Bighorn/Domestic Sheep Disease Risk Assessment Workshop, Tucson, AZ, September 27, 2007

Sponsored by: National Fish and Wildlife Foundation, University of California, Davis-Wildlife Health Center, Foundation for North American Wild Sheep, and California Department of Fish and Game.

INTRODUCTION

David A. Jessup, Ben Gonzales, California Department of Fish and Game, USA

A number of catastrophic die offs of bighorn sheep over the last several decades have been associated with contact with domestic sheep and goats. Most frequently the disease process has been pneumonia and in some cases whole herds have been lost. Efforts to enforce separation of bighorn from domestic sheep and goats as a means of disease control on public land have financial and operational implications for grazers and the need for this separation has been questioned. Federal forest and range management actions have been effected and in several cases litigation has occurred. Considerable effort has been expended by Federal and State wildlife agencies to cooperatively develop policies regarding disease prevention. Meetings sponsored by governmental and non-governmental agencies and educational institutions have allowed the accumulation of a great deal of pertinent information but it has not been widely disseminated. Risk assessment, particularly quantitative risk assessment, has great promise as a tool for objectifying risk and potentially guiding management actions. In an effort to disseminate both the maximum amount of available information on bighorn/domestic sheep disease issues and tools for risk assessment and conflict resolution a workshop has been convened following the 2007 Wildlife Society meeting.

The goal of this workshop is to provide biologist, wildlife and wild land managers and other interested parties with the most current available information on the subject, in particular methods for doing quantitative disease risk assessment, background and foundational information, as well as varied perspectives on the subject. We hope this will eventually allow government agencies, conservation organizations and grazers and their interest groups to agree on basic principles, on what we know and don't yet know about bighorn/domestic sheep disease processes, best management plans and guidelines, and how we can work together to resolve conflict, protect natural resources and provide grazers with assurance that they will be able to continue to make a living.

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THE "PAYETTE PRINCIPLES"

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The "Payette Principles" were developed and unanimously agreed upon by a group of wildlife and livestock veterinarians and researchers with a wide spectrum of views on domestic/bighorn sheep health issues at a meeting in Boise, Idaho in November 2006. These principles may be useful as common ground in further discussions of bighorn and domestic sheep (and goat) interaction and disease issues. They are:

1. a) Scientific observation and field studies demonstrate that "contact" between domestic sheep and bighorn sheep is possible under range conditions. The contact increases (Note: one panelist [AR] ultimately preferred 'can increase" to "increases") risk of subsequent bighorn sheep mortality and reduced recruitment, primarily due to respiratory disease.
   b) The complete range of mechanisms/causal agents that lead to epizootic disease events cannot be conclusively proven at this point.
   c) Given the previous statements, it is prudent to undertake management to prevent contact between these species.
2. Not all bighorn sheep epizootic disease events can be attributed to contact with domestic sheep.
3. Gregarious behavior of bighorn sheep and domestic sheep may exacerbate potential for disease introduction and transmission.
4. Dispersal, migratory, and exploratory behaviors of individual bighorn sheep traveling between populations may exacerbate potential for disease introductions and transmission.
5. There are factors (e.g. translocation, habitat improvement, harvest, weather, nutrition, fire, interspecies competition, and predation), some that can be managed and some that cannot, that can influence bighorn sheep population viability.
6. Pateurellaceae, other bacteria, viruses, and other agents may occur in healthy, free-ranging bighorn sheep.

EPIDEMICS IN WILD SHEEP: FIELD INVESTIGATIONS, GROSS FINDINGS & POPULATION EFFECTS

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Epidemics caused by several species of bacteria, viruses, chlamydiae, and macroparasites, acting alone or in various combinations, have been recorded in North American wild sheep populations for over a century. Historically, field investigations of these epidemics have focused largely on determining the most likely cause(s) of death in affected animals and the most likely (or at least the most obvious) pathogen(s) involved. Because epidemics in free-ranging wild sheep herds tend to be discovered after they are underway (sometimes well afterward), the inciting causes and ultimate sources of causative pathogens are rarely determined with certainty. Similarly, the more dramatic short-term effects of epidemics tend to be much better documented than insidious long-term effects, even though the latter may have far greater impacts on wild sheep population performance and stability. To further understand and compare mortality patterns, potential and probable risk factors, and consequences of epidemics in wild sheep, field investigations to broadly classify predominant disease processes occurring and to monitor resulting effects on population performance remain worthwhile endeavors. Training biologists and other field personnel to recognize and document clinical signs and gross postmortem lesions typically associated with the most common types of epidemics in wild sheep (e.g., systemic infections, pneumonia, “pink eye”, “mange”) could be a relatively efficient way to improve the quality and quantity of basic data on the occurrence and duration of epidemics in wild sheep populations. In addition, devising and, wherever feasible, implementing approaches to consistently identify and monitor potential epidemic risk factors and to estimate lamb recruitment and adult survival both before and after discrete epidemic events could provide a basis for better understanding the cause(s) and quantifying the impacts of epidemics. Such data also could provide a range-wide foundation for adaptive management experiments supporting risk assessment and risk management endeavors intended to diminish the frequency and magnitude of epidemics in wild sheep populations.

RESPIRATORY DISEASE IN MOUNTAIN SHEEP: KNOWLEDGE GAPS AND FUTURE RESEARCH WORKSHOP RESULTS

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We held a two-day workshop on respiratory disease in bighorn sheep (Ovis canadensis) in April 2007 to review current knowledge and to discuss priorities for future research. Objectives of the workshop were to: 1. Promote and foster interdisciplinary consultation and collaboration among laboratory researchers, diagnosticians, epidemiologists, and disease specialists and managers, 2. Provide an overview of recent and ongoing research on respiratory disease in domestic ruminants and wild sheep, and 3. Identify knowledge gaps and future research needs and provide recommendations for research priorities to funding organizations. Thirty-two participants were provided with relevant literature prior to the workshop and two keynote speakers and seven researchers and diagnosticians gave presentations on the first day. Breakout groups on the second day addressed research priorities, disease outbreak investigation, and risk assessment. Workshop participants concluded that research priorities include the identification, characterization, ecology, and epidemiology associated with the introduction of novel and/or virulent microorganisms into free-ranging bighorn sheep populations; investigation of social factors impeding acceptance and implementation of current research findings; and development of quantitative risk assessments for bighorn and domestic sheep management. Recommendations for sample collection and analysis for disease outbreak investigation were also developed. More information on this workshop is posted on the American Association of Wildlife Veterinarians web site http://www.aawv.net/. A followup workshop scheduled for the Fall of 2007 for wildlife and wildland managers, grazers and conservationists will provide a summary of the respiratory disease workshop, summarize current "best management practices" for domestic and bighorn sheep management, review methods for resolving conflicts between domestic and bighorn sheep, and emphasize the use of risk assessment.

THE PHYSICAL PROBLEMS, COSTS, AND CONCERNS OF WOOLGROWERS

Nancy E. East, Professor Emeritus of University of California, Davis, CA

The potential or actual loss of summer grazing access to high quality forage required for lamb growth is the primary concern of sheep producers that utilize area adjacent to existing or proposed bighorn sheep habitat. Over 70% of lamb and virtually 100% of high quality wool is produced in the Western states (includes TX) on summer mountain ranges.

For the individual producer, loss of summer range is likely to result in "going out of business" unless suitable replacement forage is available. Moving to new ranges does pose a number of economic and management challenges for a producer; however, providing alternate grazing is by far the best solution to preventing contact between domestic and bighorn sheep.

When the individual producer is lost, the remaining producers are concerned about the impact on all of the essential industry infrastructure, much of which is shared by cattle producers. Western range livestock producers are major supporters of livestock trucking, auction yards, processing establishments, shearing outfits, ram sales and local and national woolgrower associations.

Additionally, large ranches provide a great deal of support to their rural community. These ranches provide wages and patronize local business, contribute to education and help provide local infrastructure. This results in vibrant diversified rural communities.

WORKING TOGETHER TO RESOLVE CONFLICT

Melanie Woolever, USDA Forest Service, Denver CO. USA

The approach taken in conflict resolution often determines outcomes in terms of timeliness of solution development and implementation effectiveness. This is particularly true in the often complex and frequently politically volatile situation of management of wild and domestic sheep in order to avoid physical interactions. Collaboration is essential in conflict resolution if the objective is to protect wild sheep while keeping woolgrowers economically viable.

Experience has demonstrated that development of a site-specific team of key participants, all having a stake in the outcome and involved from the outset, is foundational to the collaborative process. Those that you are most afraid of must be at the table working shoulder to shoulder to develop solutions. Before progress can be made in developing practical solutions, teams must accept two basic tenets:

1. First, both uses are valid uses of the land, and each has history, culture, economic value and years of investment associated with them.
2. Second, that co-mingling of wild and domestic sheep almost invariably results in disease development and subsequently death in wild sheep.

Effective collaboration to develop strategies maintaining separation of the two species requires a level of trust among participants. Building trust between people with seemingly incompatible goals is a slow and tedious process which can be facilitated by encouraging participants to:

1. Consider using a neutral outside facilitator.
2. Commit to recognizing and respecting the position, needs, concerns and values of others while actively exchanging viewpoints.
3. Focus on the specific situation facing participants, not those occurring elsewhere.
4. Focus on site-specific solutions considering domestic livestock operation factors, wild sheep herd dynamics including habitat availability and migratory behavior, topography, economics, allotment availability and any other solution that might provide resolution for the specific situation.

http://www.fs.fed.us/biology/resources/pubs/wildlife/bighorn_domestic_sheep_final_080601.pdf

A QUALITATIVE DISEASE RISK ASSESSMENT OF BIGHORN AND DOMESTIC SHEEP ON THE PAYETTE NATIONAL FOREST.

Tim Schommer, USDA Forest Service, Wallowa-Whitman NF, Baker City, OR

We developed a qualitative disease risk assessment between domestic and bighorn sheep on the Payette National Forest in February, 2006. The analysis consisted of three parts: 1) a review of the scientific literature on disease transmission and the impacts that disease has on bighorn sheep populations; 2) an evaluation of population data available for bighorn populations; and 3) an expert panel assessment of risk of contact from each allotment to nearby bighorn sheep populations. The expert panel rated 23 different allotments and their associated stock driveways for risk of contact. Panelists reviewed maps of pertinent livestock management information, bighorn sheep herd movements, and bighorn herd ranges. Following group discussion of 6 different risk factors, panelists independently rated risk of contact for each allotment and driveway. Consensus was not an objective of the rating process. The weighted mean outcome for risk of contact for 1 of the 23 allotments fell into the very high risk category, 4 fell into the high risk category, 5 into the moderate risk category, 6 in the low risk category, and 7 into the very low risk category. No other factors, such as habitat loss, were identified to negatively affect bighorn sheep. The risk assessment is available at www.fs.fed.us/r4/Payette, under Bighorn Sheep Science Documents.

QUANTIFYING THE RISK OF DISEASE TRANSMISSION FROM DOMESTIC SHEEP TO BIGHORN SHEEP IN THE SIERRA NEVADA

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Overlap of ranges by bighorn and domestic sheep may present a threat to the persistence of wild populations if diseases affecting domestic animal populations are transmitted to vulnerable wildlife. Respiratory disease transmission from domestic sheep has been implicated in the declines of numerous free-ranging bighorn sheep populations, based on experimental studies in captivity and circumstantial evidence under field conditions. In California, endangered Sierra Nevada bighorn sheep number fewer than 400 individuals. Domestic sheep grazing in public and private areas near Sierra Nevada bighorn sheep habitat may threaten the recovery and persistence of this unique subspecies, but the degree of risk has not been quantitatively evaluated. We used the best available spatial, demographic, and disease data to assess the risk and impact of a respiratory disease outbreak in Sierra Nevada bighorn sheep resulting from contact with domestic sheep. In particular, detailed data on bighorn sheep movements were acquired using GPS collars and incorporated into landscape analyses. Probabilities of interspecies contact were derived by assessing the spatial overlap of bighorn sheep population fixed kernel probability distributions and public domestic sheep grazing allotments when both species were present on the landscape. Demographic and disease data were used to model population-level impacts of a respiratory disease outbreak, including cumulative herd-level mortality and the possibility of disease spread to adjacent herds of bighorn sheep. Although current management strategies, including restricting domestic sheep grazing during the bighorn sheep rut, reduced the risk of interspecies contact to less than 2% per year, our quantitative risk assessment still predicted a 50% probability of at least one respiratory disease outbreak causing catastrophic Sierra Nevada bighorn sheep herd mortality ($\geq$ 40%) during the next 70 years.

ADDING LOCATIONS TO A QUALITATIVE RISK ASSESSMENT

Patty Soucek, USDA Forest Service, Payette National Forest

In response to a Forest Plan appeal reversal by the Washington Office (WO) in 2005, the Payette National Forest (PNF) completed a report, Risk Analysis of Disease Transmission Between Domestic Sheep and Bighorn Sheep on the Payette National Forest (2006) as previously presented. One criticism of that analysis was that it lacked actual quantitative data on locations of bighorn sheep in relationship to domestic sheep. In 2007 we were able to obtain the complete telemetry record for Hells Canyon Initiative from Idaho Fish and Game for use in a LANDFIRE spatial habitat model modified to incorporate existing vegetation components. Once the data had been compiled, cleaned, and placed in a spatial model it was found that the dataset comprised 50,000 telemetry and observations points over a 10 years period. With this new dataset we were able understand the movements of individual bighorn within the boundaries of grazing allotments on the Payette National Forest. To further improve the model we followed the procedures for modeling home ranges described in "Modeling Risks of Disease Transmission From Domestic Sheep to Bighorn Sheep: Implications for the Persistence and Restoration of and Endangered Endemic Ungulate" from the UC Davis Wildlife Health Center and Department of Fish and Game Resource Assessment Program. With these tools and parameters we modeled the home ranges for both ewes and rams and for all the individual bighorn sheep that entered domestic sheep allotments. To determine potential contacts between bighorn sheep herds we created herd level home ranges or geographic population ranges for the major herds in Hells Canyon. With completion of geographic population range models it was apparent that bighorn in contact with domestic sheep could in turn contact most other bighorn populations and that domestic sheep grazing on the Payette had the potential to impact the greater Hells Canyon metapopulation.

WESTERN ASSOCIATION OF FISH AND WILDLIFE AGENCIES (WAFWA) WILD SHEEP WORKING GROUP REPORT: Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat (June 21, 2007)

Kevin Hurley, Wyoming Game and Fish Department, Cody, WY

In January 2007, the Western Association of Fish and Wildlife Agencies (WAFWA), comprised of 23 state/provincial/territorial wildlife agencies in the western U.S. and Canada, initiated a Wild Sheep Working Group, to develop a framework of recommendations upon which federal land management agencies should base their policy(ies) for managing domestic sheep and goats in wild sheep habitat. In less than 150 days, this working group, comprised of 10 state/provincial wildlife agency and 2 federal land management agency representatives, developed and submitted a 27-page report to the WAFWA Directors (contact: Kevin.Hurley@wgf.state.wy.us or view this report on the AAWV website www.aawv.net). Recommendations were partitioned, to WAFWA agencies, to federal land management agencies, and to wild sheep conservation organizations, while suggestions were made for public land domestic sheep and goat grazing permittees and private land domestic sheep and goat producers. Effective separation (both temporally and spatially) between wild sheep and domestic sheep and goats should be a primary management objective. Depending on risk of contact between wild sheep and domestic sheep and goats, management strategies should be commensurate with escalating risk of contact. Multi-stakeholder, collaborative solutions are preferred, but state/provincial wildlife agencies and federal land management agencies must be proactive to minimize or eliminate risk of contact.

In July 2007, at the WAFWA Business Meeting in Flagstaff, AZ, this report was orally presented to the WAFWA Directors. Actions taken by those Directors included 1) unanimous endorsement/acceptance of this report; 2) WAFWA agreement to send a letter to BLM, USFS, and other appropriate federal land management agencies, recommending WAFWA's report be used as the foundation for federal agencies to update their policy(ies) on management of domestic sheep and goats in wild sheep habitat; 3) encouragement by WAFWA member agencies for staff participation in September 2007 and February 2008 risk assessment workshops; and 4) report back on progress to the WAFWA Directors at their mid-winter meeting in January 2008.

SUMMARY

David A. Jessup, California Department of Fish and Game, USA

Most of the information presented at this meeting and a great deal more information on these subjects can be found at the website we have constructed under the NFWF grant: http://www.mwvcrc.org/bighorn.html and it can also be reached by going to the American Association of Wildlife Veterinarians website www.aawv.net and then click on this workshop. This website includes background information, specific disease information and research papers, an extensive list or pertinent literature, examples of both qualitative and quantitative bighorn/domestic sheep risk assessments, guidance on problem solving in the public meeting process, guidelines on grazing "best management practices" in bighorn sheep habitats and other pertinent information.

Dealing with bighorn and domestic sheep disease issues is not an impossible task. Unfortunately we have been talking past one another for about 20 years, making then breaking agreements, setting unrealistic expectations, and following some blind alleys such that relatively little progress has been made toward solving these problems. We hope that this workshop, the previous one held at UC Davis in April 2007 and the next one to be held in Salt Lake City in February 2008 will help us find common ground, become familiar and comfortable with use of risk assessment tools, identify best management practices, and forge common sense solutions that will serve conservation of bighorn sheep, but also promote highest and best use (a definition of conservation) of our western grazing lands, including their continued use for grazing. We thank all who have attended for their ideas, comments and concerns.