Southern Front are migratory in nature, using mountain foothills for winter range habitat and backcountry subalpine and alpine territories for summer range. Popular areas for viewing bighorn sheep are along the Gibson Reservoir, Sun Canyon, Ear Mountain, Ford Creek along the Benchmark Road, and Willow Creek heading up to locales around Fairview Plateau.

Bighorn Sheep Populations: From a historical standpoint, the Southern Rocky Mountain Front sheep have for the most part been a healthy and numerous herd. The most recent large-scale disease die-off (due to a pneumonia/lungworm complex) occurred in 1983 to 1984. Other sheep die-off events were recorded between the 1920s and 1930s. Although some small herd segments stay within and between these hunting districts, bighorns frequently move to and from neighboring use areas. Bighorns occupy a variety of habitats within this region, including mountain foothills and meadows, steep, rocky ridges, avalanche chutes, and cliff faces. Historical survey and inventory records for these sheep date back to the middle part of the 20th century. Sheep habitats in these hunting districts are typically rugged and, in some areas, difficult to access for survey and inventory purposes. Traditional foot/horseback and some aerial surveys are conducted biannually (fall [rut] and spring) to monitor bighorn populations. Supplemental observations are recorded during other species survey efforts or summer survey efforts (mostly related to lamb recruitment). Animals are counted and classified by gender and number of lambs. Horn curl is used to classify ram age structure: ¾-curl +, ¾-curl, 2/3-curl, ½-curl and ¼-curl.

Bighorn census figures from late fall/early winter surveys from as early as 1955 for each hunting district are enumerated below (Figures 1-4 and Tables 1, 3, 5, and 7). All four hunting districts are annually surveyed during late fall/early winter (December) and spring (April). Yearly late fall/early winter rut survey counts

typically best enumerate overall population size, especially in relation to overall ram numbers and age structure. The latter surveys vary from zero up to 389 sheep, depending on the hunting district. See below for summaries regarding sheep classification numbers, ram: ewe: lamb ratios, trapping and transplant information, and hunting and harvest information for each hunting district.

HUNTING DISTRICT 421

Hunting District 421 has traditionally seen lower sheep numbers compared to adjacent southern and western hunting districts. In 1998, 22 sheep (from the Bitterroot Mountains) were released between the North and South Forks of Deep Creek to help boost the population in this area. Traditional use areas include sections in and immediately around the North and South Forks of Deep Creek, farther north around the Ear Mountain Wildlife Management Area (WMA), and west on and around drainages associated with the Rocky Mountain and Headquarters Pass area. Conventional wintering areas include locations on and immediately adjacent to the foothills of the Rocky Mountain Front (Deep Creek north to the South Fork of the Teton River).

Based primarily on available, suitable habitat and concerns related to disease and die-offs, the population objective for this hunting district is 175 observed bighorns during early winter and spring surveys (assuming healthy ram age structure and lamb: ewe ratios). From 1966 to 2008, the average total number of sheep observed each year during late fall/early winter survey efforts was 82 (Figure 1 and Table 1). An average of 16 rams, 32 ewes, 11 lambs and 52 unclassified sheep have been observed each year. Average lamb production equals 47 per 100 ewes and observed rams ¾-curl or greater have averaged eight since 1966.

Recreation Provided: Hunting District 421 provides some private land hunting, but public lands are generally accessible for day hunting from trailheads or extended camping trips into BLM, national forest and wilderness areas. Of the four hunting districts in this complex, Hunting District 421 likely possesses the most lands inaccessible to public sheep hunting and viewing. Outfitting is limited since harvest is controlled through a limited-entry drawing, which restricts the number of nonresident hunters.

From 1912 to 1952, there was no hunting season for bighorn sheep in the greater Sun River area (this includes Hunting District 421). Beginning in 1953 and up until 1974, ram hunting seasons were permitted (Bighorn Sheep Hunting District 42). Starting in 1974, permits were changed to either-sex (ES) hunting. It was not until 1976 that Hunting Districts 421, 422, 423, and 424 were established. For purposes of this document, Table 2 summarizes licenses offered and bighorn harvest since 1976 for Hunting District 421. From 1976 to 2008, 243 licenses have been allocated (147 ES and 96 ewe licenses), with 129 rams and 36 ewes harvested (88% success for ES licenses and 38% success for ewe licenses – there is typically less hunter effort for hunting ewes compared to ram hunting). The 33-year average harvest is four sheep from the either-sex licenses and one sheep from the adult ewe licenses, although ewe licenses were not allocated in some years. Average age of harvested rams from 1981 to 2008 is 7 1/2 years old.

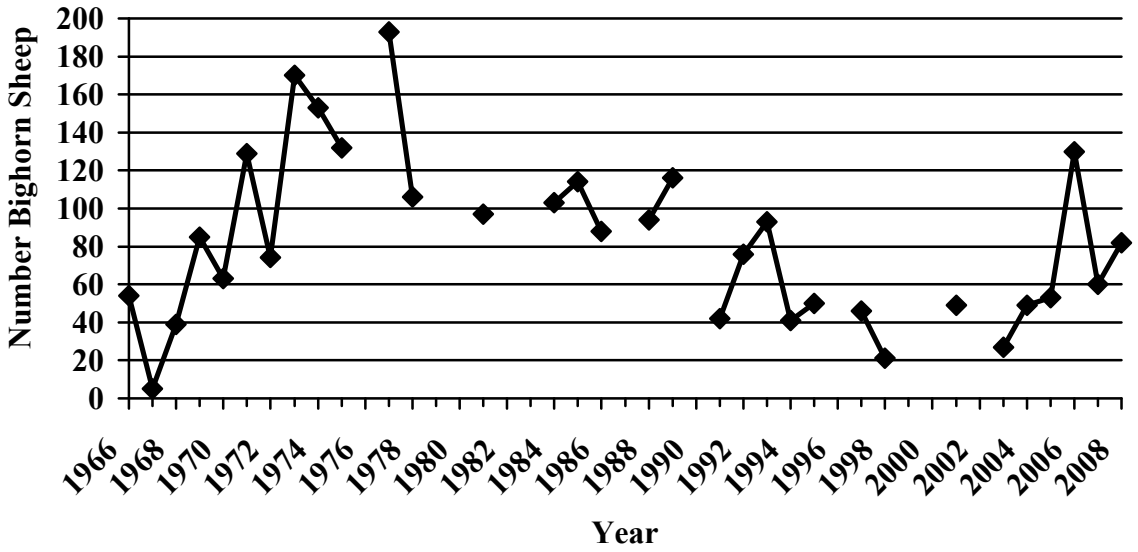


Figure 1. Total number of bighorn sheep observed during aerial/ground trend surveys (late fall/early winter) in Hunting District 421, 1966-2008. For years in which no data are present, it is unknown as to whether no sheep were observed or no survey efforts were conducted and/or recorded.

Year	Ewes	Lambs	Rams (3/4 & 3/4+)	Unclassified	Total	Ram:Ewe:Lamb
1966	33	11	10(3)		54	30:100:33
1967		2		3	5	NA
1968	30	8	1		39	3:100:26
1969	53	25	24(4)		102	21:100:43
1970	35	18	10(3)		63	29:100:51
1971	68	33	25(3)	129	129	NA
1972	31	15	23(15)	5	74	65:100:48
1973	2	1	0	167	170	NA
1974	85	30	34(19)	4	153	40:100:35
1975				132	132	NA
1976						
1977	106	49	38(18)		193	36:100:46
1978	25	7	14(13)	60	106	56:100:28
1979						
1980						
1981	47	22	8(2)	20	97	17:100:47
1982						
1983						
1984	66	12	25(9)		103	38:100:18
1985	77	7	30(7)		114	39:100:9
1986	66	13	9(5)		88	14:100:20
1987						
1988	30	13	9(6)	42	94	30:100:43
1989			31(15)	85	116	NA
1990						
1991	19	6	17(12)		42	89:100:35
1992	36	18	22(4)		76	61:100:50
1993	38	21	34(20)		93	89:100:55
1994	12	11	18(12)		41	150:100:92
1995	18	8	24(10)		50	133:100:44
1997	26	7	10	3	46	38:100:27
1998			2(2)	19	21	NA
2001			3(1)	46	49	NA
2003	1			26	27	NA
2004	1		4(2)	45	49	NA
2005				53	53	NA
2006			15(7)	115	130	NA
2007	26	6	12(8)	16	60	46:100:23
2008	30	3	29(7)	20	82	97:100:10

Table 1. Annual observations of sheep during rutting/early winter period, Hunting District 421, 1966-2008. Counts represent those sheep believed to be unique sheep counted only once per survey. For years in which no data are present, it is unknown as to whether no sheep were observed or no survey efforts were conducted and/or recorded.

Table 2. Number and types of licenses issued and subsequent harvest, Hunting District 421, 1976-2008. Harvest totals are a combination of check station data, hunter questionnaire results, harvest surveys, and transportation forms.

Year	Either-Sex Licenses	Either Sex Harvest	% Success	Ewe Licenses	Ewe Harvest	% Success
1976	10	8	80	15	2	13
1977	10	9	90	0	0	NA
1978	10	9	90	14	0	0
1979	10	9	90	4	0	0
1980	10	10	100	6	2	33
1981	10	9	90	10	7	70
1982	8	8	100	4	2	50
1983	10	8	80	10	9	90
1984	5	5	100	5	2	40
1985	5	2	40	0	0	NA
1986	5	5	100	0	0	NA
1987	5	4	80	0	0	NA
1988	5	3	60	0	0	NA
1989	5	5	100	NA	3	NA
1990	5	5	100	NA	1	NA
1991	5	4	80	10	1	10
1992	5	3	60	10	3	30
1993	2	2	100	2	1	50
1994	2	2	100	2	0	0
1995	2	2	100	2	1	50
1996	2	1	50	1	1	100
1997	2	2	100	1	1	100
1998	1	1	100	0	0	NA
1999	1	1	100	0	0	NA
2000	1	1	100	0	0	NA
2001	1	1	100	0	0	NA
2002	1	1	100	0	0	NA
2003	1	1	100	0	0	NA
2004	1	1	100	0	0	NA
2005	1	1	100	0	0	NA
2006	2	2	100	0	0	NA
2007	2	2	100	0	0	NA
2008	2	2	100	0	0	NA
Total	147	129	88	96	36	38

HUNTING DISTRICT 422

Hunting District 422 has traditionally been an area demonstrating robust sheep numbers. Because of this, the area has been one of the main focal points for sheep trapping and transplanting for the state of Montana. Since 1942, there have been 52 separate trapping and transplant efforts (sometimes multiple times per year) in this hunting district. Since 2009, a total of 944 sheep (34% of all recorded sheep transplants statewide) have been trapped out of this general area (includes Hunting Districts 422 and 423) and relocated to many parts of Montana, as well as other states. An old wooden sheep trap still stands below Castle Reef, evidence of trapping efforts from years ago. In 1944, one adult ram (from West Gallatin, Montana) was released in the Sun Canyon area. Traditional use areas in this hunting district include Hannan and Blacktail Gulches, Wagner Basin, and locales on and below Castle Reef. Conventional wintering areas include locations on and immediately adjacent to the foothills of Castle Reef, Wagner Basin, and Hannan Gulch.

Based on research related to available, suitable habitat and concerns regarding disease and die-offs, the population objective for this hunting district is 200 observed bighorns during early winter and spring surveys (assuming healthy ram age structure and ewe:lamb ratios). From 1955 to 2008, the average total number of sheep observed each year during late fall/early winter survey efforts was 194 (Figure 2 and Table 3). An average of 45 rams, 82 ewes, 37 lambs, and 62 unclassified sheep have been observed each year. Average lamb production equals 46 per 100 ewes and observed rams ¾-curl or greater have averaged 15 since 1955.

Recreation Provided: Hunting District 422 provides some private land hunting, but public lands are generally accessible for day hunting from trailheads or extended camping trips into BLM and national forest lands. Of the four hunting districts in this complex, Hunting District 422 likely possesses some of the most easily accessible public sheep hunting and viewing. Outfitting is limited since harvest is controlled through a limited-entry drawing, which restricts the number of nonresident hunters. Good bighorn sheep hunting in this hunting district is readily accessible by sheep standards.

From 1912 to 1952, there was no hunting season for bighorn sheep in the Sun River area. Beginning in 1953 and up until 1974, ram hunting seasons were permitted (Bighorn Sheep Hunting District 42). Starting in 1974, permits were changed to either-sex (ES) hunting. It was not until 1976 that Hunting Districts 421, 422, 423, and 424 were established. For purposes of this document, Table 4 summarizes licenses offered and bighorn harvest since 1976 for Hunting District 422. From 1976 to 2008, approximately 580 licenses have been allocated (254 ES and 326 ewe licenses), with 233 rams and 248 adult ewes harvested (92% success for ES licenses and 76% success for adult ewe licenses). The 33-year average harvest is 7.3 sheep from the either-sex licenses and 7.8 sheep from the adult ewe licenses. Average age of harvested rams from 1981 to 2008 is 6 1/2 years old.

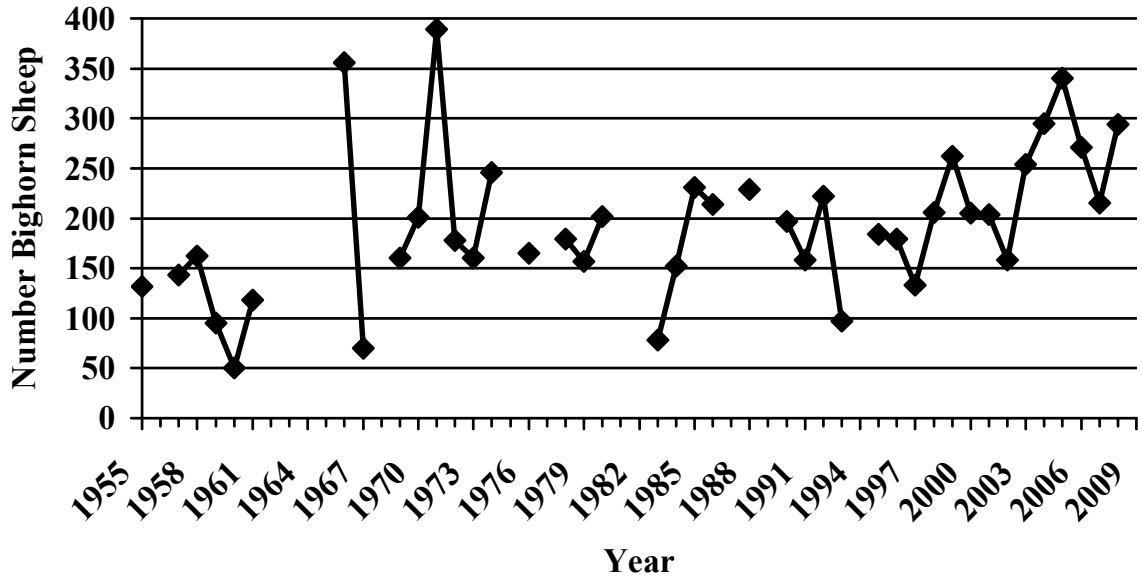


Figure 2. Total number of bighorn sheep observed during aerial and ground trend surveys (late fall/early winter) Hunting District 422, 1955-2008. For years in which no data are present, it is unknown as to whether no sheep were observed or no survey efforts were conducted and/or recorded.

Table 3. Annual observations of sheep during rut/early winter period, Hunting District 422, 1955-2008. Counts represent those sheep believed to be unique sheep counted only once per survey. For years in which no data are present, it is unknown as to whether no sheep were observed or no survey efforts were conducted and/or recorded. Year

Year	Ewes	Lambs	Rams (3/4 & 3/4+)	Unclassified	Total	Ram:Ewe:Lamb
1955	64	34	34 (9)		132	53:100:53
1957	69	29	42 (13)	3	143	60:100:42
1958	66	41	49 (11)	6	162	74:100:62
1959	38	13	20 (4)	24	95	52:100:34
1960	28	11	7 (1)	4	50	25:100:39
1961	66	24	14 (4)	14	118	21:100:36
1966[1]	198	72	86 (22)		356	43:100:36
1967	39	17	4	10	70	NA:100:44
1968[2]	193	83	65(10)	20	361	34:100:43
1969	84	46	30		160	36:100:55
1970	106	57	38		201	36:100:54
1971[1]				389	389	NA
1972	99	52	27 (2)		178	27:100:53
1973	85	34	41 (7)		160	48:100:40
1974	120	67	59 (11)		246	49:100:56
1975	102	59	51 (4)	2	214	50:100:58
1976	77	63	24 (9)	1	165	31:100:82
1978	79	37	11 (1)	52	179	14:100:47
1979	82	44	31 (2)		157	38:100:54
1980	88	59	55 (10)		202	63:100:67
1981	113	54	68 (10)		235	60:100:47
1982	103	64	66 (21)		233	64:100:62
1983	38	16	24 (2)		78	63:100:42
1984	87	20	45 (6)		152	52:100:23
1985				231	231	NA
1986	97	59	58 (11)		214	60:100:61
1988	96	56	62 (21)	15	229	65:100:58
1989	143	71	74 (36)		288	52:100:58
1990	82	52	63 (24)		197	77:100:41
1991	58	24	49 (3)	27	158	84:100:41
1992			27 (9)	195	222	NA
1993	40	12	22 (8)	23	97	55:100:30
1995	51	37	45 (15)	51	184	88:100:73
1996	93	23	63 (26)		179	68:100:25
1997	62	32	33 (18)	6	133	53:100:52
1998	93	38	68 (28)	7	206	73:100:41
1999	91	33	65 (25)	73	262	71:100:36
2000	70	37	47 (22)	51	205	67:100:53
2001	79	24	48 (20)	53	204	61:100:30
2002	60	30	19 (9)	49	158	32:100:50
2003	87	40	50 (24)	77	254	57:100:46
2004	103	35	32 (15)	125	295	31:100:34
2005	131	56	81 (31)	72	340	62:100:43
2006	125	21	96 (31)	28	271	77:100:17
2007	75	40	61 (37)	39	215	81:100:53
2008	128	34	97 (48)	35	294	76:100:27

[1] Includes Hunting Districts 422 and 423.

[2] Includes Hunting Districts 422 and 424.

Year	Either-Sex Licenses	Either Sex Harvest	% Success	Ewe Licenses	Ewe Harvest	% Success
1976	10	10	100	20	11	55
1977	10	10	100	0	0	NA
1978	10	9	90	20	12	60
1979	10	8	80	5	2	40
1980	10	10	100	18	18	100
1981	10	10	100	20	14	70
1982	6	6	100	12	11	92
1983	15	12	80	30	24	80
1984	5	5	100	5	5	100
1985	5	3	60	0	0	NA
1986	5	5	100	0	0	NA
1987	5	5	100	0	0	NA
1988	5	5	100	5	5	100
1989	10	10	100	20	16	80
1990	10	10	100	20	17	85
1991	10	9	90	20	16	80
1992	10	7	70	20	15	75
1993	5	4	80	5	3	60
1994	5	6	120	5	2	40
1995	5	5	100	5	3	60
1996	5	5	100	5	3	60
1997	8	8	100	5	5	100
1998	6	6	100	1	1	100
1999	8	8	100	0	0	NA
2000	10	10	100	0	0	NA
2001	10	10	100	0	0	NA
2002	10	NA	NA	NA	NA	NA
2003	5	5	100	1	1	100
2004	5	6	120	5	3	60
2005	5	5	100	14	13	93
2006	7	7	100	20	17	85
2007	7	7	100	20	NA	75
2008	7	7	100	25	16	64
Totals	254	233	92	326	248	76

Table 4. Number and types of licenses issued and subsequent harvest, Hunting District 422, 1976-2008. Harvest totals are a combination of check station data, hunter questionnaire results, harvest surveys and transportation forms.

HUNTING DISTRICT 423

While this hunting district has consistently demonstrated relatively good population numbers, it is on average a little less productive than Hunting Districts 422 and/or 424. Trapping and transplanting has occurred in this hunting district, however, due to the proximity to Hunting District 422 and the relatedness of being Sun River sheep, during trap efforts there was often no recorded effort to distinguish between Hunting Districts 422 and 423 regarding from where and which sheep came from which hunting district (See Hunting District 422 for information related to numbers of sheep trapped). It is known that trap efforts (with use of ground-based wooden sheep traps) used to occur in the areas around Scattering Springs and Reclamation Flats. Traditional use areas in this hunting district include locales in and around Mortimer and Big George Gulches, Arsenic Creek, Reclamation Flats and Sheep Reef. Conventional wintering areas include most of these same locations, albeit typically at lower elevations.

Based on research related to available, suitable habitat and concerns regarding disease and die-offs, the population objective for this hunting district is 200 observed bighorns during late fall/early winter and spring surveys (assuming healthy ram age structure and ewe: lamb ratios). From 1955 to 2008, the average total number of sheep observed each year during late fall/early winter survey efforts was 154 (Figure 3 and Table 5). An average of 32 rams, 66 ewes, 30 lambs, and 36 unclassified sheep have been observed. Average lamb production equals 47 per 100 ewes and observed rams ¾-curl or greater have averaged 11 since 1955.

Recreation Provided: Hunting District 423 is comprised of nearly 100% public lands (Lewis and Clark NF). Compared to the other three hunting districts in this region, hunting in this district is much more of a backcountry experience. The most accessible starting point to access this hunting district is from the Mortimer Gulch trailhead at Gibson Reservoir. This trail wraps around the north side of the reservoir and gives way to several good locations for sheep hunting and/or viewing.

From 1912 to 1952, there was no hunting season for bighorn sheep in the Sun River area. Beginning in 1953 and up until 1974, ram hunting seasons were permitted (Bighorn Sheep Hunting District 42). Starting in 1974, permits were changed to either-sex (ES) hunting. It was not until 1976 that Hunting Districts 421, 422, 423, and 424 were established. For purposes of this document, Table 6 summarizes licenses offered and bighorn harvest since 1976 for Hunting District 423. From 1976 to 2008, a little more than 486 licenses have been allocated (205 ES and just over 281 adult ewe licenses), with an estimated 187 rams and 133 adult ewes harvested (91% success for ES licenses and 47% success for ewe licenses). The 33-year average harvest is 5.7 sheep from both the either-sex licenses and the adult ewe licenses. Average age of harvested rams from 1981 to 2008 is 7.3 years old.

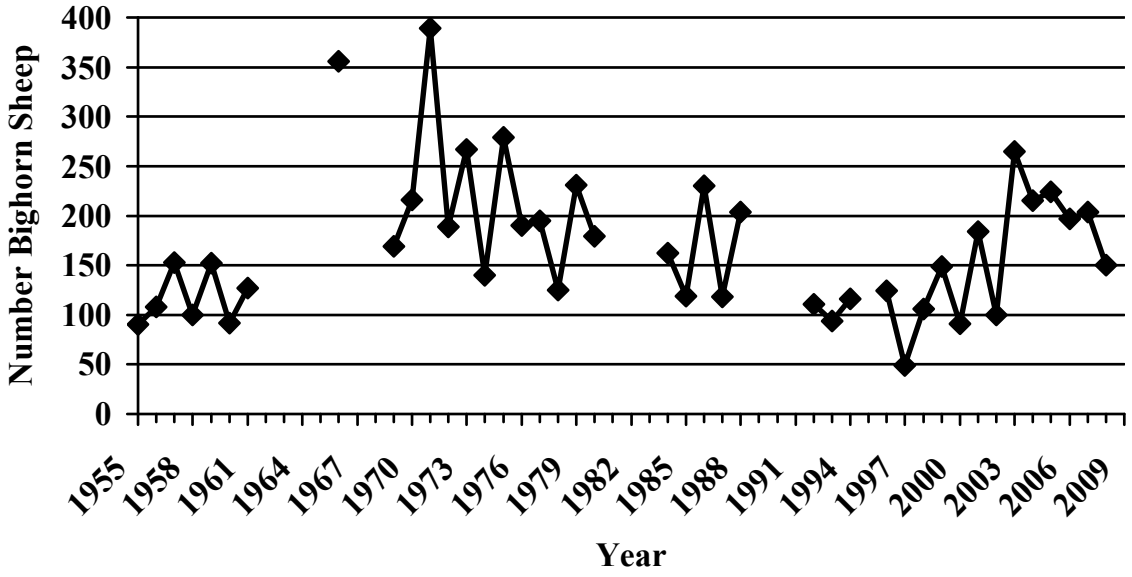


Figure 3. Total number of bighorn sheep observed during aerial and ground trend surveys (late fall/early winter) in Hunting District 423, 1955-2008. For years in which no data are present, it is unknown as to whether no sheep were observed or no survey efforts were conducted and/or recorded.

Year	Ewes	Lambs	Rams (3/4 & 3/4+)	Unclassified	Total	Ram:Ewe:Lamb
1955	33	19	16 (11)	22	90	48:100:58
1956	30	10	12 (5)	56	108	40:100:33
1957	55	36	13 (7)	49	153	24:100:65
1958	51	26	16 (9)	7	100	51:100:31
1959	51	28	33 (6)	40	152	65:100:55
1960	47	30	15 (4)		92	32:100:64
1961	69	27	26 (12)	5	127	38:100:39
1966[1]	198	72	86 (22)		356	43:100:36
1967	19	6	6		31	32:100:32
1969	61	29	29 (5)	50	169	48:100:48
1970	131	45	42 (3)		216	32:100:34
1971[1]					389	NA
1972	97	52	40 (5)	5	189	41:100:54
1973	134	74	59 (7)		267	44:100:55
1974	71	32	29 (6)	8	140	41:100:45
1975	143	62	58 (11)	16	279	41:100:43
1976	79	55	41 (5)	15	190	52:100:70
1977	81	40	35 (9)	39	195	43:100:49
1978	63	23	30 (6)	9	125	48:100:37
1979	98	44	62 (13)	27	231	63:100:45
1980	114	50	15 (2)		179	13:100:44
1981	87	46	30 (3)		161	34:100:53
1982	127	57	63 (16)		247	49:100:45
1984	98	9	55 (14)		162	56:100:9
1985	48	36	2 (1)	33	119	6:100:75
1986	116	39	56 (15)	19	230	48:100:34
1987	72	13	33 (11)		118	46:100:18
1988	80	49	56 (27)		204	70:100:61
1989	81	44	63 (18)		188	78:100:54
1992	57	26	23 (6)	5	111	40:100:46
1993	43	21	30 (7)		94	70:100:49
1994	52	31	33 (21)		116	63:100:60
1996	65	18	30 (16)	11	124	46:100:28
1997	21	12	16 (11)		49	76:100:57
1998	51	23	23 (8)	9	106	45:100:45
1999	55	23	27 (12)	44	149	49:100:42
2000	32	21	19 (11)	19	91	59:100:66
2001	55	31	43 (18)	55	184	78:100:56
2002	44	23	17 (5)	16	100	39:100:52
2003	82	44	32 (19)	107	265	39:100:54
2004	90	32	40 (9)	53	215	44:10036
2005	65	35	50 (25)	74	224	77:100:54
2006	56	11	51 (16)	79	197	91:100:20
2007	74	17	46 (25)	67	204	62:100:23
2008					150	NA

[1]Likely includes Hunting Districts 422 and 423.

Table 5. Annual observations of sheep during rut/early winter period, Hunting District 423, 1955-2008. Counts represent those sheep believed to be unique sheep counted only once per survey. For years in which no data are present, it is unknown as to whether no sheep were observed or no survey efforts were conducted and/or recorded.

Table 6. Number and types of licenses issued and subsequent harvest, Hunting District 423, 1976-2008. Harvest totals are a combination of check station data, hunter questionnaire results, harvest surveys and transportation forms.

Year	Either Sex Licenses	Either Sex Harvest	% Success	Ewe Licenses	Ewe Harvest	% Success
1976	10	9	90	30	10	33
1977	10	9	90	0	0	NA
1978	10	10	100	20	5	25
1979	12	12	100	5	0	0
1980	12	11	92	5	5	100
1981	10	10	100	2	1	50
1982	12	12	100	20	15	75
1983	12	9	75	20	13	65
1984	10	9	90	20	6	30
1985	12	4	33	0	0	NA
1986	5	5	100	0	0	NA
1987	5	5	100	0	0	NA
1988	5	5	100	NA	1	NA
1989	10	10	100	20	16	80
1990	10	9	90	20	9	45
1991	10	9	90	30	9	30
1992	10	10	100	30	12	40
1993	2	2	100	2	1	50
1994	2	2	100	2	1	50
1995	2	2	100	2	1	50
1996	1	1	100	1	0	0
1997	1	1	100	1	1	100
1998	1	1	100	0	0	NA
1999	1	1	100	0	0	NA
2000	2	2	100	0	0	NA
2001	2	2	100	0	0	NA
2002	3	3	100	2	NA	NA
2003	2	2	100	1	1	100
2004	2	2	100	5	4	80
2005	4	3	75	15	9	60
2006	5	5	100	10	7	70
2007	5	5	100	10	6	60
2008	5	5	100	10	0	0
Totals	205	187	91	281	133	47

HUNTING DISTRICT 424

Hunting District 424 has traditionally been a good area in regards to sheep productivity. Of the four hunting districts in this region, Hunting District 424 is the largest in size with sizable areas (mostly Lewis and Clark NF lands, but also some private lands) considered good sheep habitat. Due to often-robust numbers and good accessibility, this hunting district has been readily used for sheep trapping and transplanting. A sheep trap still stands near the Forest Service boundary near Ford Creek off the Benchmark road. Since 2009, a total of 298 sheep (10% of all recorded sheep transplants statewide) have been trapped out of this area and relocated to other parts of Montana, as well as other states. Traditional use areas in this hunting district include locales in and around Fairview Plateau/Mountain, Ford Creek, Sheep Sheds Mountain and McCarty Hill, and Scapegoat Mountain. Conventional wintering areas include most of these same locations, albeit typically at lower elevations.

Based on research related to available, suitable habitat and concerns regarding to disease and die-offs, the population objective for this hunting district is 200 observed bighorns during late fall/early winter and spring surveys (assuming healthy ram age structure and ewe: lamb ratios). From 1955 to 2008, the average total number of sheep observed each year during late fall/early winter survey efforts was 142. An average of 30 rams, 64 ewes, 25 lambs, and 52 unclassified sheep have been observed. Average lamb production equals 42 per 100 ewes and observed rams ¾-curl or greater have averaged seven since 1955.

Recreation Provided: Being the largest of the four hunting districts in this complex, Hunting District 424 consists of a large portion of both private and public lands. Much of the private land located in this hunting district is not considered good sheep habitat. However, bighorn sheep make use of some private lands, typically during the winter and early spring. The public land portion of this hunting district is primarily on Lewis and Clark NF lands. These lands provide year-round habitat for sheep, some of which are situated in remote locations, making survey/hunting efforts in these spots difficult at times.

From 1912 to 1952, there was no hunting season for bighorn sheep in the Sun River area. Beginning in 1953 and up until 1974, ram hunting seasons were permitted (Bighorn Sheep hunting district 42). Starting in 1974, permits were changed to either-sex (ES) hunting. It was not until 1976 that Hunting Districts 421, 422, 423, and 424 were established. For purposes of this document, Table 8 summarizes licenses offered and bighorn harvest since 1976 for Hunting District 424. From 1976 to 2008, a little more than 489 licenses have been allocated (235 either-sex licenses and ewe licenses), with an estimated 215 rams and 170 ewes harvested (91% success for either-sex licenses and 58% success for ewe licenses). The 33-year average harvest is 6.5 sheep from the either-sex licenses and 5.3 sheep from the adult ewe licenses. Average age of harvested rams from 1981 to 2008 is 8.2 years old.

Accomplishments: Due to the history and productivity of Sun River bighorn sheep, several notable accomplishments have transpired over the years. One of the main achievements for these sheep has been, and continues to be, their use as a quality source population for translocation efforts. Beginning in 1942 and continuing through 2009, sheep from the Southern Rocky Mountain Front Complex

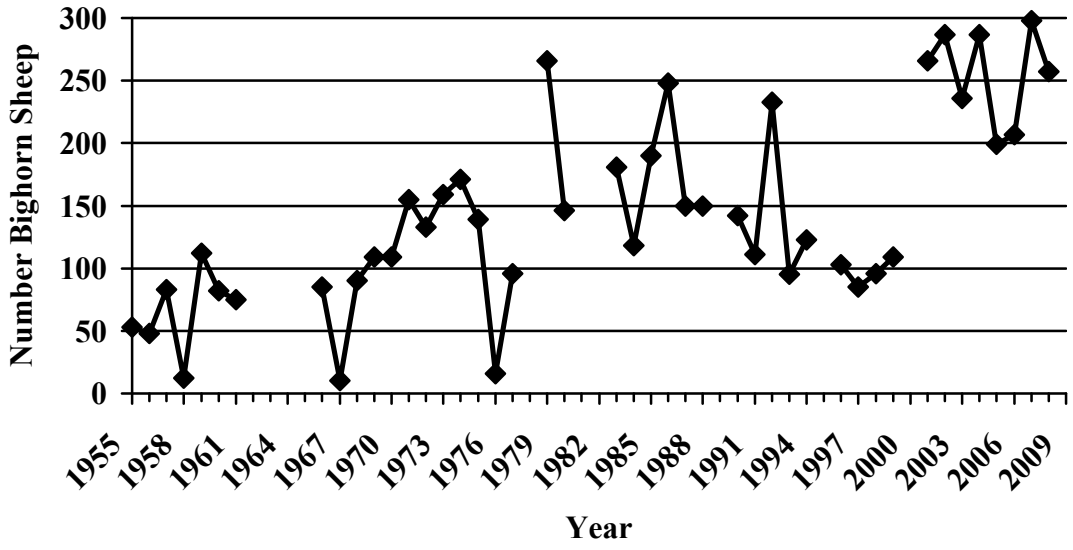


Figure 4. Total number of bighorn sheep observed during aerial and ground trend surveys (late fall/early winter) in Hunting District 424, 1955-2008. For years in which no data are present, it is unknown as to whether no sheep were observed or no survey efforts were conducted and/or recorded.

Table 7. Annual observations of sheep during rut/early winter period, Hunting District 424, 1955-2008. Counts represent those sheep believed to be unique sheep counted only once per year. For years in which no data are present, it is unknown as to whether no sheep were observed or no survey efforts were conducted and/or recorded.

Year	Ewes	Lambs	Rams (3/4 & 3/4+)	Unclassified	Total	Ram:Ewe:Lamb
1955	16	9	12 (6)	16	53	75:100:56
1956	26	15	7 (3)		48	27:100:58
1957				83	83	NA
1958				12	12	NA
1959	42	11	24 (10)	35	112	57:100:26
1960	33	25	15 (8)	9	82	45:100:71
1961	44	15	12 (1)	4	75	27:100:34
1966	58	15	12 (2)		85	21:100:26
1967		3	2	5	10	NA
1968[1]	193	83	65(10)	20	361	34:100:43
1969	59	22	28 (9)		109	47:100:37
1970	54	30	10 (4)	2	109	18:100:56
1971				155	155	NA
1972	54	33	38 (11)	8	133	70:100:61
1973	76	35	47 (12)	1	159	62:100:36
1974	74	41	35 (7)	21	171	47:100:55
1975	80	18	41 (14)		139	51:100:23
1976	3	1	10 (4)	2	16	NA
1977	35	20	26 (7)	15	96	74:100:57
1979	62	16	30 (7)	158	266	48:100:23
1980	61	36	34 (3)	15	146	56:100:59
1983	87	43	51 (9)		181	59:100:49
1984	63	18	34 (7)	3	118	54:100:29
1985	122	56	12 (3)		190	10:100:46
1986	117	47	60 (13)	24	248	51:100:40
1987	75	38	41 (6)	4	150	55:100:51
1988	84	29	32 (5)	4	150	38:100:35
1990	62	25	34 (6)	21	142	55:100:40
1991	51	25	35 (6)		111	69:100:49
1992	94	52	64 (18)	23	233	68:100:55
1993	24	14	12 (10)	45	95	50:100:58
1994	19	9	23 (12)	72	123	121:100:47
1996	48	19	26 (11)	10	103	54:100:40
1997	41	10	27 (12)	7	85	66:100:40
1998	22	6	12 (6)	56	96	55:100:27
1999	53	23	23 (10)	10	109	43:100:43
2001	70	40	43 (16)	115	266	61:100:57
2002	126	35	50 (20)	79	287	40:100:28
2003	101	51	58 (22)	26	236	57:100:50
2004	126	35	50 (20)	76	287	40:100:28
2005	43	13	33 (19)	110	199	77:100:30
2006	58	17	20 (7)	112	207	34:100:29
2007	115	17	20 (7)	112	207	60:100:29
2008	114	20	56 (22)	67	257	49:100:18

[1] Includes Hunting Districts 422 and 424.

Year	Either Sex Licenses	Either Sex Harvest	% Success	Ewe Licenses	Ewe Harvest	% Success
1976	10	8	80	15	6	40
1977	10	10	100	0	0	NA
1978	10	9	90	5	0	0
1979	15	13	87	5	0	0
1980	15	15	100	7	2	29
1981	15	9	60	10	8	80
1982	10	12	120	20	17	85
1983	10	10	100	20	13	65
1984	5	4	80	10	8	80
1985	5	5	100	0	0	NA
1986	5	3	60	0	0	NA
1987	5	4	80	NA	1	NA
1988	5	4	80	5	5	100
1989	10	10	100	NA	15	NA
1990	10	11	110	NA	8	NA
1991	10	9	90	20	14	70
1992	10	10	100	20	14	70
1993	5	5	100	2	1	50
1994	5	5	100	2	2	100
1995	5	5	100	2	1	50
1996	5	5	100	2	2	100
1997	5	5	100	2	2	100
1998	3	1	33	3	1	33
1999	1	1	100	0	0	NA
2000	2	2	100	0	0	NA
2001	2	2	100	0	0	NA
2002	5	5	100	2	NA	NA
2003	5	1	20	5	1	20
2004	5	5	100	5	5	100
2005	5	5	100	15	9	60
2006	10	10	100	19	14	74
2007	6	6	100	20	9	45
2008	6	6	100	24	10	42
Totals	235	215	91	291	170	58

Table 8. Number and types of licenses issued and subsequent harvest, Hunting District 424, 1976-2008. Harvest totals are a combination of check station data, hunter questionnaire results, harvest surveys, and transportation forms.

have been used to either augment or begin new populations of sheep in numerous locations throughout Montana, as well as in four other states. Many of our more productive sheep populations in Montana have at one time or another been supplemented by Southern Rocky Mountain Front sheep. Through 2009, approximately 45% (1,242 sheep) of all Montana sheep relocations originated from locations within the Southern Rocky Mountain Front.

These areas also continue to be one of the more productive sheep hunting locations in Montana. Sheep management in these areas has evolved to provide trophy class rams as well as good ewe hunting opportunities. In addition, recreational public viewing of these sheep is also popular, due to their accessibility at certain times of the year.

Since the 1960s, there have been several research projects related to bighorn sheep populations and associated habitats in this region. Below are a few citations related to some of the work that has been completed:

1) Schallenberger, A.D. 1966. Food habits, range use and interspecific relationships of bighorn sheep in the Sun River area, west-central Montana. M.S. Thesis, Montana State University, Bozeman, MT.

2) Erickson, G.L. 1972. The ecology of Rocky Mountain bighorn sheep in the Sun River area of Montana with special reference to summer food habits and range movements. Federal Aid Wildlife Restoration Project. W-120-R-2 and R-3. Montana Fish and Game Department, Helena, MT.

3) Frisina, M.R. 1974. Ecology of bighorn sheep in the Sun River area of Montana during fall and spring. M.S. Thesis, Montana State University, Bozeman, MT.

4) Andryk, T.A. 1983. Ecology of Bighorn Sheep in Relation to Oil and Gas Development Along the East Slope of The Rocky Mountains, Northcentral Montana.. M.S. Thesis, Montana State University, Bozeman, MT.

5) Schirokauer, D. 1996. The Effects of 55 Years of Vegetative Change on Bighorn Sheep Habitat in the Sun River Area of Montana. M.S. Thesis, Montana State University, Bozeman, MT.

Management Challenges: The primary challenges related to bighorn sheep management in these hunting districts are habitat maintenance and improvement and population management. Most of the sheep habitat in these hunting districts is on public lands (Lewis and Clark NF, BLM, and DNRC); however, there is also some good sheep habitat located on private lands on the foothills of the Front. As of yet, habitat disturbances as related to sheep habitat is either minimal or nonexistent. Oil and gas exploration and development matters have also recently been settled so that all public lands on the Rocky Mountain Front will not be exposed to such activities in the future. It will be important however, to continue to promote sheep habitat conservations efforts.

Another important aspect of bighorn sheep management is the possibility of domestic sheep interactions with wild bighorns and the threat of disease transmission. Fortunately, in recent times domestic sheep ranching along the foothills of the Front is currently very minimal, hence there is little anxiety related to the possibility of domestic/wild sheep interactions. However, it will be important to continue monitoring this area in case changes in ranching practices occur over time.

There also continues to be cooperation between the USFS and FWP in relation to habitat management plans (e.g., prescribed burns). Habitat manipulation, such as prescribed burns and/or livestock grazing allotments, will always play an important role in managing sheep numbers, distribution and migration patterns. Continued cooperation between public land management agencies and private landowners is important to help manage the habitats where bighorn sheep reside.

This region has a strong predator presence in the area including grizzly bears, black bears, mountain lions, wolverines, lynx, coyotes and wolves. It is likely that bighorn recruitment is and/or could be limited by predation, but no area research exists to verify this statement.

Population Monitoring: Sheep surveys are typically conducted twice a year for each hunting district. A late fall/early winter rut survey is conducted in December (sometimes January depending on weather conditions and scheduling) and early spring surveys are conducted in April. Rut surveys typically reveal how overall population numbers are doing, especially in relation to ram numbers and age structure. These surveys also portray how sheep are faring going into the winter season. Spring (April) surveys help enumerate overall herd size and herd health in relation to how animals wintered (e.g., lamb survival). Because sheep are usually fairly accessible, both survey efforts are typically conducted via ground (foot, horseback, or vehicle) efforts, so good classifications can

be made. Occasionally, surveys are completed aerially (fixed wing or helicopter) when permitted and necessary.

An annual summer (usually July) helicopter survey primarily looks for mountain goats and elk calf recruitment in certain parts of this complex, but sheep observations (to include lamb recruitment) are also noted due to their presence in similar habitats. Other observations for these sheep are recorded incidentally during other species survey efforts.

Summary of Public Comment

There is strong public support for maintaining robust bighorn sheep numbers as well as ram age structure for bighorn sheep in the Southern Rocky Mountain Front Complex. Whether through hunting, trapping and transplanting, or general wildlife viewing, this herd has established its importance both locally and nationally over the past several decades. Recent historical records indicate this herd is the largest in Montana and has consistently been used as a good source population for trapping and relocation efforts throughout Montana and other western states for nearly 60 years. Public desire reflects continuing the current management style with a limited number of either-sex licenses to maintain trophy class rams and ewe licenses to aid in population control as needed. There appears to be growing support for more opportunity for hunting ewes rather than relocation efforts. Continued balance between ewe hunter harvest and trapping and transplanting will be important in the future.

Management Goal

Manage for a healthy and productive bighorn sheep population of approximately 175 sheep in Hunting District 421 and 200 in each of Hunting Districts 422, 423, and 424. Maintain robust and diverse ram age structure, healthy ewe: lamb ratios, and good opportunity for hunters to harvest sheep. Utilize trapping and transplanting to assist with population management when hunter harvest is not having the desired effect.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain or improve occupied bighorn sheep habitat for the benefit of bighorns, other wildlife species and other agency mandated uses.

2) Encourage maintenance and improvement of habitat conditions on publicly owned winter ranges (primarily USFS) so that vegetation conditions on these winter ranges provide adequate forage for bighorns and other wildlife during the winter.

Habitat Management Strategies

1) Continue major efforts by public land management agencies and private landowners to control noxious weeds.

2) Work with land managing agencies and private landowners to properly manage stock and cattle grazing on bighorn sheep winter and year-round range.

3) Continue to work with the USFS and BLM to encourage prescriptive burning of selected habitat types to encourage bighorn forage utilization.

Game Damage Strategies

Game damage is at times a problem on private lands during winter and spring periods. While no specific, direct game damage assistance from FWP has occurred recently, there does seem to be some advocacy to a do so at times. During high population years, continued ewe/ram harvest opportunities along with trapping and transplanting efforts seem to relieve most game damage assistance pressure.

Access Strategies

Based on the past and current distribution of bighorns during the hunting season, lack of hunter access to these sheep has, for the most part, not been an issue.

I. Population Objectives

Hunting District 421

1) Maintain the number of bighorn sheep observed during post-season surveys within 15% of 175 sheep (approximately 150 to 200.

2) Maintain a ram: 100 ewe ratio observed during post-season surveys of at least 50 rams: 100 ewes with at least 30% of the rams having a ¾-curl.

3) Maintain the average age of 7 1/2 years for rams harvested on either-sex licenses.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana.

Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 421 is located in the Prairie/Mountain Foothills Ecological Region (see discussion of ecological regions in Chapter 1) which includes areas in north-central Montana. This bighorn population is a relatively old population (with limited more recent augmentation) and is characterized as having moderate lamb production and recruitment rates, has recently been below population objectives, and has an average ram to ewe ratio. Bighorn numbers have recently been managed primarily through harvest of limited ram licenses along with natural mortality.

The population objective of 175 (± 15%) observed bighorn sheep was derived by considering both the ability of public lands to provide forage for the majority of the wintering bighorn population and landowner tolerance for the remaining sheep that winter on private lands. Population management strategies will be directed at increasing bighorn numbers on public lands within forage allocations.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment and/or trapping and relocation. In Hunting District 421, licenses are issued under the following prescriptions (Table 9):

Standard Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep. The number of ewe licenses issued would be up to 15% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during annual fall and spring surveys, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 15% of the population objective and lamb recruitment is between 30 and 40 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 15% below the population objective and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual fall and spring surveys, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number)

Table 9. Summary of regulation types under different population criteria for ewe harvest and population management in Hunting District 421.

PRAIRIE/ MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	± 15% of 175	Between 30-40	Limited Entry Ewes	Up to 15% of Ewes
Restrictive Regulation	More than 15% below 175	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Greater than 15% above 175	Greater than 40	Limited Entry Ewes or translocate if > 25 sheep including rams are available	Up to 20% of Ewes
Hunting/ Transplant Regulation	Greater than 25% above 175	Greater than 40	Limited Entry Ewes and translocate as long as trapped numbers do not exceed twice the total ewe licenses.	Up to 15% of Ewes

above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 15% above the population objective and lamb recruitment is greater than 40 lambs:100 ewes.

Hunting/Transplant Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep and trapping/translocation. The number of ewe licenses issued would be up to 15% of the number of ewes going into the fall season. The number of sheep relocated will not exceed more than twice the total allocated adult ewe licenses. The number of ewes going into the fall season would be based on the number of ewes observed during the annual fall and spring surveys, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs.

The Hunting/Transplant Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 25% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 20% of the ¾-curl rams in the population.

The Standard Regulation will be recommended if: The population is within objective (+ 15% of 175), are 40 to 60 rams: 100 ewes, and at least 30% of the rams are at least ¾-curl (Table 10).

Restrictive Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 15% of the ¾-curl rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 15% below the population objective of 175, there are less than 40 rams: 100 ewes, and less than 30% of the rams are at least ¾-curl.

Liberal Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 25% of the ¾-curl rams in the population.

The Liberal Regulation will be recommended if: The population is more than 15% above the objective of 175, there are more than 60 rams: 100 ewes, and more than 35% of the rams are at least ¾-curl.

II. POPULATION OBJECTIVES

Hunting Districts 422, 423, and 424:

1) Maintain the number of bighorn sheep observed for each hunting district during post-season surveys within 10% of 200 sheep (180 to 220).

2) Maintain a ram: 100 ewe ratio observed for each hunting district during post-season surveys of at least 60 rams: 100 ewes with at least 30% of the rams having a ¾-curl.

3) Maintain the average age of 7 1/2 years for rams harvested for each hunting district on either-sex licenses.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting Districts

PRAIRIE/ MOUNTAIN-FOOTHILLS	Number of Either-Sex or Legal Ram Licenses is:	When the Herd Has		
		Population Size	Ram:100 Ewe ratio	% of Rams with ≥ ¾-curl
Standard Regulation	Up to 20% of the ¾-curl rams	± 15% of 175	40-60:100	≥ 30
Restrictive Regulation	Up to 15% of the ¾-curl rams	More than 15% below 175	< 40:100	< 30
Liberal Regulation	Up to 25% of the ¾-curl rams	Greater than 15% above 175	> 60:100	≥ 35

Table 10. Summary of potential ram harvest under different population parameters and criteria.

422, 423, and 424 are located in the Prairie/Mountain Foothills Ecological Region (see discussion of ecological regions in Chapter 1), that includes areas in North Central Montana. This bighorn population is a relatively old population (with some relatively high levels of trapping and translocation of sheep to other areas), characterized as having moderate lamb production and recruitment rates, has recently been at or above population objectives with relatively stable to increasing numbers, and has a relatively moderate to high average ram to ewe ratio. Bighorn numbers are typically managed through use of limited either-sex and adult ewe licenses, natural mortality, and trapping and transplanting efforts in high sheep population years.

The population objective of 200 (± 10%) observed bighorn sheep for each hunting district (422, 423, and 424) was derived by considering both the ability of public lands to provide forage for the majority of the wintering bighorn population and landowner tolerance for the remaining sheep that winter on private lands. Population management strategies will be directed at increasing bighorn numbers on public lands within forage allocations.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment and/or trapping and relocation. In Hunting Districts 422, 423, and 424, licenses are issued under the following prescriptions (Table 11):

Standard Regulation: Limited ewe licenses valid throughout the hunting districts during the general season for bighorn sheep. The number of ewe licenses issued would be up to 15% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during annual fall and spring surveys, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 10% of the population objective and lamb recruitment is between 30 and 40 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

Table 11. Summary of regulation types under different population criteria for ewe harvest and population management in Hunting Districts 422, 423, and 424.

PRAIRIE/ MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs:100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	± 10% of 200	Between 30-40	Limited Entry Ewes	Up to 15% of Ewes
Restrictive Regulation	More than 10% below 200	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Greater than 10% above 200	Greater than 30	Limited Entry Ewes or translocate if > 25 sheep including rams are available	Up to 20% of Ewes
Hunting/Transplant Regulation	Greater than 25% above 200	Greater than 30	Limited Entry Ewes and translocate as long as trapped numbers do not exceed twice the total ewe licenses.	Up to 15% of Ewes

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid throughout the hunting districts during the general season for bighorn sheep. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual fall and spring surveys, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 10% above the population objective and lamb recruitment is greater than 30 lambs: 100 ewes.

Hunting/Transplant Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep and trapping/translocation. The number of ewe licenses issued would be up to 15% of the number of ewes going into the fall season. The number of sheep translocated will not exceed more than twice the total allocated adult ewe licenses. The number of ewes going into the fall season would be based on the number of ewes observed during the annual fall and spring surveys, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs.

The Hunting/Transplant Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 25% above the population objective and lamb recruitment is greater than 30 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 20% of the ¾-curl rams in the population.

The Standard Regulation will be recommended if: The population is within objective (+ 10% of 200), there are 40 to 60 rams: 100 ewes, and at least 30% of the rams are at least ¾-curl (Table 12).

Restrictive Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 15% of the ¾-curl rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 10% below the population objective of 200, there are less than 40 rams: 100 ewes, and less than 30% of the rams are at least ¾-curl.

Liberal Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 25% of the ¾-curl rams in the population.

The Liberal Regulation will be recommended if: The population is more than 10% above the objective of 200, there are more than 60 rams: 100 ewes, and more than 35% of the rams are at least ¾-curl.

PRAIRIE/ MOUNTAIN-FOOTHILLS	Number of Either-Sex or Legal Ram Licenses is:	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of Rams with ≥ ¾-curl
Standard Regulation	Up to 20% of the ¾-curl rams	± 10% of 200	40-60:100	≥ 30
Restrictive Regulation	Up to 15% of the ¾-curl rams	More than 10% below 200	< 40:100	< 30
Prescription 3	Up to 25% of the ¾-curl rams	Greater than 10% above 200	> 60:100	≥ 35

Table 12. Summary of potential ram harvest under different population parameters and criteria.

NORTH FORK BIRCH CREEK – TETON
(Hunting District 441)

Description: Hunting District 441 encompasses the northeast corner of the Bob Marshall Wilderness and Lewis and Clark National Forest (NF), lying along the eastern slope of the Continental Divide in Teton and Pondera Counties. The area covers 598mi^2 of mountain foothills and prairie agriculture lands. The unit includes about 60% of private lands east of the Continental Divide stretching eastward to U.S. Highway 89, most of which are not bighorn habitat. The private land portion of the area is mostly cattle and hay operations, with a smaller amount of dryland grain on the eastern perimeter. Birch Creek, Dupuyer Creek, Blackleaf Creek, and the Teton River drain eastward through the area from the mountain front and the Continental Divide.

There are approximately 150 bighorns scattered from the North Fork of the Teton River to the North Fork of Birch Creek in several small herd segments: Jones Creek, Dupuyer Creek, Walling Reef, and upper Birch Creek. Sheep can occasionally be found on private lands in the Walling Reef–Swift Dam area and in the forks of Dupuyer Creek.

Public Access: Hunting and other forms of outdoor recreation occur on private and public lands throughout this portion of the Bob Marshall Wilderness Complex. Bighorn hunting access is mostly on foot or horseback on U.S. Forest Service (USFS) trails from trailheads along the Teton River, Blackleaf Canyon, Dupuyer Creek, and Birch Creek at Swift Dam. Very little of the NF and adjacent BLM lands are authorized for motorized use; however, both day trips and extended backcountry trips on foot or horseback are common from these trailheads. Access to private lands for bighorn hunting varies from limited to severely limited, with varying amounts of public use depending upon individual landowners. Fortunately, very little bighorn habitat exists on private lands in this hunting district. Hunting that does occur on private property is mainly day use, with little camping available. At present, only one FWP Block Management Area is established where bighorns occur.

Almost all of the bighorns in this hunting district are available to the public during the hunting season. Most hunters do not utilize outfitting services, even though some are available.

Bighorn Sheep Populations: Although several small herd segments stay in this hunting district, bighorns frequently move to and from neighboring use areas. Sheep habitat in this hunting district is extremely rugged and difficult to access for counting purposes. Bighorns occupy steep, rocky ridges and avalanche chutes and cliff faces, requiring helicopter use to get reliable census coverage.

Bighorn census figures since 1985 vary from 46 to 141 observed animals, with an average

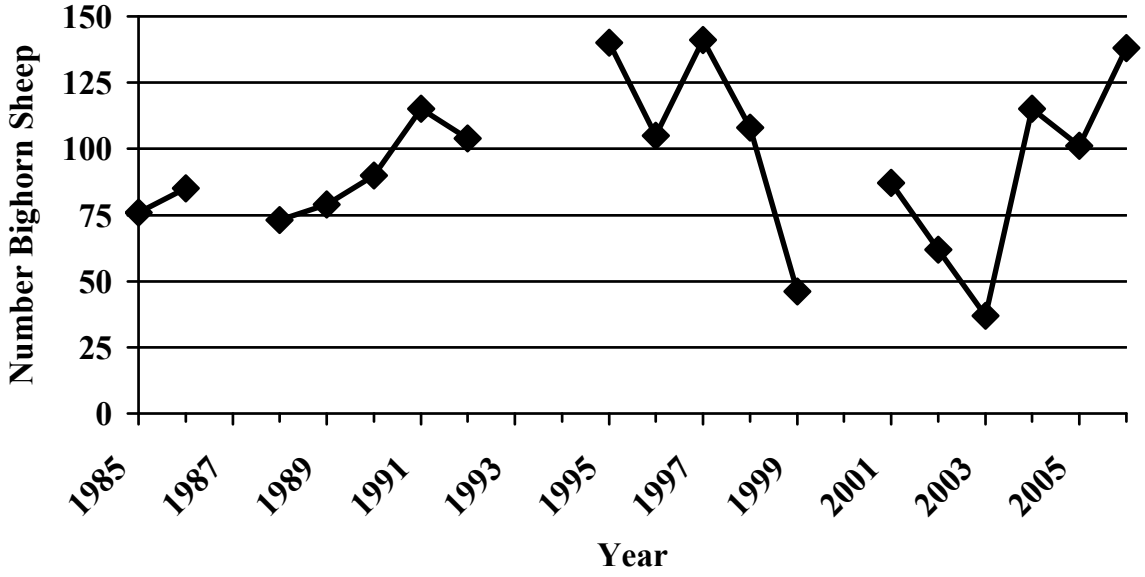


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in the North Fork Birch Creek–Teton population, Hunting District 441, 1985-2006.

count of 95 (Figure 1). For the 25-year period beginning in 1985, an average of 34 rams, 43 ewes, and 17 lambs have been observed (Table 1). The last count, in 2006, revealed 138 total sheep, with 45 rams, 72 ewes, and 21 lambs. Average lamb production equals 40 per 100 ewes, and observations of rams with ¾-curl or greater curl have averaged 17 since 1985, with 31 seen in 2006. The population objective for the hunting district is 200 bighorns.

Population augmentation has occurred three times since 1976. Thirty-nine bighorns from Sun River stock were released in 1976 in the Dupuyer Creek drainage. Thirty-two from the Lost Creek herd were introduced in February 1991 into Blackleaf Canyon. And, in December 1993, 15 bighorns were transported from Wildhorse Island to Blackleaf Canyon.

This area has a full complement of predators, including grizzly bears, black bears, mountain lions, wolverines, lynx, coyotes, and occasional wolves. It is likely that bighorn recruitment is limited by predation, but no area research exists to verify this statement.

Recreation Provided: Hunting District 441 provides limited private land hunting, but public lands are generally accessible for day hunting from trailheads or extended camping trips into the national forest and wilderness area. Hunting bighorns in this hunting district is considered a backcountry experience. Outfitting is limited since harvest is permit-only, and it doesn't appear to restrict public use in overlapping areas for other species.

Current Annual Bighorn Sheep Harvest: Table 2 summarizes permits offered and bighorn harvest since 1982, when hunting was first allowed in the area. A total of 124 licenses (including 2007) have been allocated, with 88 rams harvested. Five either-sex permits have been offered since 1995 (average of 4.8 permits since 1982). Although licenses are either-sex, no ewes or lambs have been taken since the season was initiated. From 1982 to 2007, there has been an average of 3.5 sheep harvested annually, averaging 7.4 years old, with hunter success averaging 74%.

Accomplishments: Tim Andryk, a Montana State University graduate student, conducted population-monitoring studies, including radio telemetry work in the area from 1981 to 1983 (MS Thesis: Ecology of Bighorn Sheep in Relation to Oil and Gas Development Along the East Slope of The Rocky Mountains, Northcentral Montana, 1983).

Management Challenges: Habitat maintenance and improvement are continuing challenges in bighorn management. Fortunately, since most of the sheep habitat in this hunting district is on public land, much of which is designated wilderness, loss of habitat due to human development is not anticipated. Also, oil and gas exploration and development issues have recently been settled so that all of the public lands will not be exposed to such activities in the future.

Year	Total	Rams				Ewe	Lambs	Total Rams	Uncl	Lambs:100Ewes
		1/4	1/2	3/4	Full					
1985	76	0	7	5	2	29	20	27	13	70
1986	85	1	9	23	8	13	3	69	28	23
1988	73	3	0	0	0	25	5	43	4	20
1989	79	1	3	9	2	29	7	43	28	24
1990	90	9	13	14	5	37	12	41	0	32
1991	115	3	11	10	2	60	29	26	0	48
1992	104	5	8	21	2	45	23	36	0	51
1995	140	13	11	15	4	70	27	43	0	39
1996	105	6	7	3	5	53	31	21	0	58
1997	141	4	7	13	12	76	29	36	0	38
1998	108	4	6	11	5	51	31	26	0	61
1999	46	1	3	3	3	23	13	10	0	57
2001	87	4	7	6	1	52	17	18	0	33
2002	62	6	8	10	3	32	1	29	2	3
2003	37	0	9	15	6	4	2	31	1	50
2004	115	6	7	23	7	52	20	43	0	38
2005	101	5	7	10	8	51	21	30	0	41
2006	138	7	7	16	15	72	21	45	0	29

Table 1. Classification data from aerial surveys on the North Fork Birch Creek – Teton, Hunting District 441, 1985-2006.

Table 2. Number of licenses issued and subsequent Bighorn sheep harvest, Hunting District 441, 1982-2007.

Year	Number of Licenses	Harvest
1982	4	4
1983	4	2
1984	4	1
1985	4	3
1986	4	3
1987	6	5
1988	5	3
1989	5	4
1990	5	4
1991	5	4
1992	5	1
1993	5	4
1994	3	2
1995	5	5
1996	5	2
1997	5	5
1998	5	4
1999	5	5
2000	5	5
2001	5	2
2002	5	5
2003	5	5
2004	5	2
2005	5	5
2006	5	3
2007	5	

Population Monitoring: Helicopter surveys are conducted annually to monitor bighorn populations, mostly in summer or early winter. Animals are counted and classified by sex and number of lambs. Horn curl is used to classify rams: ¾-curl +, ¾-curl, ½-curl, and ¼-curl.

Summary of Public Comment

Public comments regarding bighorn management in Hunting District 441 indicate support for the current season structure. Both hunters and non-hunters enjoy observing sheep in mountainous habitats.

Management Goal

Manage for a healthy and productive bighorn sheep population of up to 200 sheep, with an accompanying diverse age structure of rams. Cooperate with public land management agencies and private individuals in the management of bighorn habitats, and maintain good opportunity for bighorn sheep hunters to harvest sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain or improve occupied bighorn sheep habitat for the benefit of bighorns, other wildlife species, and other agency-mandated uses.

2) Encourage maintenance improvement of habitat conditions on publicly owned winter ranges (primarily USFS) so that vegetation conditions on these winter ranges provide adequate forage for bighorns and other wildlife during the winter.

Habitat Management Strategies

1) A major effort has been underway the past couple of years by public land management agencies and private landowners to control noxious weeds.

2) Work with the USFS to eliminate horse and mule grazing on bighorn winter and year-round range, especially in the Jones Creek area.

3) Continue to work with the USFS and BLM to encourage prescriptive burning of selected habitat types to encourage bighorn forage utilization.

Game Damage Strategies

Specific game damage problems have not occurred to date and are not anticipated.

Access Strategies

Based on the current distribution of bighorns during the hunting season, lack of hunter access to these sheep has not been an issue. In limited situations where sheep use private land during the hunting season, landowners either allow hunter access on their own or are enrolled in FWP's Block Management Program.

Population Objectives

1) Maintain or increase the number of bighorn sheep observed during post-season aerial surveys within 10% of 200 sheep (180 to 220).

2) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys of at least 60 rams: 100 ewes with at least 30% of the rams having a ¾-curl.

3) Maintain the average age of 7½ years for rams harvested on either-sex licenses.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 441 is located in the Prairie/Mountain Foothills Ecological Region (see discussion of ecological regions in Chapter 1), which includes much of north-central Montana. This bighorn population is a relatively old population (with more recent augmentation) and is characterized as having moderate lamb production and recruitment rates, is currently below population objective with stable to increasing numbers, and has a relatively high ram to ewe ratio. Bighorn numbers are being managed primarily through harvest of the ram segment and natural mortality.

The population objective of 200 (± 10%, 180 to 220) observed bighorn sheep depends upon both the ability of public lands to provide forage for the majority of the wintering bighorn population and landowner tolerance for the remaining sheep that winter on private lands. Population management strategies will be directed at increasing bighorn numbers on public lands within forage allocations.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations can be managed where necessary through limited-entry harvest of the female segment. In Hunting District 441, however, all bighorn hunting is currently (and has been historically) regulated by either-sex licenses. Female harvest would be allowed according to the following prescriptions when population goals are exceeded (Table 3):

Standard Regulation: Limited ewe licenses valid in the entire hunting district during the general season until November 1 (similar to adjacent Sun River districts) for bighorn sheep in this district. The number of ewe licenses issued would be up to 15% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 10% of the population objective and lamb recruitment is between 30 and 40 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season until November 1 for bighorn sheep in this district. The number of ewe licenses issued would be up to 20% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual

PRAIRIE/ MOUNTAIN-FOOTHILLS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation	± 10% of 200	Between 30-40	Limited Entry Ewes	Up to 15% of Ewes
Restrictive Regulation	More than 10% below 200	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Greater than 10% above 200	Greater than 40	Limited Entry Ewes or translocate if > 25 sheep including rams are available	Up to 20% of Ewes

Table 3. Summary of regulation types under different population criteria for ewe harvest and population management in Hunting District 441.

survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 10% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry either-sex licenses with the number of either-sex licenses issued being up to 15% of the ¾-curl rams in the population.

The Standard Regulation will be recommended if: The population is within objective (+ 10% of 200), there are 40 to 60 rams: 100 ewes, and 30% of the rams are at least ¾-curl (Table 4).

Restrictive Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 10% of the ¾-curl rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 10% below the population objective of 200, there are less than 40 rams: 100 ewes, and less than 30% of the rams are at least ¾-curl.

Liberal Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 20% of the ¾-curl rams in the population.

The Liberal Regulation will be recommended if: The population is more than 10% above the objective of 200, there are more than 60 rams: 100 ewes, and more than 30% of the rams are at least ¾-curl.

BEARTOOTH WILDLIFE MANAGEMENT AREA – GATES OF THE MOUNTAINS WILDERNESS AREA
(Hunting District 455)

Description: The Beartooth Wildlife Management Area (WMA) – Gates of the Mountains Wilderness Area (Hunting District 455) is approximately 406 mi². The 260,000 acres is comprised of 162,000 acres of private land, 14,750 acres of Department of Natural Resources and Conservation (DNRC) land, 14,000 acres of Bureau of Land Management (BLM) land, 27,000 acres of FWP land, and 42,000 acres of U.S. Forest Service (USFS) land (Helena National Forest including the Gates of the Mountains Wilderness Area). Of the total, 62% is privately owned and 38% is managed by the various public land management agencies. This hunting district is part of the Big Belt Mountains and is located about 20 miles northeast of Helena. Approximately one-half (130,000 acres) of the district is currently occupied by bighorn sheep during some portion of the year. Thirty percent of the area occupied by bighorn sheep is private land and 70% is public land.

Public Access: The Big Belt Mountains provide a good diversity of hunting experiences for both motorized and nonmotorized users. Sheep hunting access is good throughout much of the inhabited range. Private landowners on the north end of the district have worked

Table 4. Summary of potential ram harvest under different population parameters and criteria for Bighorn Hunting District 441.

PRAIRIE/ MOUNTAIN-FOOTHILLS	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of Rams with ≥ ¾ curl
Standard Regulation	Up to 15% of the ¾-curl rams	± 10% of 200	40-60:100	≥ 30
Restrictive Regulation	Up to 10% of the ¾-curl rams	More than 10% below 200	< 40:100	< 30
Liberal Regulation	Up to 20 % of the ¾-curl rams	Greater than 10% above 200	> 60:100	≥ 30

cooperatively with FWP for walk-in (foot and horseback) sheep hunting access since the district boundary was expanded to include that area in 2004. Access to public lands in the southern portion of the district is very good. The publicly owned and FWP-managed 32,320-acre Beartooth WMA is open to hunting and also provides an access route to the Gates of the Mountains Wilderness Area at the Willow Creek drainage.

Bighorn Sheep Populations: In the 1950s and 1960s, FWP and the USFS became interested in reestablishing the once native bighorn sheep population to the area, but several relocations of sheep into the Gates of the Mountains area during this period failed to create a new herd. Then in the early 1970s, a total of 112 bighorn sheep were relocated to the Beartooth WMA, and a viable sheep herd was established. Transplants began in 1971 with 49 sheep from the Sun River being released followed in 1973 with 5 more sheep from the Sun River and in 1975 with 58 additional sheep from the Sun River. Annual FWP surveys indicated the herd was growing rapidly, approaching 250 individuals by 1982. However, in the fall of 1983, FWP biologists noted a decrease in sheep numbers, and field investigations confirmed a pneumonia die-off. The die-off continued through the summer of 1984, and in October of that year, biologists could only locate 51 sheep.

Between the end of the die-off in 1984 until 1994, the bighorn sheep population stabilized at about 50 individuals. Although no large-scale die-offs occurred during this period, a lamb that died of pneumonia in 1991 suggested that disease continued to affect this sheep population. Augmentations of this population occurred in 1995 with the transplant of 19 sheep from Perma and in 1996 with the addition of 20 sheep from Upper Rock Creek. In the mid-1990s, another transplant occurred, moving 39 bighorns to the Beartooth WMA. Sheep populations observed in Hunting District 455 have been slowly increasing since 1996 (Figure 1). The total count of 226 sheep in 1983 was the highest observed since surveys were initiated in 1978 (Table 1). In 2006 and 2007, surveys were conducted in the Sheep Creek area just north of the Beartooth WMA, where a satellite herd exists (Table 2). Lamb production was relatively good in the late 1970s and early 1980s. Since the die-off during the mid-1980s, however, lamb production has been very inconsistent. The production and recruitment of lambs has started to slowly increase the past few years.

Recreation Provided: Hunting of bighorn sheep in Hunting District 455 was initiated in the fall of 1978 with the issuance of two either-sex licenses. As the bighorn population increased, the number of licenses followed the trend, with three either-sex licenses in 1981. As populations continued to increase, 15 either-sex licenses were issued in 1984, which was the highest number issued in the district to date. The die-off in the late 1980s resulted in a closed season from 1994 to 2004. In 2005, Hunting District 455 was reopened and expanded to the north into the Sheep Creek area with one either-sex license issued.

The proximity of the Big Belt Mountains to population centers, combined with good access in much of the mountain range, has made the area popular for big game hunting and wildlife viewing throughout the year. Most of the bighorn sheep in this portion of the Big Belts are

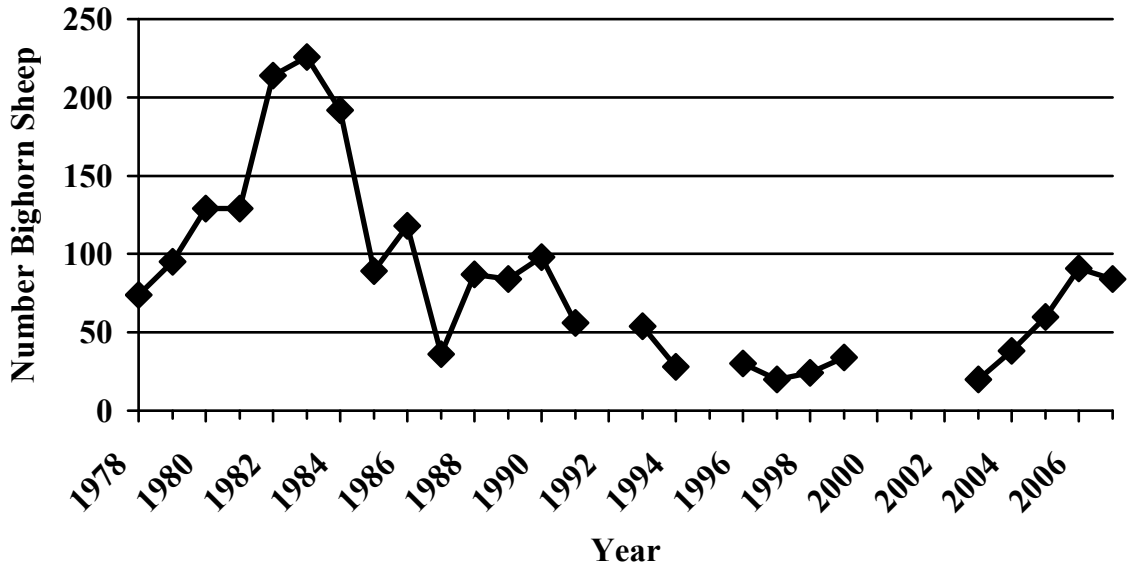


Figure 1. Total number of bighorn sheep observed during aerial and ground trend surveys in the Beartooth WMA and Gates of the Mountains Wilderness population, Hunting District 455, 1978-2008.

Table 1. Classification data from aerial surveys on the Beartooth WMA and Gates of the Mountains Wilderness, Hunting District 455, 1978-2008.

Year	Rams	Ewes	Lambs	Lambs: 100 Ewes	Total
1978	16	39	19	49	74
1979	23	43	29	67	95
1980	24	64	41	64	129
1981	29	55	45	82	129
1982	49	88	41	47	214
1983	36	128	67	52	226
1984	43	90	40	44	192
1985	13	64	12	19	89
1986	32	71	15	21	118
1987	7	22	7	32	36
1988	17	53	17	32	87
1989	16	62	6	10	84
1990	16	59	13	22	98
1991	3	48	5	10	56
1993	9	33	12	36	54
1994	1	19	8	42	28
1996	3	25	2	8	30
1997	1	10	6	60	20
1998	5	12	7	58	24
1999	8	19	7	37	34
2003[1]	9	8	3	37	20
2004[1]	14	13	11	84	38
2005[1]	22	22	16	73	60
2006[1]	22	18	8	44	48
2007[1]	17	17	9	53	43
2008[1]	6	12	6	50	24

[1]Incidental observations only, no official survey conducted.

Table 2. Classification data from aerial surveys in the Sheep Creek area, Hunting District 455, 2006-2008.

Year	Rams	Ewes	Lambs	Lambs: 100 Ewes	Total	Total Entire Hunting District
2006[1]	20	17	6	35	43	91
2007[1]	33	12	9	75	54	97
2008[1]	13	8	2	25	23	47

[1]Incidental observations only, no official survey conducted.

nonmigratory and use habitats near their release site in the southeast portion of the mountain range and private lands in the northern portion of the district. The most popular area for viewing bighorn sheep is the Holter Lake area, where boaters view sheep on a consistent basis.

Current Annual Bighorn Sheep Harvest: There was one either-sex license issued for the 2007 hunting season. From 2005 to 2007, one either-sex license was issued annually. This was the third year of hunting sheep since the district was reopened in 2004. There have been 54 rams harvested in the district since 1978, having an average age of seven years. From 2005 to 2007, one either-sex license was issued annually. Table 3 details sheep harvest in Hunting District 455 from 1978 to 2006.

Accomplishments: Game management of this portion of the Big Belts has been very successful. In 1990, the Devil's Kitchen Working Group was established to address elk management after the 1990 Beartooth WMA wildfire. The Devil's

Year	# Licenses	Harvest (Rams)	% Success	# Aged	Avg. Age
1978	2	2	100%		
1979	2	2	100%		
1980	2	2	100%		
1981	3	3	100%	2	6.0
1982	3	3	100%	3	7.0
1983	5	5	100%	5	6.5
1984	15	14	93%	13	5.5
1985	5	3	60%	3	6.0
1986	6	6	100%	6	5.0
1987	3	1	33%	1	4.5
1988	3	1	33%	1	6.5
1989	4	3	75%	3	7.5
1990	2	2	100%	2	6.5
1991	2	2	100%	2	7.0
1992	2	2	100%	2	9.5
1993	2	1	50%	1	6.5
2005	1	1	100%	1	8.5
2006	1	1	100%	1	9.5
2007	1	1	100%	1	6.5

Table 3. Number of licenses issued and subsequent harvest of bighorn sheep, Hunting District 455, 1978-2007.

Kitchen area is a wildlife-rich complex of private and publicly owned lands, including large working cattle ranches south of Cascade, the Gates of the Mountains Wilderness Area, and the Beartooth WMA. The group is comprised of individuals from a variety of interests, including area landowners, sportspeople, agencies such as the BLM, DNRC, USFS, and FWP, and private organizations including the Montana Land Reliance. The group meets approximately three times a year to discuss game management, land and habitat issues, public access strategies, and many other topics.

Management Challenges: One issue regarding bighorn sheep management in this district is maintaining separation of wild sheep and domestic sheep to avoid transmission of disease between the two species. There are a few domestic sheep herds located in the Big Belt Mountains on ranches and hobby farms. Contact between domestic sheep and wild sheep has not occurred since the mid-1980s when bighorn populations were at all-time highs. Across the Missouri River in neighboring sheep Hunting District 381, a disease die-off occurred in 2006 due to contact with domestic sheep and goats. It has yet to be seen if any of the transmission has moved to the Beartooth WMA–Gates of the Mountains herd. Bighorn sheep use of private land and maintaining public hunting access to sheep may be an ongoing issue, as currently some of these ranches are commercially outfitted for deer and elk.

Population Monitoring: To monitor the bighorn population, aerial and ground surveys are conducted annually. Typically, aerial surveys are in combination with deer and elk surveys via fixed-wing aircraft and helicopters. Currently, no aerial surveys are conducted specific to sheep in the district. Surveys are conducted in winter to early spring. Lamb surveys are typically done via ground and/or boat observations during summer months. Bighorns are counted and classified by age and sex, and rams are classified by horn class. Aerial surveys are documented by GPS, noting survey track log and observation locations.

Summary of Public Comment

Public comments regarding the bighorn sheep population and its management in Hunting District 455 indicate a high level of support for the current season structure and management. The Devil's Kitchen Working Group and the Russell Country Sportsmen Group have been longtime supporters of big game management in the area. Both hunters and non-hunters enjoy seeing bighorn sheep in this area.

Management Goal

Manage for a healthy and productive bighorn sheep population within objective numbers and with having a diverse age structure of rams. Cooperate with public land management agencies and private landowners in the management of bighorn habitats and hunter access. Maintain hunting and viewing opportunities for bighorn sheep enthusiasts.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain and/or enhance occupied bighorn sheep habitat for the benefit of big game and other wildlife species.

2) Encourage maintenance and improvement of habitat conditions on publicly owned winter ranges (USFS and FWP) to provide adequate forage for big game, including bighorns, especially during winter.

Habitat Management Strategies

1) FWP has worked in cooperation with private landowners in the Beartooth WMA area on rest-rotation grazing systems totaling about 23,000 acres to enhance vegetative conditions for wildlife, especially big game. The 2007 Meriwether Wildfire, which burned approximately 42,500 acres in the Gates of the Mountains Wilderness Area and the Beartooth WMA, will greatly enhance habitat conditions in the area for bighorns.

2) Noxious weed control is an annual effort by many landowners in the Devil's Kitchen area. Noxious weed control efforts are a priority in habitat and vegetation management on the Beartooth WMA.

3) In 1971, six vegetation transects were initiated on the Beartooth WMA and are visited every three to five years. These transects will continue to be monitored over time to assess percent cover, plant species composition, percent usage, and other pertinent information.

4) Recommendations regarding habitat and big game management are made by the Devil's Kitchen Working Group and are evaluated annually by landowners and agencies involved. Some of these recommendations cover hunting season regulations, which would help direct future management of big game, including bighorn sheep.

Game Damage Strategies

Specific game damage problems have not occurred to date and are not anticipated. Bighorn numbers in the district can be managed through hunting and trapping and transplanting as they approach or are at population objectives.

Access Strategies

FWP has actively pursued access to private lands for sheep hunting. Based on the current distribution of bighorns during the hunting season, lack of hunter access to these sheep has not been an issue. Where sheep use private land during hunting seasons, private landowners have been very cooperative in allowing sheep hunting access since the district boundary was expanded to incorporate these private lands in 2004. Access to public lands is also good in the district.

Population Objectives

1) Maintain the number of bighorn sheep observed during post-season aerial surveys within 10% of 250 sheep (225 to 275), including 150 sheep in the Beartooth WMA–Gates of the Mountains and 100 in the Sheep Creek area.

2) Maintain a ram: 100 ewe ratio observed during post-season aerial surveys of at least 60 rams: 100 ewes with at least 30% of the rams having a ¾-curl.

3) Maintain the average age of 7½ years for rams harvested on either-sex licenses.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 455 is located in the Prairie/Mountain Foothills Ecological Region (see discussion of ecological regions in Chapter 1), which includes much of southwest Montana. This bighorn population is a relatively recently established population

and is characterized as having moderate lamb production with fair recruitment rates, is currently below population objective with stable numbers, and has a relatively high ram to ewe ratio. Since numbers are below objectives, management is through either-sex licenses with no ewe harvest. Another option for managing this population is the use of these sheep as transplant stock should populations become greater than 10% above 250.

The population objective of 250 (± 10%) observed bighorn sheep was derived by considering both the ability of public lands to provide forage for the majority of the wintering bighorn population and landowner tolerance for the remaining sheep that winter on private lands. Population management strategies will be directed at maintaining bighorn numbers consistent with landowner tolerance as well as maintaining the number of sheep wintering on public lands within forage allocations established in allotment management plans.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment. In Hunting District 455, licenses are issued under the following prescriptions (Table 4):

Standard Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep. The number of ewe licenses issued will be up to 15% of the number of ewes going into the fall season, which is based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs.

The Standard Regulation will be recommended if: The total number of bighorns counted on the survey area is within 10% of the population objective and lamb recruitment is between 30 and 40 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: Limited ewe licenses valid in the entire hunting district during the general season for bighorn sheep. The number of ewe licenses issued will be up to 20% of the number of ewes going into the fall season, which is based on the number of ewes observed during the annual survey, assuming 5% mortality of adults, and adding recruitment of one-half the previous year's lambs,

OR if the number of ewes and rams is at least 25 sheep (minimum transplant number) above objective, the surplus could be used for transplanting.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is greater than 10% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 15% of the ¾-curl rams in the observed population.

The Standard Regulation will be recommended if: The population is within objective (+ 10% of 250), there are 40 to 60 rams: 100 ewes, and 30% of the rams are at least ¾-curl (Table 5).

PRAIRIE/ MOUNTAIN FOOTHILLS	Observed Totals	Recruitment = Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation_	± 10% of 250	Between 30-40	Limited Entry Ewes	Up to 15% of Ewes
Restrictive Regulation	More than 10% below 250	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Greater than 10% above 250	Greater than 40	Limited Entry Ewes or translocate if > 25 sheep including rams are available	Up to 20% of Ewes

Table 4 . Summary of regulation types under different population criteria for ewe harvest and population management.

Table 5. Summary of potential ram harvest under different population parameters and criteria.

PRAIRIE/ MOUNTAIN-FOOTHILLS	Number of ES or Legal Ram Licenses Is	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of Rams with ≥ ¾ curl
Standard Regulation	Up to 15% of the ¾-curl rams	± 10% of 250	40-60:100	≥ 30
Restrictive Regulation	Up to 10% of the ¾-curl rams	More than 10% below 250	< 40:100	< 30
Liberal Regulation_	Up to 20% of the ¾-curl rams	Greater than 10% above 250	> 60:100	≥ 30

Restrictive Regulations: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 10% of the ¾-curl rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 10% below the population objective of 250, there are less than 40 rams: 100 ewes, and less than 30% of the rams are at least ¾-curl.

Liberal Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 20% of the ¾-curl rams in the population.

The Liberal Regulation will be recommended if: The population is more than 10% above the objective of 250, there are more than 60 rams: 100 ewes, and more than 30% of the rams are at least ¾-curl.

BOULDER
(Hunting District 500)

Description: Hunting District 500 begins nearly 40 miles south of Big Timber, contains approximately 159,479 acres (250mi²) of terrain, and is in the Southern Mountains Ecological Region. With the exception of several small mining claims totaling less than 718 acres, the district is managed by the Gallatin National Forest as part of the Absaroka-Beartooth Wilderness. The headwaters of the Main Boulder River and Slough Creek as well as tributaries of the Stillwater River originate within the district. Numerous mountain peaks ranging from 9,000 to 11,000 feet rise above cirque lake basins and scattered forests of whitebark pine and spruce. Bighorn sheep range over a large portion of the district from lower-elevation habitat to high-elevation ridges and saddles in the summer and fall. Sheep are restricted to high-elevation windblown ridgetops and mountain peaks during the harsh winters.

While the winter range for the Stillwater bighorns is found outside the hunting district boundary, it will be described here because it contributes rams to the Hunting District 500 hunt area. The Stillwater winter range is the only low-elevation winter range in the Beartooth Mountains, lying between 5,200 feet and 5,800 feet in elevation. It is located along the Stillwater River about five miles southwest of Nye. This winter range is in the Chinook zone where nearly constant winds keep the ground free of snow. Traditionally the winter range was a bluebunch wheatgrass/Idaho fescue type. However, in recent years the native range has been abandoned in favor of reclaimed mining land belonging to Stillwater Mining Company (SMC). Some satellite winter ranges occur along the West Fork of the Stillwater and on Sheep Mountain.

Public Access: Hunting District 500 provides a good diversity of hunting experiences, including limited motorized hunting access on ATV trails with walk-in or horseback hunting in the interior.

Bighorn Sheep Populations: Sheep from three different populations may be found within the boundary of Hunting District 500 during summer and fall, including rams from the Stillwater herd; the Monument Peak herd, which is resident to the upper Boulder area; and sheep associated with Yellowstone National Park winter ranges, who spend part of the summer and fall months within the hunting district. The Monument and Yellowstone herd units are composed entirely of native sheep and have never been augmented with transplanted sheep from other areas. The Stillwater herd was augmented twice with rams. In 1970, two rams were relocated from the Sun River herd.

They disappeared shortly after placement in the Stillwater. In 1984, three rams were placed on the Stillwater winter range from the National Bison Range just before the rut. These rams isolated themselves from the native sheep during the rut that year and were gone from the area by the next year, so they did not make a genetic contribution to the population.

The Stillwater sheep population ranged from 50 to 60 sheep throughout the mid-1970s and early 1980s but dropped below 40 in the mid-1980s and averaged less than 30 sheep on winter range from 1989 to 1999 (Figure 1). However, there has been a significant increase in bighorn numbers in the last few years. This increase is largely the result of increased lamb production and survival, which in turn is likely the result of younger, more productive ewes making up the majority of the ewe population. If this trend continues, this herd may be well on its way to recovery, at least in the short term. Maximum counts of bighorns in each sex and age class indicated that there were a minimum of 46 bighorns on the Stillwater winter range in December 2006. These included 12 rams (two yearlings), 25 ewes (one yearling) and nine lambs for ratios of 42 adult rams and 38 lambs: 100 adult ewes (Table 1). The 2005-06 count was somewhat below the 2004-05 count of 53 sheep. However, due to the mild winter conditions in 2006, it is extremely unlikely that all of the sheep were present on the winter range. By comparing the sex and age structure of the 2004-05 population, and the 2005-06 population it appeared that we were missing three prime-aged rams and five adult ewes. Given the lush growth conditions of the 2005 growing season and the mild winter of 2006, it seems unlikely we could lose this many adult animals since no deaths were documented on the winter range. Thus, it is not unreasonable to suggest that there could have been another five to eight adults in the population in 2006. Those adult ewes could also have had another two or three lambs. It is quite possible that this population was approaching 60 sheep in 2006.

Sheep numbers on the upper Boulder (Monument Peak) winter range increased steadily from 16 sheep in 1999 to 42 sheep in 2006 (Figure 2). The 2004 count of 37 sheep and the 2006 count were the two highest counts ever recorded in this district (Table 2). It is interesting to note that the high counts of the early 1980s came following a period of five years in which a domestic sheep allotment located in the area had been inactive for four of those five years. The allotment was used annually from 1985 to 1996, and from 1985 to 1999, winter range counts typically accounted for fewer than 20 sheep. The domestic sheep allotment has been inactive since 1996 and was officially retired by the U.S. Forest Service (USFS) in 2006.

Bighorn sheep in this area winter at elevations in excess of 10,000 feet. Deep snow confines sheep to windblown ridgetops with extremely limited forage. Escape cover consists of rocky outcroppings, ledges, and cliffs. There are some potential winter range areas west of Boulder Pass that are presently unoccupied, but it is unlikely that this bighorn herd will ever grow much beyond 40 to 50 animals.

In the Lower Boulder River drainage another population of bighorn was established beginning in 1985 with a transplant of 23 sheep from Lost Creek and Rock Creek. Subsequent transplants continued in 1987 with the release of 12 sheep from Lost Creek and 7 sheep from Upper Rock Creek, an additional 26 sheep from Perma in 1995 and 30 sheep from Upper Rock Creek in 1997. Shortly after the last transplant a band of domestic sheep were moved into the vicinity

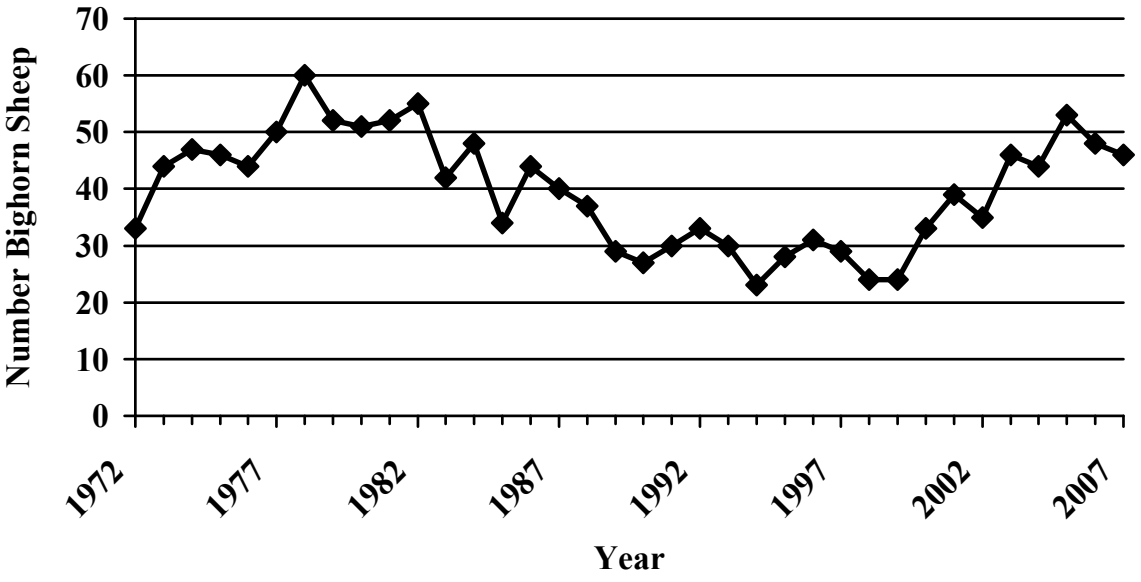


Figure 1. Total number of bighorn sheep observed during trend surveys on the Stillwater winter range, Hunting District 500, 1972-2007.

Table 1. Total number and classification of bighorn sheep on the Stillwater winter range, Hunting District 500,1971-2007.

Year	Total	Rams		Ewes		Lambs	Lambs/100 Ad Ewes	Yrlg/100 Ad Ewes	% Yrlg Survival	Rams/100 Ad Ewes
		Ad	Yrlg	Ad	Yrlg					
1972	33	3	1	17	1	11	65	12	-	18
1973	44	3	5	18	4	14	78	50	82	17
1974	47	5	2	18	7	15	83	50	64	28
1975	46	4	3	22	6	11	50	41	60	18
1976	44	5	2	27	1	9	33	11	27	19
1977	50	5	6	25	2	12	48	32	89	20
1978	60	8	5	27	4	16	59	33	75	30
1979	52	9	3	24	1	15	60	17	25	38
1980	51	11	6	24	2	8	33	33	53	46
1981	52	13	1	24	3	11	46	17	50	54
1982	55	13	5	24	2	11	46	29	64	54
1983	42	14	2	18	2	6	33	22	36	77
1984	48	14	9	18	1	6	33	55	167	78
1985	34	9	1	18	1	5	28	11	33	50
1986	44	7	3	26	2	6	23	19	100	27
1987	40	9	2	15	3	11	73	33	100	60
1988	37	6	2	24	2	3	12	17	80	25
1989	29	6	0	22	0	1	5	0	0	27
1990	27	5	0	17	1	4	24	6	100	29
1991	30	5	1	18	2	4	22	17	100	28
1992	33	5	2	19	1	6	32	16	100	26
1993	30	6	1	17	3	3	18	24	67	35
1994	23	3	1	12	1	6	50	17	67	25
1995	28	4	1	13	3	7	54	31	80	31
1996	31	5	2	14	3	7	50	36	71	36
1997	29	4	3	13	1	8	62	31	67	31
1998	24	5	2	10	2	5	50	40	57	50
1999	24	7	0	11	0	6	55	0	0	64
2000	33	7	2	13	4	7	54	46	100	54
2001	39	10	3	16	1	9	56	25	57	62
2002	35	10	2	17	2	4	24	24	50	59
2003	46	10	1	18	3	14	78	29	100	56
2004	44	10	1	20	5	8	40	30	43	50
2005	53	10	3	25	4	11	40	28	88	44
2006	48	10	2	22	2	10	45	18	36	45
2007	46	10	2	24	1	9	38	12	33	42

of the bighorn sheep. A die-off of these sheep began in 1999 and continued in 2000. Prior to the onset of the die-off there were an estimated 100 bighorn sheep in the population and a new hunting district (504) was created in 2000 with 1 legal ram permit issued. In 2001, there were no remaining bighorn sheep and the hunting district was closed.

Recreation Provided: Only a small number of hunting districts in Montana and the United States offer unlimited sheep hunting opportunity. The rugged habitat combined with relatively small sheep populations scattered over a large area produce a challenging hunt, well suited for an unlimited-opportunity, quota-regulated harvest. Sheep are found entirely on USFS land with access opportunities ranging from ATV-accessible areas outside the wilderness boundary, to areas accessible only by foot or horseback both inside and outside the wilderness. The non-hunting public also enjoys the opportunity to observe bighorn sheep in a high-elevation, pristine mountain setting.

Current Annual Bighorn Sheep Harvest: Due to the extremely low numbers of bighorns on the Stillwater winter range, the hunting season was closed in this district from 1991 to 1993. In 1994, new hunting district boundaries were drawn for Hunting District 500. This was done in such a way as to eliminate the seasonal ranges of the Stillwater bighorn herd from the open hunting area and yet allow hunting opportunity on bighorns from other herds that occasionally occupied the western-most portions

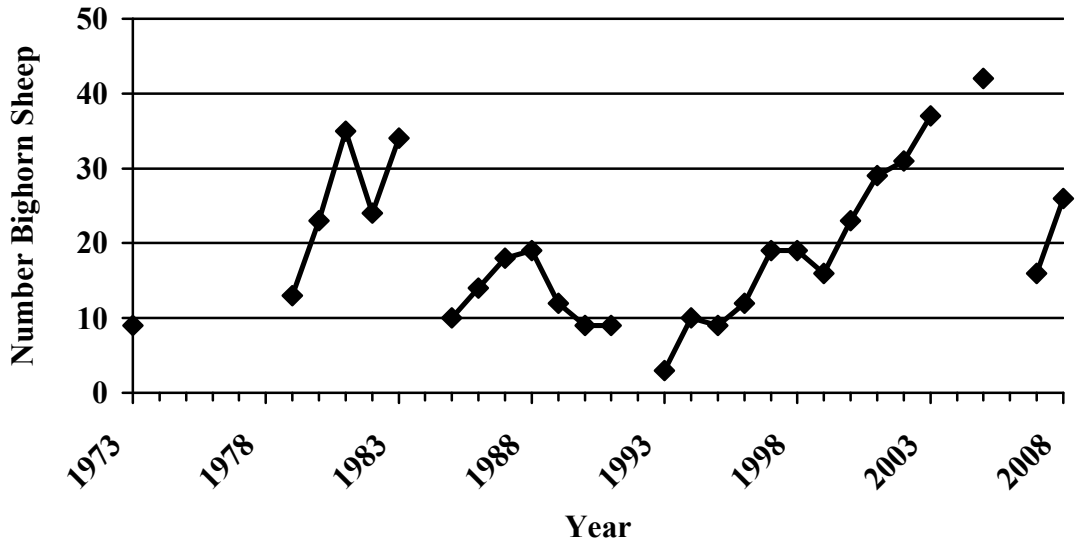


Figure 2. Total number of bighorn sheep observed during trend surveys on the Monument Peak winter range, Hunting District 500, 1973-2008.

Year	Rams		Total Rams	Ewes	Lambs	Unclass	Total	Lambs:100 Ewes	Rams:100 Ewes
	<3/4 Curl	>3/4 curl							
1973	2	0	2	5	2	0	9	0.40	0.40
1979	2	1	3	4	0	6	13	0.00	0.75
1980	2	0	2	4	0	17	23	0.00	0.50
1981	3	0	3	6	0	26	35	0.00	0.50
1982	4	1	5	17	2	0	24	0.12	0.29
1983	8	1	9	19	6	0	34	0.32	0.47
1985	4	0	4	6	0	0	10	0.00	0.67
1986	2	0	2	7	5	0	14	0.71	0.29
1987	5	3	8	7	3	0	18	0.43	1.14
1988	4	2	6	6	5	2	19	0.83	1.00
1989	2	0	2	7	3	0	12	0.43	0.29
1990	1	0	1	7	1	0	9	0.14	0.14
1991	1	0	1	6	2	0	9	0.33	0.17
1993	1	0	1	1	1	0	3	1.00	1.00
1994	2	0	2	6	2	0	10	0.33	0.33
1995	0	2	2	6	1	0	9	0.17	0.33
1996	1	0	1	7	4	0	12	0.57	0.14
1997	2	1	3	12	4	0	19	0.33	0.25
1998	3	2	5	12	2	0	19	0.17	0.42
1999	4	2	6	7	3	0	16	0.43	0.86
2000	4	2	6	10	7	0	23	0.70	0.60
2001	2	2	4	16	9	0	29	0.56	0.25
2002	4	2	6	10	3	12	31	0.30	0.60
2003	7	0	7	24	6	0	37	0.25	0.29
2005	8	3	11	20	11	0	42	0.55	0.55
2007	2	0	2	12	2	0	16	0.17	0.17
2008	3	1	4	18	4	0	26	0.22	0.22
Average	3.07	0.93	4.00	9.70	3.26	2.33	19.30	0.35	0.47
Min	0	0	1	1	0	0	3	0	0.14
Max	8	3	11	24	11	26	42	1	1.14

Table 2. Total number and classification of bighorn sheep on the Monument Peak winter range, Hunting District 500, 1973-2008.

of old Hunting District 500. Increased numbers of bighorns in the upper Boulder drainage led to a small expansion of the hunting district in 2004 along with an increase in the quota from one legal ram to two legal rams. In 2008, the district was once again expanded, moving a portion of the northern boundary from Wounded Man Creek north to Flood Creek. This change was instituted primarily to increase hunter access and allow hunters to spread out over a larger area within an unlimited district. Through the mandatory check we know that hunters took three rams in 2007, but since the statewide hunter questionnaire survey has not been completed, other comparable data are not available (Table 3).

Accomplishments: Perhaps the most significant management accomplishment has been the successful establishment and use of an unlimited hunt area, which provides any hunter with the opportunity to hunt bighorn sheep, and which only a small number of hunting districts in Montana offer.

Another major accomplishment that will ensure long-term sheep population viability in this area was the elimination of a domestic sheep grazing allotment located on summer and winter bighorn ranges. The Haystack Allotment had been active in the upper Boulder area for many years. This allotment overlapped part of the summer and most of the winter range of the upper Boulder sheep population.

Table 3. Number of licenses issued and subsequent harvest, Hunting District 500, 1975-2007.

Year	Permits Issued	Hunters Hunting	Total Harvest	% Success	Effort
1975	84	66	3	5	132
1976	54	37	2	5	148
1977	31	22	1	4	154
1978	34	19	0	0	-
1979	53	45	2	4	114
1980	78	35	4	11	44
1981	52	42	0	0	-
1982	50	33	1	3	198
1983	88	56	4	7	98
1983*	2	2	2	100	16
1984	47	26	2	8	117
1984*	1	1	1	100	-
1985	52	32	2	6	96
1986	40	21	1	5	189
1987	36	19	2	11	56
1988	25	9	2	22	15
1989	27	22	1	5	97
1990	34	28	0	0	-
1991			Closed		
1992			Closed		
1993			Closed		
1994	33	24	0	0	-
1995	28	22	1	5	120
1996	20	15	0	0	-
1997	14	8	1	12	47
1998	4	3	0	0	-
1999	19	13	1	8	54
2000	2	2	0	0	-
2001	4	4	0	0	-
2002	11	9	1	11	48
2003	8	3	1	33	14
2004	47	25	2	8	59
2005	31	25	1	4	-
2006	26	-	1	-	-
2007	-	-	3	-	-

The allotment has been vacant for the last 10 years, having been used last in 1996. The USFS permanently retired this allotment in 2006. The recent growth in the upper Boulder bighorn sheep population may well be due in part to the lack of competition from domestic sheep on summer and winter range and the removal of any potential disease threat associated with the domestics.

Recovery of the Stillwater bighorn herd from a population low of less than 25 animals to its present size of more than 50 sheep has been dramatic. This recovery has taken the concerted efforts of the SMC, Custer National Forest, (NF) FWP, Montana Department of Environmental Quality, and local private landowners. Efforts have included, but are not limited to, such diverse activities as native range inter-seeding, establishment of a grazing system on the winter range, distribution of medicated apple pulp and medicated salt for lungworm control, seasonal road closures on winter range, and oversight on reclamation seed mix. An informal working group meets biannually to review habitat improvement options available for this bighorn herd.

Management Challenges: High-elevation conditions coupled with extreme weather and rugged habitat make annual population surveys difficult. However, continued monitoring of the Stillwater and Monument Peak herds is essential for guiding ram harvest opportunities in the future. These small sheep populations can fluctuate dramatically from year to year, making it difficult to determine if observed population changes are the result of survey conditions or actual population changes.

In winter, bighorn sheep are restricted to windblown ridgetops by deep snow. Snowmobile activity can be heavy on the established trail system between Box Canyon and the wilderness boundary. During winter helicopter sheep surveys, snowmobile tracks are frequently observed inside the wilderness boundary. Snowmobile activity occurring on ridgetops utilized by sheep during winter may cause increased mortality in wintering sheep through several mechanisms. Snowmobiles may force sheep from forage and cause increased energy expenditure. Snowmobile tracks may also provide a pathway for predators to access sheep normally protected by deep snow. Enforcement of travel restrictions inside and outside the wilderness boundary is essential to ensure winter survival of sheep in this area.

The Stillwater winter range is heavily impacted by mining activity. Most of the present bighorn use is currently on reclamation sites that have no more than a 20-year life expectancy. Further, these reclamation sites are small in size, resulting in relatively high densities of sheep, especially as the population increases. This situation increases the likelihood of a density-related disease outbreak. Bighorns have not used traditional native range in the Stillwater valley for 20 years. As reclamation phases out at the end of mining, the fate of these bighorns will become uncertain.

Population Monitoring: To monitor the Monument Peak bighorn population, aerial surveys are conducted annually using a helicopter. Surveys are conducted in late winter through early spring. Many of these sheep are migratory and start moving off of winter range areas around mid-April, depending on snow conditions. To get a total count for population trend, the surveys must be conducted prior to that time. The entire area occupied by bighorn sheep during winter is flown. Bighorns are counted and classified by age and sex, and rams are classified by horn class.

The Stillwater population can be monitored via ground counts. Typically the best counts come between late December and early January. These counts are typically supplemented by helicopter surveys of the entire area, including satellite winter ranges, to ensure all bighorns are tallied.

Summary of Public Comment

Public comments regarding the bighorn sheep population and its management in this hunting district indicates a high level of support for the current season structure. Both hunters and non-hunters enjoy viewing bighorn sheep in this area.

Management Goal

Manage for a healthy and productive bighorn sheep population with a diverse age structure of rams while increasing total sheep numbers. Coordinate with public land management agencies in the management of bighorn habitat, and provide quality hunter opportunity through unlimited hunting on a quota-based system.

Habitat Objectives

1) Sheep in Hunting District 500 spend the entire year on Forest Service lands. A large percentage of the hunting district lies within the Absaroka-Beartooth Wilderness. No habitat improvements or manipulations will be undertaken in the wilderness area.

2) Maintain the Stillwater winter range in a healthy and productive condition.

Habitat Management Strategies

1) Continue the grazing management strategy on the native winter range on the Custer National Forest and adjacent private lands.

2) Continue working with the SMC to ensure maximum quantity and quality of reclamation available to bighorns.

3) Develop a plan for phasing out reclamation as the life of the SMC mine draws to a close.

4) Evaluate options for drawing bighorns back to traditional winter range.

Game Damage Strategies

Specific game damage problems have not occurred to date and are not anticipated. Bighorn sheep spend the entire year on national forest lands and do not migrate into private lands where game damage could be a problem.

Access Strategies

Based on the current distribution of bighorns during the hunting season, lack of hunter access to these sheep has not been an issue and is not anticipated to be an issue in the future.

Population Objectives

Stillwater Winter Range:

1) Maintain the number of bighorn sheep observed during post-season aerial surveys between 50 and 60 sheep.

Monument Peak Winter Range:

1) Maintain the number of bighorn sheep observed during post-season aerial surveys between 35 and 45 sheep.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 500 is located in the Southern Mountains Ecological Region (see discussion of ecological regions in Chapter 1), which includes high-elevation mountainous habitat throughout much of south-central Montana. Winter range habitat, winter severity, and winter forage conditions are the primary factors limiting this population. During winter the Monument Peak bighorns are confined to narrow bands of habitat on windblown ridgetops and mountain peaks. Forage is extremely limited. To date, overpopulation has not been a concern for this herd. Numbers are maintained at low levels through natural mortality. In contrast, the Stillwater herd winters in the Chinook zone of the Stillwater valley. Here native-vegetation winter ranges have been virtually abandoned while bighorns concentrate their foraging efforts on mine reclamation. Yet in both herds, natural mortality has prevented overpopulation from occurring. This hunting district has supported a harvest of one to two rams: year without reducing population viability.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment. In Hunting District 500, sheep populations have never reached levels that necessitate or could support ewe harvest. Natural regulation through limited winter habitat and forage holds the population at relatively low levels.

Rams: The harvest strategy for rams in this hunting district is to have a quota that is relatively stable over time. This is accomplished by setting the quota equal to the long-term average number of three-year-old rams seen during winter trend counts. These are the rams that will be entering the ¾-curl (legal) age class the following year. This strategy eliminates the need to constantly juggle quotas based on slight variations in recruitment in rams to the legal age class. Following this strategy, the quota for Hunting District 500 can be set at two for the long term, based on the recruitment rate of Stillwater rams to the legal age class.

BEARTOOTH MOUNTAINS, HELLROARING
(Hunting Districts 501 & 502)

Description: The Beartooth and Hellroaring hunting districts (Hunting Districts 501 and 502) of the Beartooth Mountains encompass approximately 1,053mi² with 23% privately owned and 77% managed by various public land management agencies, and are located in the Southern Mountains ecological region. The Beartooth Mountains are one of Montana's largest mountain ranges, running from the Clarks Fork of the Yellowstone River on the east to the Boulder River on the west. This is Montana's highest range of mountains, with many peaks topping out at over 12,000 feet including Montana's highest peak, Granite Peak, at 12,804 feet. Hunting Districts 501 and 502 encompass the eastern two-thirds of the mountain range.

Approximately 300mi² of these hunting districts (28%) are currently occupied by bighorn sheep during some portion of the year. Essentially 100% of the area occupied by bighorns is public land. There are approximately 150mi² of bighorn sheep winter/year-round range in these units. Virtually all of the bighorn habitat is managed by the U.S. Forest Service (USFS) - Custer National Forest (NF) and Gallatin National Forest (NF). The lion's share of the bighorn habitat lies within the Absaroka-Beartooth Wilderness. Only two significant bighorn ranges lie outside the wilderness boundary. Approximately 10mi² of the Hellroaring winter range in Hunting District 502 lies within the Line Creek Plateau Research Natural Area administered by the Custer NF. At the southern edge of Hunting District 501, approximately 25mi² of bighorn summer/fall range lies outside the Absaroka-Beartooth Wilderness on Forest Service land administered by the Gallatin NF.

The winter range for the bighorns in Hunting District 501 is on the alpine plateaus along both sides of the West Rosebud drainage south of Absarokee. These wintering areas range in elevation from slightly over 9,000 feet to in excess of 11,000 feet. During the summer, most of the ewes, lambs, and sub-legal rams from these winter ranges migrate south to the north edge of Yellowstone National Park (YNP) in the vicinity of Cooke City. For the most part, the mature rams do not make this seasonal migration.

The bighorns in Hunting District 502 winter on the alpine plateaus on both sides of the Rock Creek drainage south of Red Lodge. Again, these winter ranges may exceed 11,000 feet in elevation. During the summer, nearly all of these sheep migrate into the Pilot/Index Peak/Cache Creek area of northern Wyoming and YNP. Typically these bighorns do not return to the winter range until at least mid-October. Rams that spend part of the winter in the Rock Creek drainage also spend all or part of the rut in the Clark's Fork Canyon in Wyoming.

Public Access: Excellent access is available to all portions of these bighorn hunting districts. Given the wilderness nature of these areas, most access is by foot or horseback. The steepness of the terrain dictates that horse use is limited to major drainages. The steep canyon walls and limited vegetation for horse feed generally precludes the use of horses in many of the areas frequented by bighorns. Vehicle access is limited to the Beartooth Highway, the main Rock Creek Road, and the Hellroaring Road in Hunting District 502. In Hunting District 501, vehicle access is limited to the Daisy and LuLu Pass Roads near Cooke City and the Benbow Mine Road near Dean. The latter is merely an access road, not a road across bighorn habitat.

Bighorn Sheep Populations: From the early 1970s through the 1980s, these bighorns migrated to a low-elevation spring range along West Rosebud Creek. Typically they occupied this spring range from early April until mid-June. During this time, trend counts were relatively easy. However, the spring migration has not occurred in recent years. Counts are now dependent on high-elevation midwinter helicopter flights. During most winters, wind conditions at these high elevations preclude safe helicopter surveys.

The 2004 count of 78 bighorns was the second-highest count ever obtained for this herd (Figure 1). Included in that count were 16 lambs for a lamb: ewe ratio of 33:100, which was slightly above the long-term average ratio of 29 lambs: 100 ewes (Table 1). Since 1972, lamb survival has exceeded 40 lambs: 100 ewes only seven times.

Also since 1972, an average of 13 rams have been counted per year in the West Rosebud area. Five of these rams are ¾-curl or larger

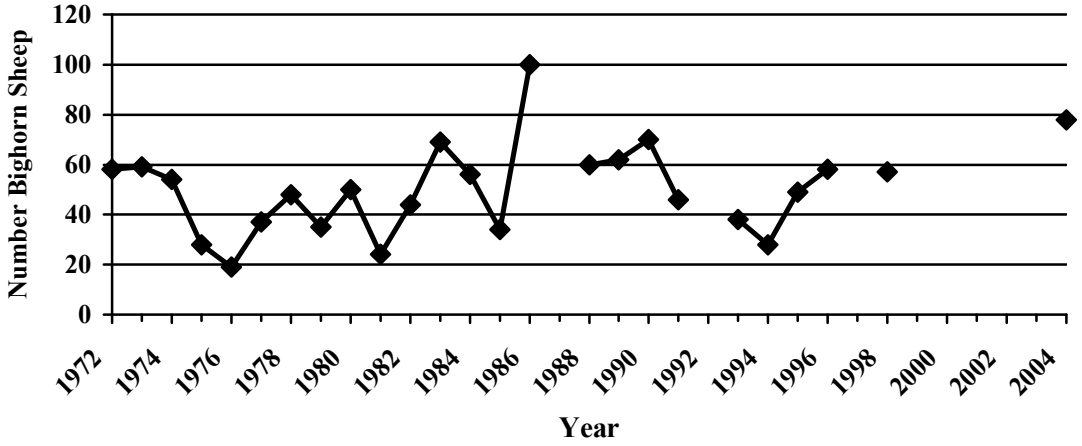


Figure 1. Total number of bighorn sheep observed during trend surveys on the West Rosebud winter range, Hunting District 501, 1972-2004.

Table 1. Bighorn sheep population parameters, Hunting District 501, 1972-2004.

Year	Total	Lambs	Rams	¾+ Rams
1972	58	14	10	3
1973	59	12	14	9
1974	54	2	10	3
1975	28	3	6	2
1976	19	3	3	
1977	37	11	5	2
1978	48	10	14	5
1979	35	1	15	4
1980	50	9	13	4
1981	24	7	6	3
1982	44	11	12	6
1983	69	11	22	9
1984	56	9	20	6
1985	34	3	21	8
1986	100	19	23	6
1988	60	4	14	5
1989	62	5	18	6
1990	70	4	19	11
1991	46	3	10	3
1993	38	2	11	6
1994	28	5	4	
1995	49	11	11	4
1996	58	10	18	5
1998	57	15	6	3
2004	78	16	13	5

rams. During the 2004 count, the number of rams in each category equaled the long-term average.

The bighorn herd in Hunting District 502 appears to have peaked in the late 1970s and early 1980s when over 90 individuals were counted (Figure 2). The population remained relatively high through the late 1980s when counts stayed above 80 sheep. However, in April 1991 a late-winter blizzard blanketed the winter range with four to six feet of heavy, wet snow. There were no windblown slopes for the bighorns to forage on after this storm. Those conditions remained for more than 10 days. The result was that the following year (1992) only 19 bighorns could be counted during an intensive helicopter survey. By spring 1993, only 11 bighorns could be found.

In 2004, 41 bighorns were tallied on the Hellroaring winter range. Eighteen of these were rams, including twelve ¾-curl rams (Table 2). The lamb: ewe ratio in 2004 was only 21:100, which was well below the long-term average of 35:100. The ram: ewe ratio of 94:100 was the second highest ever recorded for this herd.

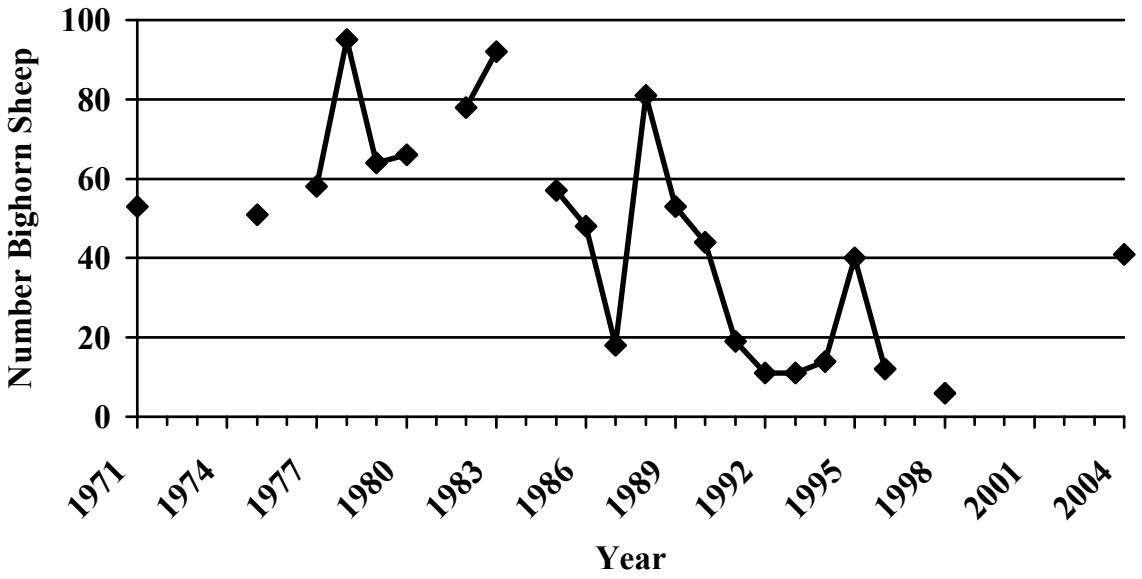


Figure 2. Total number of bighorn sheep observed during trend surveys on the Hellroaring winter range, Hunting District 502, 1971-2004.

Year	Total	Lambs	Rams	¾+ Rams
1971	53	14	3	
1975	51	6	11	3
1977	58	17	15	5
1978	95	29	20	4
1979	64	8	21	7
1980	66	7	13	3
1982	78	19	15	6
1983	92	15	22	8
1985	57	9	14	7
1986	48	4	5	2
1987	18	3	6	3
1988	81	18	16	4
1989	53	11	7	2
1990	44	2	12	
1991	19	6	4	
1992	11	4	1	
1993	11	1	2	
1994	14	3	1	
1995	40	12	3	
1996	12	2	5	
1998	26	6	7	2
2004	41	4	18	12

Table 2. Bighorn sheep population parameters, Hunting District 502, 1971-2004.

Recreation Provided: From the late 1950s through 1974, the entire Beartooth Mountain Range from the Clarks Fork River to the Boulder River was included in one large hunting district (Hunting District 501). In 1975, this area was broken into Hunting Districts 500, 501, and 502. These hunting districts are managed as part of Montana's "unlimited" areas (as had been old Hunting District 501). In these unlimited areas, license sales are not limited but harvest is controlled through the use of a quota on the number of ¾-curl rams that can be taken. When a ram is harvested, the successful hunter must report the kill to FWP within 48 hours. When the quota is reached in a hunting district, the season is closed on 48 hours notice.

Since 1975, an average of 76 bighorn licenses have been issued each year in Hunting District 501 (Table 3). However, typically only about two-thirds of the license holders actually participate in a hunt on an annual basis. The

Table 3. Number of licenses issued and subsequent harvest, Hunting District 501, 1975-2007[1].

Year	Licenses Issued	Hunters Hunting	Total Harvest	% Success	Effort[2]
1975	112	88	1	1	704
1976	94	63	3	5	168
1977	89	73	2	3	256
1978	84	65	2	3	227
1979	108	79	1	1	553
1980	89	46	3	7	138
1981	93	63	0	0	-
1982	54	26	2	8	104
1983	75	38	3	8	51
1984	62	44	3	7	103
1985	52	38	2	5	114
1986	99	74	2	3	149
1987	109	47	3	6	92
1988	63	35	3	9	48
1989	54	35	4	11	31
1990	63	49	3	6	66
1991	60	45	4	9	44
1992	57	48	2	4	125
1993	74	46	3	7	68
1994	54	37	2	5	112
1995	69	45	2	4	94
1996	46	33	1	3	170
1997	62	41	0	0	-
1998	66	50	1	2	288
1999	64	35	4	11	29
2000	82	61	3	5	75
2001	87	66	3	5	117
2002	81	58	3	5	165
2003	87	51	3	6	88
2004	75	57	3	5	163
2005	105	41	3	7	56
2006	75	NA	3	NA	NA
2007	NA	NA	3	NA	NA

[1] Includes former Hunting District 502 after 1999
[2] Effort = Days/ram harvested

average number of hunters afield in Hunting District 501 each year since 1975 has been 51. Between 1975 and 1992, an average of 75 bighorn licenses were sold annually for Hunting District 502 (Table 4). On average only 62% of the permit holders hunted each year.

The rams that winter in Hunting District 502 spend the summer and early fall in northern Wyoming and YNP. They are generally unavailable to hunters until late in the autumn. Older rams move into the area later than younger rams. Because of these migration patterns, the hunting season in Hunting District 502 ran from November 19 to December 15 from 1983 to 1992.

Following the 1991 die-off of bighorns in Hunting District 502, the hunting season was closed in this area beginning in 1993. The closure remained in effect through the 1999 season. Increased counts of bighorns on the winter range resulted in this area being reopened to hunting beginning in 2000. However, it was opened as a subunit of Hunting District 501 with a separate quota of one ¾-curl ram.

Hunting District 502 was reopened as a separate hunting district in 2008 with a quota of two legal rams.

Current Annual Bighorn Sheep Harvest: Since 1975, the average harvest of rams in

Year	Permits Issued	Hunters Hunting	Total Harvest	% Success	Effort[1]
1975	153	115	3	3	268
1976	115	97	0	0	-
1977	92	67	0	0	-
1978	94	73	0	0	-
1979	160	83	5	6	100
1980	53	16	2	12	56
1981	59	28	2	7	70
1982	45	27	2	7	94
1983	111	66	4	6	99
1984	81	49	4	8	47
1985	74	39	3	8	26
1986	67	34	4	12	23
1987	62	36	2	6	51
1988	51	30	1	3	158
1989	49	31	2	6	65
1990	49	31	2	6	53
1991	16	8	1	12	53
1992	29	20	1	5	85

Table 4. Number of licenses issued and subsequent harvest, Hunting District 502, 1975-1992.

[1] Effort = Days/ram harvested

Hunting District 501 has been 2.4 rams per year, which equated to an average hunter success of slightly less than 5%. Between 1975 and 1992, the ram harvest in Hunting District 502 averaged 2.1 rams per year, which equated to an average hunter success of slightly more than 4%. Since old Hunting District 502 was reopened as a subunit of Hunting District 501, a total of five rams have been harvested in this area (average = 0.6 rams per year). All of these rams were taken between 2001 and 2004.

Accomplishments: The most significant accomplishment has been the successful establishment and long-term use of the "unlimited" season type, which provides any hunter with the opportunity to hunt bighorn sheep. Only a small number of hunting districts in Montana (and no place else in the United States) offer unlimited bighorn hunting opportunity. Extremely rugged habitat combined with low-density sheep herds provides the ultimate hunting challenge.

Management Challenges: In winter, bighorn sheep are restricted to windblown ridgetops by deep snow. Snowmobile activity can be heavy on the winter ranges adjacent to the Beartooth Highway. During winter helicopter sheep surveys, snowmobile tracks are frequently observed inside the wilderness boundary. Snowmobile activity occurring on ridgetops utilized by sheep during winter may cause increased mortality in wintering sheep through several mechanisms. Snowmobiles may force sheep away from key foraging areas and cause increased energy expenditure. Snowmobile tracks may also provide a pathway for predators to access sheep normally protected by deep snow. Over time, excessive harassment of bighorns by snowmobilers could lead to abandonment of portions of their winter range. Enforcement of travel restrictions inside and outside the wilderness boundary is essential to ensure winter survival of sheep in these areas.

Population Monitoring: To monitor the bighorn population, an attempt is made to conduct annual helicopter surveys. Surveys are conducted between midwinter and early spring. The entire area occupied by bighorns during winter is flown. Bighorns are counted and classified by age and sex. Rams are also classified by age (up to three years old) and horn class. Extreme weather conditions on these high-elevation winter ranges sometimes make annual surveys impossible.

Summary of Public Comment

Public comments regarding the bighorn sheep population and its management in this hunting district indicates a high level of support for the current season structure.

Management Goal
Manage for healthy and productive bighorn sheep herds with a diverse age structure of rams at current numbers.

Habitat Objectives
Bighorns in Hunting Districts 501 and 502 spend the entire year on Forest Service lands. The vast majority of this land lies within the Absaroka-Beartooth Wilderness. No habitat improvements or manipulations will be undertaken in the wilderness area.

Habitat Management Strategies
Not applicable due to wilderness designation.

Game Damage Strategies
Since these herds are restricted to USFS lands, primarily wilderness-designated lands, game damage is not an issue.

Access Strategies
USFS access to all major trailheads in Hunting Districts 501 and 502 are adequate and secure.

Population Objectives

West Rosebud Winter Range:
1) Maintain the number of bighorn sheep observed during post-season aerial surveys between 60 and 80 sheep.

Hellroaring Winter Range:
1) Maintain the number of bighorn sheep observed during post-season aerial surveys between 40 and 60 sheep.

Population Management Strategies
Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting Districts 501 and 502 are located in the Southern Mountains Ecological Region (see discussion of ecological regions in Chapter 1), which includes high-elevation mountainous habitat throughout much of south-central Montana. Winter range habitat, winter severity, and winter forage conditions are the primary factors limiting this population. During winter bighorns are confined to narrow bands of habitat on windblown ridgetops and mountain peaks. Forage is extremely limited. To date, overpopulation has not been a concern for these herds. Numbers are maintained at low levels through natural mortality. These hunting districts have supported a harvest of two to three rams: year without reducing population viability.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment. In Hunting Districts 501 and 502, sheep populations have never reached levels that necessitate or could support ewe harvest. Natural regulation through limited winter habitat and forage holds the population at relatively low levels.

Rams: The harvest strategy for rams in these hunting districts is to have a quota that is stable over time. This is accomplished by setting the quota equal to the long-term average number of three-year-old rams seen during winter trend counts. These are the rams that will be entering the ¾-curl age class the following year. This strategy eliminates the need to constantly juggle quotas based on slight variations in recruitment in rams to the legal age class. Following this strategy the quota for Hunting District 501 has been stable for 30 years. The same strategy was followed to develop the quota for Hunting District 502 when the hunting district was reopened in 2008.

PRYOR MOUNTAINS
(Hunting District 503)

Description: The Pryor Mountains (Hunting District 503) encompass approximately 350mi^2 with 19% privately owned and 81% managed by various public land management agencies, and are located in the Prairie/Breaks ecological region. However, bighorns are restricted to an area of about 40mi^2 on the east side of the hunting district, all of which is federal land. Of this 40mi^2 60% is controlled by the National Park Service Bighorn Canyon National Recreation Area (NRA), while nearly all of the rest falls under the jurisdiction of the Bureau of Land Management (BLM). The area occupied by sheep lies west of Bighorn Lake (Yellowtail

Reservoir). Bighorns are distributed along the reservoir from the Montana-Wyoming state line on the south to Deadman Creek on the north. They are also found along both sides of Sykes Ridge, primarily south of Layout Creek. Ram groups can be found on Burnt Timber Ridge and on the southeast end of Big Pryor (Red Pryor) Mountain. The sheep occupy relatively low elevations ranging from the reservoir shore at about 3,650 feet to East Pryor Mountain at a bit less that 8,800 feet. Nearly all of the area frequented by bighorn sheep lies between 4,300 and 6,000 feet in elevation. The habitats where bighorns concentrate are among the driest sites in Montana. The closest permanent weather station to the bighorn range is at Lovell, Wyoming, where the average annual precipitation is slightly less than seven inches per year. These dry sites are dominated by Utah juniper (*Juniper osteoperma*). With a narrow band of curlleaf mountain mahogany (*Cercocarpus ledifolius*) near the state line. Wheatgrasses (*Agropyron* spp.) are the most common grass species, as well as a preferred bighorn forage. However, in this dry climate, grass plants are not common and forage production from grasses is poor.

Public Access: Because all of the land occupied by bighorn sheep is in public ownership, excellent access is available to all portions of the habitat. Vehicle access is limited to the paved road to Barry's Landing (Yellow Hill Road) and the Mystery Cave, Burnt Timber Ridge, Crooked Creek and Big Pryor (Red Pryor) Mountain roads. Most of these roads are only accessible to four-wheel-drive vehicles.

Bighorn Sheep Populations: During the winter of 1973, Wyoming Game and Fish Department personnel relocated bighorns from the Whiskey Basin herd into the north end of the Bighorn Mountains. In 1975, six to eight of these sheep moved 10 to 12 miles, crossed Bighorn Lake, and recolonized historical bighorn habitat at the Bighorn Canyon NRA. During the winters of 1971 and 1974, FWP relocated a total of 80 bighorns into the Bear Canyon area of Big Pryor Mountain with transplants of 35 sheep from the Sun River in 1971 and 45 sheep from the Sun River in 1974. While none of these bighorns were ever observed on the Bighorn Canyon NRA, they were seen within about 5 miles. Further, genetic work by Fitzsimmons (1992) suggested that genetic contributions from Montana bighorns might explain the genetic diversity of the Pryor Mountain population. In any case the Pryor herd grew at near the maximum potential rate for bighorns and numbered between 75 and 80 sheep in the spring of 1989 (Coates 1989). Kissel (1996) estimated (using the population estimation program NOREMARK) that the population had increased to slightly over 200 animals during 1993 to 1994 and may have then declined to 125 by 1996. Schoenecker et al. (2003) estimated (using the Idaho Sightability Model) the herd size at 94 to 95 animals in 1998 and 1999. While these two population estimators are not strictly comparable, there is agreement that the herd declined in size. Schoenecker et al. (2003) estimated that the population increased to about 115 bighorns in 2001 and remained stable through 2003. Trend counts would indicate a declining herd through 2004 followed by an increase through 2008 (Figure 1). There has been a steady increase in the number of lambs counted since 2000, indicating a healthy population (Table 1).

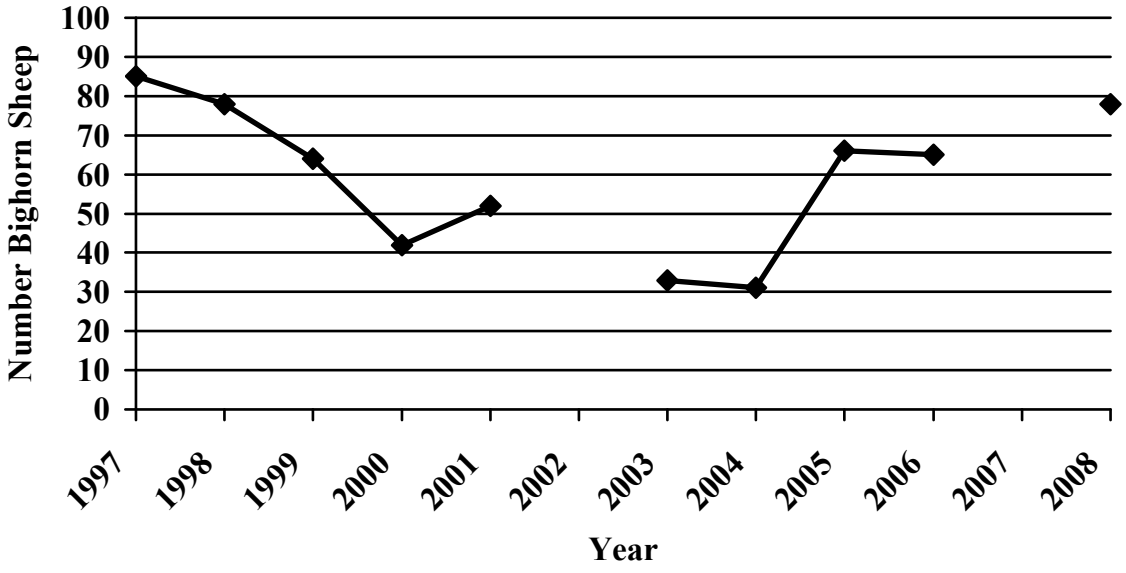


Figure 1. Total number of bighorn sheep observed during trend surveys on the Pryor Mountain bighorn range, Hunting District 503, 1997-2008.

Table 1. Bighorn sheep population parameters, Hunting District 503,

Year	Total	Lambs	Rams	¾+ Rams
1997	85	6	22	14
1998	78	13	12	7
1999	64	15	10	5
2000	42	1	11	1
2001	52	6	8	2
2003	33	7	4	1
2004	31	4	6	0
2005	66	8	23	11
2006	65	9	16	8
2008	78	15	20	10

Recreation Provided: Hunting District 503 has been open to hunting of ¾-curl rams on a limited-entry basis since 1990 (Table 2), when hunting was initiated with the issuance of two licenses. As the population increased, the number of licenses was increased to four in 1994. Then as bighorn sheep numbers declined and lamb recruitment decreased, the number of licenses issued was reduced to one from 2000 to 2004. High counts of ¾-curl rams along with increased lamb recruitment resulted in an increase in the number of licenses in 2005 to three. Beginning in 2008, these three licenses were made valid for either-sex bighorns rather than only for ¾-curl rams.

The overlap of the bighorn range with the Pryor Mountain Wild Horse Range, combined with good access by virtue of public ownership, has made the area popular for wildlife viewing during all seasons of the year. Popular areas for viewing bighorn sheep include Devil's Canyon Overlook, Booz Canyon, and the Barry's Landing/Hillsboro area.

Current Annual Bighorn Sheep Harvest: Between 1990 and 2007, a total of 42 licenses have been issued and 41 rams have been harvested (Table 2). That equates to an overall success rate of 98%. In recent years three rams have been taken annually by three license holders.

Table 2. Number of licenses issued and subsequent harvest, 1990-2007.

Year	Permits Issued	Hunters Hunting	Total Harvest	% Success	Effort
1990	2	2	2	100	1
1991	2	2	2	100	13
1992	2	2	2	100	12
1993	2	2	2	100	9
1994	4	4	4	100	7
1995	4	4	4	100	9
1996	4	4	4	100	18
1997	4	4	4	100	6
1998	2	2	2	100	7
1999	2	2	2	100	8.5
2000	1	1	0	0	-
2001	1	1	1	100	11
2002	1	1	1	100	15
2003	1	1	1	100	13
2004	1	1	1	100	5
2005	3	3	3	100	NA
2006	3	3	3	100	NA
2007	3	3	3	100	NA

Accomplishments: This population of bighorn sheep has increased relatively rapidly since colonizing the area in 1976. The fall of 2007 will be the 18th year that sheep hunts have been conducted in this hunting district. During that time only one hunter chose not to harvest a ram. Coates (1989) successfully completed a MS degree describing the habitat utilization and interspecific interactions of bighorns on the wild horse range. Kissel (1996) followed up with a PhD study of the competitive interactions between mule deer, bighorn sheep, and wild horses. Schoenecker et al. (2003) and Roelle (2003) reported on additional bighorn population and habitat studies conducted by the U.S. Geological Survey for the Bighorn Canyon NRA.

Management Challenges: Maintaining separation of wild sheep and domestic goats to avoid transmission of disease between the two species may be the greatest management challenge in the foreseeable future. A domestic goat "rancher" has started an operation on the state line in Wyoming just five to six miles from a bighorn ram winter concentration area. This operation currently involves about 75 unherded and unfenced goats. The presence of these goats not only poses a disease threat to the bighorns, but they also have forced FWP to abandon plans to relocate additional bighorns to the east end of Big Pryor Mountain. Of further concern is Wyoming Game and Fish's use of goats for weed control on the Yellowtail Wildlife Habitat Management Area just south of Horseshoe Bend. Several thousand goats are herded in this area during the summer months. Montana's bighorns have been observed within five miles of this area during the period of goat occupation.

A substantial portion of the occupied bighorn habitat in this hunting district overlaps the Pryor Mountain Wild Horse Range. To a large degree, range condition of bighorn habitat is determined by grazing impacts from wild horses. Recent range studies have shown the wild horse range to be badly overgrazed and in poor range-vegetative condition.

Population Monitoring: To monitor the bighorn population, aerial surveys are conducted annually using a helicopter. Surveys are generally conducted in early winter. The entire area occupied by bighorns during winter is flown. Bighorns are counted and classified by age and sex. Rams are also classified by age (up to three years old) and horn class.

Summary of Public Comment

Public comments regarding the bighorn sheep population and its management in this hunting district indicates a high level of support for the current season structure.

Management Goal

Manage for a healthy and productive bighorn sheep herd with a diverse age structure of rams at current numbers. Pursue opportunities to expand bighorn distribution and numbers on Big Pryor Mountain.

Habitat Objectives

Encourage improvement of habitat conditions on BLM and NPS lands so that vegetation conditions on these ranges provide adequate forage for bighorns and other wildlife.

Habitat Management Strategies

Continue to work with BLM to keep wild horse numbers within the ecological carrying capacity of the range.

Game Damage Strategies

Since this herd is restricted to public lands, game damage is not an issue.

Population Objectives

Maintain the number of bighorn sheep observed during post-season aerial surveys between 70 and 100 sheep. Pursue relocation of ewe and lamb groups to Big Pryor Mountain with the goal of maintaining 50 to 75 additional bighorns in that area.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. Hunting District 503 is located in the Prairie/Breaks Ecological Region (see discussion of ecological regions in Chapter 1). Forage is extremely limited because of the desert-like conditions that result from low levels of precipitation. The population appears to have stabilized at moderate levels after peaking out in the early 1990s. Numbers are maintained at these moderate levels through natural mortality

and limited lamb survival. This hunting district will support a harvest of two to three rams: year without reducing population viability at the current herd size.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment. In Hunting District 503, sheep populations have never reached levels that necessitate or could support ewe harvest. Natural regulation through limited winter habitat and forage holds the population at relatively low levels.

Rams: The long-term harvest management strategy goal is to set the ram license level equal to the average number of three-year-old rams seen during winter trend counts. These are the rams that will be entering the ¾-curl age class the following year. This strategy eliminates the need to constantly juggle license numbers based on slight variations in ram recruitment.

FERGUS, LITTLE ROCKIES, MIDDLE MISSOURI BREAKS, CHOUTEAU-BLAINE-PHILLIPS (MISSOURI RIVER BREAKS COMPLEX)

(Hunting Districts 482, 620, 622, 680)

Description: The Missouri River Breaks Complex, comprised of bighorn sheep Hunting Districts 482, 620, 622 and 680, represents approximately 3,863mi^2. Approximately 475mi^2 (12%) of these hunting districts are currently occupied by bighorn sheep during some portion of the year. The higher-quality sheep habitat includes the steep-walled canyons and adjacent ridges and benches (breaks) of the Missouri River, primarily between the mouth of the Judith River on the west and Timber Creek on the east.

Twenty-one percent of the area occupied by bighorn sheep is private land and 72% is federal land: 58% managed by the Bureau of Land Management (BLM) and 14% managed by the U.S. Fish and Wildlife Service (USFWS). Six percent is State Trust land, and less than 1% is Fort Belknap Indian Reservation tribal land. Most of the BLM land is located within the Upper Missouri River Breaks National Monument. All USFWS land is within the Charles M. Russell National Wildlife Refuge (NWR).

The Missouri River Breaks bighorn sheep use many different areas throughout the year, but there is no distinctly recognized winter range. Cattle graze the less steep bench tops and river and creek bottoms on privately owned and BLM-managed federal lands. Small grains are grown on some of the larger, privately owned benches. There are six Wilderness Study Areas (WSAs) on BLM lands (five within Hunting Districts 680 and 482 and one within Hunting District 622) and two Proposed Wilderness Areas on the Charles M. Russell NWR in Hunting District 622 that lie within occupied sheep range.

Public access: The Missouri River Breaks provides a diversity of hunting experiences, including motorized hunting on portions of the periphery, walk-in hunting on the interior, and access by boat along the Missouri River and Fort Peck Reservoir. Access to the public lands is somewhat restricted as most roads to public lands cross privately owned lands. At this point in time, many private landowners allow public access across their property to public lands having sheep. Some also allow access to sheep on their own property. In addition, there are numerous public access roads that do provide access to sheep habitat on BLM land (the Whiskey Ridge, Stafford Ferry, Sunshine Ridge, DY Trail, and Lower Two Calf Roads in Hunting District 482; the Zortman and Landusky Roads in Hunting District 620; the Telegraph Creek, Kill Women Creek, and Plum Creek Roads in Hunting District 622; and the Gist Ranch Road and the Lloyd Road in Hunting District 680). The Upper Missouri River Breaks National Monument travel plan will close some spur roads in order to provide habitat security for sheep. Ongoing efforts are being made by FWP to enter into access agreements with private landowners to continue to provide public access across their property to important public lands. All motorized trails have been closed on Proposed Wilderness Areas within the Charles M. Russell NWR, however, the Missouri River and Fort Peck Reservoir also provide access to BLM and USFWS lands.

Bighorn Sheep Populations: Throughout the 1800s early explorers, pioneers, and river travelers commonly observed bighorn sheep along the Missouri River in what is now eastern and central Montana. By the early

part of the 20th century, the combination of livestock competition, habitat loss, disease, and unregulated hunting had contributed to the extirpation of bighorn sheep from the Missouri River Breaks of Montana. By the 1940s, plans were underway to reintroduce sheep back into the Breaks.

In 1947, 16 bighorns from Colorado were reintroduced into Billy Creek in northern Garfield County. By 1951, this population had more than tripled to an estimated 54 animals. A limited license hunting season was instituted in 1955. Two sheep were harvested in 1955, none in 1956, but by 1963 this population had disappeared. The demise was attributed to habitat deficiencies, competition with livestock for forage, disease, and social and physiological complications from overlap with domestic sheep.

From 1958 to 1961, a total of 45 bighorn sheep were released into a 1,400-acre enclosure at the mouth of Two Calf Creek in Fergus County, located on the Missouri River on the western edge of the Charles M. Russell NWR. Transplants consisted of 9 sheep from the Sun River in 1958, 13 sheep from the National Bison Range in 1959, 11 sheep from the National Bison Range in 1960 and 12 sheep from the Sun River in 1961. By 1969, this population, which regularly moved in and out of the enclosure, had increased to about 90 animals. Limited license hunting was instituted in 1969. Eighteen licenses were issued during 1969, 1970, and 1971 in this area (Hunting District 482). During the winter of 1971-72, the population experienced a die-off. During the remainder of the 1970s, the population was stable at 20 to 30 animals and hunting of this population was closed.

In 1980, 28 bighorn sheep from the Sun River were released 25 miles farther up the Missouri River at Chimney Bend, near Lone Pine Rapids, in Fergus County. Upon release, some of the sheep quickly crossed to the north side of the river. These sheep subsequently pioneered into adjoining Breaks habitat on both sides of the river 20 miles farther upriver to Birch Creek and the mouth of the Judith River and downriver, where they merged with the surviving sheep near the mouth of Two Calf Creek. In 1986, this population was estimated at 105 animals. In 1987, limited license hunting was instituted for this population occupying the north and south side of the Missouri River (Hunting District 680). After 1987, the population continued to increase. Fixed-wing aerial surveys were conducted by FWP and BLM in 1990, 1992, and 1994. In 1995, a complete coverage aerial survey, using a helicopter, found 462 sheep (227 on the north side of the Missouri and 235 on the south side). In 1996, to expand the distribution of hunters and harvest, this large sheep population and hunting district was split into two hunting districts: the north side became Hunting District 680 and the south side became Hunting District 482.

In 1980, 28 bighorn sheep from the Sun River were also released into the Mickey-Brandon Buttes area in Phillips County, on the north side of Fort Peck Reservoir on the Charles M. Russell NWR. Approximately half of these sheep immediately left the transplant area and moved 13 miles farther east into the Iron Stake Ridge/Larb Hills area. In 1986, a total of 90 sheep were observed during ground surveys, and a limited license hunting season was instituted for these two fairly distinct herds in Hunting District 622. Some interchange of rams apparently takes place between the Mickey-Brandon Buttes and Iron Stake Ridge/Larb Hills sheep herds. Sheep habitat in both areas appears to be filled; however, there is additional sheep habitat east of the Larb Hills across Timber Creek, where sheep are pioneering. Sheep habitat in the Mickey-Brandon Buttes area is the more limited, and habitat degradation and disease is a concern.

In 1972, 42 bighorn sheep were transplanted from the Sun River into the Little Rocky Mountains outside of the Fort Belknap Indian Reservation, on the northern edge of the Missouri River Breaks, in Phillips County. An additional 21 sheep from the Sun River were released in 1974. Surveys from 1981 to 1986 indicated that this sheep population was fairly stable at approximately 60 observed sheep. In 1982, a total of 59 sheep were counted during ground surveys and a limited license hunting season was initiated in Hunting District 620. Sheep numbers peaked in 1996 when 87 sheep were observed during a helicopter survey, but the population crashed in 1998 due to a disease outbreak, and only 20 sheep were observed in subsequent surveys. The hunting season was closed in 1999 and the population has been slowly rebuilding. This population has also been impacted by mining activities at the Zortman and Landusky gold mines, and several sheep died from cyanide poisoning in the 1980s and 1990s. Since the closure of these mines in 1998, sheep distribution has changed, and sheep now frequent reclaimed mining lands throughout most of the year. It also appears that interchange of rams occurs between this population and Hunting District 680.

HUNTING DISTRICT 482

Hunting District 482 has approximately 150mi^2 of occupied sheep habitat, which is less occupied habitat than on the north side of the Missouri River in Hunting District 680. Population trend data for Hunting District 482 is summarized in Figure 1 and Table 1. Over the years, Hunting District 482 has usually had proportionately fewer ewes and more rams than Hunting District 680. This is not a result of harvest management, but more a consequence of subtle differences in habitat and habitat selection. Furthermore, the Missouri River, which separates Hunting District 482 from Hunting District 680, is not an impediment to sheep. Movements of sheep between these two hunting districts are probably not uncommon occurrences during certain times of the year. Coordination and collaboration between FWP Regions is necessary in managing these two hunting districts as one population, and in accounting for these nuances.

HUNTING DISTRICT 680

Bighorn sheep numbers have been steadily increasing in Hunting District 680 since the initial transplant of 28 sheep in 1980. One of the earliest surveys was conducted by BLM personnel in December 1986. A total of 63 sheep were observed on the north side of the Missouri River, including 18 rams. Surveys conducted by FWP using fixed-wing aircraft in 1990, 1992, and 1994 resulted in observations of a total of 48, 73, and 83 total sheep, respectively (Figure 2 and Table 2). Helicopter surveys were initiated in 1995, and 227 sheep

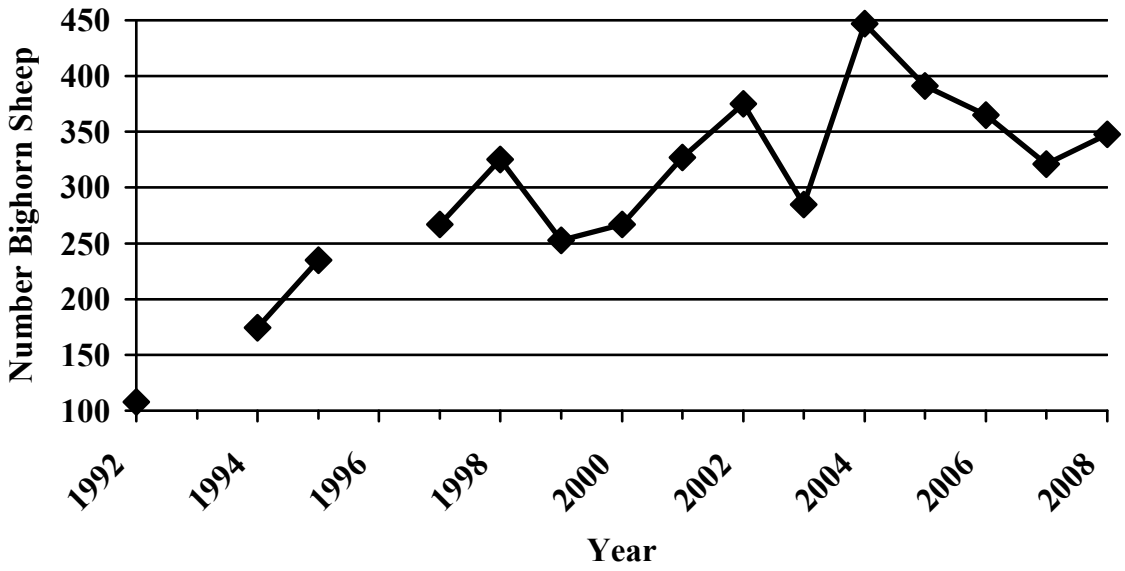


Figure 1. Total number of bighorn sheep observed during aerial trend surveys in Hunting District 482, 1992-2008.

Table 1. Bighorn sheep population parameters, Hunting District 482, 1992-2008.

Year	Ewes	Lambs	Rams	¾+ Rams	Unclass.	Total
1992	33	25	34	11	16	108
1994	34	34	50	27	39	174
1995	104	56	75	42		235
1997	86	44	83	31	36	267
1998	151	73	101	70		325
1999	120	47	86	42		253
2000	121	81	65	36		267
2001	146	64	117	56		327
2002	150	95	110	45	20	375
2003	117	80	88	47		285
2004	202	94	151	55		447
2005	141	95	155	80		391
2006	144	69	152	89		365
2007	130	83	108	60		321
2008	170	73	105	59		348

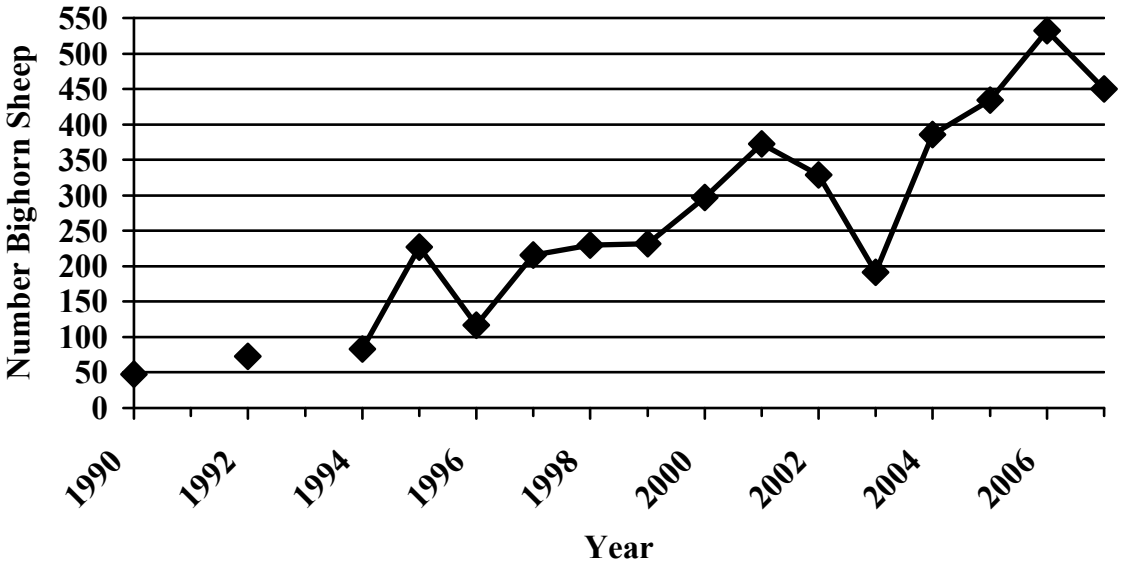


Figure 2. Total number of bighorn sheep observed during aerial trend surveys in Hunting District 680, 1990-2007.

Year	Ewes	Lambs	Rams	¾+ Rams	Unclass.	Total
1990	24	8	16	2		48
1992	37	6	30	18		73
1994	40	15	28	15		83
1995	88	40	99	42		227
1996	44	19	54	22		117
1997	117	22	77	38		216
1998	139	59	32	21		230
1999	119	66	47	25		232
2000	126	86	65	24		297
2001	161	102	110	39		373
2002	154	80	95	33		329
2003[1]	80	31	80	43		191
2004	172	80	134	63		386
2005	201	111	122	55		434
2006	260	130	142	75		532
2007	235	96	119	84		450

Table 2. Bighorn sheep population parameters, Hunting District 680, 1990-2007.

[1] The survey in 2003 only covered a portion of the area because of mechanical problems with the helicopter.

were observed that year. Counts continued to steadily increase until 2006 when a total of 532 bighorns were observed, including 142 rams of which more than half were ¾-curl or larger. The total count in 2007 was slightly lower at 450 after 60 sheep were trapped and transplanted during the previous two winters and the ewe harvest had increased the previous fall. Lamb production in all years has been excellent, ranging from 40 to 60 lambs: 100 ewes.

A research study was conducted on these sheep in the late 1990s, during which a total of 30 sheep were trapped and collared. The sheep with radio transmitters were monitored for three years, and habitat use, sheep movements and distribution, and population estimates for this herd were determined.

HUNTING DISTRICT 622

Hunting District 622 has approximately 116mi^2 of occupied sheep habitat and is located on the north side of Fort Peck Reservoir. Sheep habitat in this hunting district is more limited and of lower quality when compared to other Missouri River Breaks bighorn sheep hunting districts and thus supports lower population densities of bighorns as compared to Hunting Districts 482 and 680. Ewe habitat is especially limited in the Mickey-Brandon Buttes area and habitat degradation is a concern due to the high concentration of ewe bands on this small area. Population data for Hunting District 622 is summarized in Figure 3 and Table 3. Between 1997 and 2001, lamb and ewe numbers dropped to less than half of previous levels in

Figure 3. Total number of bighorn sheep observed during aerial trend surveys in Hunting District 622, 1988-2008.

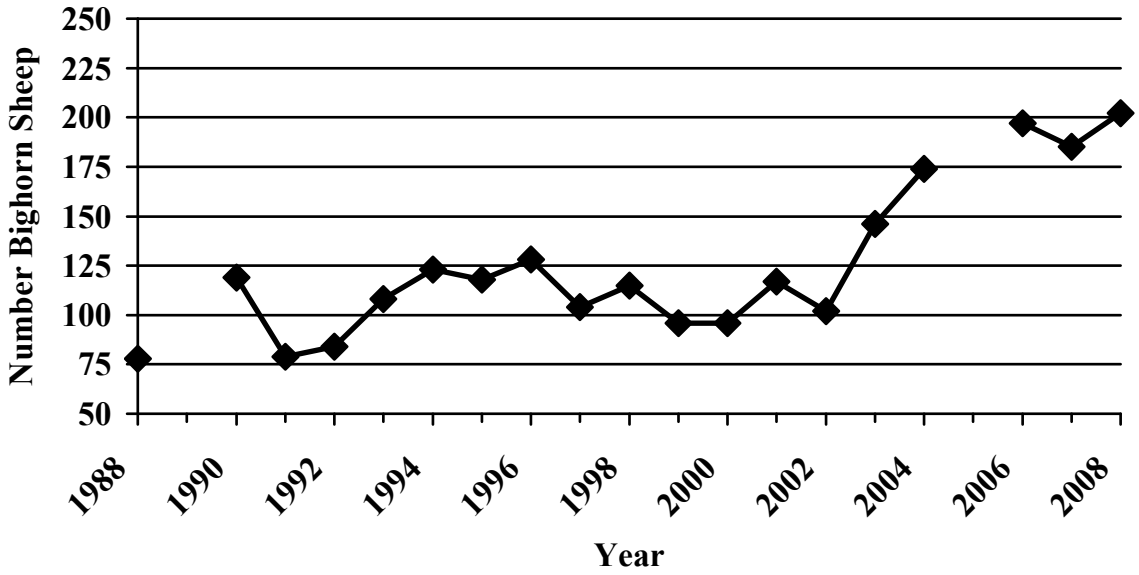


Table 3. Bighorn sheep observed during surveys [1/], Hunting District 622, 1992-2008.

Year	Ewes	Lambs	Rams	¾+ Rams	Unclass.	Total
1986	51	14	46	10	0	91
1988	30	11	34	4	3	78
1990	49	28	36	7	6	119
1991	42	9	27	4	1	79
1992	38	8	32	5	6	84
1993	46	18	27	7	0	91
1994	66	27	30	20	0	123
1995	55	28	23	8	12	118
1996	46	26	52	16	4	128
1997	46	18	40	11	0	104
1998	52	16	47	14	0	115
1999	32	7	54	15	3	96
2000	35	18	42	21	1	96
2001	47	17	51	28	2	117
2002	41	19	33	11	9	102
2003	57	45	41	17	3	146
2004	57	36	66	17	15	174
2006	80	39	73	37	5	197
2007	90	41	54	14	0	185
2008	82	38	82	40	0	202

[1/] Surveys were conducted using a helicopter in 1986, 1988, 1994-1997 and 2006-2008. All other years were counts from the ground using 11 to 23 people.

the Mickey-Brandon Buttes subpopulation. Although no sick or dead animals were found, this decrease is believed to have been disease and nutrition related and was largely the result of very poor reproduction for a period of 5 years. By 2002, habitat conditions improved on the Buttes, due to decreased grazing and browsing pressure by sheep and sheep numbers subsequently rebounded. Bighorn sheep in the Iron Stake Ridge/Larb Hills area did not experience this population decline and sheep have been steadily increasing in this area and also adjacent habitat in deer and elk Hunting District 631.

HUNTING DISTRICT 620

Hunting District 620 has approximately 43mi^2 of occupied sheep habitat and is located in the Little Rocky Mountains. Sheep habitat in this hunting district consists of grassy meadows on the southern face of this small mountain range, reclaimed areas of the Zortman and Landusky gold mines, and several interior mountain peaks. The closure of the Zortman and Landusky mines in 1998, along with reclamation of mining land, has resulted in a decrease in disturbance and improved habitat conditions for these sheep. Most of the sheep in this hunting district are now found on grassy slopes within

reclaimed mine lands. Population data for Hunting District 620 is summarized in Figure 4 and Table 4.

Recreation Provided: The Missouri River Breaks is nationally recognized as a premier sheep hunting area in North America, and licenses for this area are highly coveted. Between 1982 and 2007, a total of 469 either-sex sheep licenses were issued for Missouri River Breaks hunting districts. These lucky hunters harvested 459 rams for an amazing success rate of 98%. During this time period, 301 adult ewe licenses for these units were also issued to hunters.

Wildlife viewing and photography are other important activities provided by these sheep populations. River floaters on the "Wild and Scenic" portion of the Missouri River (within the Breaks National Monument) frequently see bighorn sheep along the steep ridges overlooking the river, or if they are especially lucky, a band will be along the shoreline, having come down for a drink. Likewise, most hunters and fishermen utilizing the Charles M. Russell NWR will never have a sheep license in their pocket, but it is common to see bighorn sheep while deer or elk hunting on the refuge or when fishing on Fort Peck Reservoir.

Current Annual Bighorn Sheep Harvest: Hunting District 482 provides varied hunting opportunities. Most of the bighorn sheep in this

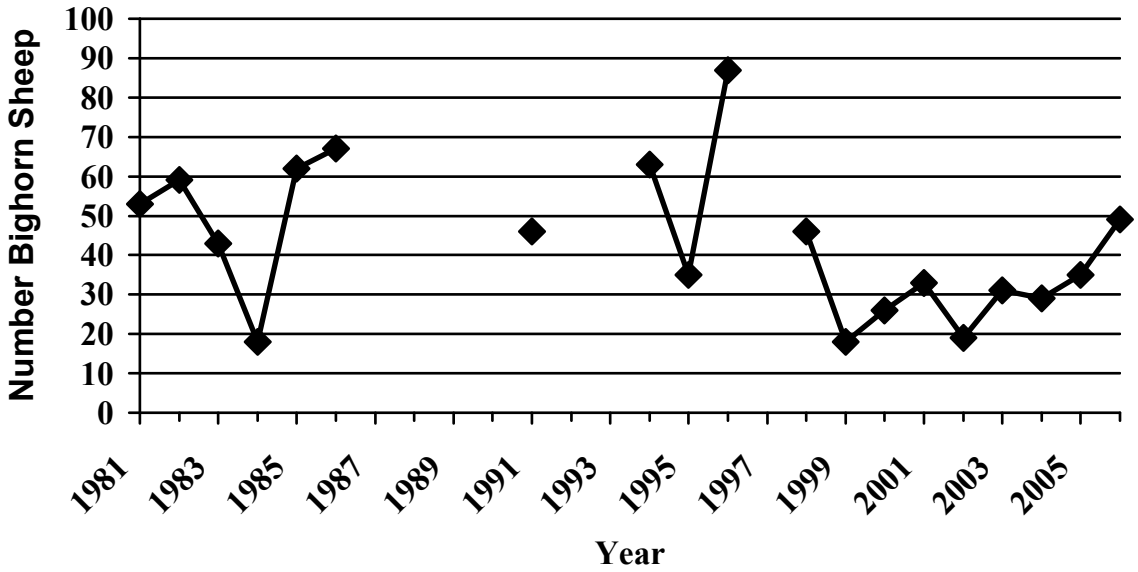


Figure 4. Total number of bighorn sheep observed during aerial trend surveys in Hunting District 620, 1981-2006.

Year	Ewes	Lambs	Rams	¾+ Rams	Unclass.	Total
1981	28	28	11	0	0	53
1982	22	13	13	0	15	59
1983	24	13	6	1	0	43
1984	10	6	2	0	0	18
1985	26	8	16	1	12	62
1986	30	20	17	4	0	67
1991	9	9	5	0	23	46
1994	40	17	2	0	0	63
1995	26	9	0	0	0	35
1996	44	23	16	1	4	87
1998	11	9	10	0	16	46
1999	0	0	3	0	15	18
2000	0	0	2	0	24	26
2001	0	0	4	1	29	33
2002	7	6	4	1	4	19
2003	19	8	6	1	0	31
2004	10	9	10	3	0	29
2005	20	11	4	0	0	35
2006	12	7	5	0	25	49

Table 4. Bighorn sheep population parameters, Hunting District 620, 1981-2006.

district can be reached by boat on the Missouri River, then by hiking up into the Breaks sheep habitat from the river below. This is a very strenuous but doable approach, except when the river freezes. Sheep can also be reached more easily from on top. About one-half of the sheep habitat can be accessed from above by way of public roads or public two-track roads on BLM lands. Access to the remaining sheep habitat requires landowner permission, as there are no legal public access roads across some private lands to the BLM lands beyond. Some landowners in Hunting District 482 outfit or charge an access fee to hunt on their land or to cross their land.

Based primarily on concerns related to disease and potential die-offs, and recognizing that virtually all suitable sheep habitat in Hunting District 482 has basically been occupied for the past 10 years, the population objective for Hunting District 482 is, to hold the population at 350 observed sheep pre-hunting season, while maintaining enough mature rams so the average age of harvested rams is 6.5 years old. A sub-objective is to keep ewe numbers at 150, or slightly below. Harvest data is summarized for Hunting District 482 in Table 5. The average age of rams harvested in 2007 was 6.9 years old. Since 1999, there have been 99 rams harvested in Hunting District 482, which averaged 7.0 years old. And since 1999, the median number of ewes counted during preseason aerial surveys was 141 ewes (Table 1).

Hunting of bighorn sheep in Hunting District 680 was initiated in the fall of 1987 with the issuance of two either-sex licenses, which were valid on both the north and south sides of the Missouri River (Table 6). As the population increased, the number of either-sex licenses were increased to five in 1988 and to 15 in 1995. In 1996, the Missouri River was used to divide the hunting district into two areas, which today are Hunting District 680 north of the Missouri River and Hunting District 482 south of the Missouri River.

The number of either-sex licenses in Hunting District 680 has been steadily increased, with 20 issued in 2007. For the rams harvested in 2007 in Hunting District 680, the average age was 7.3 years, the average base circumference of the larger horn was 16.2 inches, and the average length of the longer horn was 39.2 inches.

As bighorn sheep numbers continued to increase, ewe licenses were initiated in 1996 with 10 licenses being issued for Hunting District 680. The number of ewe licenses was increased to 20 in 2002, to 30 in 2005, to 40 in 2006, and to 60 in 2007. The number and types of licenses issued for Hunting District 680 is listed in Table 6. The population objective for bighorn sheep in this unit is 450 sheep plus or minus 10%. All sheep habitat in this unit has been occupied for at least the last 10 years.

Hunting District 622 also provides good hunting opportunities for those lucky enough to draw a sheep license for this area. Most of the bighorn sheep in Hunting District 622 can be accessed through public land managed by the BLM or Charles M. Russell NWR. Since all the sheep within the refuge occur in roadless areas, hunters must be prepared for a hike of at least several miles. Access to sheep habitat on BLM land in the Larb Hills can also be difficult since private land blocks the best access points. Hunters can reach some of this sheep habitat by hiking in from the sides, but this is a difficult approach since it involves traversing wide canyons with steep sidewalls. Another way to access remote sheep habitat in Hunting District 622 is by boat from Fort Peck Reservoir.

Table 5. Number and types of licenses issued and subsequent harvest, Hunting District 482, 1996-2007.

Year	Number Either-Sex Licenses	Ram Harvest	Number Ewe Licenses	Ewe Harvest
1996	8	8	8	5
1997	8	8	8	7
1998	8	8	10	8
1999	8	8	2	1
2000[1]	8	9	2	2
2001	8	8	2	2
2002[1]	8	9	2	2
2003[1]	12	13	2	1
2004[1]	10	11	2	2
2005	10	10	2	1
2006[1]	15	16	20	12
2007[1]	15	16	20	17

[1] The Montana bighorn sheep auction license holder harvested a sheep in this hunting district these years.

Year	Number Either-Sex Licenses	Ram Harvest	Number Ewe Licenses	Ewe Harvest
1987	2	2	-	-
1988	5	5	-	-
1989	5	5	-	-
1990	5	5	-	-
1991	5	5	-	-
1992	5	5	-	-
1993	5	5	-	-
1994	6	6	-	-
1995	15	14	-	-
1996	15	15	10	8
1997	15	15	10	6
1998	10	10	10	6
1999	10	10	1	1
2000	10	10	10	6
2001	10	10	10	7
2002	15	13	20	13
2003	10	8	20	10
2004	10	9	20	13
2005	15	16[1]	30	12
2006	15	14	40	23
2007	20	19[2]	60	23

Table 6. Number and types of licenses issued and subsequent harvest, Hunting District 680, 1987-2007.

[1] The Montana bighorn sheep auction license holder harvested a sheep in this hunting district in 2005.
[2] The auction license holder also harvested a sheep in this hunting district in 2007.

Although hiking up ridges from the lake is a difficult task, sheep are also occasionally found close to the water.

Based primarily on concerns related to disease and potential die-offs, and recognizing that most suitable sheep habitat in Hunting District 622 has been occupied for the past 10 years, the population objective is 175 to 200 observed sheep, while maintaining enough mature rams so the average age of harvested rams is at least 6.5 years old. A sub-objective is to keep preseason ewe numbers between 25 and 30 on Mickey and Brandon Buttes. The average age of rams harvested in 2007 was 7.5 years old. Since 1987, there have been 97 rams harvested in Hunting District 622, which averaged 6.7 years old (Table 7). The average number of ewes observed on Mickey and Brandon Buttes since 1987 is 24.

Hunting was initiated in Hunting District 620 in 1982 but was closed following a die-off in 1998 (Table 8). Since that time no licenses have been issued for this hunting district; however, starting in 2008 either-sex bighorn sheep licenses in Hunting District 680 are also valid in Hunting District 620. This change was made because sheep have recovered from the die-off and because there appears to be movement of rams between these two adjacent hunting districts. Hunting opportunities are marginal in the Little Rockies since most sheep occur on private land closed to hunting; however, some sheep also occur on land managed by the BLM that currently has good public access through private land enrolled in Block Management.

All sheep habitat within this hunting district is currently occupied, and sheep numbers have been rebuilding from the 1998 die-off. The population objective for Hunting District 620 is 75 to 100 sheep, but most of the sheep occur on privately owned mine lands, it is difficult to manage this population. Dense tree cover also makes it impossible to get accurate counts during aerial or ground surveys, but reports from mine reclamation workers indicate that this population currently numbers between 80 to 90 animals.

Accomplishments: The populations of bighorn sheep in all units of the Missouri River Breaks have increased relatively rapidly since the first transplants were made. The licenses for these hunting districts are highly sought after because

Table 7. Number and types of licenses issued and subsequent harvest, Hunting District 622, 1987-2007.

Year	Number Either-Sex Licenses	Ram Harvest	Number Ewe Licenses	Ewe Harvest
1987	2	2	0	0
1988	5	5	0	0
1989	5	4	0	1
1990	5	4	0	0
1991	5	5	0	0
1992	5	4	0	0
1993	5	5	0	0
1994	5	5	0	0
1995	5	5	0	0
1996	7	7	5	4
1997	5	5	3	3
1998	4	4	1	0
1999	3	3	1	1
2000	3	3	0	0
2001	3	3	0	0
2002	4	4	0	0
2003	4	4	0	0
2004	4	4	0	0
2005	4	4	0	0
2006	7	7	0	0
2007	7	7	0	0
2008	7	7	1	1

Table 8. Number and types of licenses issued and subsequent harvest, Hunting District 620, 1982-1998.

Year	Number Either-Sex Licenses	Ram Harvest	Number Ewe Licenses	Ewe Harvest
1982	2	2	0	0
1983	2	2	0	0
1984	2	2	0	0
1985	2	2	0	0
1986	2	2	0	0
1987	2	2	0	0
1988	5	4	0	0
1989	5	5	0	0
1990	5	5	0	0
1991	5	4	0	0
1992	5	3	0	0
1993	5	3	0	0
1994	2	2	0	0
1995	2	1	0	0
1996	2	2	0	0
1997	2	2	0	0
1998	2	2	0	0

of the numbers of rams available and the size of horns these rams produce. Many of these rams grow to a large size at an early age because of the high-quality habitat, sheep densities that are kept low relative to available habitat, and the fact that they do not migrate to separate summer and winter ranges. A large percentage of the sheep habitat in Hunting Districts 680 and 482 is within the Upper Missouri River Breaks National Monument, and a large portion of sheep habitat in Hunting District 622 is within the Charles M. Russell NWR. These two areas attract a considerable amount of public attention for hunting as well as wildlife viewing.

FWP has conducted several capture and transplant operations on these sheep populations. In 2000, five ewes were captured in Hunting District 680 along with 15 ewes

from Hunting District 482, and all 20 were transplanted to the Elkhorn Mountains in Hunting District 380. In 2002, 16 ewes and four yearling rams were captured in Hunting District 680 and transplanted to the Hells Canyon area of Idaho and Oregon. In 2005, a total of 14 sheep were captured in Hunting District 680 along with 35 sheep from Hunting District 482 and transplanted to Nebraska. These sheep included 34 adult ewes, seven yearling ewes, three female lambs, four yearling rams, and one male lamb. In 2006, a total of 20 sheep (13 ewes, two yearling rams, three female lambs, and two male lambs) were captured in Hunting District 680 and transplanted to the Bighorn Mountains of Wyoming. Also in 2006, another 19 sheep (14 ewes, three yearling rams, and two male lambs) were captured in Hunting District 622 (Mickey-Brandon Buttes area of south Phillips County) and transplanted to the Little Missouri River breaks in North Dakota. In 2007, a total of 20 sheep (17 adult ewes, one yearling ram, and two adult rams–a two-year-old and a three-year-old were captured in Hunting District 680 and also transplanted to the Little Missouri River breaks. Another 20 sheep (15 adult ewes, one yearling ewe, three yearling rams, and a two-year-old ram) were captured in Hunting District 680 and transplanted to the Wildcat Hills in Nebraska.

Management Challenges: Access across private land to sheep habitat on public land is a problem in some areas. This makes it difficult to manage sheep within population objectives, especially when hunting is used as a management tool through the use of adult ewe licenses. FWP is working to acquire access agreements and Block Management Areas for sheep hunting in these hunting districts.

Another management challenge is keeping the populations within or below carrying capacity to reduce the potential of die-offs and habitat degradation. Implementing ewe hunting seasons and issuing sufficient numbers of licenses is one management option. Trapping and transplanting programs are also used. Sometimes sportsmen and land managing agencies are not supportive of these various management practices, and working with these individuals and agencies can at times be challenging, especially when some agencies, such as the Charles M. Russell NWR, have different management objectives and/or control road access on their lands.

The BLM travel plan, part of the Upper Missouri River Breaks National Monument Resource Management Plan, and Proposed Wilderness Areas within the CMR also restricts access by eliminating spur roads and closing or seasonally closing other roads to provide habitat security for sheep and other wildlife species. This reduced access may increase the need to use trapping and transplanting programs to keep sheep within population objectives.

Population Monitoring: Aerial surveys are flown annually in Hunting Districts 482 and 680 and annually or biannually in Hunting District 622 using an FWP helicopter and FWP pilot. Surveys are conducted in July or August each summer in Hunting Districts 482 and 680. Surveys in Hunting District 622 are conducted during February while elk are being surveyed; a June ground survey is also conducted in the Mickey-Brandon Buttes area to better monitor ewe numbers and lamb production and recruitment. Hunting District 620 is only periodically surveyed due to dense timber in this area making it difficult to spot sheep. During surveys all bighorns are counted and classified by age and sex. Rams are classified into various horn-size categories.

Management Goals

Manage for healthy and productive bighorn sheep populations having a diverse age structure of rams. Work with public land management agencies and private individuals in managing bighorn sheep habitat, and maintain excellent opportunity for bighorn sheep hunters to harvest sheep.

Habitat Objectives

1) Develop cooperative programs that encourage public and private land managers to maintain approximately 300,000 acres of occupied bighorn sheep habitat.

2) Encourage improvement of habitat conditions on publicly owned lands (BLM and Charles M. Russell NWR) so vegetation conditions on these lands provide high quality forage and habitat for bighorns and all wildlife species.

Habitat Management Strategies

1) The BLM (in cooperation with FWP) has developed allotment management plans that will enhance vegetation for the benefit of bighorn sheep and other wildlife species. Some vegetation manipulation through prescribed burning has also been implemented by the BLM to make areas more attractive as feeding sites for wildlife.

2) Work cooperatively with the Charles M. Russell NWR and BLM to manage bighorn sheep and other ungulates at population levels that will prevent habitat degradation from occurring. Sentinel shrub and forb species will be used as an indicator to the habitat's condition.

Game Damage Strategies

Specific game damage problems with bighorn sheep occasionally occur in Hunting Districts 482 and 680. In these districts, many of the flat benchlands adjacent to rough breaks in the heart of the sheep habitat are privately owned lands that are seeded to small grains. Having sufficient numbers of ewe licenses and transplanting sheep as the population gets above objective levels helps to minimize game damage problems.

Access Strategies

Access in most of these hunting districts is currently good; however, there are no long-term commitments that this will continue into the future. Several county roads, along with the Missouri River and Fort Peck Reservoir, provide access to some of the perimeter and core sheep habitat areas. FWP has pursued access agreements and Block Management contracts with private landowners who control access to public lands or have sheep on their properties. There are currently several ranches in Block Management in Hunting Districts 620 and 622, which provide good access to public land having bighorn sheep. FWP will continue to pursue access agreements, conservation easements, and block management agreements where possible, and continue to work with the BLM and Charles M. Russell NWR to maintain access roads to sheep habitat in these areas.

Population Objectives

FWP bighorn sheep population objectives are designed to keep bighorn sheep habitat in a healthy condition and reduce crowding on ewe ranges. High-density populations can increase the spread of lungworm and other diseases. By managing sheep populations below the carrying capacity of their habitat, FWP hopes to prevent or minimize the occurrence of catastrophic die-offs.

1) Maintain the number of bighorn sheep observed during aerial surveys at 300 to 350 sheep for Hunting District 482, 400 to 450 sheep for Hunting District 680, 175 to 200 sheep for Hunting District 622, and 75 to 100 sheep for Hunting District 620.
2) For all hunting districts, maintain a ram to ewe ratio observed during aerial surveys of at least 45 rams: 100 ewes with at least 30% of the rams having a greater than ¾-curl.
3) For all hunting districts, maintain an average age of 6½ years for harvested rams.

Population Management Strategies

Strategies to manage bighorn sheep populations are being based, in part, on how bighorn populations respond demographically within five ecological regions across Montana. Bighorn populations and therefore objectives for the various populations and subsequent monitoring programs vary across Montana and depend largely on the environment or ecological region where they occur. The Missouri River Breaks Complex bighorn sheep herds are located in the Prairie/Breaks ecological region (See Discussion of ecological regions in Chapter 1), which includes the Missouri River Breaks of central and eastern Montana. These bighorn herds are relatively recently established populations and are characterized as having moderate to high lamb production with good recruitment rates. These herds are at or above population objective with stable to increasing numbers and relatively high ram to ewe ratios. Bighorn numbers are currently being managed primarily through ewe harvest, modest harvest of rams, and transplanting to other areas.

The population objectives in the Missouri River Breaks Complex were derived by considering the ability of public and private lands to provide sufficient forage for the bighorn populations. Landowner tolerance was also a consideration. Population management strategies will be directed at maintaining bighorn numbers consistent with landowner tolerance as well as maintaining the number of sheep on public lands within forage allocations established in allotment management plans.

Prescriptive Harvest Management

Ewes: Bighorn sheep populations are managed where necessary through limited-entry harvest of the female segment (Table 9).

Standard Regulation: The number of ewe licenses issued could be up to 25% of the number of ewes going into the fall season. The number of ewes going into the fall season would be based on the number of ewes observed during the annual survey.

The Standard Regulation will be recommended if: The total number of bighorns

PRAIRIE/BREAKS	No. Bighorns Counted on Survey Area	Recruitment Lambs: 100 Ewes	Regulation Types	Harvest Rates
Standard Regulation_	± 10% of population objective	Between 30-40	Limited Entry Ewes	Up to 25% of Ewes
Restrictive Regulation	More than 10% below population objective	Less than 30	Fewer than 5 ewe licenses	Less than 10% of ewes
Liberal Regulation	Greater than 10% above population objective	Greater than 40	Limited Entry ewes and translocate if > 25 sheep including rams are available	Up to 25% of Ewes

Table 9. Summary of Regulation types under different population criteria for ewe harvest and population management.

counted on the survey area is within 10% of the population objective and lamb recruitment is between 30 and 40 lambs: 100 ewes.

Restrictive Regulation: Fewer than five ewe licenses would be prescribed.

The Restrictive Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% below the population objective and lamb recruitment is less than 30 lambs: 100 ewes.

Liberal Regulation: If the number of ewes in the population exceeds the long-term average by greater than 10%, and the number of ewe licenses issued would exceed 25% of the number of ewes observed during aerial surveys, then capture and translocation of ewes will be used.

The Liberal Regulation will be recommended if: The total number of bighorns counted on the survey area is more than 10% above the population objective and lamb recruitment is greater than 40 lambs: 100 ewes.

Rams:

Standard Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 25% of the ¾-curl rams in the population.

The Standard Regulation will be recommended if: The population is within objective (+ 10%), there are at least 40 to 60 rams: 100 ewes, and 40% of the rams are at least ¾-curl (Table 10).

Restrictive Regulation: Limited-entry through issuing either-sex licenses with the number of either-sex licenses issued being up to 10% of the ¾-curl rams in the population.

The Restrictive Regulation will be recommended if: The population is more than 10% below the population objective, there are less than 40 rams: 100 ewes, and less than 30% of the rams are at least ¾-curl.

PRAIRIE/BREAKS	Number of Either-Sex or Legal Ram Licenses Is	When the Herd Has		
		Population Size	Ram: 100 Ewe ratio	% of Rams with ≥ ¾-curl
Standard Regulation	Up to 25% of the ¾-curl rams	± 10% of Pop Obj.	40-60:100	≥ 40
Restrictive Regulation	Up to 10% of the ¾-curl rams	More than 10% below Pop Obj.	< 40:100	< 30

Table 10. Summary of potential ram harvest under different population parameters and criteria.

BLUE HILLS
(Region 7)

Description: Hunting District 704 contains approximately 5,411mi² with 68% privately owned and 32% managed by various public land management agencies, and is located in the Prairie/Breaks ecological region. The Blue Hills bighorn sheep occupy a small portion (less than 3%) of elk and deer Hunting District 704 approximately 20 miles east of Miles City. The area is roughly bounded by the Yellowstone River to the north, the Powder River to the east, Johnson Creek and Second Creek to the south, and the Pine Hills to the west. Bighorn sheep are widely scattered throughout the area and do not seem to exhibit any large migratory patterns throughout the year. Information on seasonal ranges is not available due to lack of survey data.

The habitat occupied by bighorn sheep is the ponderosa pine/Rocky Mountain juniper breaks on the west side of the Powder River. Grassland and shrub grasslands are found along the creek bottoms and ridgetops and are interspersed throughout the area occupied by bighorn sheep. The major land use in the area is livestock grazing.

Public Access: There is very little public access to the Blue Hills bighorn sheep population at this time. The majority of the public land in this area is surrounded by private land that is not open to public access. Initially, public access for hunting the Blue Hills bighorn sheep population was allowed by private landowners in the area. A hunting season was initiated in 1965 and ran through 1988. Change of landowners and attitudes toward public access gradually reduced hunting opportunity to the point where the season was closed in 1989.

Bighorn Sheep Populations: In 1958, 12 bighorn sheep (N=7 from Wild Horse Island and N=5 from Gibson Lake/Sun River) were introduced into the Blue Hills. The population increased and was estimated at 65 to 70 animals in 1965. From 1966 to 1972, the population of bighorn sheep was estimated to have stabilized at around 70 to 80 animals. In 1975, the population fell to an estimated 41 bighorn sheep. In 1976, FWP supplemented the Blue Hills population with 25 bighorn sheep from the Sun River. No further population estimates were available until 2004. In 2004, a two-day aerial survey was conducted on the Blue Hills bighorn sheep population and 42 sheep were observed. No surveys have been conducted since 2004. Currently, the best estimate of the Blue Hills bighorn sheep population is between 50 to 70 animals based on landowner, FWP, and Bureau of Land Management (BLM) sightings.

FWP agreed to conduct the 2004 survey after a meeting with many of the landowners that control access to the Blue Hills bighorn sheep herd area. The survey was cost-shared with the BLM and was a good faith attempt to show the landowners in the area that FWP was willing to expend public funds and manpower to survey this population if the access issues could be resolved. As of the winter of 2007-08, there has been no change in the public access situation.

Recreation Provided: Hunting of the Blue Hills bighorn sheep herd was initiated in 1965 with the issuance of three ¾-curl licenses. This was reduced to two ¾-curl licenses from 1966 to 1972. From 1973 to 1979 the season was changed to a two either-sex license season. This was increased to three either-sex licenses from 1980 to 1988. The season was closed in 1989. Table 1 shows the history of season types and subsequent harvest of the Blue Hills bighorn sheep herd.

Table 1. Season types and harvest of the Blue Hills bighorn sheep population, 1965-1989.

Year(s)	Season Type/ Number of Permits	Ram Harvest	Ewe Harvest	Total Harvest
1965	3- ¾-curl	3	0	3
1966-1972	2- ¾-curl	7	0	7
1973-1975	2 ES	3	0	3
1976-1979	2 ES	3	0	3
1980-1988	3 ES	20	1	21
1989	closed			

Other recreational activities such as wildlife viewing of this bighorn sheep population are very limited due to the lack of public access.

Current Annual Harvest: Hunting season has been closed since 1989.

Accomplishments: Originally, the population objective for the Blue Hills herd was 50 adult bighorn sheep. The population increased rapidly from 1958 to 1965 to 65 to 70 bighorn sheep, at which time a hunting season was instituted. The population has stabilized at around 50 to 70 bighorn sheep.

FWP continues to work with the BLM on identifying and protecting critical bighorn sheep habitat within the Blue Hills herd range. The BLM is in the process of completing their Miles City Resource Management Plan (RMP) covering the next 10 years. FWP has been working in cooperation with BLM to ensure there is sufficient protection of Blue Hills bighorn sheep habitat within this plan. FWP and BLM also cooperated on a helicopter survey of this population in 2004.

In 2001, FWP acquired a conservation easement on the 13,851-acre Fluss Ranch along the Powder River. This ranch is on the extreme north and east edge of the Blue Hills bighorn sheep range. Several bighorn sheep rams have been observed using this property.

Several meetings with landowners within the Blue Hills bighorn sheep range have occurred to try to address and resolve the current access issues. No favorable results have occurred to date but this dialog continues.

Management Challenges: The main issue in relation to the Blue Hills bighorn sheep herd is the lack of public access. The population is currently at a level where limited-entry hunting could be reinstituted, yet the lack of public access for hunters precludes this at this time. Work continues with the affected landowners.

Maintaining separation of wild sheep and domestic sheep to avoid disease transmission between the two species is another issue. Currently there are several domestic sheep herds on the edges of the Blue Hills bighorn sheep range, and domestic sheep are used along the Powder River to help control leafy spurge. In 2003, a bighorn ram came into contact and actually bred several domestic ewes. This ram was removed, but it is uncertain if he had returned to the wild herd before removal. Sightings of bighorn sheep in 2003-04 decreased, indicating a reduction in the population. FWP needs to work with the BLM during the current RMP process to ensure any new BLM grazing allotments within the Blue Hills bighorn sheep range consider the effects of domestic sheep on the existing wild sheep population.

Population Monitoring: Currently, population estimates are only gathered through casual observations from landowners, hunters, and FWP and BLM personnel. A decision was made to not expend funds to survey this population until the access issues can be satisfactorily worked out.

Summary of Public Comment

Comments from the public generally indicate a concern over lack of access to these sheep for hunting and viewing. Concerns are also expressed regarding the long-term health and viability of this population due to the proximity of domestic sheep and the potential for disease transmission between the two species.

Management Goal

Manage for a healthy and productive bighorn sheep population with a diverse age structure. Cooperate with public land managers and private landowners in the management of bighorn habitats, and improve or gain the opportunity for bighorn sheep hunters to harvest sheep.

When and/or if the public access issue is rectified, FWP will begin to collect more reliable population information, and then will be able to more specifically address habitat and population management strategies.

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APPENDICES

APPENDIX A

Glossary of Terms

Buffer Zone: A defined and delineated space on a landscape established by wildlife managers to prevent contact and disease transmission between wild sheep and domestic sheep and goats across that geographic space.

Bighorn Sheep: A member of the species *Ovis canadensis* found throughout the mountains of western North America. They occur from the Peace River in Canada to northern Mexico and east to the Badlands of the Dakotas. Eight races are reported if one counts the extinct Audubon's bighorn.

Contact: Direct contact or close proximity between body parts of two animals during which a disease might be transmitted from one to another. In this document, "contact" typically refers to nose-to-nose or face-to-face interaction that may lead to the transmission of respiratory disease via secretions or aerosols. Synonymous with "Interaction".

Die-off: A large-scale mortality event that impacts many animals from a population and may have significant demographic consequence to the long-term persistence of that population. In this report, such mortality events are usually caused by respiratory disease epidemics involving bacterial and/or other pathogens alone or in various combinations.

Disease: The word disease means literally "free of ease". Disease is any impairment that modifies or interferes with normal functions of an animal, including responses to environmental factors such as nutrition, toxicants, and climate. Typically, disease involves transmission of and exposure to some infectious agent, but it may involve noninfectious causes such as congenital defects.

Double Fencing: Two fences running parallel around a landscape or pasture to prevent contact between animals across the fence line, designed to inhibit disease transmission.

Effective Population Size: The average size of a population in terms of the number of individuals that can contribute genes equally to the next generation. The effective population size is usually smaller than the actual size of the population.

Effective Separation: Spatial and/or temporal separation between wild sheep and domestic sheep and goats resulting in minimal to no risk of contact and subsequent transmission of respiratory disease between animal groups.

Enzootic: Endemic in animals. An enzootic disease is constantly present in an animal population, but usually only affects a small number of animals at any one time.

Epizootic: An epizootic is a disease that appears as new cases in a given animal population, during a given period, at a rate that substantially exceeds what is "expected" based on recent experience (i.e., a sharp elevation in the incidence rate). Epidemic is the analogous term applied to human populations. High population density is a major contributing factor to epizootics.

Feral: An animal of a domestic species that resides in a non-domestic setting and is not presently owned or controlled.

Founder Effect: In population genetics, the founder effect is the loss of genetic variation that occurs when a new population is established by a very small number of individuals from a larger population. The founder effect is a special case of genetic drift. In addition to founder effects, the new population is often a very small population and so shows increased sensitivity to genetic drift, an increase in inbreeding and relatively low genetic variation.

Genetic Drift: Genetic drift is the random change in the genetic composition of a population due to chance events causing unequal participation of individuals in producing succeeding generations. Along with natural selection, genetic drift is a principal force in evolution.

Interaction: Direct contact or close proximity between body parts of two animals during which a disease might be transmitted from one to another. In this document, "interaction" typically refers to nose-to-nose or face-to-face interaction that may lead to the transmission of respiratory disease via secretions or aerosols. Synonymous with "Contact".

Metapopulation: A metapopulation consists of a group of spatially separated populations of the same species that interact at some level. A metapopulation is generally considered to consist of several distinct populations together with areas of suitable habitat that are currently unoccupied.

Minimum Viable Population: A minimum viable population is the smallest isolated population having at least a 95% probability of surviving at least 100 years (Shaffer 1983).

Migration or Migratory: A term used to refer to the movement of individuals or genes (gene flow) across a landscape; typically refers to movements from one seasonal habitat to another, or between breeding and nonbreeding habitats.

Population Bottleneck: A population bottleneck (or genetic bottleneck) is an evolutuonary event in which a significant percentage age of a population or species is killed or otherwise prevented from reproducing. Population bottlenecks increase genetic drift, as the rate of drift is inversely proportional to the population size. They also increase inbreeding due to the reduced pool of possible mates.

Risk/Risk Assessment/Risk Management: In this context, evaluation of the probability that a wild sheep population could experience a disease event with subsequent demographic impacts. Identification of what factors might contribute to the probability of a disease event. Management actions taken to reduce the probability of exposure and/or infection among, or between, animals. Examples of risk management include separation of infected and noninfected animals, treatment of infected individuals, vaccination, manipulations of the host environment, or manipulations of the host population.

Spatial Separation: A defined physical distance between animal populations.

Stray: A domestic sheep or goat physically or temporally separated from its associated flock or band.

Stressor: A specific action or condition that causes an animal to experience stress and the subsequent physiological results of that stress.

Temporal Separation: Segregating animal populations over time to prevent contact, such that they may occupy the same physical space but at different times.

Transmission: The physical transfer (direct or indirect mechanisms) of a disease agent from one animal to another, either within an animal population or between animal populations. In some instances, transmission can lead to full expression of disease in individuals or populations.

Trailing: The planned ambulatory movement of domestic sheep and goats across a landscape or within a corridor to reach a destination where grazing or use will be allowed.

Viability: The demographic and genetic status of an animal population whereby long-term persistence is likely.

APPENDIX B

Listing of Montana Bighorn Sheep Research Compiled by Glenn L. Erickson January 2008

Behavior:

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APPENDIX C

Transplant history of bighorn sheep in Montana, 1922-2009.

Year	Source	Number	Release Location
1922	Banff, Alberta, Canada	12	National Bison Range, Lake Co.
1939	National Bison Range, Lake Co.	23	Hart Mountain Refuge, Oregon[1]
	National Bison Range, Lake Co.	2	Washington State University, Pullman (for research)
	Mission Mtns., Missoula Co.	2	Wildhorse Island, Lake Co.
1942	Sun River, Teton Co.	11	Gates of the Mountains, Lewis & Clark Co.
1943	Sun River, Teton Co.	3	Gates of the Mountains, Lewis & Clark Co.
1944	West Gallatin, Gallatin Co.	1	Sun River, Teton Co.
	Ural-Tweed, Lincoln Co.	2	West Gallatin River, Gallatin Co.
1947	Sun River, Teton Co.	2	West Gallatin River, Gallatin Co.
	Sun River, Teton Co.	6	Wildhorse Island, Lake Co.
	Colorado, Tarryall herd, Park Co.	16	Billy Cr. Missouri River Breaks, Garfield Co.
1954	Sun River, Teton Co.	6	16 Mile Canyon, Gallatin Co.
	Wildhorse Island, Lake Co.	12	Kootenai Falls, Lincoln Co.
1955	Wildhorse Island, Lake Co.	9	16 Mile Canyon, Gallatin Co.
	Wildhorse Island, Lake Co.	8	Bull Mtn., Jefferson Co.
	Wildhorse Island, Lake Co.	4	Kootenai River, Lincoln Co.
	Sun River, Teton Co.	3	Bull Mtn., Jefferson Co.
1956	Sun River, Teton Co.	13	Sheep Cr., Cascade Co.
	No source available	1 to 4	National Zoological Park, Washington, D.C.
1957	Sun River, Teton Co.	7	Bull Mtn., Jefferson Co.
	Wildhorse Island, Lake Co.	6	Bull Mtn., Jefferson Co.
1958	Wildhorse Island, Lake Co.	5	Sheep Cr., Cascade Co.
	Sun River, Teton Co.	9	Two Calf Cr., Missouri River Breaks, Fergus Co.
	Wildhorse Island, Lake Co.	7	Blue Hills, Custer Co.
	Sun River, Teton Co.	5	Blue Hills, Custer Co.
1959	Sun River, Teton Co.	13	Eddy Cr., Sanders Co.
	Wildhorse Island, Lake Co.	6	Thompson River, Sanders Co.
	National Bison Range, Lake Co.	13	Two Calf Cr., Missouri River Breaks, Fergus Co.

Appendix C. Continued

1960	National Bison Range, Lake Co.	34	Stickney Cr. Big Belt Mtns., Lewis & Clark Co.
	National Bison Range, Lake Co.	11	Two Calf Cr., Missouri River Breaks, Fergus Co.
	Sun River, Teton Co.	8	Hannan Gulch, Sun River, Teton Co.
	Sun River, Teton Co.	3	Sheep Cr. Big Belt Mtns., Cascade Co.
1961	Sun River, Teton Co.	12	Two Calf Cr., Missouri River Breaks, Fergus Co.
1962	Sun River, Teton Co.	18	Sheep Cr. Little Belts Mtns., Meagher Co.
1963	National Bison Range, Lake Co.	5 (rams)	Ural-Tweed, Lincoln Co.
	National Bison Range, Lake Co.	6 (rams)	West Gallatin River, Gallatin Co.
	National Bison Range, Lake Co.	14	Doris Mtn., Flathead Co.
1964	Sun River, Teton Co.	25	Willow Cr. Tobacco Root Mtns., Madison Co.
1967	Sun River, Teton Co.	22	Highland Mtns., Silver Bow Co.
	Sun River, Teton Co.	25	Olson and Foster Cr., Deer Lodge Co.
1968	Sun River, Teton Co.	32	Prickly Pear Cr., Lewis & Clark Co.
	Sun River, Teton Co.	2	Stillwater River, Beartooth Mtns., Stillwater Co.
	Sun River, Teton Co.	16	Petty Cr., Missoula Co.
	National Bison Range, Lake Co.	15	Teakettle Mtn., Flathead Co.
1969	Sun River, Teton Co.	18	Highland Mtns., Silver Bow Co.
	Wildhorse Island, Lake Co.	23	Berray Mtn., Cabinets Mts, Sanders Co.
	Sun River, Teton Co.	13	Highland Mtns., Silver Bow Co.
1970	Sun River, Teton Co.	2	Stillwater River, Beartooth Mtns., Stillwater Co.
1971	Sun River, Teton Co.	35	Pryor Mtns., Carbon Co.
	Ford Cr., Lewis & Clark Co.	5	Beartooth Game Range, Big Belt Mtns., Lewis & Clark Co.
	Sun River, Teton Co.	36	Beartooth Game Range, Big Belt Mtns., Lewis & Clark Co.
	Ford Cr., Lewis & Clark Co.	8	Beartooth Game Range, Big Belt Mtns., Lewis & Clark Co.
	Sun River, Teton Co.	3	State Veterinary Laboratory, Gallatin Co. (for research)
1972	Sun River, Teton Co.	19	East Fork Bitteroot River, Ravalli Co.
	Sun River, Teton Co.	16	East Fork Bitteroot River, Ravalli Co.
	Ford Cr., Lewis & Clark Co.	21	Little Rockies, Phillips Co.
1973	Sun River, Teton Co.	5	Beartooth Game Range, Big Belt Mtns., Lewis & Clark Co.
	Sun River, Teton Co.	6	State Veterinary Laboratory, Gallatin Co. (for research)

Appendix C. Continued

1974	Sun River, Teton Co.	27	Pryor Mtns., Carbon Co.
	Sun River, Teton Co.	21	Little Rocky Mtns., Phillips Co.
	Sun River, Teton Co.	18	Pryor Mtns., Carbon Co.
1975	Sun River, Teton Co.	31	Rock Cr., Granite Co.
	Ford Cr., Lewis & Clark Co.	31	Berray Mtn., Sanders Co.
	Sun River, Teton Co.	11	Beartooth Game Range, Big Belt Mtns., Lewis & Clark Co.
	Sun River, Teton Co.	47	Beartooth Game Range, Big Belt Mtns., Lewis & Clark Co.
	Wildhorse Island, Lake Co.	2	Berray Mtn., Sanders Co.
1976	Sun River, Teton Co.	25	Blue Hills, Custer Co.
	Sun River, Teton Co.	39	Sheep Cr., Pondera Co.
1979	Wildhorse Island, Lake Co.	41	14 Mile Cr.,Sanders Co.
	Wildhorse Island, Lake Co.	25	Rock Cr., Granite Co.
	Wildhorse Island, Lake Co.	18	Washington State University, Pullman, WA
	Wildhorse Island, Lake Co.	14	Flathead Indian Reservation, Little Money, Sanders Co.
	Wildhorse Island, Lake Co.	11	Flathead Indian Reservation, Sanders Co.
1980	Sun River, Teton Co.	28	Missouri River Breaks, Fergus Co.
	Sun River, Teton Co.	28	Missouri River Breaks, Phillips Co.
1981	Wildhorse Island, Lake Co.	5	14 Mile Cr., Sanders Co.
1982	Sun River, Teton Co.	13	Washington State University, Pullman, WA (for research)
1984	Rock Creek, Granite Co.	1	release location unknown
	National Bison Range, Lake Co.	3	Stillwater River, Beartooth Mtns., Stillwater Co.
1985	National Bison Range, Lake Co.	4	Petty Cr., Missoula Co.
	Thompson Falls, Sanders Co.	2	Lost Cr., Deer Lodge Co.
	Thompson Falls, Sanders Co.	7	Mill Cr. Absaroka Mtns., Stillwater Co.
	Lost Creek, Deerlodge Co. and Rock Cr, Granite Co.	23	Boulder River, Absaroka Mtns., Park Co.
	Lost Creek, Deerlodge Co.	39	Tendoy Mtns., Beaverhead Co.
	Cinnabar Mtn., Park Co.	13	Mill Cr. Absaroka Mtns., Park Co.
	Thompson Falls, Sanders Co.	2	National Bison Range, Lake Co.
1986	Thompson Falls, Sanders Co.	14	Tendoy Mtns., Beaverhead Co.

Appendix C. Continued

1987	Lost Creek, Deerlodge Co.	28	Ranch Cr., Granite Co.
	Lost Creek, Deerlodge Co.	12	Boulder River, Absaroka Mtns., Park Co.
	Upper Rock Cr., Granite Co.	7	Boulder River, Absaroka Mtns., Park Co.
	Ural-Tweed, Lincoln Co.	2	Wildhorse Island, Lake Co.
	Upper Rock Cr., Granite Co.	14	Bonner, Missoula Co.
1988	Thompson Falls, Sanders Co.	19	Squaw Cr., Madison Co.
1989	Lost Creek, Deerlodge Co.	25	Boulder River, Absaroka Mtns., Park Co.
	Thompson Falls, Sanders Co.	5	Quake Lake, Hilgard Peak, Madison Co.
	Lost Creek, Deerlodge Co.	19	Taylor and Hilgard Peaks, Gallatin Co.
	Sun River, Teton Co.	7	Joseph, Washington
1990	Sun River, Teton Co.	38	Painted Rock, Bitteroot Mtns., Ravalli Co.
	Sun River, Teton Co.	30	Bonner, Missoula Co.
1991	Lost Creek, Deerlodge Co.	32	Blackleaf Canyon, Teton Co.
	Lost Creek, Deerlodge Co.	28	West Fork Bitterroot River, Bitterroot Mtns., Ravalli Co.
1992	Highland Mtns., Silver Bow Co.	35	Sleeping Giant, Big Belt Mtns., Lewis & Clark Co.
1993	Wildhorse Island, Lake Co.	32	Sleeping Giant, Big Belt Mtns., Lewis & Clark Co.
	Wildhorse Island, Lake Co.	15	Blackleaf Canyon, Teton Co.
	Wildhorse Island, Lake Co.	26	Little Mile Cr., Gallatin Co.
	Wildhorse Island, Lake Co.	8	Washington State University, Pullman (for research)
	Thompson Falls, Sanders Co.	3	National Bison Range, Lake Co.
1994	Wildhorse Island, Lake Co.	47	Oregon (2 sites)
1995	Perma, Sanders Co.	19	Beartooth WMA[2], Lewis & Clark Co. and Cascade Co.
	Perma, Sanders Co.	26	Boulder River, Sweet Grass Co.
1996	Rock Creek, Granite Co.	20	Beartooth WMA, Lewis & Clark Co. and Cascade Co.
	Rock Creek, Granite Co.	25	Elkhorn Mtns., Broadwater Co.
1997	Milltown, Missoula Co.	30	Elkhorn Mtns., Broadwater Co.
	Rock Creek, Granite Co.	19	Tendoy Mtns., Beaverhead Co.
	Rock Creek, Granite Co.	30	Boulder River, Sweet Grass Co.
1998	Bitterroot Mtns., Ravalli Co.	22	Deep Cr., Teton Co.

Appendix C. Continued

2000	Missouri River Breaks, Blaine Co. and Fergus Co.	20	Elkhorn Mtns., Broadwater Co.
	Thompson Falls, Sanders Co.	16	Kootenai Falls, Lincoln Co.
	Sun River, Teton Co.	27	Sapphire, Mtns., Ravalli Co.
2001	Sun River, Teton Co.	32	Highland Mtns., Silver Bow Co.
	Bonner, Missoula Co.	3	Highland Mtns., Silver Bow Co.
2002	Missouri River Breaks, Blaine Co.	20	Idaho/Oregon Hells Canyon
	Sula, Ravalli Co.	23	Utah
	Sula, Ravalli Co.	14	Highland Mtns., Silver Bow Co.
	Sun River, Teton Co.	30	Tendoy Mtns., Beaverhead Co.
2003	Missouri River Breaks, Blaine Co.	30	Greenhorn Mtns., Madison Co.
	Bonner, Missoula Co.	2	Kootenai Falls, Lincoln Co.
2004	Sun River, Lewis & Clark Co.	24	Kootenai Falls, Lincoln Co.
	Sun River, Teton Co.	39	Greenhorn Mtns., Madison Co.
	Sun River, Lewis & Clark Co.	10	Bitterroot Mtns., Ravalli Co.
	Bitterroot Mtns., Ravalli Co.	12	Sheep potentially infected with *Brucella ovis*, Colorado[3] (for research)
	Thompson Falls, Sanders Co.	35	Utah, Flaming Gorge
2006	Missouri River Breaks, Phillips Co.	19	North Dakota, Little Missouri River
	Missouri River Breaks, Blaine Co.	20	Wyoming, Big Horn Mountains
	Ten Lakes, Lincoln Co.	2	Ural-Tweed, Lincoln Co.
2007	Sun River, Teton Co.	32	Nebraska
	Sun River, Lewis & Clark Co.	30	Utah
	Missouri River Breaks, Blaine Co.	20	North Dakota
	Missouri River Breaks, Blaine Co.	20	Nebraska
	Ruby Mountains, Madison Co.	18	Highland Mtns., Silver Bow Co.
	Plains, Sanders Co.	42	Wyoming (Laramie Peak)
	Bonner, Missoula Co.	27	Utah
	Rock Creek, Granite Co.	15	Utah
	E. Fk. Bitterrrot River, Ravalli Co.	25	Utah

2008	McCarty Hill/Ford Cr., Lewis & Clark Co.	18	Soap Gulch, Highland Mtns., Silver Bow Co.
	Willow Cr./ Ford Cr., Lewis & Clark Co.	13	Soap Gulch, Highland Mtns., Silver Bow Co.
	Sun Canyon /Castle Reef, Teton Co.	24	Camp Cr., Highland Mtns., Silver Bow Co.
	Mortimer & Big George Gulch, Teton Co.	10	Camp Cr., Highland Mtns., Silver Bow Co.
	Wildhorse Island, Lake Co.	38	Kootenai Falls, Lincoln Co.
	Flathead Indian Reservation, Lake Co.	24	Rocky Boys Indian Reservation, Hill Co. and Chouteau Co.
2009	Willow Cr./Ford.Cr., Lewis & Clark Co.	30	Utah
	Sun Canyon/Gibson Res., Teton Co.	30	Utah
Sheep Transplants: Summary			
	Total sheep trapped within Montana	2,067	for transplants within Montana
	Total sheep trapped within Montana	465	for transplants outside of Montana
	Total sheep trapped outside of Montana	28	for transplants to Montana
	Total sheep trapped (management)	2,560	transplanted for restoration or augmentation
	Total sheep trapped (special)	66	for research studies and zoos

[1] Kraft, E. 2006. Untold Tales of Bison Range Trails. Stoneydale Press, Stevensville, MT. Pp 24-25.
[2] Wildlife Management Area
[3] Sent to Colorado as part of a bighorn stress/disease study.
Note: The National Bison Range has exchanged rams with other "parks, private refuges and agencies" over the years. Kraft, E. 2006. Untold Tales of Bison Range Trails. Stoneydale Press, Stevensville, MT. Pp 34-35.

APPENDIX D

Money generated from the annual auction of a bighorn sheep license, 1986-2009.

Year	Amount
1986	79,000
1987	109,000
1988	93,000
1989	74,000
1990	61,000
1991	80,000
1992	88,000
1993	205,000
1994	310,000
1995	281,000
1996	220,000
1997	238,000
1998	300,000
1999	130,000
2000	95,000
2001	100,000
2002	90,000
2003	132,500
2004	160,000
2005	160,000
2006	115,000
2007	140,000
2008	195,000
2009	245,000
Total	3,700,500

The 49th Montana legislature provided the FWP Commission authority under Title 87-2-722 to auction one bighorn sheep license each year. A wildlife conservation organization is given the authority by the Commission to conduct the auction and may retain up to 10% of the proceeds. All remaining proceeds from the auction must be used for the substantial benefit of mountain sheep. Auction funds must be used in conjunction with any other funds the department uses for the management of bighorn sheep.

The primary uses of the funds generated by the auction of a bighorn license have included funding translocation of bighorns within Montana, aerial survey and monitoring efforts, habitat acquisition and easements, several research projects including a number of graduate studies and habitat enhancement projects on private and public lands.

APPENDIX E

Bighorn Sheep Transplant Site Assessment Form

Fill out the following list of items as the various aspects of the potential transplant site are quantified according to the Habitat Evaluation Procedure (HEP) in the Translocation Section. Attach a map showing the potential site, including the overall area, potential lambing habitat, summer range and winter range.

1) Is this potential transplant site to your knowledge historical bighorn sheep habitat?

2) Are there any existing bighorn sheep populations in the vicinity? Yes No (circle one). If yes, what is the name of the population, distance to it, and the likelihood for interchange assuming the establishment of a new population?

   a. Name of nearest bighorn sheep population _____
   b. Distance from core habitat _____
   c. Likelihood of interchange: High Medium Low Unknown (circle one)

3) Are there any significant barriers to movement that need to be considered and if there are provide details and suggested mitigations if any ? For example: prescribed burn to open up migration corridors where conifers are establishing on former grasslands.

4) Based on your assessment of escape terrain in the entire potential area as described in the HEP (item 1) is there enough suitable habitat to support a MVP of 125 animals? What is the total estimated size of potential habitat from this analysis? If the area can support more animals what would be the estimate of total number of bighorn sheep the area could support at the appropriate density (see Translocation Section for densities in relation to habitat type)?

   a. Is there suitable habitat for MVP – Yes No (circle one)
   b. Size of potential habitat _____ km2/mi2
   c. Total number of bighorns the area can support _____

5) Based on your assessment of potential winter range as described in the HEP (item 2) is there enough suitable habitat to support a MVP of 125 animals? What is the total estimated size of potential winter range habitat from this analysis? If the area can support more animals because of the size of potential winter range habitat what would be the estimate of total number of bighorn sheep the area could support at the suggested maximum density of 20 bighorn sheep /km2?

   a. Is there suitable winter habitat for MVP – Yes No (circle one)
   b. Size of potential winter habitat _____ km2/mi2
   c. Total number of bighorns the area can support _____

6) Based on your assessment of potential lambing habitat range as described above in the HEP (item 3) is there enough suitable habitat to support a MVP of 125 animals? What is the total estimated size of potential lambing habitat from this analysis? If the area can support more animals because of the size of potential lambing habitat what would be the estimate of total number of bighorn sheep the area could support at the suggested amount of habitat (6 ha) required for each lambing ewe?

   a. Is there suitable lambing habitat for MVP – Yes /No (circle one)
   b. Size of potential lambing habitat _____ km2/mi2
   c. Total number of bighorns the area can support _____

7) Based on your assessment of potential summer range as described in the HEP (item 4) is there enough suitable habitat to support a MVP of 125 animals? What is the total estimated size of potential summer range habitat from this analysis? If the area can support more animals because of the size of potential summer range habitat what would be the estimate of total

number of bighorn sheep the area could support at the suggested amount of habitat (8.4 – 9.7 km2) required to support the 65 – 75 nonbreeding bighorn sheep?

a. Is there suitable summer habitat for MVP – Yes No (circle one)
b. Size of potential summer habitat _____ km2/mi2
c. Total number of bighorns the area can support _____

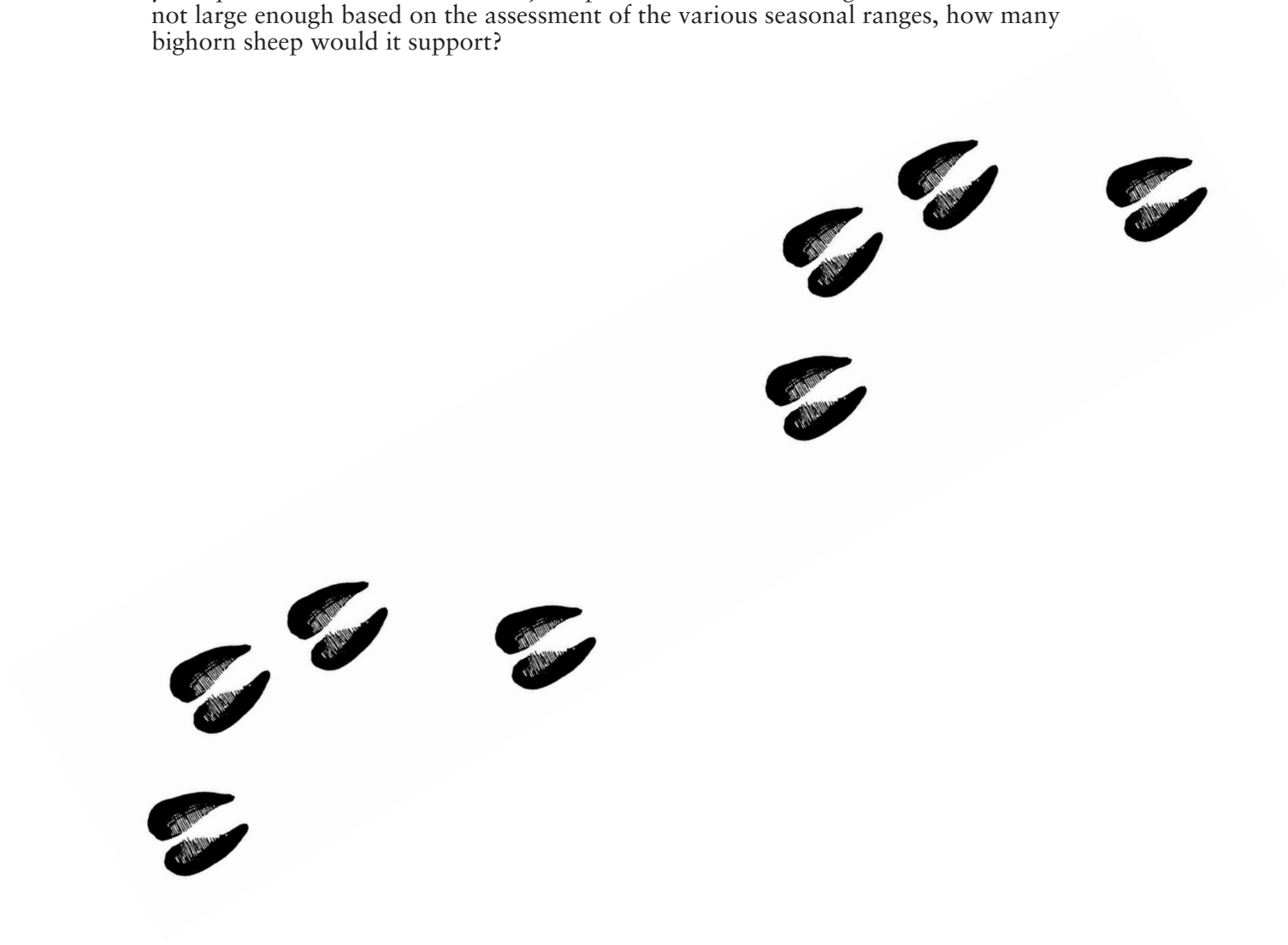
8) Are there domestic sheep or goats near this site? If so approximately how many and what would be their distance from the habitat to be potentially occupied by bighorn sheep? Are the domestic animals located on private or public lands? Is there opportunity for spatial/temporal separation based on minimum suggested distance of 23 km, effective physical barriers or other mitigating facors (provide description in (item c) below?

a. Number of domestic sheep and goats and distance to potential bighorn habitat_____
b. Located on Private or Public lands (describe): _____
c. Opportunity for separation:

9) Based on the overall assessment of seasonal ranges the highest estimated number of bighorn sheep the area would be expected to sustain would be the lowest number of any of the seasonal ranges. What is the maximum number of bighorn sheep the area will support?

a. Maximum estimated number of bighorns the area can support _____

10) Assuming there is adequate habitat to support an MVP of bighorn sheep what is your qualitative assessment on the juxtaposition of seasonal ranges. If the area is not large enough based on the assessment of the various seasonal ranges, how many bighorn sheep would it support?



APPENDIX F

Biomedical Protocol For Free-Ranging Bighorn Sheep (*Ovis Canadensis*) In Montana:

Capture, anesthesia, tagging, sampling, transportation, and necropsy procedures.

Montana Fish, Wildlife & Parks

Research Laboratory
1400 South 19th
Bozeman, Montana

General

Capture and chemical immobilization of free-ranging bighorn sheep should be carried out by a team of professionals with proper training, experience, and expertise in wildlife capture, veterinary anesthesia, and animal handling. Capture data should be recorded on the standard Wildlife Immobilization Form. In Montana, adult body weights vary from ~70 kg (150 lbs) in females to ~110 kg (240 lbs) in males. Three-month-old lambs weigh ~23 kg (50 lbs). The rut typically occurs mid-November to late December. Gestation lasts 174 days, thus lambing usually occurs in the spring (mid-May to late June). Capture during the last trimester of pregnancy (mid-March onward) should be avoided whenever possible.

Legal Considerations

The purpose of the Montana FWP Animal care and Use Committee (FWP-ACUC) is to facilitate utilization of free-ranging wildlife in Montana for scientific study in accordance with the U.S. Department of Agriculture Animal Welfare Act. To this end, all requests (internal and external)for scholarly study of wildlife in Montana must be submitted to and approved by the FWP-ACUC.

Physical Immobilization

The net-gun has been found to have considerable advantages over the use of ground nets and chemical immobilization methods for capturing bighorn sheep. In a study by Kock et al (1987), the use of the net-gun resulted in the lowest proportion of compromised sheep at 11%, had no capture myopathy (CM) mortality, and resulted in a 2% accidental mortality. The use of drop-nets resulted in 15% compromised sheep, a CM mortality rate of 2%, and an accidental mortality rate of 1%. A similar proportion of sheep were compromised with drive-nets (16%). This method also had the highest CM mortality rate at 3%, and an accidental mortality rate of less than 1%. Chemical immobilization resulted in the most compromised sheep at 19%, had a CM mortality rate of 2%, and caused the most

accidental deaths at 6%. Drop-nets and drive-nets were comparable when combining total mortality with rates for compromised bighorn sheep, 18% and 19%, respectively. Chemical immobilization had the highest combined measure of risk at 27% and net-gun lowest at 12%.

The use of blindfolds and hobbles is necessary to reduce stress and possible injury. Bighorn sheep should be kept sternal whenever possible. Handling, lifting, or moving animals should be done in a manner that reduces the potential for injury to joints and the neck. Lifting animals by the head, neck, or individual legs is not acceptable and may result in injury. Bighorn sheep captured during net-gun operations and requiring the use of a helicopter to transfer sheep should be kept sternal. The use of a "transport bag" slung under the helicopter or placement of sheep inside the helicopter are both suitable options. Slinging bighorn sheep by hobbled legs and upside down may be necessary in certain situations but should be minimized to reduce the possibility of aspiration of rumen content. If required, slinging bighorn sheep upside down under a helicopter should be limited to distances of less than ½ mile.

Chemical Immobilization

Bighorn sheep may be immobilized by darting them from the ground or from a helicopter. Anesthesia is similar to that used with other ungulate species; however, careless use of immobilization drugs in bighorn sheep can contribute to hyperthermia, cardiac dysfunction, respiratory depression, lowered blood pressure, localized blood pooling, acidosis, bloat, and aspiration. The most common complications encountered during anesthesia are respiratory depression, hyperthermia, and bloat. Capture stress and/or capture myopathy are potentially serious complications that can be very difficult to treat in a field situation. Treatment is often unsuccessful.

There are several immobilizing drug choices for anesthesia of bighorn sheep:

1) Carfentanil ~0.045 mg/kg + ~0.2 mg/kg xylazine has been shown to produce reliable immobilization. A total adult dose of 3.5 – 4.5 mg carfentanil with 15 – 20 mg xylazine provides rapid induction and safe anesthesia. Antagonism using 100 mg of naltrexone/mg of carfentanil given both IM and IV to reduce the possibility of renarcotization. Xylazine may be antagonized with 1.0 – 3.0 mg/kg tolazoline given slowly IV.

2) Etorphine (M99®) is another opioid suitable for immobilizing free-ranging bighorn sheep. A total adult dose of 4.5 - 5 mg combined with 20 mg xylazine provides rapid induction and safe anesthesia. It is important not to under dose when using potent opioids as immobilization agents. Antagonism with naltrexone at 50.0 mg/mg etorphine used, given both IM and IV to reduce the possibility of renarcotization. Xylazine may be antagonized with 1.0 – 3.0 mg/kg tolazoline given slowly IV.

3) Medetomidine + ketamine is a reasonable non-opioid alternative for field immobilization of bighorn sheep that have not been stressed. A combination of 0.05 mg/kg medetomidine + 2 mg/kg ketamine provides reliable anesthesia. Induction may be prolonged, is adversely affected by noisy or stressful conditions and a period of 10 to 15 minutes after recumbency must elapse before the animal is handled. Antagonize with atipamezole at 5:1 dose of medetomidine administered or at 0.25 mg/kg.

4) 0.3 mg/kg of xylazine + 2.5 mg/kg of Telazol® may also provide reliable immobilization in calm animals, avoiding the use of potent opioids. The xylazine should be antagonized with 1.0 – 3.0 mg/kg tolazoline administered slowly IV. This combination may not be appropriate for immobilizing stressed animals, and due to extended recovery times is generally not recommended.

5) 1 mg/kg xylazine + 4 mg/kg ketamine. Xylazine may be antagonized with 1.0 – 3.0 mg/kg tolazoline administered slowly IV. Least appropriate option.

Withdrawal periods must be observed in animals that may potentially be hunted for food and animals must be tagged for future identification. Consult the FWP Prescription Drug Acquisition and Use Protocol for withdrawal periods.

Additional doses for immobilization

Animals that are not recumbent 20 minutes after darting should be re-darted with a full dose. Animals showing obvious but incomplete drug effects may be darted with a half-dose. Opioids should never be under-dosed. In most

situations, anesthesia may be prolonged by administering a bolus of ketamine IV at a dose of 1 to 2 mg/kg every 15 to 20 minutes.

Adjunctive Therapy

At the discretion of the veterinarian, animals that are injured as a result of the immobilization process may receive prophylactic antibiotic therapy (Procaine + benzathene penicillin administered at 30,000 IU/kg IM). Animals captured for transplantation within Montana will be administered vitamin E, selenium, an antibiotic such as Florfenicol, and drugs to remove parasite loads such as Ivermectin. These adjunctive therapies may be administered to sheep captured for other reasons. Dosages of such drugs will be administered based on body size and recommendations stipulated on the vial. Changes to dosages may be made at the discretion of the veterinarian. Withdrawal periods of 30 days or more depending on drugs administered must be observed in animals that may potentially be hunted for food.

Handling of Immobilized Animals

Once the animal is recumbent, it should be approached with caution and with as little noise as possible. Eye covers should be placed on the animal immediately; they act as an additional means of restraint, protect the eyes, and can prolong and improve the effects of immobilization. Monitoring of vital signs should begin as soon as possible after recumbency. Respiration and oxygenation are the most critical indications of an animal's well- being under anesthesia, and pulse oximetry should be used as an adjunct to monitoring whenever possible. Cardiac monitoring is also important, especially in animals immobilized by one of the agents that can cause bradycardia or hypotension. Temperature monitoring and control is important too. Animals generate a significant amount of heat during the exertion of capture and once immobilized have no means with which to dissipate it.

Baseline body temperatures (BT), heart rates (HR), and respiratory rates (RR) have been recorded from chemically immobilized bighorn sheep (Franzmann, 1971; Kock, 1987). Stress, exertion, ambient temperature and capture technique are known to influence the values. Safe expected ranges at capture are: BT 39.1°C (102.4°F) to 41.2°C (106°F), HR 125 to 130 beats per minute (b/min), and RR 40 to 64 respirations per minute (r/min). These ranges incorporate all seasons and the use of a central nervous system depressant drug. Values considered critical and an indication that corrective action should be taken include: BT 41.5°C (106.7°F), HR 145 b/min, and RR 75 r/min. Persons trained in monitoring vital signs should be present during bighorn sheep capture and immobilization procedures.

In warm weather, elect to immobilize animals in the cooler periods of the day and use water to wet the animal down to increase cooling. Sheep are also prone to hyperthermia. In very cold conditions, be vigilant for evidence of hypothermia and be prepared to respond accordingly. Immobilized bighorn sheep are best placed in sternal recumbency to reduce the complications of bloat and regurgitation. As with all ruminants, the head should be elevated slightly above the level of the rumen to prevent regurgitation and the mouth should be slightly lower than the neck to allow saliva to drain. Ensure that the nostrils are clear and that the animal is breathing without difficulty. Remove the dart and needle and clean and treat the dart wound with topical antibiotic prior to reversing the immobilization and releasing the animal.

Tagging and Sampling

All animals will be ear-tagged using an identifying FWP plastic ear tag with a unique identifying number and the following printed on the back: "Call Before Eating". On occasion, bighorn sheep may be captured for radio-tagging or sampling purposes and should be processed according to the aim of the project. Neck bands or radio collars (VHF or GPS) should be fitted according to the size, age, and sex of the animal.

Body measurements should be recorded according to established protocols. Blood is collected from the jugular vein by needle and syringe or using the BD Vacutainer® system. To facilitate sampling, blood should be collected immediately after capture of the animal. A small area of the neck is prepared (swabbed with chlorhexidine in alcohol) to visualize the jugular vein. In adults, 2 x 8.5 ml serum separator tubes (SST, red/tiger top) and 1 x 3.0 ml K2EDTA tube (purple top) should be used. Up to 10% of the circulating blood volume can be taken on a single occasion from normal healthy (adult) animals on an adequate plane of nutrition with minimal adverse effect. The SST tubes should be protected from rapid cooling for at least one hour to ensure complete coagulation. Serum should then be separated by centrifugation (8,000 rpm for 10 minutes) and stored at –20°C (-4°F) in 2 ml cryogenic vials.

Where feasible, pharyngeal/tonsillar swabs (using Dacron-tipped polyester culture swabs and Port-A-Cul transport media, available

from the Wildlife Lab in Bozeman) should be collected for Pasteurella and Mycoplasma cultures. These swabs are to be shipped overnight, on ice to:

Dr. Glen Weiser
University of Idaho
Caine Veterinary Teaching Center
1020 E. Homedale Rd
Caldwell, ID 83607
208-454-8657

Hair (with roots) is sampled using pliers (transferred to a 2 ml cryogenic vial), two skin biopsies may be taken from the inside of an ear using a sterile 4 – 6 mm biopsy punch, and feces is collected from the rectum using latex gloves and then transferred to a sterile 15 ml plastic tube or Whirlpak. Additional biological materials should be sampled according to specific study protocols and follow accepted procedures. Hair and skin biopsies may be preserved in 96% ethanol. Feces are kept cool but not frozen for parasite analysis.

Euthanasia

Consistent with AVMA Panel on Euthanasia (2000) and as specified in the euthanasia guidelines of the FWP Prescription Drug Acquisition and Use Protocol.

Necropsy Procedures

In case of a capture-related mortality, the carcass should be transported to a veterinary diagnostic laboratory for a complete necropsy or, as an alternative, an affiliated veterinarian or biologist can perform a field necropsy after consultation with the laboratory.

Wildlife Laboratory

Department of Livestock
Montana Fish, Wildlife & Parks
Montana Veterinary Diagnostic Lab
1400 S. 19th Ave.
South 19th and Lincoln
Bozeman, MT 59718
406-994-6357
406-994-4885

To ensure rapid cooling, skinning the carcass and opening the abdominal cavity (while preserving the integrity of the organs) can be considered. If transportation to the laboratory is not possible within 24 to 48 hours, the carcass should be frozen.

Long Distance Transportation

If transportation of live animals is necessary, it must be conducted in a manner that produces the least amount of stress to the animals. Bighorn sheep should be held in suitable trailers ambulatory and able to see. Trailers specifically designed for transporting sheep are preferred. These trailers generally allow for the separation of sheep into small groups of four or less. Standard horse trailers can be used for moving sheep, but the insides of the trailers should be rounded with no square corners that allow sheep to congregate in one area. Floors of trailers should be lined with straw or other suitable material. All trailers should have adequate ventilation to allow for air transfer through the trailer, yet openings should be in locations or of small size to minimize the potential for injury to legs, heads, or other body parts that may become lodged in openings. Adult rams (more than three years old) should be separated from ewes and lambs when transporting. The maximum number of sheep in a trailer should not exceed 10 per 40 square feet of floor space (Foster 2005). Sheep held in trailers should be observed frequently but discretely to assess health status. Bighorn sheep should be transported as quickly as possible to release sites, minimizing their stay in trailers and reducing exposure to human disturbance.

Additional information regarding capture and transportation of wild sheep is available in the "Wild Sheep Capture Guidelines" sponsored by the Northern Wild Sheep and Goat Council and Desert Bighorn Council (Foster 2005).

Literature

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3) Kock MD, Jessup DA, Clark RK, Franti CE, Weaver RA. 1987. Capture methods in five subspecies of free-ranging bighorn sheep: an evaluation of drop-net, drive-net, chemical immobilization and the net-gun. J Wildl Dis. 23(4):634-40.

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5) Franzmann AW. 1971. Comparative physiologic values in captive and wild bighorn sheep. J Wildl Dis. 7(2):105-8.

6) Foster CL. 2005. Wild Sheep Capture Guidelines. Biennial Symposium of the Northern Wild Sheep and Goat Council. 14:211-282.

IACUC Approval

This biomedical protocol has been approved by the FWP Institutional Animal Care and Use Committee (IACUC) with the following stipulations:

1) Approval was granted for a five-year period ending December 2012.

2) IACUC approval applies to management activities only. All research activities will require additional IACUC review.

Capture or handling activities that do not follow methodologies stipulated in this protocol will be done without IACUC approval.

IACUC attending Members:

Tom Carlsen, Acting Chair
Ken Hamlin, FWP Research Biologist
Dr. Dave Hunter, DVM
Karin Jennings, Public Representative

Wildlife Division Approval

Methodologies presented in this document are to serve as the guidelines for bighorn sheep capture, handling, and transportation for management situations undertaken by Montana FWP. Variation from methodologies provided in this protocol should only be conducted under the guidance of the FWP wildlife veterinarian.

_____

Ken McDonald,
Wildlife Division Administrator

_____

Date

APPENDIX G

Bighorn Sheep Survey

DATE: _____ TIME: T.O._____ LAND: _____ TEMP: _____ CLOUDS:_____
WIND: _____ PRECIP: _____GROUND:_____ OBSERVER:_____PILOT:_____
NOTES:_____
_____
_____

WAYPT. NO.	LOCATION	TOTAL	EWES	LAMBS	RAMS (curl)				NOTES
					0-1/4	1/4-1/2	1/2-3/4	3/4+	

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