

# Bighorn Sheep Herd Die-offs in British Columbia: The Need for a Provincial Wild/Domestic Sheep Separation Strategy

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## Introduction

Perhaps the most critical threat to British Columbia's iconic bighorn sheep population is the threat of disease from domestic animals. This report recommends legal changes to ensure best management practices are implemented to prevent the spread of fatal diseases from domestic livestock to wild bighorn sheep, thinhorn sheep and mountain goats. The disease of primary concern is the transfer of pneumonia-causing bacteria from domestic sheep to wild bighorn sheep.<sup>1</sup> However, it should be noted that domestic goats, llamas and alpacas can also be disease carriers, and wild thinhorn sheep and mountain goats may also be at risk.



## The Value of Bighorn Sheep

Bighorn sheep have a long history of social and cultural importance in British Columbia. Bighorn sheep rank with grizzly bears, mountain goats and orcas as iconic symbols of wild British Columbia.

This symbolism runs deep – in fact, a stylized bighorn sheep comprises almost one-third of the Province's official Coat of Arms. This reflects the early history of European settlement of British Columbia, where bighorn hunting provided food for early settlers and explorers. One of these explorers was Simon Fraser, who, during explorations of the Fraser River for the Northwest Company, reported encounters with bighorn sheep and their use as a food source.<sup>2</sup>

However, long before European settlement, First Nations hunted bighorn sheep. Bighorns were particularly valuable to First Nations as an emergency source of food easily hunted in winter ranges. In addition to providing a source of meat, First Nations utilized bighorn hides and bighorn horns and bones to produce a variety of implements and prized ceremonial objects.<sup>3</sup>

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<sup>1</sup>Goats, llamas, and alpacas have also been recognized as potential carriers of the disease involved, and wild populations of thinhorn sheep and mountain goats may potentially be at risk. However, the main issue involves domestic bighorn sheep, and therefore for the sake of convenience, this report will generally refer only to bighorn sheep and domestic sheep. In most cases, the recommendations concerning these species will apply to other potentially disease-carrying livestock and other threatened wild ungulates. Note that other species of concern will be discussed separately when they raise specific management issues.

<sup>2</sup>RA Demarchi, CL Hartwig & Donald A Demarchi, "Status of the California Bighorn Sheep in British Columbia" (March 2000) No b-98 Wildlife Bulletin 31 at 31.

<sup>3</sup> First Nations hunting of bighorns likely started as early as the end of the last Ice Age. For information on First Nations use of bighorns, see: RA Demarchi, CL Hartwig & Donald A Demarchi, "Status of the California Bighorn Sheep in British Columbia" (March 2000) No b-98 Wildlife Bulletin 31 at 31.

Recreational hunting of bighorn sheep in British Columbia began in the mid-1800s. The sport continues to be popular today, with enthusiasts willing to expend large amounts of money for the opportunity to hunt bighorn sheep. British Columbia's special permit program provides hunters with the opportunity to bid for a limited number of licences per year to hunt an animal out of season. For example, in 2013, a hunter from the United States paid \$275,000 for the opportunity to hunt either a bighorn or thimhorn sheep in British Columbia. The Habitat Conservation Trust Foundation (HCTF), which receives the proceeds from these sales to use for conservation purposes, reports receiving \$1.6 million from the sale of special permits for mountain sheep and elk hunts from 2000-2010.<sup>4</sup> Similar programs in other jurisdictions, including Alberta and various American states, have also raised significant amounts for conservation programs.<sup>5</sup>

The social value of the charismatic bighorn sheep is demonstrated by the frequent use of bighorn images in works of art and in product marketing. This popularity is reflected in the number of conservation groups that direct a significant proportion of their attention to the species. Indeed, a number of groups are dedicated almost entirely to the conservation of wild sheep.<sup>6</sup> Organizations dedicated primarily to wild sheep conservation in North America include the Wild Sheep Society of British Columbia, the Wild Sheep Foundation, the Wild Sheep Foundation Alberta, the Northern Wild Sheep and Goat Council, the Society for the Conservation of Bighorn Sheep, and the Rocky Mountain Bighorn Society.

Clearly, bighorn sheep make important tangible and intangible contributions to British Columbia society. Bighorns continue to be highly significant socially, culturally and spiritually to Interior First Nations. Bighorns are one of the symbols of the province which attract tourists to visit our province. They are a significant draw for wildlife viewing enthusiasts, and wild sheep hunting is a significant source of tourism and government revenue. The prominence of bighorns in art, literature, advertising, and other cultural productions reflect the unique aesthetic value of this British Columbia icon.

Clearly, the loss of this species (or even a regional population) would be viewed as a tragic loss by most British Columbians.

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<sup>4</sup>Larry Pynn, "Special sheep hunt offered by B.C. government generates record \$275,000 for conservation," *The Vancouver Sun* (11 February 2013) online: *The Vancouver Sun* <<http://www.vancouversun.com/news/Special+sheep+hunt+offered+government+generates+record+conservation/7949471/story.html>>

<sup>5</sup>RA Demarchi, CL Hartwig & Donald A Demarchi, "Status of the California Bighorn Sheep in British Columbia," (March 2000) No b-98 Wildlife Bulletin 31at 32.

<sup>6</sup>RA Demarchi, CL Hartwig & Donald A Demarchi, "Status of the California Bighorn Sheep in British Columbia," (March 2000) No b-98 Wildlife Bulletin 31at 31.

## Bighorn Sheep Population Decline—and Obstacles to Recovery

Nineteenth century European settlement caused a dramatic decline in North America's bighorn sheep population. In the United States, bighorn populations declined from an estimated 1.5–2 million to less than 20,000 by 1960. This decline was attributed to unregulated hunting, habitat loss, disease, and competition for forage with livestock. Intensive recovery efforts in the United States have only succeeded in increasing the bighorn sheep population to an estimated 57,000 in 2012.<sup>7</sup>

Similarly, the British Columbia population declined severely in the second half of the nineteenth century due to overhunting, habitat loss, and the introduction of domestic sheep. Regulation of hunting and measures to protect winter range habitat have allowed the population to recover to a limited degree. However, bighorns remain vulnerable.<sup>8</sup> The Province currently designates bighorn sheep as a vulnerable species of special concern, which could become threatened or endangered if proper conservation measures are not followed.<sup>9</sup>

Today, transmission of pneumonia from domestic animals threatens to frustrate bighorn recovery efforts. Domestic sheep, as well as goats and camelids (llamas and alpacas), are known to carry a number of bacteria strains that can cause pneumonia in sheep and related animals. Domestic sheep, which originate genetically from species domesticated in Eurasia, have developed a high degree of resistance to these types of bacteria, and rarely manifest symptoms. However, bighorn sheep apparently lack inherited immunity -- as evidenced by the fact that animals which come in contact with these bacteria often develop fatal pneumonia.<sup>10</sup> The result has been periodic herd die-offs. Pneumonia outbreaks can have severe consequences, often resulting in 75-100% herd mortality.<sup>11</sup>

The threat posed by domestic sheep grazing was recognized in British Columbia at least as early as 1923, when Allan Brooks attributed the near extirpation of bighorns from the province to a combination of overhunting and the introduction of domestic sheep, and concluded that the survival of bighorns required the exclusion of domestic sheep from bighorn ranges.<sup>12</sup> A number of historical accounts from

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<sup>7</sup>Joshua M O'Brien et al, "Incorporating Foray Behavior into Models Estimating Contact Risk Between Bighorn Sheep and Areas Occupied by Domestic Sheep" (2013) 38:2 Wildlife Society Bulletin (forthcoming) at 1-2.

<sup>8</sup>British Columbia, Ministry of Environment, Lands and Parks, *Bighorn Sheep in British Columbia* (British Columbia: Province of British Columbia, 2000).

<sup>9</sup> Bighorn sheep are not currently listed under Canada's *Species at Risk Act* (SARA), and are not listed as endangered or threatened under BC's *Wildlife Act*. In British Columbia, however, bighorn sheep have been placed on the province's blue list as a species of special concern. This listing officially recognizes that the species is vulnerable and could become threatened or endangered if proper conservation measures are not followed.

<sup>10</sup>Joshua M O'Brien et al, "Incorporating Foray Behavior into Models Estimating Contact Risk Between Bighorn Sheep and Areas Occupied by Domestic Sheep" (2013) 38:2 Wildlife Society Bulletin (forthcoming) at 1-2.

<sup>11</sup>Elena Garde et al, "Examining the Risk of Disease Transmission between Wild Dall's Sheep and Mountain Goats, and Introduced Domestic Sheep, Goats, and Llamas in the Northwest Territories" (2005) Other Publications in Zoonotics and Wildlife Disease, Paper 29 at 28-29.

<sup>12</sup>Brian Harris, Helen Schwantje & Bert van Dalfsen, *Managing the Risk of Disease Transfer between Wild and Domestic Sheep in the Southern Interior of BC* (British Columbia: Habitat Conservation Trust Foundation, March 2011), at 4.

the United States dating to at least as early as 1910 also recognized a correlation between bighorn population decline and the advent of domestic sheep grazing.<sup>13</sup>

Over the last thirty years a body of scientific literature has identified the causal link between the introduction of domestic animals and wild sheep die-offs.<sup>14</sup> This research culminated in a 2010 study where researchers tagged examples of *Mannheimia haemolytica* – a bacteria carried by domestic sheep and shown in previous studies to cause severe pneumonia and rapid death in bighorns – in the nasal cavities of domestic sheep. Following a period of various levels of exposure to the domestic animals, all four bighorns used in the study developed fatal pneumonia. The researchers confirmed that the tagged bacteria had been transmitted from the domestic sheep to fatally infect the bighorns.<sup>15</sup> Another contemporaneous study supported the conclusion that bacteria from domestic sheep is the likely cause of pneumonia-related bighorn die-offs.<sup>16</sup>

This experimental research is consistent with the long-time field observations of a link between exposure to domestic sheep and wild sheep die-offs. The weight of evidence strongly suggests that where pneumonia-related die-offs of bighorns occur following exposure to domestic sheep, the domestics are the likely source of the disease.<sup>17</sup>

The significance of the threat posed by domestic sheep to bighorns in Canada is evident in the number of large scale herd die-offs that have been attributed to pneumonia outbreaks. In a recent report, a team of researchers composed a table [see Table 1 below] showing nine pneumonia-related die-offs of captive and wild bighorns in British Columbia and Alberta from 1927 to 2000. Seven of the nine cases resulted in herd mortality described as significant or recorded as being in excess of 60%. For example, in 1999-2000, a major all ages die-off attributed to bacterial pneumonia spread from domestic sheep killed

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<sup>13</sup>Wild Sheep Working Group, *Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat* (United States: Western Association of Fish and Wildlife Agencies, 2012) at 4.

<sup>14</sup>Wild Sheep Working Group, Western Association of Fish and Wildlife Agencies, *Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat* (United States: Western Association of Fish and Wildlife Agencies, 2012) at 4.

<sup>15</sup>Paulraj K Lawrence et al “Transmission of *Mannheimia Haemolytica* from Domestic Sheep (*Ovis Aries*) to Bighorn Sheep (*Ovis Canadensis*): Unequivocal Demonstration with Green Fluorescent Protein-Tagged Organisms” (2010) 46:3 *Journal of Wildlife Diseases* 706 at 706-707, 713-715.

<sup>16</sup>This second study concerns the bacteria *Mycoplasma ovipneumoniae*. This bacteria is present in both domestic sheep and bighorns, but on its own has not been seen to lead to the development of fatal pneumonia in bighorns. In a trial involving four bighorn sheep, however, the researchers found that three of the animals, after being infected with *Mannheimia haemolytica*, developed fatal pneumonia. The fourth animal, which was already infected with *Mannheimia haemolytica*, but had not developed symptoms, also developed fatal pneumonia following exposure. The researchers concluded that *Mycoplasma ovipneumoniae* may increase the susceptibility of bighorns to *Mannheimia haemolytica*, but that fatal pneumonia did not develop unless the latter bacteria was present. See: Rohana P Dassanayake et al “*Mycoplasma Ovipneumoniae* can Predispose Bighorn Sheep to Fatal *Mannheimia Haemolytica* Pneumonia” (2010) 145 *Veterinary Microbiology* 354 at 354-355, 358.

<sup>17</sup>This conclusion is supported by the observation that, while some bighorn die-offs have occurred in the absence of reported contact with domestics, die-offs that may be attributed to domestics have usually been more severe. See: Wild Sheep Working Group, *Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat* (United States: Western Association of Fish and Wildlife Agencies, 2010), at 6.

approximately 75% of the bighorns belonging to one herd in the Okanagan Valley.<sup>18</sup> Recently, there appears to have been another major disease-related die-off in the Chasm Creek bighorn herd near Clinton – with the population dropping from close to 100 to approximately 27 over the winter of 2012/2013, with no lambs surviving. Initial blood sample results show that the domestic sheep-derived *Mycoplasma ovipneumonia* is circulating in the remaining herd.<sup>19</sup>

This latest incident highlights the often catastrophic results of disease outbreaks in bighorn herds, and the consequences of the failure to take province-wide action following the major 1999-2000 Okanagan die-off.

**Table 1: Bacterial pneumonia related die-offs in bighorn sheep in Canada<sup>20</sup>**

Date	Location	Proposed Cause	Outcome
1999-2000	Okanagan Valley, BC	Bacterial pneumonia, mixed organisms, domestic contact	75% dead
1998	Elk Valley, East Kootenay, BC	Bacterial pneumonia, <i>P. multocida</i>	Low mortality, no progression
1988	Captive herd, AB	Pneumonia after vaccine trial	All died
1985-86	Sheep River, AB	<i>M. haemolytica</i> type A	60-65 BHS reported dead
1981-83	East Kootenay, BC	Multiple organisms, lungworm	approximately 65% reduction in multiple herds
1978	Sheep River Sanctuary, AB	<i>Pasteurella</i> /verminous pneumonia	10% died
1970's	University of BC captive herd	Pneumonia	All died
1964-66	East Kootenay, BC	Bacterial and verminous pneumonia, domestic contact	Significant mortality in multiple herds
1920s	East Kootenay, BC	Bacterial and verminous pneumonia, domestic contact	Significant mortality in multiple herds

<sup>18</sup>Elena Garde et al, "Examining the Risk of Disease Transmission between Wild Dall's Sheep and Mountain Goats, and Introduced Domestic Sheep, Goats, and Llamas in the Northwest Territories" (2005) Other Publications in Zoonotics and Wildlife Disease, Paper 29 at 31.

<sup>19</sup> See "Bighorn Sheep Population on Sharp Decline in Caribou", CBC Kamloops (17 December 2013) online: <http://www.cbc.ca/kamloops/mt/2013/12/17/kamloops-restaurant-shut-down-after-norovirus-outbreak/> Note that the blood sample results information comes from a source that is currently confidential.

<sup>20</sup>Elena Garde et al, "Examining the Risk of Disease Transmission between Wild Dall's Sheep and Mountain Goats, and Introduced Domestic Sheep, Goats, and Llamas in the Northwest Territories" (2005) Other Publications in Zoonotics and Wildlife Disease, Paper 29 at 31.

Something needs to be done to stop the die-offs. Lending urgency to this issue is the fact that domestic sheep farming is a growing industry – which will likely create even more risks for the bighorns. An increase in demand for lamb meat, both nationally and internationally, has heightened interest in sheep farming in Canada.<sup>21</sup> In addition, a recent rise in historically low wool prices is likely to add to the industry’s momentum.<sup>22</sup> Statistics Canada’s Census of Agriculture showed an increase in the number of sheep and goat farms in the Thompson-Okanagan region from 111 to 131 from between 2006 and 2011 alone.<sup>23</sup>

## Solving the Problem: Strategies for Protecting Bighorn Sheep

How can the risk to bighorns be reduced? Veterinary science has yet to produce a vaccine effective against *Mannheimia haemolytica* in domestic livestock or wildlife. Treating wild bighorns with antibiotics following disease outbreaks, furthermore, is logistically difficult if not impossible.<sup>24</sup> O'Brien *et al* observe that, given the lack of effective vaccine or treatment options, “[t]o reduce the risk of outbreaks, most wildlife, livestock, and land management professionals recommend physically separating the species using buffers around occupied bighorn habitat.”<sup>25</sup> On this issue, the Western Association of Fish and Wildlife Agencies (WAFWA)'s Wild Sheep Working Group states that:

*WAFWA collectively believes that effective separation between wild sheep and domestic sheep or goats should be a primary management goal of state, provincial, or territorial agencies responsible for wild sheep management. With respect to domestic sheep or goats, the concept of effective separation is based on the premise that these two domestic species are incompatible with wild sheep, because of potential fatal disease transmission to wild sheep. Domestic sheep or goats should not concurrently share or occupy the same range where conservation of wild sheep is a clearly-stated management goal.*<sup>26</sup>

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<sup>21</sup> Trudy Kelly Forsythe, “Canadian lamb markets growing,” Farm Credit Canada (11 April 2014) online: <<https://www.fcc-fac.ca/en/ag-knowledge/publications/fcc-express/fcc-express-archives/20140411.html#story7>>.

<sup>22</sup> Magie Van Camp, “Have You Any Wool?,” *Country Guide* (31 May 2011) online: <<http://www.country-guide.ca/2011/05/31/have-you-any-wool/37208/>>.

<sup>23</sup> Canada, Statistics Canada, 2011 Farm and Operator Table by Geography (Canada: Government of Canada, 2012) online: <<http://www29.statcan.gc.ca/ceag-web/eng/transpose-var-transposer.action?geoid=590000000&selectedVarIds=4>>.

<sup>24</sup> Brian Harris, Helen Schwantje & Bert van Dalfsen, *Managing the Risk of Disease Transfer between Wild and Domestic Sheep in the Southern Interior of BC* (British Columbia: Habitat Conservation Trust Foundation, March 2011), at 7.

<sup>25</sup> See O’Brien *et al*, at 2; and see Singer and Gudorf 1999, Schommer and Woolever 2001, Garde *et al* 2005, CAST 2008, WAFWA 2012.

<sup>26</sup> Wild Sheep Working Group, *Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat*, (United States: Western Association of Fish and Wildlife Agencies, 2010), at 5.

A recent report addressing the situation in British Columbia, published by the Northern Wild Sheep and Goat Council, concurs with this assessment, and accepts a 15-km buffer zone as the generally accepted minimum distance that should be maintained between wild and domestic sheep.<sup>27</sup>

The BC Ministry of Environment (MoE) has also recognized that “[l]ivestock ranching is the primary threat to Bighorns through disease transmission, range depletion, and resource competition.”<sup>28</sup> In response, MoE reports have concurred with other authorities in holding that the maintenance of zero contact between domestic and wild sheep must be a primary conservation objective. These reports have cited a buffer of 10–16km as a general guideline to prevent contact.<sup>29</sup> Alberta’s Environmental Protection Fish and Wildlife Services bighorn sheep management plan takes a similar position, recognizing the association between bighorn herd die-offs and pneumonia transmitted from domestic sheep – and recommending that domestic sheep grazing should not be permitted in areas where there is potential for contact with bighorns.<sup>30</sup>

Unfortunately, BC currently lacks an effective management strategy to prevent disease transmission from domestic sheep to bighorn sheep. The persistent recurrence of herd die-offs demands an effective management strategy. And the situation is more urgent because sheep farming is expanding -- and is likely to expand more – in the areas where bighorns roam. Without action, herd die-offs may occur with increasing frequency. The Province needs to act decisively and comprehensively to protect bighorns. We need to protect this vulnerable species “of special concern” from decline.

### ***Step One: Mapping of Bighorn Territory and Identifying Areas of Risk***

Separating wild and domestic sheep appears to be the only effective way to prevent disease transmission. But before government can act to separate the species, it must have a reliable way to determine exactly where bighorn sheep are located – and where they are most likely to come into contact with domestic animals.

Fortunately, the US government has developed a reliable tool for mapping bighorn sheep territory. The United States Forest Service (USFS) commissioned research to develop a sophisticated mapping tool to support their sheep separation policies. Research results were published in 2013, and the USFS and

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<sup>27</sup>Dave Zehnder “Bighorn and Domestic Sheep Interface Program in Southeastern British Columbia” (2006) 15 Biennial Symposium Northern Wild Sheep and Goat Council 122 at 123.

<sup>28</sup>RA Demarchi *Bighorn Sheep: Ovis canadensis* (British Columbia: Ministry of Environment, Accounts and Measures for Managing Identified Wildlife, 2004), at 9.

<sup>29</sup>RA Demarchi, CL Hartwig & Donald A Demarchi, “Status of the California Bighorn Sheep in British Columbia” (March 2000) No b-98 Wildlife Bulletin 31 at pp 36-37; RA Demarchi “*Bighorn Sheep: Ovis canadensis*” (British Columbia: Ministry of Environment, Accounts and Measures for Managing Identified Wildlife, 2004), at 14.

<sup>30</sup>Alberta, Environmental Protection Fish and Wildlife Services, *Management Plan for Bighorn Sheep in Alberta* (Alberta: Wildlife Management Planning Series Number 6, July 1993) at 26-28.

other US land management agencies are now using this tool to implement wild/domestic sheep separation plans. The motivation for the development of this mapping tool was the failure of older models to account for certain aspects of bighorn sheep behaviour. Bighorns usually remain within a certain core herd home range, but individuals will periodically leave the herd and may travel as far as 50km on extended “forays” outside normal herd territory. Bighorns can be attracted to, and interact with, domestic sheep that they encounter on these forays.<sup>31</sup> The USFS researchers have described the relevance of such “forays” to designing a wild/domestic sheep separation strategy:

*Foraging animals risk contact with and infection from domestic sheep and, if infected, may act as vectors, triggering outbreaks on rejoining their herds or contacting other bighorn sheep populations. This behavior complicates risk of contact analysis because these forays may have disproportionate importance in transmission of disease, but are typically ignored in home range or other analyses that focus on areas with highest probability of use.*<sup>32</sup>

To address this limitation, the USFS-commissioned study developed a method of mapping bighorn sheep territory which produces a map that accounts both for a “core herd home range” and a “foray” area outside that home range.

This tool tracks herd animals over a number of years to establish a data set of telemetry points, representative of the movements of bighorns in a particular herd.<sup>33</sup> Once this data is acquired, two layers of statistical analysis are then used to determine a “risk of contact” model between that herd and domestic sheep. The first layer shows a core herd home range (in which most of the members of the herd will be at most times) and an area outside that range frequented by individuals when exhibiting foray behaviour. The second layer accounts for bighorn habitat preferences and travel routes between areas of high value habitat – and shows where bighorns are most likely to be when in their core herd home range and when in foray areas. The tool combines these two layers of information and produces a map that shows the probability of bighorns contacting domestic sheep located at different points within their territory.<sup>34</sup>

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<sup>31</sup>Joshua M O’Brien et al, “Incorporating Foray Behavior into Models Estimating Contact Risk Between Bighorn Sheep and Areas Occupied by Domestic Sheep” (2013) 38:2 Wildlife Society Bulletin (forthcoming) at 2.

<sup>32</sup>Joshua M O’Brien et al, “Incorporating Foray Behavior into Models Estimating Contact Risk Between Bighorn Sheep and Areas Occupied by Domestic Sheep” (2013) 38:2 Wildlife Society Bulletin (forthcoming) at 2.

<sup>33</sup>To be representative, developing this data set requires tracking a sufficient number of individuals within a herd (a combination of radio-collaring and visual observations were used in this study) over a sufficient number of years (for the two herds covered in this study, the data set comprised the years 1997-2009, and the other the years 2007-2009). See Joshua M O’Brien et al, “Incorporating Foray Behavior into Models Estimating Contact Risk Between Bighorn Sheep and Areas Occupied by Domestic Sheep” (2013) 38:2 Wildlife Society Bulletin (forthcoming) at 2-3.

<sup>34</sup>Joshua M O’Brien et al, “Incorporating Foray Behavior into Models Estimating Contact Risk Between Bighorn Sheep and Areas Occupied by Domestic Sheep” (2013) 38:2 Wildlife Society Bulletin (forthcoming) at 3-6.

The USFS has accepted this mapping tool and uses it to develop wild/domestic sheep separation policies. In 2010, on the basis of evidence produced by this tool, the USFS closed approximately 70% of the grazing allotments available for domestic sheep in the Payette National Forest.<sup>35</sup> This decision was challenged by wool growers and others on a number of grounds – including the validity of basing the closure decision on this “risk of contact” model. The plaintiffs’ claim was rejected. In the course of its decision, the court emphasized the extent both of the data acquired and the experts consulted by the USFS. The court stated that “the model’s reliability and integrity is corroborated by the process by which it was developed.”<sup>36</sup> The court also found that the motivation for developing the model was supported by the majority of scientific literature which recognizes the potential for disease transmission and bighorn herd die-offs, and the management option of wild/domestic sheep separation to prevent this occurrence.<sup>37</sup>

Thus, the US Forest Service has developed a reliable tool to map bighorn territory, assess foraging activity and determine the probability of contact with nearby domestic sheep. This mapping tool is supported by impressive scientific credentials. And a US court has upheld its use for defining areas where domestic sheep should be excluded. Fortunately, we can now scientifically define the area where domestic sheep and goats should be kept away from bighorns.<sup>38</sup>

### *Sheep Separation Strategies*

After the “risk of contact” area is defined, the question becomes how to separate the species in that area. Two principal methods have been employed to prevent contact between bighorn sheep and domestic sheep. One option is the US federal government approach of establishing total exclusion zones, where domestic sheep are simply prohibited.<sup>39</sup> A second option would not exclude domestic sheep from these areas but require that they be kept within a no-contact fence (a double-fence that creates a small buffer zone – *e.g.* 1-10 metres wide – around domestic animals). A management option involving a combination of these strategies might also be employed.

Determining which strategy to follow requires assessing the relevant science to ensure that the risk of bighorn infection will be reduced to a level where species recovery is no longer limited. The impact of

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<sup>35</sup>*Idaho Wool Growers Association et al v Tom Vilsack et al*, Case no 1:12 cv-469 AWT (D Idaho 2014) at 2.

<sup>36</sup>*Idaho Wool Growers Association et al v Tom Vilsack et al*, Case no 1:12 cv-469 AWT (D Idaho 2014) at 15. Note that the decision of the court was ultimately guided by the standards of judicial review applicable in the United States.

<sup>37</sup>*Idaho Wool Growers Association et al v Tom Vilsack et al*, Case no 1:12 cv-469 AWT (D Idaho 2014) at 9.

<sup>38</sup>Like most examples of statistical modeling, certain of its parameters are likely subject to reasoned debate and improvements may be introduced over time. This level of uncertainty, inherent to the nature of statistical modeling, is not a reasonable basis to avoid or delay employing a reputable tool required to develop the only form of management strategy currently accepted as providing a chance of protecting bighorn herds from further die-offs related to contact with domestic sheep.

<sup>39</sup>On federal lands.

different options on other stakeholders – particularly domestic sheep farmers – should also be taken into account, with a view to adopting the option or set of options that will have less impact on other stakeholders without sacrificing conservation objectives.

The option of using no-contact double fencing around farms in “risk of contact zones” – instead of total exclusion – would allow farming to continue in such zones. This would potentially lessen the impact on the domestic sheep industry. However, this option has a number of drawbacks – chief of which is the lack of evidence that it would actually work. Limited experience with use of fencing – and dispute about the amount of actual fence separation required – make it difficult to predict the extent to which widespread use of no-contact fencing could reduce incidence of transmission.

The problem is that *Mannheimia haemolytica* may be spread by direct nose to nose contact but can also travel a short distance as an aerosol. This latter fact has led to debate about the minimum distance that should be maintained between wild and domestic sheep by a double fence. Estimates of an acceptable separation distance range from 1-10 metres.<sup>40</sup> The lack of an established standard presents a significant obstacle, as setting a definition for a no-contact fence in a regulatory scheme would involve a significant degree of guesswork. Erring on the side of caution would suggest adopting a separation distance towards the higher end of the range of proposed options.

But there is a more fundamental problem. Even if a theoretically adequate separation distance is established, the effectiveness of fencing is limited by the requirement for vigilant maintenance – and by livestock’s perseverance in escaping enclosures. As any farmer can attest, animals quite commonly escape fences – which is problematic in a situation where a single escape could create a disease vector and trigger a herd die-off. This suggests that any fencing solution is likely to be less effective than a generous exclusion zone.<sup>41</sup>

In addition, the cost of fencing limits its desirability. A 2005 estimate placed the cost of no-contact fencing for domestic sheep farms located in the East Kootenay region of British Columbia at \$310,000 for the 15km distance required. This distance was based only on those farms located in areas of highest concern which were likely to choose the fencing option.<sup>42</sup> The use of no-contact fencing has other costs – including the loss of productivity of the area of land between the fences.<sup>43</sup> While government

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<sup>40</sup>Wild Sheep Working Group, Western Association of Fish and Wildlife Agencies, *Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat* (United States: Western Association of Fish and Wildlife Agencies, 2012) at 18; Brian Harris, Helen Schwantje & Bert van Daltsen, *Managing the Risk of Disease Transfer between Wild and Domestic Sheep in the Southern Interior of BC* (British Columbia: Habitat Conservation Trust Foundation, March 2011), at 7.

<sup>41</sup>Dave Zehnder “Bighorn and Domestic Sheep Interface Program in Southeastern British Columbia” (2006) 15 Biennial Symposium Northern Wild Sheep and Goat Council 122 at 126.

<sup>42</sup>Dave Zehnder “Bighorn and Domestic Sheep Interface Program in Southeastern British Columbia” (2006) 15 Biennial Symposium Northern Wild Sheep and Goat Council 122 at 126.

<sup>43</sup>Certain fencing options can potentially minimize this effect. One option is to use a triangular system whereby the second fence juts inward from an angle from the base of the perpendicular perimeter fence. While this option minimizes loss of

subsidies for fence construction might address such issues, such subsidies could actually create a perverse incentive for landowners to introduce new sheep and get fences paid for.

Therefore, a precautionary approach probably requires the implementation of exclusion zones in critical areas. This approach is being vigorously implemented on federal lands in the US. In addition to US Forest Service initiatives, a recent draft report from the US Bureau of Land Management (BLM) addresses the issue of granting sheep grazing rights near bighorn sheep habitat. Again, the BLM report was developed to ensure that decisions about allocating grazing rights take into account the potential for sheep diseases to damage nearby bighorn populations.<sup>44</sup> Specifically, the mandate of the BLM report is to develop a management plan for the allocation of grazing allotments “that includes reasonable means to avoid or mitigate domestic sheep contact with and potential disease transmission to bighorn sheep populations.”<sup>45</sup>

The BLM adopted the risk of contact model developed by the United States Forest Service as the scientific basis for its management recommendations with regard to the allocation of grazing allotments. This model requires mapping bighorn sheep movements to determine a core herd home range (CHHR). The risk of interspecies contact between bighorns and domestic sheep allowed to graze within and around this area may then be calculated.<sup>46</sup>

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pasture, its effectiveness is premised on the viability of a relatively short separation distance of around one metre. A second option would see the use of a wire perimeter fence and an inside electric fence. This option could be more cost effective and allow farmers more flexibility, since the electric fencing could be removed at times when sheep are not in pasture. Electric fencing would also allow flexibility to experiment with different separation distances. On the other hand, electric fencing may not be as secure as a second wire fence. See Dave Zehnder “Bighorn and Domestic Sheep Interface Program in Southeastern British Columbia” (2006) 15 Biennial Symposium Northern Wild Sheep and Goat Council 122 at 126.

<sup>44</sup>United States, United States Department of the Interior, Bureau of Land Management, *Draft Cottonwood Resource Management Plan for Domestic Sheep Grazing and Supplemental Environmental Impact Statement* (Idaho, BLM Cottonwood Field Office, May 2014), s 1.3.

<sup>45</sup>United States, United States Department of the Interior, Bureau of Land Management, *Draft Cottonwood Resource Management Plan for Domestic Sheep Grazing and Supplemental Environmental Impact Statement* (Idaho, BLM Cottonwood Field Office, May 2014), s 1.3.

<sup>46</sup>Specifically, the BLM report adopts the following indicators: **Bighorn Sheep Summer/Winter Source Habitat Available for Domestic Sheep Use** – Source habitat contains characteristics that contribute to positive population growth for bighorn sheep, which may or may not actually occupy this habitat. Potential use varies by season (summer/winter). Should this habitat be available for domestic sheep use, the potential for contact increases; **Bighorn Sheep Summer/Winter CHHR Available for Domestic Sheep Use** – The CHHR is the area within which most bighorn herd individuals spend at least 95 percent of their time. Should a CHHR be available for domestic sheep use, the allotment has a predicted contact rate of one or more (1+) interspecies contacts per year, thus contributing to potential disease transmission and disease outbreaks. The higher the number of acres of CHHR overlap with domestic sheep allotments, the greater the number of contacts that could occur annually; **Distance between BLM Lands Available for Domestic Sheep Use and Nearest Bighorn Sheep CHHR or Area of Interest** –This is the distance between lands within BLM allotments that would be available for domestic sheep grazing and the nearest CHHR. The shorter the distance, the greater the likelihood of contact between species; **Probable Contacts per Year between Domestic and Bighorn Sheep** – This is the number of contacts per year predicted between the two species, which is considered a primary factor contributing to potential disease transmission, disease outbreaks, and population persistence; **Ranking of Effects on Bighorn Sheep Population Persistence** – This is the rank order of the estimated adverse effects on the persistence of affected herds. See: United States, United States Department of the Interior, Bureau of Land Management, *Draft Cottonwood Resource Management Plan for Domestic Sheep Grazing and Supplemental Environmental Impact Statement* (Idaho, BLM Cottonwood Field Office, May 2014), s 2.5.

Following the scientific evidence in light of its policy objectives, the BLM report recommends an exclusion zone that would exclude domestic sheep from three of the four grazing allotments in the management area. This recommendation maintains a 9 mile minimum distance between domestic sheep and bighorn sheep core herd home ranges. Although the report notes that a 9-mile buffer is no longer BLM policy, it maintains this standard as a general guideline.<sup>47</sup>

Application of the Precautionary Principle suggests that – in light of potential problems with fencing and the lack of evidence of its effectiveness – domestic sheep should be excluded throughout the entire risk of contact area (core herd home range and foray area). The US has developed a trustworthy tool for defining risk areas where domestic sheep and goats should be excluded. Adopting such an exclusion approach would provide the highest degree of protection for bighorn sheep.

In the alternative, a more complex and less reliable approach could be taken: it may be possible on the basis of current knowledge to produce an estimate regarding the effectiveness of no-contact fencing. A risk of contact model could then use this estimate – and exclude domestic sheep from the core herd home range and higher risk of contact areas, but allow domestic sheep to be kept within no-contact fencing in lower “risk of contact” areas outside the core herd home range.

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<sup>47</sup>The BLM estimated that this recommended option which maintains a minimum 9 mile exclusion zone around bighorn sheep core herd home range, presents a risk of contact of 0.00002 incidents per year. The estimated risk level posed by this option is significantly lower than that of all the other options considered which would permit at least some grazing, with the next lowest at 0.07345. It also is only slightly higher than the 0.0 contact risk posed by a total prohibition. Given the economic value of grazing and the determination that such a low level of risk is unlikely to affect bighorn survival and growth, the BLM chose to recommend this option. The BLM report provides an example of how the risk of contact model functions in application. Its application in this case concerned an area where domestic sheep would potentially be permitted to graze on public lands -- the effect of fence lines to contain domestic sheep was not a factor in the risk of contact calculation. The risk of contact model, however, could be a useful tool for evaluating the effectiveness of a no-contact fencing strategy. Provided the extent to which any particular form of no-contact fencing reduces the risk of disease transmission were known, factoring this information into the risk of contact model would provide a risk of contact estimate for the area. All other factors being equal, presumably the estimated number of contacts per year would be lower than in an area where no-contact fencing was not employed. The question would then be whether the use of any particular no-contact fencing reduces the risk of contact in an area below an acceptable level.

The principal factor limiting this approach is the lack of sufficient evidence to determine the effectiveness of no-contact fencing methods. A separation strategy based solely on the use of no-contact fencing would require the assumption that no-contact fencing will reduce the risk of contact below an acceptable level, even in the core herd home range. At the moment, given the lack of evidence and the known limitations of fencing strategies, it is doubtful that this assumption would be warranted. The precautionary principle employed in the interest of bighorn conservation suggests that – given current knowledge – a separation strategy should employ an exclusion zone throughout bighorn sheep core herd home ranges. See United States, United States Department of the Interior, Bureau of Land Management, *Draft Cottonwood Resource Management Plan for Domestic Sheep Grazing and Supplemental Environmental Impact Statement* (Idaho, BLM Cottonwood Field Office, May 2014), s 2.3.3, ss 2.4.1-2.4.3.

## Recommendation #1:

The Province should enact legislation to require either:

- Complete exclusion of domestic sheep and goats from areas where there is an unacceptable risk of contact, as determined by the mapping tool currently used by the US Forest Service and Bureau of Land Management; or
- Exclusion of domestic sheep and goats from the areas defined by the above US government mapping tool – with the exception that domestic sheep could be allowed in a limited number of “lower risk of contact” areas if restrained by adequate no-contact fencing.

The most effective way to implement such a policy would be through new legislation or an amendment to existing provincial legislation, since this would provide uniform protection for bighorn sheep throughout the province.

### *Protecting Thinhorn Sheep and Mountain Goats from Domestic Pack Animals*

The thinhorn sheep population of northern British Columbia has escaped exposure to domestic sheep and the diseases they carry and has not experienced the same human impact that bighorns have in the south of the province. However, there is a concern because thinhorn sheep populations likely have greater geographic connectivity and an even lower tolerance to introduced diseases than bighorns. Although they are a different species, thinhorns are closely related to bighorns and are likely susceptible to the same diseases. Thus, researchers have concluded that if thinhorns were exposed to domestic sheep, a disease such as pneumonia could spread rapidly throughout a large segment of the population.

Note that domestic goats and camelids (llamas and alpacas) may also carry the relevant diseases. While domestic sheep farming is not a common activity in thinhorn territory, the use of pack animals by hunters is increasingly common. This has led researchers to conclude that preventative actions should be taken to prevent thinhorn exposure to domestic sheep, llamas, alpacas, goats and other potential disease carriers. Specifically, a recent scientific report recommends that sheep and other potentially disease carrying domestic animals should not be used as pack animals or be pastured within thinhorn territory.<sup>48</sup>

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<sup>48</sup>Elena Garde et al, “Examining the Risk of Disease Transmission between Wild Dall’s Sheep and Mountain Goats, and Introduced Domestic Sheep, Goats, and Llamas in the Northwest Territories” (2005) Other Publications in Zoonotics and Wildlife Disease, Paper 29 at 1-3.

Due to North American farming preferences, domestic goats and camelids have not posed the same threat as domestic sheep. However, the fact that these species are potential carriers of the same diseases as domestic sheep suggests that any regulations on wild/domestic sheep separation should include these species as well. This is especially important with regard to thinhorn sheep, where use of goats and camelids as pack animals may lead to these animals posing a greater risk than domestic sheep.<sup>49</sup>

Besides bighorn and thinhorn sheep, pneumonia carried by domestic livestock may also pose a threat to wild mountain goats. Less is known concerning the potential risk to mountain goats, since their habitats at high elevation have so far isolated them from contact with domestics. Mountain goats, however, are likely susceptible to many of the same diseases as wild sheep and domestic sheep and goats, and their lack of exposure suggests that – like thinhorn sheep – they lack any degree of inherited immunity. As such, especially with regard to the increasing use of domestic livestock as pack animals by hunters, researchers have recommended proactive regulations to prevent contact.<sup>50</sup>

The state of Alaska recently responded to these concerns by prohibiting the use of domestic sheep and goats as pack animals when hunting wild sheep, mountain goats, and muskox on public lands.<sup>51</sup>

## **Recommendation #2:**

Llama, goat and alpaca farms should be subject to the same restrictions as those applying to domestic sheep farms near bighorn ranges.

## **Recommendations # 3:**

Government should prohibit the use of llamas, alpacas and domestic sheep and goats as pack animals when hunting wild sheep, mountain goats, and muskox.

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<sup>49</sup>Elena Garde et al, “Examining the Risk of Disease Transmission between Wild Dall’s Sheep and Mountain Goats, and Introduced Domestic Sheep, Goats, and Llamas in the Northwest Territories” (2005) Other Publications in Zoonotics and Wildlife Disease, Paper 29 at 98-100.

<sup>50</sup>Elena Garde et al, “Examining the Risk of Disease Transmission between Wild Dall’s Sheep and Mountain Goats, and Introduced Domestic Sheep, Goats, and Llamas in the Northwest Territories” (2005) Other Publications in Zoonotics and Wildlife Disease, Paper 29 at 98-100.

<sup>51</sup>Alaska, Alaska Department of Fish and Game, *2014-2015 Alaska Hunting Regulations* (Alaska: Alaska Department of Fish and Game, 2014) at 19.

## *Restricting Grazing Licences on Public Land*

In British Columbia, the granting of grazing permits for domestic animals to carry out vegetation control under the *Forest and Range Practices Act* is an additional concern. Such permits can place disease carriers in the habitat of wild sheep and goats.

Section 42 of the *Forest Planning and Practices Regulation* contains provisions for health monitoring of sheep used in grazing operations, and similar provisions could be imported to the *Range Planning and Practices Regulation*. There are significant limitations to this approach, however, since to be effective at providing protection to wild sheep, this type of provision requires a high degree of monitoring and cooperation between government, veterinarians, and sheep grazers.<sup>52</sup> Current guidelines for issuing permits give environment officials the discretion to establish buffer zones to prevent contact between wild species and domestic sheep – but no minimum protective parameters are set.<sup>53</sup>

A far more effective and easier to implement policy would be an amendment to the *Range Planning and Practices Regulation* to prohibit grazing of domestic sheep, goats, llamas and alpacas on any Crown land where there is risk of contact with wild sheep and goats. Considering the risk to iconic wildlife, such a measure is justified.

### **Recommendation #4:**

Government should amend the criteria for issuing grazing permits to prohibit grazing domestic sheep, goats, llamas and alpacas when there is risk of contact with wild sheep and goats, as determined by the mapping tool currently used by the US Forest Service and Bureau of Land Management.

## *Compensating Affected Farmers*

Many existing sheep farmers should be able to transition to alternative agricultural activities without much difficulty. However, funds should be made available to current farmers that require assistance to transition away from farming activity that threatens bighorn sheep. As discussed above, the Habitat Conservation Trust Foundation receives substantial funding from the sale of mountain sheep and elk

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<sup>52</sup>*Forest Planning and Practices Regulation*, BC Reg 14/2004, s 42.

<sup>53</sup> See the Ministry of Forests and Range Sheep Vegetation Management Guidelines, Appendix 2, which states: “Projects sites must be situated so that: \*generally, any proximity or physical contact with wild sheep or goat species is avoided \* specifically, where the Ministry of Environment determines that the transmission of infectious organisms is a risk to any wild ungulate, a buffer zone to prevent physical contact between wild species and domestic sheep used for vegetation management must be established. The size of the buffer zone should be based on the Ministry of Environment’s assessment of site-specific conditions. When MELP judges that there is a potential for infectious organism transfer between domestic sheep and resident wild ungulates, wild ungulate conservation and health will receive the higher priority.”

hunting permits. Such funding should be earmarked for a farmer assistance transition fund until current farmers have been properly assisted.

## **Recommendation # 5**

Funds that the Habitat Conservation Trust Foundation receives from the sale of special permits for mountain sheep and elk hunts should be earmarked to assist domestic sheep farmers with the transition away from agricultural practices that put bighorn sheep at risk.

### ***Other Relevant Information***

Note that implementing the above law reform proposals would be consistent with the growing body of laws designed to prevent the spread of disease among wild, exotic, and domestic animals. See [Appendix A](#) for a discussion of current biosecurity laws designed to prevent the spread of disease from game farms and fish farms to wildlife. [See [Appendix A, Biosecurity and Livestock to Wildlife Disease Transmission](#).] It is past time for us to prevent the spread of disease from sheep farms to British Columbia's iconic bighorn sheep.

[Appendix B](#) discusses potential alternative measures to protect sheep, such as conservation covenants, *profit a prendres*, subsidized fencing programs, and local government legislation. Among other things, that Appendix discusses the failed effort by the Regional District of Okanagan-Similkameen to attempt to protect bighorns, and points out why provincial action is preferable to such local, *ad hoc*, piecemeal approaches.

## Conclusion

Bighorn sheep populations in North America remain well below historic numbers. There is general agreement among conservation biologists and wildlife managers that disease transmission from domestic sheep is the primary factor limiting recovery. When transmission of pneumonia-causing bacteria from domestics to wild sheep precipitates a herd die-off, the resulting mortality rates are usually catastrophic. Most conservation biologists and wildlife management agencies in both Canada and the United States now recommend that separation between wild and domestic sheep must be maintained if the wild populations are to have a significant chance of survival in the long term. In the United States, a number of jurisdictions have started to implement separation strategies to prevent contact between wild and domestic sheep on public lands.

The current US scientific model for identifying “risk of contact” areas should be adopted in BC to completely exclude domestic sheep and goats from “risk of contact” areas. Alternatively, domestic sheep could be allowed in a limited number of “low risk of contact” areas, if restrained by adequate no-contact fencing.

Due to the locations of most of British Columbia’s bighorn herds, it is unlikely that an effective sheep separation strategy can be implemented without measures that address farm practices on private property. British Columbia has demonstrated a willingness to regulate farm activities in order to prevent the spread of diseases among domestic livestock, and to prevent the spread of diseases from wildlife kept as livestock to native wildlife. There is no principled reason why the province, under a similar rationale and in the interest of protecting some of its most iconic and economically valuable wildlife, should refuse to extend farm regulations to address this concern. Funds from the sale of special permits for mountain sheep and elk hunts should be dedicated temporarily to assist affected sheep farmers to transition away from activity that threatens bighorn sheep.

In addition, government should prohibit the use of llamas, alpacas and domestic sheep and goats as pack animals when hunting wild sheep, mountain goats and muskox. Llama and alpaca farms should be subject to the same restrictions applying to sheep and goats.

While British Columbia has taken some limited regulatory measures with regard to grazing permits on public lands, a legislative prohibition on the granting of grazing permits in “risk of contact” areas is necessary to ensure protection for wild sheep and goats on public lands.

Finally, it should be noted that government may actually have no choice – it may, indeed, be legally obligated to act decisively to protect bighorn sheep, thimhorn sheep, and mountain goats. To fail to do so may be a breach of government’s obligation to respect Aboriginal rights with respect to these species

of great importance to First Nations. While it is beyond the purview of this paper to fully canvass such important obligations to First Nations, [Appendix C](#) contains preliminary discussion about this vital subject. More research should be done on this issue.

## List of Recommendations:

### Recommendation #1:

The Province should enact legislation to require either:

- Complete exclusion of domestic sheep and goats from areas where there is an unacceptable risk of contact, as determined by the mapping tool currently used by the US Forest Service and Bureau of Land Management; or
- Exclusion of domestic sheep and goats from the areas defined by the above US government mapping tool – with the exception that domestic sheep could be allowed in a limited number of “lower risk of contact” areas if restrained by adequate no-contact fencing.

### Recommendation #2:

Llama, goat and alpaca farms should be subject to the same restrictions as those applying to domestic sheep farms near bighorn ranges.

### Recommendations # 3:

Government should prohibit the use of llamas, alpacas and domestic sheep and goats as pack animals when hunting wild sheep, mountain goats, and muskox.

### Recommendation #4:

Government should amend the criteria for issuing grazing permits to prohibit grazing domestic sheep, goats, llamas and alpacas when there is risk of contact with wild sheep and goats, as determined by the mapping tool currently used by the US Forest Service and Bureau of Land Management.

### Recommendation # 5

Funds that the Habitat Conservation Trust Foundation receives from the sale of special permits for mountain sheep and elk hunts should be earmarked to assist domestic sheep farmers with the transition away from agricultural practices that put bighorn sheep at risk.

# APPENDIX A

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## Biosecurity and the Issue of Livestock-to-Wildlife Disease Transmission

Biosecurity is a growing area of concern for the agricultural industry. This is shown in the growing body of legislation concerning livestock health, and the prevention of disease transmission from game farms and aquaculture operations to wildlife and wild fish populations. Although domestic livestock diseases that mainly pose a threat to wildlife may not fall squarely under current animal health or game farm/aquaculture legislative schemes, the basic principle behind these schemes – to prevent disease transmission between farm animals and wildlife – is applicable.

In British Columbia, the *Game Farm Act* provides that fallow deer, reindeer, and bison can only be kept by a person who possesses either a valid licence issued under that legislation or under the *Wildlife Act*.<sup>54</sup> The *Game Farm Regulation* provides that licence-holders must confine game to their property and maintain custody of animals during transport.<sup>55</sup> Pursuant to the *Game Farm Regulation*, the *British Columbia Game Farm Manual* (the Manual) sets standards and conditions for those holding licences to possess fallow deer, reindeer, and bison. A number of these standards and conditions reflect a concern for the prevention of contact between farmed game animals and wildlife. The Manual provides that it is unlawful to allow fallow deer and reindeer and bison “to escape or come in contact with wildlife.”<sup>56</sup> This policy reflects the recognition expressed in the Manual that:

*Agricultural production of game farm animals raises international concerns about disease and genetic contamination that could possibly affect wildlife or domestic livestock in British Columbia. To minimize this risk, preventative measures and certain health requirements have been established by the Chief Veterinarian for British Columbia.*<sup>57</sup>

The Manual addresses this concern – in addition to the general prohibition on allowing contact between game farm animals and wildlife – through the imposition of specific farming practices that must be followed by game farm license holders. For fallow deer and reindeer, potential farmers must demonstrate in their license application that they can satisfy minimum fencing standards. Where imported animals are required to be quarantined in accordance with Agriculture and Agri-Food Canada's

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<sup>54</sup>*Game Farm Act*, RSBC 1996, c 168, s 9(3).

<sup>55</sup>*Game Farm Regulation*, BC Reg 232/91, s 4.

<sup>56</sup>British Columbia, Ministry of Agriculture, *Game Farm Manual* (British Columbia: Ministry of Agriculture), ss 1.2.1-1.2.2.

<sup>57</sup>British Columbia, Ministry of Agriculture, *British Columbia Game Farm Manual* (British Columbia: Ministry of Agriculture), ss 2.3, 3.3.

Importation Policy, for the duration of the quarantine period they must be kept within a double fence with a minimum six feet spacing between the fence lines.<sup>58</sup> For bison, the Manual does not set minimum fencing standards, but does provide recommendations for farmers so that they do not violate their licences by allowing the escape of animals from their premises.<sup>59</sup> Furthermore, even though fencing standards are not imposed for bison, the escape of animals is treated as serious matter requiring action:

*With the elimination of provincial fencing standards and the initial site inspection, the Ministry of Environment, Lands and Parks (MELP) enforces the Wildlife Act more rigidly pursuant to bison at large. With the approval of MAFF, under this legislation, MELP has the authority to immediately destroy any game farm animal at large that is posing a threat to people, property, wildlife or wildlife habitat.*<sup>60</sup>

Part of the rationale for imposing legislative restrictions on farming game animals is the recognition that the escape of these animals poses threats to wildlife, both through genetic contamination and disease transfer. A similar concern is addressed in regulations made with respect to aquaculture under the *Fisheries Act*. The *Pacific Aquaculture Regulations* provide that when issuing a license to engage in aquaculture activities, the Minister of Fisheries and Oceans may impose conditions with respect to a number of matters, including monitoring diseases among both farmed fish and nearby wild stocks, and the prevention of the escape of farmed fish.<sup>61</sup>

In both game farming and aquaculture, government has recognized that farm operations can pose a risk of disease transfer to wildlife -- and laws have been created to address these concerns. So far, however, to our knowledge, similar legal measures have not been taken to address situations where domestic livestock pose similar disease threats to wildlife.

There is existing legislation that should be considered, as solutions to the bighorn sheep problems are developed. For example, the Canadian government's *Health of Animals Act* (the Act) provides that a person in the control, care, or possession of an animal must immediately notify the nearest veterinary inspector in the event that person becomes aware of a reportable disease or toxic substance in or around that animal.<sup>62</sup> The Act stipulates measures for the containment of reportable diseases, including a provision requiring that diseased animals cannot be kept on undivided or unenclosed land.<sup>63</sup> Reportable diseases are declared at the discretion of the Minister of Agriculture and are listed under the

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<sup>58</sup>British Columbia, Ministry of Agriculture, British Columbia *Game Farm Manual* (British Columbia: Ministry of Agriculture), s 2.1.3.4.

<sup>59</sup>British Columbia, Ministry of Agriculture, British Columbia *Game Farm Manual* (British Columbia: Ministry of Agriculture), s 3.1.3.3.

<sup>60</sup>British Columbia, Ministry of Agriculture, British Columbia *Game Farm Manual* (British Columbia: Ministry of Agriculture), s 3.2.5.

<sup>61</sup>*Pacific Aquaculture Regulations*, SOR/2010-270, ss 3-4.

<sup>62</sup>*Health of Animals Act*, SC 1990, c 21, s 5(1).

<sup>63</sup>*Health of Animals Act*, SC 1990, c 21, s 9.

*Reportable Diseases Regulations*. The current listing suggests an interpretation of the Act that focuses on livestock diseases that may be a threat to other livestock and/or to humans, rather than wildlife.<sup>64</sup>

British Columbia's *Animal Health Act* (the Act) was significantly revised in 2014. The current version of the Act contains a general prohibition against causing disease, which requires that:

*A person responsible for an animal must not, in keeping or dealing with animals or in engaging in a regulated activity, act in a manner that the person knows, or ought to know,*

*(a) may cause conditions that contribute to*

*(i) the presence of a notifiable or reportable disease,*

*(ii) the transmission or spread of a notifiable or reportable disease between animals, or*

*(iii) the transmission of disease from animals to humans, or*

*(b) may interfere with the prevention, control or eradication of a notifiable or reportable disease.<sup>65</sup>*

The Act contains a number of provisions requiring action to prevent the spread of notifiable and reportable diseases, including granting authority to the chief veterinarian to establish quarantine and surveillance zones on the basis of a reasonable belief that a reportable disease is present in that area, in addition to the power to seize and destroy animals on the basis of the reasonable belief that other preventative measures would be inadequate to protect animal or public health.<sup>66</sup>

As the above discussion of laws reveals, biosecurity is a significant and evolving concern in both agriculture and aquaculture. Both federal legislation and recently strengthened legislation in British Columbia impose significant requirements on farmers to contain and eliminate diseases that threaten animal and human health. Federal laws on aquaculture and BC laws on game farming impose restrictions on keeping wildlife – and recognize that wildlife farms can pose disease and genetic risks to wild populations of related species. There remains a startling gap – at least with regard to the actual regulatory application of current animal health legislation – when domestic livestock diseases present a threat to wildlife health, but not to the health of other livestock or humans.

Nevertheless, some actions could be taken under the *Animal Health Act* to protect bighorns. Under this Act, the term “animal” is defined as any member of the animal kingdom and any organism prescribed as an animal.<sup>67</sup> “Animal health” is defined as “the health of a population or subpopulation of animals, and includes the preservation of a population or subpopulation of animals that is at risk of being exposed to

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<sup>64</sup> *Reportable Diseases Regulations*, SOR/91-2.

<sup>65</sup> Bill 19, *Animal Health Act*, 2nd Sess, 40th Parliament, BC, 2014, s 3.

<sup>66</sup> Bill 19, *Animal Health Act*, 2nd Sess, 40th Parliament, BC, 2014, ss 27-29.

<sup>67</sup> Bill 19, *Animal Health Act*, 2nd Sess, 40th Parliament, BC, 2014, s 1.

or affected by a notifiable or reportable disease.”<sup>68</sup> A disease may be listed as notifiable for the purposes of obtaining further information, avoiding barriers to trade, or other reasons in the public interest. A disease may be listed as reportable for the purposes of protecting animal or public health, avoiding barriers to trade, or other reasons of public interest.<sup>69</sup> It seems clear that a pathogen such as *Mannheimia haemolytica* falls under the definition of a disease posing a threat to animal health, since the definition of animal under the legislation appears broad enough to include wildlife. Thus, there are grounds for listing the disease for the purpose of protecting animal health. The preservation of wildlife – almost certainly an issue of public interest – provides an additional ground for listing. Given the relevance of both these purposes, the reportable disease category would more accurately reflect the nature of the problem posed by *Mannheimia haemolytica*.

The federal *Health of Animals Act* is less precise in its definitions and lacks explicit criteria by which ministerial discretion should be exercised when making listing decisions concerning the category of reportable disease. The definition of “animal” that it provides, although vague, is very broad and seems to include wildlife. Given the broad definition of “animal” and the fact that protecting animal and human health are guiding concerns for listing decisions, it seems that a livestock disease which threatens wildlife falls within the scope of contemplated targets for listing.<sup>70</sup>

However, the problem is that both the provincial and federal animal health statutes seem designed to detect and address outbreaks of diseases that occasionally afflict livestock, and to eradicate these diseases where they appear. *Mannheimia haemolytica*, on the other hand, is a disease that is already known to be commonly present in domestic sheep kept on farms. Since the domestic sheep have immunity, the disease is unlikely to be identified as a problem. Indeed, it may only present a problem when domestic sheep come into contact with susceptible wildlife. Listing the disease under either or both of these acts could have the effect of causing significant inconvenience for farmers whose flocks will not contact wild sheep and pose no problem. In addition, the current lack of effective measures to prevent domestic sheep from acting as carriers might undermine the conventional utility of a listing.

A similar difficulty would follow from including domestic sheep under a legislative instrument such as game farm or aquaculture regulations. This type of legislation provides rules for keeping animals or fish of a certain type at any location within the applicable jurisdiction. The problem posed by domestic sheep in this instance, however, only arises in limited areas within the jurisdiction.

Both forms of legislation are relevant, however, because they establish precedents that when keeping animals presents a threat to animal health (including wildlife health), the farm operation responsible

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<sup>68</sup>Bill 19, *Animal Health Act*, 2nd Sess, 40th Parliament, BC, 2014, s 1.

<sup>69</sup>Bill 19, *Animal Health Act*, 2nd Sess, 40th Parliament, BC, 2014, s 1.

<sup>70</sup>Bill 19, *Animal Health Act*, 2nd Sess, 40th Parliament, BC, 2014, s 2.

cannot be said to be following “normal farm practices”. *Mannheimia haemolytica* and similar pathogens do not fall squarely within the category of diseases producing occasional outbreaks in livestock that the animal health acts target. Nor do they fall squarely in the category of the disease threats regulated in the relatively new industries of game farming and aquaculture.

The animal health acts discussed, however, show that there is no principled basis for ignoring a livestock disease that threatens wildlife health -- especially when preventative measures are available. The situation is also closely analogous to the issue addressed in game farms and aquaculture legislation, since it involves a disease persistent among the farmed population that poses a continual threat to wildlife. Given that the province is willing to regulate farm practices for game animals throughout its jurisdiction -- in part due to a recognized threat to wildlife -- it is difficult to justify not taking similar action to protect wildlife from farmed domestic animals. The case for such action is especially strong, since the regulations would only be required in limited areas adjacent to wild bighorn herds.

# Appendix B

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## Potential Alternative Measures

We have made recommendations for actions we think would best protect bighorn sheep. However, short of the recommendation we have made, piecemeal measures might be taken to attempt to achieve the same objective. These measures could involve buying-out existing sheep producers with a provision to restrict future sheep farming on the property. One method for achieving this restriction is through the use of conservation covenants. However, the ability to enter into conservation covenants to restrict agricultural activities on properties in the Agricultural Land Reserve (ALR), is limited by the need to obtain Agricultural Land Commission (ALC) approval. Unless the ALC adopts a stance in favor of such covenants -- which it has previously shown unwillingness to do -- this is unlikely to be an effective strategy. Furthermore, the purchase of covenants involves a significant cost, with one recent estimate amounting to an average of \$21,000 per farm.<sup>71</sup> In addition, such purchases could perversely create an incentive for other farmers to actually import sheep, to secure future buy-outs.

A second option that might be considered by individuals and conservation groups is the purchase of a *profit a prendre* to farm sheep on properties within risk of contact zones. The purchaser would gain the exclusive right to keep sheep on a property, and by refraining from exercising that right, would exclude sheep from that property. In British Columbia, this strategy might potentially have the advantage of avoiding ALR rules concerning covenants affecting agriculture. The cost of purchase, however, has recently been estimated to be similar to that of covenants.<sup>72</sup> Furthermore, both the covenant approach and the *profit a prendre* approach are dependent on landowners willingly agreeing to sell their rights. It seems unlikely, therefore, that such an approach will be consistently effective, given that a single farmer unwilling to agree to such an arrangement could thwart conservation efforts with respect to an entire herd. Again, there is the risk that such an approach could be exploited by landowners who decide to actually bring in sheep for the specific purpose of forcing those concerned with bighorn sheep conservation to then buy them out. Since conservation groups have limited resources, they may not be able meet subsequent landowner demands – and an increased disease risk to bighorn herds could actually be the paradoxical result of such a strategy.

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<sup>71</sup>Dave Zehnder “Bighorn and Domestic Sheep Interface Program in Southeastern British Columbia” (2006) 15 Biennial Symposium Northern Wild Sheep and Goat Council 122 at 124; Brian Harris, Helen Schwantje & Bert van Daltsen, *Managing the Risk of Disease Transfer between Wild and Domestic Sheep in the Southern Interior of BC* (British Columbia: Habitat Conservation Trust Foundation, March 2011), at 5.

<sup>72</sup>Dave Zehnder “Bighorn and Domestic Sheep Interface Program in Southeastern British Columbia” (2006) 15 Biennial Symposium Northern Wild Sheep and Goat Council 122 at 125.

In addition to the above options, conservation groups and government may try to achieve sheep separation by funding farmers to install no-contact fencing on their properties. This strategy has been applied on some farms in British Columbia. Besides the questionable effectiveness of no-contact fencing, this measure is quite dependent on farmer acceptance and the availability of ample conservation funding. And this measure could also be exploited by farmers seeking low cost fencing<sup>73</sup> -- and could create a perverse incentive to import domestic sheep.

Thus, relying on conservation groups and governments to fund exclusion zones and fencing presents various serious practical limitations.

### *Local Government Action*

As discussed, the best option to protect bighorn sheep is the new provincial legislation recommended above. However, if this is not possible, additional less effective and more cumbersome remedies may be available. One would be for local governments to take action.

Although less effective than a province-wide solution, there may be some advantages to enabling local governments to act in this regard:

- Local bylaws may be quicker to implement while a more comprehensive provincial scheme is under development.
- Once a provincial scheme has been implemented, allowing local governments to make additional regulations may provide an ability to account for unforeseen issues arising in local contexts.

Such local government action would be piecemeal – and indeed may not be legally feasible. The British Columbia Ministry of Agriculture recently quashed a bylaw developed by the Regional District of Okanagan-Similkameen that was intended to implement a wild/domestic sheep separation strategy within its boundaries. This bylaw would have established a sheep separation zone within which all domestic sheep and goats had to be kept within a no-contact fence. Furthermore, in the sheep separation zone, the bylaw would have prevented anyone from owning fewer than twenty-five sheep or goats –

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<sup>73</sup>Brian Harris, Helen Schwantje & Bert van Dalssen, *Managing the Risk of Disease Transfer between Wild and Domestic Sheep in the Southern Interior of BC* (British Columbia: Habitat Conservation Trust Foundation, March 2011), at 5.

with exceptions for 4-H clubs and for breeding stock.<sup>74</sup> The bylaw would not have required the actual exclusion of domestic sheep and goats from any part of the sheep separation zone.<sup>75</sup>

Nevertheless, the Okanagan-Similkameen bylaw ran into trouble, and was never implemented because it did not receive approval of the Minister of Agriculture. In British Columbia, land designated as agricultural by the province falls under the Agricultural Land Reserve (ALR), which is administered by the Agricultural Land Commission (ALC). The Ministry of Agriculture retains the ability to impose limits on the power of municipalities to pass bylaws with respect to farming activities in this area. These limits are incorporated within the provisions of the *Local Government Act* that grant zoning powers to municipalities. Specifically, section 903(5) of the *Local Government Act* provides:

*(5) Despite subsections (1) to (4) but subject to subsection (6), a local government must not exercise the powers under this section to prohibit or restrict the use of land for a farm business in a farming area unless the local government receives the approval of the minister responsible for the administration of the Farm Practices Protection (Right to Farm) Act.*

Thus, the Minister of Agriculture retains broad discretion to prevent a municipality from passing bylaws affecting farm operations within the Agricultural Land Reserve. In addition s. 2(3) of the *Farm Practices Protection (Right to Farm) Act* provides a farmer with protection from being found in contravention of local bylaws if the farmer is carrying out “normal farm practices”.

The preferable approach to the bighorn sheep problem is to take a consistent approach province-wide, and follow the recommendations made in the main paper above. However, government may want to supplement this approach by amending the law to clearly grant local governments power to regulate sheep farming that threatens wild sheep – free of Ministerial veto, and free of the constraints on initiating contravention proceedings found in the *Farm Practices Protection (Right to Farm) Act*.<sup>76</sup>

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<sup>74</sup> The bylaw contained limited exceptions to allow fewer than twenty-five animals to be kept by 4-H Clubs and similar organizations as part of a project supervised by the organization and for the separate keeping of male sheep or goats intended for breeding a flock of twenty-five or more, provided in each case that the animals were kept within a no-contact fence.

<sup>75</sup> Regional District of Okanagan Similkameen, by-law No 1838.05, 2007, *A Bylaw to Amend Animal Control Bylaw No. 1838, 2006* (9 March 2007), ss 3.1-3.2.

<sup>76</sup> For example, among other things, the Province might amend the Agricultural Land Reserve Use, Subdivision and Procedure Regulation to allow local governments to prohibit sheep as a use on land in the Agricultural Land Reserve. For land not in the ALR, local governments could rezone that land out of agricultural zoning, so that it would no longer be captured by the *Farm Practices Protection Right to Farm Act*. Sheep could then be zoned or regulated out of the interface areas on land not in the ALR.

# Appendix C

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## Aboriginal Rights with Respect to Bighorn Sheep

Bighorn sheep are extremely important culturally and socially to Interior First Nations, due to a long history of traditional use. This history of traditional use is probably sufficient to establish an existing aboriginal right to the use of bighorn sheep under section 35(1) of the *Constitution Act, 1982*, in the absence of evidence of express intent by the Crown to extinguish this right, given the criteria established by the Supreme Court of Canada, in *R v Sparrow* (“*Sparrow*”).<sup>77</sup> The Supreme Court in this case established criteria for determining whether legislation interferes with an aboriginal right so as to constitute an infringement of section 35(1), and if so, whether that infringement is justifiable. Determining whether there has been an infringement requires asking three questions: 1. Is the limitation unreasonable?, 2. Does the limitation create undue hardship?, 3. Does the limitation deny the holders of the right their preferred means of exercising that right?. Where a *prima facie* violation is found, the analysis then proceeds to the question of justification. A violation may be justified where there is a valid legislative objective (such as the conservation of a natural resource or the prevention of harm to the public), and where the Crown in pursuing this objective has dealt fairly with the First Nations affected, in a manner consistent with its fiduciary duties and the Honour of the Crown”.<sup>78</sup>

In *Sparrow*, the Supreme Court held that the regulation of a salmon fishery constituted a *prima facie* violation of an existing aboriginal right to use that fishery. This infringement could only be justified as a conservation measure provided the Crown showed respect for section 35(1) by providing that, after conservation, the aboriginal right to the fishery would take precedence over all other users. Therefore, quotas for non-aboriginal commercial and recreational purposes could not be issued unless the amount of salmon available was more than sufficient to meet both the demands of conservation and the amount needed to satisfy traditional aboriginal use requirements.<sup>79</sup>

The ruling in *Sparrow* addresses situations where government regulation affects the ability of aboriginals to engage in traditional usage of a resource. The situation in this case is somewhat different, since it concerns the failure to impose regulations on the domestic sheep industry to protect wild sheep -- rather than regulations that directly limit the ability of aboriginals to utilize a traditional resource.

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<sup>77</sup>*R v Sparrow*, [1990] 1 SCR 1075, at paras 28-30, 38-40. Note that the test in *Sparrow* and other SCC cases states that to qualify as an aboriginal right an activity must be an element of a practice, custom or tradition *integral to the distinctive culture* of the aboriginal group asserting the right. Strictly speaking, this is narrower than all “traditional uses” because some things regarded as traditional are post-contact and may have become integral only because of European influence. However, that distinction is likely not relevant in the case of bighorn sheep, which were being used in practices, customs and traditions integral to the distinctive culture of the relevant First Nations prior to European influence.

<sup>78</sup>*R v Sparrow*, [1990] 1 SCR 1075, at paras 70-76.

<sup>79</sup>*R v Sparrow*, [1990] 1 SCR 1075, at paras 77-78.

However, there are at least two reasons why these situations are analogous. First, the distinction between decisions to regulate and decisions not to regulate is questionable in practice. Considering the holding in *Sparrow*, it would seem absurd to find that the Crown is unable to violate aboriginal rights by prioritizing non-aboriginal interests when assigning fishery quotas, but could simply refrain from regulating the fishery and allow overfishing by non-aboriginals to destroy the potential for a traditional aboriginal fishery. Second, in this case the province has made a regulatory choice to legally allow -- and beneficially sanction in various ways -- farming practices in bighorn habitat that directly threaten bighorns. This regulatory choice appears to be one which potentially places the interests of a small segment of the sheep farming industry ahead of the maintenance of a sufficient population of bighorns to meet traditional aboriginal usage requirements. Therefore, even under a narrower reading of *Sparrow*, it is doubtful that this decision fulfills provincial obligations to First Nations under section 35(1).

The United States has recognized the principle that tribal interests should be taken into account in management decisions affecting bighorn sheep historically used by tribes. The Department of the Interior Bureau of Land Management (BLM), in formulating bighorn sheep management plans with regard to grazing by domestic sheep, has been required to factor into account the treaty rights of US Tribes. For example, where grazing domestic sheep on public lands had the potential to adversely affect bighorn sheep populations which featured in the socio-cultural activities of the Nez Perce Tribe -- as a source of food and of materials for the production of ceremonial objects -- the BLM recognized that management decisions had a direct impact on treaty rights. Specifically, the BLM found that treaty rights concerned both the maintenance of a population of bighorns in harvestable numbers and the maintenance of that population over the range in which hunting had traditionally taken place. The BLM therefore took into account the effect that various potential management options would have in regard to these two factors in reaching its recommended plan.<sup>80</sup>

Although Aboriginal law in the United States is different from that in Canada, the BLM report nevertheless provides an instructive example of how British Columbia can in practice meet its own obligations to First Nations under the criteria established in *Sparrow*. In Canada, furthermore, even more may be demanded of the government in this regard, since according to *Sparrow* once conservation requirements are fulfilled, the ability of First Nations to satisfy traditional use requirements takes precedence over all other interests.

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<sup>80</sup>United States, United States Department of the Interior, Bureau of Land Management, *Draft Cottonwood Resource Management Plan for Domestic Sheep Grazing and Supplemental Environmental Impact Statement* (Idaho, BLM Cottonwood Field Office, May 2014), s 4.3.