Final Report and Recommendations

from the

Wyoming

State-wide Bighorn/Domestic Sheep Interaction

Working Group

September 2004

Table of Contents

Introduction

For the past several years, conflict and confrontation relative to interaction between bighorn sheep and domestic sheep has escalated. Most notable of the issues that have arisen is the potential transfer of disease between these species, but other concerns relative to habitat and other issues have also been raised. A variety of strategies have been used to stabilize or enhance wild sheep populations, including transplant of sheep for new herds, analysis of nutritional needs, and implementation of prescribed fire and other vegetative treatments to enhance or expand habitat. At the same time, Wyoming's domestic sheep industry has been severely impacted by numerous factors, and the economic, biological and social implications of that recession are of equal concern to the State as is the welfare of its bighorn sheep herds. Domestic sheep producers have attempted to stabilize their industry through marketing initiatives, maintenance of the forage base, and reductions in costs of operation. A combined result of efforts to enhance bighorn sheep populations and stabilize the domestic sheep industry is that, in some specific areas, the interaction between domestic and wild sheep has led to considerable consternation, and a general sense that the options for resolution are an "either-or" alternative.

In response to these conflicts, Governor Jim Geringer and United States Senator Craig Thomas asked interested parties to consider a statewide approach to developing collaborative recommendations and actions that would address these issues and hopefully, lead to long-term stabilization of both wild sheep herds and the domestic sheep industry. A meeting of interested parties was held on 8 February 2000, in Pinedale, Wyoming, with 52 people attending. Among these were federal and state land and wildlife management agencies, domestic sheep producers, Congressional staff, county officials, environmental organizations, agricultural producer groups, and media. At that meeting, the participants agreed:

It is the goal of the Wyoming Bighorn/Domestic Sheep Interaction Working Group to maintain healthy bighorn sheep populations while sustaining an economically viable domestic sheep industry in Wyoming.

The Group identified issues of concern related to interactions between bighorn and domestic sheep, prioritized them, and established four categories of issues for further examination and discussion. Five subcommittees were established to analyze the current base of information (two of the five subcommittees were later combined into one), and those groups developed potential solutions, as well as recommendations to state and federal wildlife and habitat managers *(see Appendix A, Working Group Meeting Report*, 2/8/00 *meeting).* The primary areas of concern evolved into the following categories:

1. The role, myths, and science of inter-species disease transmission and bighorn sheep stressors: a review of existing scientific literature on the subject, and development of a future research agenda on these issues. Two subcommittees worked in this area initially (Disease and Stresses, Research), but were combined into a single Disease, Stresses and Research subcommittee at a later date.
2. Management of bighorn and domestic sheep habitat and the political will to manage that. A Habitat and Management Protocols subcommittee was formed to address these issues.
3. Compatibility of bighorn sheep herds and an economically viable domestic sheep industry. The Economic Viability, Loss of Allotments, and Distrust of Agencies subcommittee addressed these issues.

4. Public Perceptions and opinions of sheep, their management, and the domestic sheep industry. The Information Flow/Education subcommittee was charged with both Working Group and general public education and information responsibilities.

In addition, participants agreed to continue meeting and seeking resolution of these issues in a manner consistent with the stated goal. Additional representation was sought where needed, and the group expanded to accommodate that representation. Over the course of the following 3.5 years, the group met more than nine times in locations around the state, usually with subcommittee meetings preceding the Working Group meeting. Presentations, given or arranged for by members, were frequently made at both subcommittee and Working Group meetings, exploring issues such as current knowledge about wild sheep disease, taxonomy of wild sheep, domestic sheep practices, bighorn and domestic sheep habitat needs, and a variety of other pertinent topics. As subcommittees developed recommendations, they were forwarded to the statewide group for further discussion. The process relied on consensus-based decision-making, and all subcommittees were inclusive of representation from the full variety of members on the Working Group. The first item of agreement was a list of "guiding principles" for bighorn sheep/domestic sheep interactions. The list (which follows) is not prioritized.

Terms of Agreement

- The domestic sheep industry is important to Wyoming and should be protected; this includes protection and stability of grazing allotments and management changes only on a willing permittee basis, not under a sense of urgency or duress.
- Bighorn sheep are important to Wyoming and should be protected and enhanced in terms of numbers, health, and distribution.
- Diseases may be interchanged between domestic and bighorn sheep; in Wyoming, *Pasteurella* spp.-induced pneumonia is the most important.
- Pasteurellosis in sheep is a very complex issue that needs better understanding by all concerned individuals, agencies, and organizations.
- A variety of stressors play important roles in inducing pasteurellosis in sheep.
- Hybridization between bighorn and domestic sheep should be discouraged.
- There is a need to better define the role of predation in bighorn sheep dynamics.
- Zero risk of disease is unattainable, but management can reduce risk and stress.
- Core native bighorn herds are those populations that have never been extirpated and repopulated; this includes the Targhee herd, the entire Absaroka Range (five herds), the Whiskey Basin herd, and the Jackson herd.
- There is a need to develop Wyoming-based, multi-disciplinary research and solutions. These could also serve as models for other states.
- Research conducted in Wyoming is preferable, but quality, balanced research conducted, and solutions developed, elsewhere should be recognized and used, where applicable.
- Use balanced scientific information.
- Use adaptive management to resolve problems.

- ❖ There is a need for open, non-inflammatory communication. There is a risk of disease transmission, but rhetorical dialogue and interchange among all parties on degrees of risk is not beneficial or desirable.
- ❖ Existing and/or potential conflicts between domestic and both core native and transplanted bighorn sheep should not be used as surrogate issues to force or effect resource management decisions; the retirement, reduction, or removal of grazing allotments and management changes should be only on a willing permittee basis, not under a sense of urgency or duress.
- ❖ No net loss of domestic sheep industry AUMs in Wyoming is an important goal. While that may not be achievable in every given retirement, reduction, or removal of grazing allotments or management change, an honest effort to achieve that goal will be made in every case, with the economic viability of the individual permittee and the industry as the foremost concerns.

RECOMMENDATIONS

Disease, Stress, and Research Committee

– All parties to the Wyoming Bighorn/Domestic Sheep Interaction Working Group recognize that:

  - o There are some disease agents that occur in both domestic sheep and bighorn sheep. There is evidence that if Bighorn and domestic sheep are in close contact, health problems and die-offs may occur. Some disease agents may be transmitted between both species;

  - o There are Bighorn sheep die-offs that occur with no apparent relationship to contact with domestic sheep;

  - o The above observations are both valid and not mutually exclusive;

  - o Bacterial pneumonias are not the only diseases of concern, although perhaps they (especially Pasteurella sop.) are the most catastrophic;

  - o The risks of disease transmissions are often unknown; they may, however, be site-specific; and

  - o Reasonable efforts must be made by domestic sheep producers, permittees, and wildlife and land management agencies to minimize the risk of disease transmission, and to optimize preventive medical and management procedures to ensure healthy populations of Bighorn and domestic sheep.

– In recognition of the above factors, when recommendations of the Wyoming Bighorn/Domestic Sheep Interaction Working Group have been followed and/or a cooperative agreement has been reached by affected agencies, permittees, and landowners, participants will be held harmless in the event of disease impacting either Bighorn or domestic sheep. While this is more a social and professional clause than a

legal one, all parties agree to publicly acknowledge what happened, but to not point fingers. Affected parties can decide to try again.

- Priority for protection of Bighorn sheep should be on native core populations.

- Removal of Bighorn sheep or domestic sheep from areas of current overlap should not be an immediate and unilateral objective. The use of separation as one management tool, if possible and desirable, should be achieved through negotiation between affected parties and willing permittee(s). This means that this group will not say that separation must be made immediately, or that it is the only possible response. We recognize that separation and removal are not synonymous.

- Cooperative efforts should be undertaken to quickly notify the permittee or producer and the appropriate agency to remove any stray domestic or Bighorn sheep in areas that would allow contact between domestic and Bighorn sheep. Bighorn and domestic sheep strays should be removed with a common sense approach.

- The Wyoming Game & Fish Department will prepare a map showing distribution of occupied habitat for native core and reintroduced Bighorn sheep populations.

- The Wyoming Wildlife/Livestock, Disease Research Cooperative should be formally established and funded with the goal of becoming the pre-eminent entity of its kind, and all parties agree to work toward this goal.

- This group encourages the Animal Damage Management Board to solicit and consider predator research as it might relate to Bighorn sheep.

Additional issues arose over the course of meeting discussions. The Group agreed that some, such as the scientifically-accepted taxonomy of the various subspecies of wild sheep, were important considerations but beyond control of any of the participants. [This concern was lessened by the recent taxonomic separation of British Columbia-derived California bighorn sheep (*Ovis canadensis canadensis)* preferred by WGFD for reintroductions in some portions of Wyoming for acclimation reasons from Sierra Nevada California bighorn sheep (*O. canadensis californiana,* now *O. canadensis sierrensis)* which is federally listed as threatened That could decrease the possibility of reintroduced populations being petitioned for listing as threatened or endangered.] Other issues, such as the need for a successful public process design for bighorn sheep reintroduction projects, were assigned to standing or ad hoc subcommittees for consideration.

The Group gave its full support to existing efforts to establish and fund the Wyoming Wildlife/Livestock Disease Research Partnership. The establishing Memorandum of Understanding (MOU) has been signed, and the Board of Directors and officers have been selected. The Partnership is a joint effort among the Wyoming Game and Fish Department, the Wyoming Department of Agriculture, the Wyoming Livestock Board, the University of Wyoming, and the Wyoming State Veterinary Laboratory. The intent is to implement a disease investigation program for mutual or shared wildlife and domestic livestock diseases. The research program will address "the growing need to understand, manage, control, and hopefully pre-empt diseases of wildlife and livestock that significantly impact the other in the State."

Monies to provide research grant funding have been solicited from Federal and local governments and private sources to match the $200,000 committed by the Wyoming State Legislature. The Wyoming Congressional delegation has been instrumental in obtaining over one half million dollars in Federal research money for the Partnership. Pasteurellosis is not the Partnership's only research funding focus, but is one of its top priorities. The Partnership and the American Sheep Industry Association mutually support each other's bighorn and domestic sheep vaccination research.

In an example of proactive contact with land management agencies, the Working Group sent a letter to Shoshone National Forest Supervisor Rebecca Aus requesting implementation of a prescribed burn on the Jim Mountain/North Fork Shoshone River. The Forest had to postpone a planned prescribed burn there when a federal burn moratorium was put in place after the Los Alamos/Cerro Grande fire in the spring of 2000. Because of the anticipated benefits of the burn to the habitat of a core native bighorn sheep herd in that area, the Working Group urged that the prescribed burn be implemented in 2001 or as soon as conditions allow.

In addition, the following recommendations were developed by subcommittees and approved by the statewide Working Group. Those recommendations are the essence of this report. The recommendations are more fully explained later in the report.

Recommendations to Decision-Makers, Management Agencies, and Industry

Recommendations to the Wyoming Game and Fish Commission, Wyoming Board of Agriculture, and Wyoming Livestock Board

1. Develop capture/testing protocols that will reduce capture stress
2. Develop preconditioning protocols that will enhance survivability of translocated bighorns
3. Pursue joint funding of infrared remote sensing technology for wildlife surveys
4. Take advantage of remote sensing for vegetative condition when possible
5. Cooperate, together with Wildlife Services, in developing appropriate predator management protocols
6. Work to identify vacant suitable habitat and its vegetative condition/trend
7. Compile/develop GIS map layers
    a. core native bighorn herd management areas with seasonal use indicated
    b. transplanted bighorn herd management areas with seasonal use indicated
    c. active domestic sheep allotments with seasonal use/management strategies (rotation, etc.) indicated
    d. vacant and closed domestic sheep allotments
    e. sheep allotments currently permitted for cattle)
8. Work with Federal agencies and permittees to identify replacement AUMs
9. Support research on vaccines/delivery systems, preconditioning techniques, and stress testing through fecal sampling
10. Manage human interactions to reduce stress
11. Manage hunting to reduce stress and maintain herd objectives

12. Help develop, fund, and deliver bighorn and domestic sheep education/outreach programs to the public
13. Pursue additional State/Federal/private funding for the Wyoming State Veterinary Laboratory
14. Assist with multi-interest efforts to secure funding for the Wyoming Wildlife/Livestock Disease Research Partnership
15. Pursue bighorn sheep translocations using the Group's recommendations for public process *(see Appendix L)*
16. Use some of the wildlife revenues for habitat enhancement projects that will serve both bighorn and domestic sheep
17. Work with Wyoming FNAWS and others to develop a public marketing strategy for bighorn sheep management activities that will also benefit domestic sheep
18. As much as possible, follow the recommendations of the Wyoming State-wide Bighorn/Domestic Sheep Interaction Working Group and utilize expertise and experience of Working Group participants where planning local bighorn sheep management

Recommendations to Federal Agencies

1. Extend non-use beyond 3 years for domestic sheep allotments (Forest Service)
2. Take advantage of remote sensing for vegetative condition when possible
3. Pursue joint funding of infrared remote sensing technology for wildlife surveys
4. Assist WGFD in identifying vacant suitable bighorn habitat and vegetative condition/trend therein
5. Assist WGFD in developing/compiling GIS map layers
6. Support the research agenda for bighorn and domestic sheep
7. Help develop, fund, and deliver bighorn and domestic sheep education/outreach programs to the public
8. Coordinate management of bighorn stress factors with WGFD
9. Make identification of replacement AUMs a standard practice when considering closure or vacation of domestic sheep allotments
10. Assess currently vacant and closed allotments for suitability to re-open for active use, or to use as emergency 'grassbanks'
11. Assess non-use suspended AUMs and sheep AUMs being used by wild horses, to determine if any domestic sheep use can be re-opened
12. Pursue additional State/Federal/private funding for the Wyoming State Veterinary Laboratory
13. Assist with multi-interest efforts to secure funding for the Wyoming Wildlife/Livestock Disease Research Partnership
14. Use some of the wildlife revenues for habitat enhancement projects that will serve both bighorn and domestic sheep
15. Work with Wyoming FNAWS and others to develop a public marketing strategy for bighorn sheep management activities that will also benefit domestic sheep
16. Standardize allotment administration to the greatest extent possible within agency units and between agencies
17. As much as possible, follow the recommendations of the Wyoming State-wide Bighorn/Domestic Sheep Interaction Working Group and utilize expertise and experience of Working Group participants when planning local bighorn sheep management

Recommendations to the Domestic Sheep Industry

1. Take advantage of remote sensing for vegetative condition when possible
2. Pursue joint funding of infrared remote sensing technology for wildlife surveys
3. Assist Federal and State agencies in identifying vacant suitable bighorn habitat and vegetative condition/trend therein
4. Support research on vaccines/delivery systems, preconditioning techniques, and stress testing through fecal sampling
5. Support making identification of replacement AUMs a standard practice when considering closure or vacation of domestic sheep allotments
6. Pursue grazing management strategies that will reduce impacts and enhance bighorn survival
7. Help develop, fund, and deliver bighorn and domestic sheep education/outreach programs to the public
8. Pursue additional State/Federal/private funding for the Wyoming State Veterinary Laboratory
9. Assist with multi-interest efforts to secure funding for the Wyoming Wildlife/Livestock Disease Research Partnership
10. As much as possible, follow the recommendations of the Wyoming State-wide Bighorn/Domestic Sheep Interaction Working Group and utilize expertise and experience of Working Group participants when planning local bighorn sheep management
11. Work with Wyoming FNAWS, WWGA, WSGA, and others to develop a public marketing strategy for bighorn sheep and habitat management activities that will also benefit domestic sheep
12. Encourage voluntary allotment monitoring by permittees in conjunction with Federal and State agencies

Recommendations for No Net Loss of Wyoming Domestic Sheep AUMs on public lands (*sustaining domestic sheep industry capacity*)

1. Reconfigure domestic sheep allotment boundaries to avoid overlap with bighorn habitat
2. Determine the number of domestic sheep AUMs overlapping on bighorn sheep habitat; industry and Federal agencies work together to locate potentially available replacement AUMs
3. Assess domestic sheep industry desire for additional AUMs; industry and federal agencies work together to locate potentially available AUMs to meet that need
4. Identify difference in management styles between federal agency units, and between agencies, and those impacts on bighorn and domestic sheep management

Recommended Prioritization of Ongoing and Needed Research

Disease/Health Research

1. Effective preventative vaccines/outbreak-control antibiotics/parasite control, and delivery systems
2. Effective bighorn sheep translocation preconditioning techniques including long-term sedatives, vaccination, and low-level exposure to resident bighorn sheep before release
3. Bighorn sheep capture protocols, including typing *Pasteurella* spp. and banking isolates Genetic resistance
4. Domestic sheep blood serum sample collection and banking, sheep lambing management styles
5. Remote stress detection through fecal coliform sampling, development of long-term sedatives

NutritionlHabitat/Predation Research

1. Monitor bighorn sheep nutritional requirements, especially micronutrients
2. Monitor bighorn habitat selection and habitat nutritional carrying capacity
3. Determine impacts of predation on bighorn sheep, including lamb recruitment and disruption leading to commingling
4. Determine target predator species and effectiveness of control programs
5. New Technology: Remote sensing vegetative and animal surveying technology

Recommendation for the Future of the State-wide Bighorn/Domestic Sheep Interaction Working Group

The Group should meet at least annually, more often as needed, to review research and management results from the past year and use adaptive management methods to make additional recommendations to the Commissions, Federal agencies, and the domestic sheep industry. Responsibility for convening a meeting of the Work Group at least annually will rest with the Wyoming Game and Fish Department.

Detailed Recommendations Developed by Subcommittees and Adopted by the Working Group

Recommendations to Address Disease, Stressors, and Research

I. Disease Management Tools

A. **PREVENTION OF PASTEURELLOSIS** (and secondarily, other diseases)

1. Bighorn sheep translocations should:
    a. Use only monitored source herds
    b. Develop disease-monitoring protocols that include periodic capture and testing for diseases of concern
    c. Pre-condition source herds with antibiotics and vaccinations
2. Precondition bighorn sheep to be transplanted
    a. Pre-condition transplant sheep with appropriate antibiotics and vaccinations
    b. Pre-condition transplant sheep with feed/nutritional supplements if appropriate
3. Manage for appropriate population densities (to reduce the risk of density-dependent disease outbreaks/transmission and likelihood of ram dispersal)
    a. Establishment of population objectives should include disease and stress considerations
    b. Adhere to population objectives.
        i. If herd is below objective, consider habitat enhancements, predator management, ram-only hunting seasons
        ii. If herd is above objective, consider ewe harvests or periodic removals of sheep through trapping
4. Nutrition -poor nutrition contributes to disease susceptibility
    a. Monitor to determine if bighorn sheep are getting minimum levels of energy, macronutrient, and micronutrient needs

b. Consider habitat improvement projects (or supplements) when habitat is not providing minimum levels of nutritional needs

5. Stress is an important contributor to disease susceptibility
    a. Identify human disturbances and manage to minimize that stressor
    b. Customize the upcoming Northern Wild Sheep and Goat Council standardized capture protocol (designed to minimize capture/monitoring/pre-conditioning stressors) for use in Wyoming
    c. Predators cause stress that contributes to disease susceptibility
        i. Monitor predator impacts
        ii. Implement predator control when appropriate
6. Separation of bighorn sheep from domestic sheep
    a. Use techniques and options developed and agreed upon cooperatively by wildlife and land managers and permittees; including:
        i. Geographic/topographic barriers
        ii. Seasonal or spatial separation through domestic sheep grazing management
        iii. Habitat enhancements that attract wild sheep away from domestic sheep areas
        iv. Evaluate re-stocking of vacant allotments to minimize commingling potential
        v. Evaluate translocations to minimize commingling potential
        vi. Evaluate allotments to identify opportunities to convert those allotments with high commingling potential to cattle and open vacant allotments or convert from cattle to sheep allotments where commingling potential is lower
        vii. Negotiate financial incentives for permittees to waive domestic sheep allotments with high commingling potential back to the appropriate land management agency
    b. Develop a commingling response protocol that includes the following:
        i. Removal of wandering bighorn sheep (transfer to Sybille or Wyoming State Veterinary Lab)
        ii. Immediate, two-way notification of commingling sightings
        iii. Meetings between WGFD field personnel and domestic sheep permittees with allotments in/near core native bighorn sheep herds, to develop a sensible post turn-off stray removal protocol
        iv. Development of outreach materials by WGFD and USFS, asking recreational forest users to immediately notify USFS of stray domestic sheep or bighorn sheep in unusual locations
        v. Instruction for domestic sheep herders to not leave sick domestic sheep behind when trailing or moving from or between allotments
7. Veterinary techniques to prevent *Pasteurella* outbreaks in bighorn sheep
    a. Vaccinate bighorn and domestic sheep against *Pasteurella* and pre-disposing bacteria and viruses as antibiotics/vaccines and delivery techniques are developed
    b. Use wormers with bighorn and domestic sheep to eliminate pre-disposing conditions; lungworms are of particular concern, could be treated with medicated feed

c. Institute an anthelmintic program to control mites in bighorn and domestic sheep

8. Identify and test sheep that appear to have genetic resistance to certain diseases
9. Develop methods to analyze sheep for chronic stress
10. Monitor populations to insure genetic heterozygosity (prevent in-breeding)

B. CONTROL OF DISEASE OUTBREAKS

1. Customize the upcoming Northern Wild Sheep and Goat Council standardized disease outbreak control protocol for use in Wyoming
2. Accurately diagnose cause of death with necropsy
3. Remove diseased sheep
    a. Euthanize and necropsy
    b. Transport to a holding facility for quarantine and/or treatment
4. Research the outbreak-control effectiveness of newly-developed drugs
5. Insure isolation of diseased herds and individuals from disease-free herds
6. Minimize stress on herds experiencing or recovering from a disease outbreak
7. Investigate the effectiveness of vaccination to control outbreaks
8. Consider the effect of other factors such as water availability, temperature or other environmental extremes, etc. Manage to avoid, minimize, or mitigate when possible

C. MANAGEMENT FOR HEALTHY BIGHORN SHEEP

1. Manage and improve the habitat to enhance nutritional status, encourage use of unoccupied suitable areas, increase physical separation from domestic sheep, and discourage commingling
    a. Maintain or re-establish migration corridors unless that will facilitate commingling with domestic sheep
    b. Prevent/reduce timber encroachment on bighorn sheep habitat, especially crucial winter ranges and lambing areas, through either commercial removal or prescribed burns
    c. Identify bighorn sheep habitats where fire is needed to manage for desired vegetation; then design and implement fire management programs in those areas (public and private lands)
    d. Enhance appropriate forage production using
        i. prescribed burns
        ii. pitting and other mechanical treatments to create micro-habitats, manipulate vegetative competition, and enhance water retention
        iii. seeding desired forage species
        iv. fertilizing for desired forage species
        v. noxious weed control
    e. Manage domestic sheep grazing timing, intensity, and frequency to enhance bighorn sheep forage
    f. Consider water developments to enhance bighorn sheep distribution and to move competing wildlife and livestock away from preferred bighorn sheep foraging areas
2. Control populations to maintain numbers at or below herd objectives
3. Provide nutritional and mineral supplementation when appropriate, to enhance health or to assist in creating physical separation between bighorn and domestic sheep
4. Determine an appropriate recruitment rate for each herd

5. Develop predator control protocols that will help achieve bighorn sheep herd recruitment goals and be most effective while minimizing stress on bighorn sheep

II. Stress Management Tools

A. **MONITORING**

1. Environmental factors such as persistent high or low precipitation, snow depths, and temperatures, because they affect disease susceptibility, reproductive success, and growth
2. Habitat quality including nutritional quality and mobility/visibility impairments that affect bighorn sheep health, seasonal mobility, escape from predators, and inclination to pioneer new habitats
3. Disturbances that affect feeding and movement patterns and can introduce additional stress
4. Monitor other ungulates in the area for potentially-transmissible diseases

B. MANAGEMENT

1. Control predators, if appropriate
2. Minimize human/pet interactions, if appropriate
3. Adopt capture protocols that minimize stress
4. Adopt survey protocols that minimize stress, including such considerations as minimizing flight heights and time spent surveying, and optimizing weather conditions
5. Control pre-disposing diseases and internal/external parasites
6. Prevent interactions with other ungulates, when possible, if there are potentially negative behavioral or health impacts on bighorn sheep
7. Minimize stress during the summer when bighorn sheep are putting on their winter fat (strategies could include shortening hunting seasons, limiting human access on summer/fall ranges, etc.)

III. Predation Management Tools

A. MONITORING

1. Lamb survivability and recruitment, both numbers and causes
2. Influence of predators on herd disruption/dispersals and commingling potential
3. The biological effects of control methods on non-target species
4. The effects of weather on various control methods
5. Results of predator control activities

B. MANAGEMENT

1. Evaluate effectiveness of past predator control efforts in Whiskey Basin and elsewhere
2. Conduct a literature review of predation impacts on Bighorn sheep
3. Design and implement area-specific and species-specific predator control programs as appropriate
4. Develop a list of lethal and non-lethal methods of controlling each predator target species
5. Determine if those methods are practicable, applicable, and meet local/State/Federal standards on their respective lands
6. Determine the economic feasibility of methods, and funding availability

7. Determine if applicable agencies have the necessary personnel, equipment, and funding

IV. Research Agenda

A. DISEASE/HEALTH

1. Veterinary tools and techniques
   a. Develop vaccines and delivery techniques for *Pasteurella* pneumonia for both domestic and wild sheep (there was a pilot study in Colorado, Sybille may be the site of a second pilot project. It appears that vaccination spreads to herd- mates just like infections do, so self-vaccination may be feasible. Live vaccines don't eliminate the bacteria, it changes the resident strain to a less-lethal type.)
   b. Develop vaccines and delivery techniques for other viral diseases that threaten domestic and wild sheep, as they're identified
   c. Develop effective methods of treating wild sheep parasites (possibly with medicated feed or licks)
   d. Develop effective treatments and delivery methods for antibiotic treatments of bighorn sheep during disease outbreaks
   e. Test delivery methods such as oral delivery, biobullets, inhalants, and using domestic sheep to plant self-vaccinating medications
2. Preconditioning of translocated bighorn sheep
   a. Determine if there is a benefit from being held in captivity for preconditioning
   b. Develop long-term sedatives to decrease capture/translocation stress
   c. Develop vaccines and delivery techniques for use during the preconditioning period
   d. Develop protocols for thorough disease monitoring (by sampling blood and feces) during preconditioning
   e. Determine if there is a benefit to exposing bighorn sheep transplantees to a few resident bighorn sheep or domestic sheep during preconditioning to provide a low-level exposure to indigenous diseases
3. Stress
   a. Develop methods to analyze sheep for chronic stress
   b. Determine whether or not fecal cortisol is an effective method for determining stress in free-roaming herds
   c. Develop and test long-term tranquilizers as a means of reducing capture and translocation stress. This is a low priority in research right now
4. Predation
   a. Determine the species of predator responsible for bighorn sheep predation
   b. Identify the seasonal timing of predation
   c. Evaluate the stress to bighorn sheep from predation.
   c. Determine public perceptions of predator control to enhance bighorn sheep survival
5. Disease sampling and banking of isolates
   a. Develop a standard protocol detailing uniform methods for routinely collecting samples from captured bighorn sheep, for disease analyses

b. Type the varieties of *Pasteurella* pneumonia species in both bighorn sheep and domestic sheep
c. "Bank" a variety of *Pasteurella* spp. isolates from captured bighorn sheep for future reference and research
d. "Bank" samples of domestic sheep serum for future testing and research
e. Locate and list all bighorn and domestic sample "banks"
f. Summarize information on past domestic and bighorn sheep sample collections

6. Genetics and management techniques
   a. Determine if certain breeds of domestic sheep are more/less likely to carry diseases of concern for bighorn sheep
   b. Monitor shed lambing vs range lambing to determine if there are any effects on infectious disease-related issues

B. NUTRITION/HABITAT/PREDATION

1. Determine what micronutrients are essential for healthy immune systems in bighorn sheep, and how to best insure the sheep obtain adequate amounts in the wild
2. Develop and test protein/mineral supplement blocks for bighorn sheep
3. Determine how habitat improvements influence nutritional status and health in bighorn sheep, to help determine accurate carrying capacities of specific herd habitats
4. Radio-collar translocated bighorn sheep and monitor closely, to understand habitat and forage selection by the newly-released bighorns
5. Conduct a literature review of predation impacts on bighorn sheep (it appears that mountain lions are the biggest predator problem, much more so than coyotes, wolves, or grizzly bears (no Whiskey Basin bighorn sheep have been lost to wolves or grizzlies)
6. Determine the potential for predators to spread diseases important to bighorns
7. Understand the balance and interaction between predators and bighorn sheep diseases and how the balance/imbalances affect population health and numbers.

C. NEW TECHNOLOGY

1. Test applicability of remote sensing techniques for determining forage types and extents of sheep ranges
2. Use GPS (Global Positioning System) collars to accurately document bighorn sheep movements.
3.

Habitat & *Management Protocols Subcommittee*

I. Monitoring

A. HABITAT QUALITY

1. Conifer encroachment
2. Vegetative changes in both community composition and productivity
3. Utilization, by bighorns and/or domestic sheep
6. Cumulative habitat fragmentation -by roads/travel ways, fences, wildfire, etc.
7. Nutritional quality of various ranges

B. MIGRATION BARRIERS
C. DISPLACEMENT -by predators, recreationists, wildfire, etc.
D. COMPETITION with other wildlife and domestic livestock -forage, water, space, behavioral, etc.
E. HERD GENETIC VARIABILITY
F. EFFECTIVENESS OF HABITAT ENHANCEMENT PROJECTS

II. Management

A. CONDUCT VEGETATIVE MANAGEMENT PROJECTS, such as on the North Fork of the Shoshone, to improve productivity and open migration corridors
B. ENCOURAGE PIONEERING of unused suitable habitats by opening migration corridors, developing water sources, placing mineral/supplement blocks, etc.
C. BETTER DELINEATE CRUCIAL RANGES -summer, winter, lambing, migratory corridors
D. ESTABLISH REALISTIC HERD OBJECTIVES
E. MAINTAIN HERDS AND HERD OBJECTIVESAT OR SLIGHTLY BELOW carrying capacity
F. MANAGEMENT STRESSORS, where possible, to avoid, minimize, or mitigate effects on bighorn sheep

III. Research

A. INVESTIGATE NUTRITIONAL REQUIREMENTS of Bighorns, especially micronutrients
B. IDENTIFY VACANT HABITAT that is suitable
C. DETERMINE THE CONDITION AND TREND of potential, suitable but vacant habitat
D. **DEVELOP GIS MAP LAYERS** of bighorn sheep herd management areas, active and vacant and closed domestic sheep allotments, bighorn sheep seasonal use patterns where domestic sheep allotments overlap bighorn herd management areas, rotation patterns and on-off dates where domestic sheep allotments overlap bighorn sheep herd management areas, and sheep allotments currently permitted for cattle

Recommendations to Address Economic Viability, Loss of Allotments, and Distrust of Agencies

I. Management Operating Principles for All Stakeholders

A. COLLECTIVELY WORK to maintain healthy Bighorn sheep herds
B. COLLECTIVELY WORK to maintain the domestic sheep industry in Wyoming
C. DO NOT USE BIGHOM/DOMESTIC SHEEP INTERACTIONS as a surrogate for removing domestic sheep from public lands, or other land use decisions
D. DECISIONS REGARDING CLOSING and/or retiring sheep allotments should be made only on a willing permittee basis
E. REPLACEMENT OF LIKE AUMS should be a goal whenever domestic sheep allotments are vacated or closed

II. Communication Operating Principles for All Stakeholders

A. WE ALL COMMIT TO SUPPORT each other's roles in Bighorn sheep management
B. WE ALL AGREE TO INFORM each other about Bighorn/domestic issues at the earliest possible Opportunities
C. WE ALL AGREE TO WORK TOGETHER to resolve conflicts
D. WE ALL AGREE TO STOP MISINFORMATION as soon as we hear it
E. WE ALL COMMIT TO SEEKING common ground

F. **WE ALL COMMIT TO BRINGING** everyone together to talk, most particularly when a conflict occurs

Recommendations to Address Information Flow/Education

I. ASSESS PUBLIC PERCEPTIONS regarding bighorn sheep management

II. DEVELOP outreach strategies

III. DEVELOP marketing strategies

Appendices

A. Working Group Meeting Report -2/8/00

B. Working Group Meeting Report -3/31/00

C. Working Group Meeting Report -6/29/00

D. Working Group Meeting Report -8/18/00

E. Working Group Meeting Report -12/14/00

F. Working Group Meeting Report -4/4/01

G. Working Group Meeting Report -5/31/01

H. Working Group Meeting Documents -1/7 /02

- ACTION ITEMS
- BIGHORN SHEEP NECROPSY PROTOCOL
- Designing a protocol: What should you do if you are faced with a bighorn sheep die-off?
- Meeting participants

I . Working Group Meeting Report 6/29/04

J. A Review of *Pasteurella* Pneumonia in Domestic and Wild Sheep

K. Subcommittee Final Report – Bighorn Sheep Disease/Stress/Predators/Research

L. Public Process Design for Bighorn Sheep Reintroduction

- New Bighorn Sheep Transplant Proposals in Cooperative Review Areas
- Bighorn Sheep Supplemental Transplant Proposals in Existing Herd Units
- Public Process Recommendations

M. DEFINITIONS – BIGHORN SHEEP MANAGEMENT AREAS

N. Map – Statewide Bighorn Sheep Management Areas

O. A Review of Predation on Bighorn Sheep (*Ovis Canadensis*)

P. Habitat Subcommittee Meeting (9/13/01)