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Mr. Stan Ebel
Great Divide Llamas
7902 North County Road 27
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Dear Stan:

The purpose of this letter is to provide you with some facts concerning Johne's disease, especially as it relates to llamas. Specifically, we hope this information will be useful in discussions between the llama community and parks service personnel concerning llama use. This is essentially a restatement of information presented at our meeting on February 13, 1995.

Johne's disease is also known as paratuberculosis and is caused by *Mycobacterium paratuberculosis*. This is a very slow growing bacterial organism that in susceptible species typically causes weight loss, protein loss through the gut wall, and usually diarrhea in affected animals eventuating in death. The infection can occur by ingestion of the organism in feces or colostrum when the animal is very young. It appears that some infections occur when the fetus is still *in utero*. Under normal circumstances, it appears to take a fairly heavy oral inoculation for the animal to contract the disease. Although the infection is typically contracted when the animal is a neonate, the disease signs do not manifest in the infected animal until two to five years of age because of the slow growing nature of the organism.

Johne's disease represents a truly significant problem in our domestic production livestock, including sheep, goats and cattle. These animals appear to be common hosts for the organism, and the disease can become endemic in a flock or herd. Johne's disease is most commonly seen in the more moist regions of the country such as the East and the Midwest, and is most commonly seen when animals are maintained in confinement, presumably because this enhances fecal contamination and spread of the organism. By contrast, the disease has a much lower prevalence in herds maintained on range in the semi-arid and arid regions of the country.

It is suspected that all wild ruminants also are susceptible to infection with paratuberculosis because it has been identified on a sporadic basis in a substantial number of different wild species. The disease signs reported to occur when *M. paratuberculosis* infects the wild ruminants are similar to those reported for the disease in domesticated ruminants. Johne's disease also has been reported to sporadically affect some equine species.

All of the preceding information is quite well established in the veterinary scientific literature and presents an interesting contrast with what has been seen with the

occurrence of this disease in llamas. To date, only four cases of Johne's disease have been documented in llamas, although a thorough search of the literature indicates one additional case where typical lesions of the disease were noted but the organism was not specifically identified. Not only has the disease been infrequently found in llamas in North America, but the reported cases have tended to be unusual in being quite young or quite old, as compared to the typically affected cow or sheep. The course of the disease in llamas has been short, with death occurring shortly after clinical suggestion of disease. It is most likely that the low reported incidence of this problem in llamas is a true representation of the disease in the species because it is unlikely that the disease has been inadvertently overlooked. By comparison with our domestic ruminant livestock, llamas have tended to maintain a high individual monetary value and, therefore, death and disease in this species has typically been closely scrutinized using standard but extensive diagnostic methods. Llamas are frequently placed in close contact with the domestic ruminant livestock and thus should have ample opportunity to contract the disease and show signs if they were highly susceptible to this problem.

While the low reported incidence of Johne's disease in llamas is significant in itself in suggesting that llamas are an extremely infrequent carrier of the *M. paratuberculosis* organism, these findings also illustrate another important issue. In the interaction between infectious organisms and mammalian hosts, there are typically strong associations between a given host and a given pathogen species. When an organism invades a host to which it is not optimally adapted, it will usually not develop an endemic infection and rather will tend to occur in a sporadic and somewhat unusual pattern as compared with the disease in the more typical host. This appears to be a common phenomenon in llamas in North America. To date, there are no identified pathogens that are specifically adapted to llamas as a host species. That is to say, that if you scour the veterinary literature, you will find reports of llamas that have contracted viral and bacterial problems from horses, cattle, sheep and goats. But there are no reported incidences of diseases contracted by these other species specifically from contact with llamas. This may not be surprising given that llamas are not standard ruminants. While they possess a forestomach for fermentation of vegetative foodstuffs, they have evolved separate from the common hoof stock ruminants, which include our domestic and wild ruminant species in North America.

There are no guarantees and it would be inaccurate to suggest that llamas cannot spread disease. Certainly our understanding of animal diseases is being refined on an ongoing basis and new information will add to our understanding of llama diseases and their risk to other species. However, our current knowledge demonstrates that Johne's disease is uncommon in llamas and is likely contracted by llamas from contact with other species and is not an endemic llama problem. On this basis, it is inappropriate to view llamas as posing a substantial threat as a vector specifically for Johne's disease transmission to wildlife species.

As we stated in our letter to Mr. Dabney on February 16, we understand that there may be significant reasons to justify banning nonindigenous species from Canyon Lands Park and possibly other park systems based upon diseases, biological, behavioral and ecological arguments. It is scientifically unsound, however, to formulate a policy about llama use based specifically on a concern about Johne's disease spread by these animals.

We hope the information we have tried to clarify here is of some use in your discussions with the park service about policy. If we can be of further help in answering questions that may arise about Johne's disease, please feel free to contact us at any time.

Sincerely yours,

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FBG:rk

cc: Mr. Walter D. Dabney
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