



BRIEF

on

SOUTH AMERICAN CAMELID DISEASE RISK to WILD SHEEP

by

WAFWA Wild Sheep Initiative & Wildlife Health Committee

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INTRODUCTION

There has been concern and misunderstanding regarding use of South American Camelids (SACs are llamas and alpacas, vicuñas, and guanacos) in occupied wild sheep range. Of the group, llamas and occasionally alpacas are used as pack animals in North America; the others are not. Some wildlife- and land-management agencies have prohibited or proposed to limit pack llama use based on concern that SACs might be able to carry and/or transmit pathogens known to cause disease in wild sheep (see Appendix 1). The Western Association of Fish and Wildlife Agencies (WAFWA) Wild Sheep Initiative (WSI) and Wildlife Health Committee (WHC) provides this brief, including a suggested path forward and recommendations for use of SACs in wild sheep range. The scope of this document is limited to the use of SACs in North America. We recognize that other nonnative domestic species, notably horses or yaks may be used for packing in wild sheep ranges and that use of these animals around naïve populations may also represent a risk for disease and/or parasite introduction.

The 2017 *Risk Assessment on the use of South American Camelids for Back Country Trekking in British Columbia*, is the most recent published risk assessment that reviews the literature on pathogens of SACs. The Centre for Coastal Health (CCH) was contracted by the British Columbia (BC) Ministry of Forests, Lands, Natural Resources Operations, and Rural Development and the Alaska Department of Fish and Game to update a previous risk assessment, completed in 2003. The focus of the 2017 Assessment was to update the previous assessment of the risk of SACs used in backcountry trekking in British Columbia and for other jurisdictions in western Northern America.

The objective of the 2017 Risk Assessment was to identify potential risks to the health of bighorn sheep populations posed by llamas and alpacas used in wild sheep habitat. From the literature reviewed for this assessment, seven pathogens were identified as potential disease risks (*Mannheimia haemolytica*, *Pasteurella* spp., contagious ecthyma, bovine viral diarrhea virus (BVDV), *Mycobacterium avium paratuberculosis*, Bluetongue virus, and *Mycobacterium bovis*). While presence of these diseases in SACs appears to be rarely reported, the potential for SACs to serve as vectors or disease carriers should be considered. The risk assessment also stated that should llamas and alpacas be found to be susceptible to infection with *Mycoplasma ovipneumoniae* (*M. ovi*), a bacterial pathogen considered to be an initiating agent in pneumonia in wild sheep, then the level of concern would be increased. It should be noted that *M. ovi* was not detected from limited nasal swab sampling of llamas kept alone or comingled with domestic sheep in British Columbia. The 2017 Assessment also stated that other pathogens associated with wild sheep and mountain goat disease (e.g., bovine viral diarrhea, contagious ecthyma, parapox virus, *M. haemolytica*, *Pasteurella* spp, Johne's Disease, and Bluetongue virus) are rare to uncommon in SACs. However, a publication reported significant prevalence rates for BVDV in North American llamas and alpacas (Kamil et al. 2009). Additionally, Rivera et al. (1987) reported the detection of antibodies to (and inferred infection by) parainfluenza-3, bovine respiratory syncytial virus and Diaz et al. detected antibodies to *M. hemolytica* and *Pasteurella multocida* in camelids in Argentina. Bovine respiratory syncytial and parainfluenza type 3 viruses, *P. multocida* and *M. hemolytica* have been found in cases of acute pneumonia in neonatal alpacas (Rosadio et al. 2011).

To date, no peer-reviewed literature exists on confirmed disease transmission from SACs to any mountain ungulates; however, given the environmental and health risks wild sheep currently face and the ability for diseases to be transmitted from other domestic animals to wild sheep (e.g. domestic sheep and cattle), a preventive approach should be taken. It is understood that agencies managing wild sheep may consider risk assessment in varying degrees, depending on the situation. For instance, the WSI and WHC acknowledge that herd health assessments of some populations of thinhorn sheep (i.e., Dall's, Stone's sheep) conclude that they are naïve to domestic livestock pathogen exposure, compared to most bighorn populations in the western U.S., southern British Columbia, Alberta, and Mexico. Recently, a unique strain of enzootic *M. ovi* was detected in several wild ungulate populations in Alaska, including Dall's sheep. Exposure of thinhorn sheep to novel pathogens could be catastrophic to thinhorn sheep populations in northern Canada and Alaska. Therefore, to preserve their health, any reasonable management actions that can be taken to reduce the risk of disease introduction to thinhorn sheep should be employed. Lastly, the number of llamas and alpacas tested and reported for many key pathogens (e.g., *M. ovi*) is less than is needed to determine whether or not they may act as carriers. A more robust sampling of SACs is required to confirm the absence of pathogens, and to fill in such knowledge gaps. In addition, the lack of reported disease in SACs due to *M. ovipneumoniae* and other pathogens is not a proxy for the inability to carry the pathogen. Because of recent developments in molecular and non-culture methods for the detection and identification of pathogens, tests conducted prior to 2010 should not be used to support the lack of risk of pathogen exposure from llamas.

While llamas are the most frequently used SAC for packing, the occurrence of pathogens in other SACs can be used to inform the risk of pathogen transfer. To ensure reasonable and science-based decisions are made by wildlife- and land-management agencies/jurisdictions, more SAC pathogen-testing data is desirable and necessary to safeguard wild sheep. The WSI and WHC provide the following summary of the issues, current knowledge and data gaps, next steps, and recommendations for future action(s).

A. Issue Summary:

1. SACs, primarily llamas, are currently used as recreational pack animals in the United States (U.S.) and Canada.
2. There is no current comprehensive and published dataset of SAC test results for pathogens considered a threat to wild sheep, particularly *M. ovi*.
3. Risk Assessments completed by independent contractors for agencies utilize data from various sources and are just that, risk assessments for agency use. The purpose of a risk assessment is to qualitatively and/or quantitatively determine the risk of disease introduction or emergence from an identified action or change in the environment. Risk assessments may also identify prevention or mitigation strategies and rank them in terms of costs and benefits. WAFWA's WSI or WHC has no official position concerning disease or pathogen transfer risk from SACs to wild sheep (SACs are not addressed in the WSI's 2012 *Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat*). The WSI and WHC encourage development of data sets and research designed to best complete our knowledge and understanding of this issue.
4. Individuals and associations that use SACs as pack animals are generally opposed to land-management agencies developing policies, positions, or regulations limiting SAC use on public lands associated with wild sheep with no scientific basis. This opposition is largely based on outdated and minimal pathogen/disease sampling.

B. Current Knowledge and Information Gaps

1. Based on limited testing to date, *M. ovi* has not been identified from a SAC.
2. Only one published experiment, nearly 30 years ago, was conducted to study pathogen transmission to bighorn sheep involving llamas, domestic goats, mountain goats, cattle, domestic sheep, and mouflon sheep. (Foreyt 1994). Bighorns only became sick and died after contact with domestic and mouflon sheep. At the time of the study, *P. haemolytica* was a pathogen of concern. It was isolated in all the study animals except llamas. However, because animal testing did not include *M. ovi* and other pathogens of current concern, results are inconclusive relative to current diagnostic methods.
3. In general, SACs, specifically llamas, do not appear to have many endemic diseases. However, bacterial pneumonia (*P. multocida* and *M. hemolytica*) has been identified in individuals. Antibodies to parainfluenza-3, bovine respiratory syncytial virus, and *Pasteurella* spp. have been detected. Such an immune response suggests that infection without clinical signs may occur and therefore transmission during a transient infection may also occur.
4. To date, infectious disease transmission from SACs to wild sheep has not been documented

C. Recommendations

1. Generate a comprehensive SAC pathogen profile in western North America using current molecular microbiome methods. Use this data to support policy and guideline development to include recommendations for management of SACs for outdoor recreation in occupied wild sheep range, including no restrictions, if SACs are found to be void of pathogens of concern to wild sheep health.
2. Determine whether or not camelids housed with domestic sheep or goats infected with pathogens of concern can become carriers of the pathogens and act as short- or long-term reservoirs.
3. Until the comprehensive pathogen dataset is created the following measures should be employed to reduce the risk:
 - a. SACs should be segregated from other livestock known to carry pathogens of concern to wild sheep if those SACs are to be used to recreate in occupied wild sheep range.
 - b. Avoid use of SACs in thornhorn ranges where populations are known to be naïve to pathogen exposure.
 - c. Develop recommended health protocols (vaccination, deworming, etc.) for llama and alpaca owners that will be packing with their animals in wild sheep ranges.
 - d. Proposed regulations and recommendations on the use of SACs in wild sheep ranges should consider the wild sheep population history, including exposure and carriage of pathogens of concern.

D. Suggested Next Steps

The WSI and WHC recommend a facilitated collaborative forum with leaders from the SAC community, domestic animal and wildlife health professionals, wild sheep and land managers, and conservation organization representatives with the goal of learning and sharing perspectives. This forum would:

1. Allow wild sheep managers and SAC users to find common ground and gain a greater appreciation for each other's interests/concerns, wild sheep conservation and health issues, animal husbandry, recreational use, and management practices.
2. Seek agreement in developing policy/guidelines for west-wide management of SACs used for trekking and hunting.
3. Identify funding for the recommended testing needed to improve the knowledge base on SAC pathogen profiles and potential risk to wild sheep.

APPENDIX 1 –

REGULATIONS OR PERSPECTIVES VARY BY AGENCIES ON RECREATIONAL USE OF SACs IN WILD SHEEP HABITAT

1. On August 9, 2005, Alaska Department of Fish & Game (ADF&G) issued a News Release stating their concerns over use of llamas when hunting Dall's sheep, mountain goat, and/or muskox (Caprinae family).
2. Alaska Board of Game in 2013 prohibited using pack goats for hunting but not SACs.
3. National Park Service in Alaska beginning in 2015 prohibited domestic sheep and goats. SACs are prohibited except as pack animals with superintendent authorization.
4. In 2016, AK-BLM-EI banned pack llamas based upon pathogen/disease transmission from pack llamas to wild sheep using referencing "2013 Herriges - AK-TWS" paper.
5. British Columbia (BC) Ministry of Forests, Lands, Natural Resources Operations, and Rural Development has regulations for the use of pack goats and SACs for hunting, but do not apply to trekking use. BC Parks Act (through Park management Plans) prohibit the use of pack sheep, goats and SACs for trekking in Northern Provincial Parks (i.e., those overlapping thinhorn sheep range).
6. In 2018, AKDF&G Director Bruce Dale submits letter to the Greater Appalachian Llama & Alpaca Association stating that no intentions to promote or limit the use of SACs on public land in Alaska, but the Department will continue to focus and enhance evaluations of disease risk from SACs.
7. In 2019, through revision of their Wildlife Act Phase II, the Northwest Territories enacted regulations to prohibit domestic sheep, goats and SACs from the Mackenzie and Richardson Mountains, as a measure to reduce risk to wild sheep.
8. 2019: Idaho Department of Fish and Game completes Mountain Goat Management Plan.
9. Arctic National Wildlife Refuge proposed regulations in 2020 to ban all pack goats and SACs.
10. American Association of Small Ruminant Practitioner's (AASRP) February 2020 policy opposes banning camelid pack animals on public lands.
11. In 2019/2020, the USFS-Chugach Nation Forest in Alaska issued a Draft Record of Decision to propose a ban on the use of llamas in the CNF.
12. 2020: Arizona's Tonto National Forest limits use of SAC's requested through special use commercial permits that are within designated wild sheep habitat.
13. Bureau of Land Management proposed regulations in 2021 in the Central Yukon Planning Area Alaska - Resource Management Plan, that the use of domestic sheep and goats would be limited, and camelids would be considered on a case-by-case basis.

LITERATURE CITATIONS AND PUBLICATIONS THAT HAVE BEEN REFERENCED AND REVIEWED

1. 1987: Publication of “*Serological Survey of Viral Antibodies in the Peruvian Alpaca (Lama pacos)*”. (Rivera H, Madewell BR, Ameghino E)
2. 1994: Publication of “*Effects of Controlled Contact Exposure Between Healthy Bighorn Sheep and Llamas, Domestic Goats, Mountain Goats, Cattle, Domestic Sheep, or Mouflon Sheep*”. (Foreyt, W.J.)
3. 2003: Publication of “*Communicable Disease Risks to Wildlife from Camelids in British Columbia*”. (Schwantje and Stephen 2003).
4. 2005: Publication of “*Examining the Risk of Disease Transmission between Wild Dall Sheep and Mountain Goats and Introduced Domestic Sheep, Goats, and Llamas in the Northwest Territories*”. (Garde et al 2005).
5. 2009: Publication of “*Viral diseases of New World camelids. Veterinary Clinics of North America Food Animal Practice*”. (Kapil S, Yearly T, Evermann JF)
6. 2011. Publication of “*Respiratory syncytial and parainfluenza type 3 viruses coexisting with P. multocida and M. hemolytica in acute pneumonias of neonatal alpacas*”. (Rosadio R, Cirilo E, Manchego A Rivera H).
7. 2012: Publication of “*Recommendations For Domestic Sheep and Goat Management in Wild Sheep Habitat*”. (WAFWA-WSWG).
8. 2013: Publication of *Reducing Disease Risk to Dall’s Sheep and Mountain Goats from Domestic Livestock*” (Jim Herriges, AK – Eastern Interior – BLM (AK-EI-BLM) and AK-Wildlife Society.
9. 2016: Publication of “*Thinhorn Sheep Conservation Challenges and Management Strategies for the 21st Century*”. (WAFWA-WSWG).
10. 2016: Publication “*BLM-1730 – Management of Domestic Sheep and Goats to Sustain Wild Sheep*”.
11. 2017: Publication “*Invited Paper: Pneumonia in Bighorn Sheep: Risk and Resilience*”. (E. Francis Cassirer).
12. 2017: Publication of “*Serological survey of Antibodies to M. Haemolytica and P.multocida in Camelids from Argentina*”. (Diaz et al)
13. 2018: Publication of “*Risk Assessment on the Use of South American Camelids for Back Country Trekking in British Columbia*”. (Centre for Coastal Health), CCH-RA-17.
14. 2018: Minimum Requirements Decision Guide Workbook (MRDG), “*Bighorn Sheep Monitoring in the Alta Toquima and Arc Dome Wilderness Areas*”. BLM, NPS, USFS, USFWS
15. 2018: Publication “*North American Conservation Vision 2020*”. Wild Sheep Foundation.
16. 2020: BLM-Central Yukon Draft Resource Management Plan/Environmental Impact Statement.
17. 2020: AK-BLM Western Interior/Bering Sea: The Draft RMP/EIS.