



BRIEF

on

SOUTH AMERICAN CAMELID DISEASE RISK to WILD SHEEP

by

WAFWA Wild Sheep Initiative & Wildlife Health Committee



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INTRODUCTION

This brief was drafted independently by WAFWA member scientists to elevate the best available wildlife science, veterinary literature, and agency protocols that have bearing on contemporary concerns or misunderstanding regarding use of South American Camelids (SACs are llamas and alpacas, vicuñas, and guanacos) as pack animals 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. 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, pathogen and/or parasite introduction.

When biologists noted the increased use of llamas for recreational activities in wild sheep and goat habitat, risk assessments to evaluate the potential for disease transmission were commissioned (Stephen and Schwantje 2003, Garde et al. 2005, Centre for Coastal Health 2017). The risk assessments evaluated the literature available regarding the presence of wild sheep and goat pathogens in healthy llamas as well as the occurrence of infectious diseases in sick llamas. 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. Since 2017, methods of pathogen detection, transmission, and research into carrier states for various pathogens have led us to reconsider some of the findings of the previous risk assessment. However, there still exists many gaps in our knowledge of important risk factors.

In the preparation of this brief, we reviewed current literature and research to update our assessment of the potential risks to the health of bighorn sheep populations posed by llamas and alpacas used in wild sheep habitat. We included reports on viruses and bacteria that may be found in healthy llamas and other SACs, especially those that are kept with other domestic species, as well as agents that are found in sick llamas and SACs that could pose a risk to wild sheep and goats. From the literature reviewed for this assessment, eight pathogens were identified as potential disease risks (*Mannheimia haemolytica*, *Pasteurella* spp., contagious ecthyma, bovine viral diarrhoea virus (BVDV), bovine respiratory syncytial virus, parainfluenza virus type 3, *Mycobacterium avium paratuberculosis*, and *Mycobacterium bovis*) (Kapil et al. 2009, Konieczny and Pomorska-Mól 2024). While presence of these pathogens in SACs appears to be rarely to uncommonly reported, the potential for SACs to serve as vectors or disease carriers should be considered. Furthermore, recent surveillance has reported significant prevalence rates for BVDV in North American llamas and alpacas (Kamil et al. 2009, Topliff et al 2009). Additionally, several authors have reported the detection of antibodies to (and inferred infection by) parainfluenza-3, bovine respiratory syncytial virus (Marcoppido et al 2010, Picton 1993, Rivera et al. 1987). 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). Most

recently, highly pathogenic avian influenza was identified in healthy alpacas on a farm where the disease was also found in poultry (USDA-APHIS, 2024). Additionally, should llamas and alpacas be found to be susceptible to infection, clinically or subclinically, with *Mycoplasma ovipneumoniae*, 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 *Mycoplasma ovipneumoniae* was not detected from limited nasal swab sampling of llamas kept alone or comingled with domestic sheep in British Columbia.

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 disease transmission risk 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 strain of enzootic *Mycoplasma ovipneumoniae* not found in wild sheep populations in the lower 48 states was detected in several wild ungulate populations in Alaska, including Dall's sheep (Lieske et al. 2022). 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. ovipneumoniae*) is less than is needed to determine whether or not they may act as healthy carriers. A more robust sampling of SACs is required to confirm the absence of a carrier state for important pathogens for wild sheep and goats, and to fill in such knowledge gaps. 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 and parasites considered a threat to wild sheep, particularly *M. ovipneumoniae*.
3. 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. Risk Assessments completed by independent contractors for agencies utilize data from various sources and are just that, risk assessments for agency use. WAFWA's WSI or WHC has no official position concerning disease or pathogen transfer risk from SACs to wild sheep. The WSI and WHC encourage development of data sets and research designed to best complete our knowledge and understanding of this issue.

B. Current Knowledge and Information Gaps

1. Based on limited testing to date, *M. ovipneumoniae* has not been detected in 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 molecular methods for detection of *M. ovipneumoniae* 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.

C. Recommendations

1. Using current molecular microbiome methods, assess llamas and other SACs, especially those kept in proximity with other domestic species for the presence of bacterial and viral agents. 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 and parasites of concern to wild sheep health.
2. Determine whether or not camelids housed with domestic sheep or goats infected with pathogens or parasites of concern can become carriers of the pathogens and act as short- or long-term reservoirs.
3. Until the comprehensive pathogen and parasite 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 or parasites of concern to wild sheep if those SACs are to be used to recreate in occupied wild sheep range.
 - b. Use of SACs in thornhorn ranges where populations are known to be naïve to pathogen exposure should not occur.
 - 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 demographic and health history, including exposure and carriage of pathogens or parasites 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, supported with regulations 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.

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