October 6, 2015
Regular Meeting
Public Works
Dept. Report

Crowley Lake Ball Field Overflow Irrigation Project/New Trees


Public Works
Dept. Reports

October 6, 2015
Regular Meeting
Item #9b
Public Works

Long Term Planning for Conway Ranch

Tony Dublino

Environmental Services Manager

Mono County, California

May 28, 2015

Dear Tony,

Your e-mail dated May 20, 2015 regarding the involvement of the USFWS and CDFW in the monitoring of our domestic sheep and bighorn sheep while on the Mattley and in the Bodie Hills, was rather interesting, to the extent that they feel it necessary to be involved in County business. The Mattley and Conway are County property, but I am sure they have a vested interest, somehow. We have seen the result of their involvement on many occasions. In 2006, however, CDFW's , Tom Stevenson, got a little carried away with his agenda when he was caught collaring FIM's domestic sheep and harassing FIM's employees. The Sheriff had to be called to resolve the issue and the collars were removed. Things like this resulted in a loss of trust between the agency and FIM, and created a lot of hard feelings. Now it is starting all over again, only this time he is using YOU. His agenda has always been to remove all grazing from the area. In the spirit of co-operation and co-ordination we ask for a copy of any e-mails or letters from the two agencies in regards to this matter of monitoring us on the Mattley and in the Bodie Hills. We have always tried to do ALL that has been asked of us by the agencies, because we want to keep our family business for our children and grandchildren. As far as our grazing, being done in a "responsible" way, we have always tried to do just that. Our "BMP"s are probably more stringent than yours. We have "more" to lose. We also know what the USFWS and CDFW can do in the name of bighorn, because we have already lost 7 grazing allotments. I can guarantee you that they were not taken for "over grazing". Why would they want to monitor us on BLM land in Bodie? There are NO bighorn there. At least they have not be put there to our knowledge, yet. As for co-operation and co-ordination and open communication, we agree that there is a big need for it. You and Kris have built a good working relationship , and communication has been good. Kris is in communication with the sheep herders on a regular basis, and we feel that no matter what situation comes up, it will be handled quickly and in policy. If there is a problem or any issue that may come up, they WILL contact Kris and the ranch. They also know what to do in the event that they should encounter a bighorn. We also think that communication is important and as such will be done. We look forward to receiving the e-mails or letters that you received from the USFWS and CDFW regarding this issue. We are reviewing all our requirements of the BMP's and will refresh our herders accordingly. Thank you for your time and we look forward to your correspondence regarding this matter.

Sincerely yours,

June 4, 2015

Fred Fulstone's Comments

I don't think the USFWS and California Fish and Game should be monitoring our bands of sheep on private land and/or BLM lands. We have our men and guard dogs with our sheep on the ground 24/7. We have grazed our sheep in close proximity with the BHS for the last 30 years with no problems. The BLM is also monitoring our sheep on our allotments.

When the California Fish and Game first transferred BHS (big horned sheep) into the allotment next to us, they agreed to confine those sheep to their allotment, and would consider the program a failure if they wandered out. The BHS were in our allotment within 24 hours and the Fish and Game did nothing but tried to get our sheep off our allotment, which they finally did.

We found the Fish and Game harassing our herder and sheep. We finally called the sheriff to stop them. Stephenson apologized and said he would not do it again.

Fish and Game has plenty of work to take care and monitor their own sheep and not allow them to encroach onto our areas. That's the law, and guidelines. If one gets over the line they should capture the BHS and take it back to its herd. If managed correctly, these BHS would not leave their area. The BHS rams should be thinned because the big ones run off the small ones.

The Fish and Game was told by experts to put sensors up on their range so they could tell if one wandered off. Don't just try to put us out of business.

To finalize this, it has never been proven that diseases pass from domestic sheep to BHS on the open range. Stress caused by poor management causes BHS to die.

FRED FULSTONE, JR.
MARIANNE F. LEINASSAR
Phone: 775-465-2381
Fax: 775-465-1200

F.I.M., CORP.
Farming and Livestock

P.O. BOX 12
SMITH, NEVADA 89430

October 20, 2014

EMAIL TO: Mono County Board of Supervisors

re: Conway and Mattly Ranches: F.I.M. Corp Response to letter sent to Mr. Tony Dublino by Tom Stephenson, California Dept of Fish and Wildlife

Dear Sirs:

October 14, 2014 CDFW biologist Tom Stephenson sent to Mr. Tony Dublino a letter opposing sheep grazing and making other proposals concerning the pending Conservation Easement on the Conway and Mattly Ranches. Mr. Stephenson opposes sheep grazing based on his eagerness to claim that domestic sheep cause disease in bighorn sheep. That letter is a topic on the Board of Supervisors' meeting October 21, 2014.

Please remind Mr. Stephenson that Mono County has an established policy concerning Sierra Nevada Bighorn Sheep as specified in Resolution No. R07-81 *"A Resolution of the Mono County Board of Supervisors Regarding the Proposed Designation of Critical Habitat for the Sierra Nevada Bighorn Sheep by the U.S. Fish and Wildlife Service"*, and the Board will consider Mr. Stephenson's comments is so far as they are consistent with existing County policy. (See Attachment No. 1.)

Sierra Nevada Bighorn Sheep were transplanted into Lee Vining Canyon in 1986. F.I.M. Corporation sheep have grazed in close proximity to the SNBS since the 1986 release of the bighorns. The agency Biologists have been predicting that their SNBS would "catch" disease from our sheep, so they have watched the SNBS carefully for symptoms and tested them for pathogens. In these 28 years California Fish and Game (now California Dept. of Fish and Wildlife) has not documented any transfer of disease.

Please remember that there has been sheep grazing on Conway and Mattly Ranches since 1940, both before and after the bighorn sheep were transplanted to Mono County. Throughout the most recent 13 years we at F.I.M. Corporation have grazed within the Conway and Mattly Ranches as well as federal grazing areas to the west and no "disease transmission" has occurred.

The accusation of what the biologists call disease transmission is just supposition and false statements by people who claim to be scientists. Reputable Veterinarians who are also Epidemiologists have consistently stated that there is no record of the disease transmission in natural habitats. Mr. Stephenson claims that disease transmission is inevitable but the direct experience with bighorn sheep in Mono County indicates that there is no basis for Stephenson's fears.

Please consider the following comments by F.I.M. Corporation to Mr. Stephenson's letter and include our conclusions with any response by Mono County to CDFW:

CDFW first paragraph ends with a statement that "It is the goal and responsibility of CDFW to protect and maintain viable populations of fish and wildlife resources throughout the State."

CDFW has clearly failed to meet their goal of viable Sierra Nevada Bighorn Sheep in any location north of Mammoth Lakes. The reasons are well documented in that the area lacks dependable winter range so the animals are killed by severe winter weather and those not killed by the cold are killed by predators especially Mountain Lions. There is no record of domestic sheep causing disease in the bighorns but there are plenty of examples of bighorn sheep becoming weak due to the stress of being captured and transplanted by biologist and their weakened immune systems result in the bighorns dying from stress induced pneumonia brought on by pathogens already present in the respiratory systems of the bighorn sheep. No transfer of pathogens is necessary since the bighorns are already infected.

The presence of pathogens is well documented by CDFW Veterinarian Ben Gonzales and further discussed in Attachment 2 by Dr. Don Knowles and Dr. Anette Rink; in Attachment 3 by Dr. Glen Weiser, in Attachment 4 by the United States Animal Health Association report on wildlife and livestock disease interactions dated October 2007; and in Attachment 5, CAST Report: Pasteurellosis Transmission Risks between Domestic and Wild Sheep, August 2008. Each of these papers essentially state there is no proof of disease transmission from domestic sheep to bighorn sheep in natural habitats. Mr. Stephenson been provided with this information and chooses to ignore it in favor of boldly stating that domestic sheep pathogens always cause disease in bighorn sheep in paragraph 3.

First sentence third paragraph: Mr. Stephenson states that: "Contact between bighorn and domestic sheep typically causes fatal pneumonia in bighorn that can persist in populations for decades and cause large-scale population declines." He says this in spite of one of his cited experts, Dr. Bill Foreyt, having stated during a bighorn sheep symposium in Boise that he now defines "contact" between domestic sheep and bighorn sheep that is necessary for disease transmission as requiring at least "60 days in an enclosure". Furthert Dr. Foreyt stated "I don't know what happens under field conditions". Each of Stephenson's

statements are dramatic and intended to worry or scare the people who hear them but each of them are also false and no longer accepted by experts.

Mr. Stephenson even states that sheep grazing in Conway and Mattly Ranches are the highest risk of disease transmission to SNBS throughout the range of the species and the presence of domestic sheep will prevent him and his partners in the US Fish and Wildlife Service from delisting the SNBS under the Endangered Species Act. First the highest recorded risk of pneumonia in bighorn sheep has occurred as a result of the stress of biologists capturing and transplanting the animals. Biologists activities not only transplant bighorns but failure of adequate Veterinary supervision means that along with the transplanted animals all the disease pathogens and parasites are transplanted too. Careless transplanting protocols are dangerous and deadly to bighorns but there still is no proof of bighorn sheep die-offs being a result of contact with domestic sheep.

Delisting the bighorn sheep by the USFWS is promised when the numbers rise to a specified levels not when all the domestic sheep are sold by their owners. To date the SNBS in Mono County has failed to increase in accordance with normally expected biological increase. Most large mammal populations increase at a rate of about 20% per year. Based on an increase of 20% per year since 1986, the SNBS population in Lee Vining and Lundy Canyon areas should be over 2,000 bighorn sheep. As it is there are fewer bighorns alive in Mono County than the numbers that have been transplanted and released into the County. The CDFG and USFWS recovery plan and the CDFW management have failed.

The proposals for transplanting Sierra Nevada Bighorn Sheep into Mono County include a statement to the effect that if the animals fail to reproduce and thrive in Mono County the survivors will be captured and placed in suitable locations with dependable year round habitats. CDFW failure to produce a healthy population of bighorn sheep should mean it is time to rescue the surviving SNBS and move them to a safe location outside of Mono County.

Page 2 second paragraph describes two or possibly four bighorn rams that Mr. Stephenson believes were in the area near the Mattly Ranch. This is in direct contradiction with the testimony of Mr. Philip Partridge. Mr. Partridge was responsible for observing and recording the locations of SNBS during airplane overflights that included areas near both Lee Vining and Bridgeport. Mr. Partridge has provided an affidavit (Attachment 6to the effect that from 2001 to 2007 he did not observe or located a single SNBS in the Bodie Hills and Dog Creek areas.

Page 3, second paragraph, refers to grants received by the County to purchase the Conway and Mattly ranches. Please remind Mr. Stephenson that the purchase of these properties was primarily sought in order to prevent further real estate development of the area. In other words the purchase of the development rights was more important than the purchase of the land itself. With the retirement of development rights the remaining uses of the land and water rights

will be restricted to agriculture, recreation, and possibly aquaculture as spelled out in the restrictive covenants accepted at the time of purchase. The National Fish and Wildlife Foundation and the California State Parks should both be satisfied with this result.

Please see the F.I.M. Corporation comments concerning the proposed Conservation Easement for additional discussion of future management of the Conway Ranch and Mattly Ranch.

Thank you for your attention:

BY EMAIL:

/s/ Fred Fulstone
Fred Fulstone
F.I.M. Corporation
P.O.Box 12
Smith, NV 89430
(775)465-2381

/s/Marianne F. Leinassar
Marianne F. Leinassar
F.I.M. Corporation
P.O.Box 12
Smith, NV 89430
(775)465-2381

ATTACHMENT #1

RESOLUTION NO. R07 - 81

A RESOLUTION OF THE MONO COUNTY BOARD OF SUPERVISORS REGARDING THE PROPOSED DESIGNATION OF CRITICAL HABITAT FOR THE SIERRA NEVADA BIGHORN SHEEP BY THE U.S. FISH AND WILDLIFE SERVICE

WHEREAS, The Board of Supervisors supports the need to protect the Bighorn Sheep in the Eastern Sierra, and it believes that this need must be balanced with the needs of the people, and

WHEREAS, Tourism and agriculture are the two leading economic engines in Mono County and provide millions of dollars annually to our County's economy, and

WHEREAS, Recreational usage of public lands in Mono County, which comprise over ninety-five percent (95%) of the County's land base, includes back-country skiing, snowmobiling, hiking, and off-road vehicle travel, and

WHEREAS, The U.S. Assistant Secretary for Fish and Wildlife and Parks in correspondence to the Director of the U.S. Fish and Wildlife Service, dated April 28, 2004, stated, " 'critical habitat' is a legal and administrative exercise that adds very little additional conservation benefit to a listed species", and

WHEREAS, The U.S. Assistant Secretary for Fish and Wildlife and Parks in the aforementioned correspondence goes on to state, "critical habitat designations must not be based on speculation or determinations that lack supporting data. Working with landowners, local governments, states and tribes on a voluntary partnership basis often provides benefits superior to the designation of critical habitat ", and

WHEREAS, The Mono County Board of Supervisors heard testimony on September 4, 2007, from the California Department of Fish and Game regarding possible disease transmission from domestic sheep to bighorn sheep, which was contradicted by testimony from experts in the fields of veterinary medicine and range management, and

WHEREAS, Livestock grazing is the primary component of our agricultural economy in Mono County and provides critical health and stability of rangeland, fuels reduction, the addition of nutrients to the soil and the increase in certain crop production, such as alfalfa, and

WHEREAS, According to the Mono County Annual Crop Report, the economic value of the lamb harvest in Mono County has averaged over a million dollars annually over the last five years, and

WHEREAS, The Quarterly Report of the Sierra Nevada Bighorn Sheep Recovery Program (April – June, 2007) states that only thirty-two (32) Sierra Nevada bighorn sheep are present in the Mount Gibbs and Mount Warren Herd Units combined, and

WHEREAS, Less than one percent (1%) of the proposed critical habitat overlaps with land that is currently designated as federal grazing allotments in Mono County.

WHEREAS, There are unresolved issues regarding the scientific name of the Bighorn sheep found in the Eastern Sierras from Mammoth Lakes to the Bridgeport area, and

WHEREAS, These conflicting issues include scientific disagreements concerning the genetic makeup of various bighorn herds in the Eastern Sierras, and the best available scientific data has only recently become available,

NOW, THEREFORE, BE IT RESOLVED by the Mono County Board of Supervisors as follows:

SECTION ONE: That any change in taxonomy of bighorn sheep in Mono County must be based on a proper scientific approach, which cannot be accomplished through this current Federal Register regulatory process.

SECTION TWO: That all areas of the proposed designation of critical habitat for the Sierra Nevada bighorn sheep in Mono County which overlap with federal grazing allotment lands be removed from such designation.

SECTION THREE: That no restriction to public access or recreation be imposed on any of the lands in Mono County proposed for critical habitat for the Sierra Nevada bighorn sheep.

PASSED AND ADOPTED this 20th day of November, 2007, by the following vote:

AYES : Bauer, Farnetti, Hazard, Hunt, Reid
NOES : None.
ABSTAIN : None.
ABSENT : None.

ATTACHMENT #:

ATTEST:

Lynda Roberts
Clerk of the Board

Duane "Hap" Hazard

DUANE "HAP" HAZARD, Chair
Board of Supervisors

APPROVED AS TO FORM:

Marshall Rudolph

COUNTY COUNSEL by Lynda Roberts

Outline of Concerns relating to the perception of disease transmission issues at the Livestock/Wildlife interface in the Western United States

By Don Knowles, DVM, PhD and Anette Rink DVM, PhD.

Abstract:
The following document is a synopsis of opinions and data derived from the current literature addressing the risk domestic sheep represent concerning pneumonia of big horn sheep. The summary below acknowledges that domestic sheep have been shown, in some situations, including experimental mixing to share certain pathogens. What is not known is the true risk domestic sheep present to big horn sheep or the contributions of a multitude of other risk factors such as carrier big horns, other wildlife, other domestic animals and big horn sheep genetics, especially immunogenetics.

Introduction:
The issue is not whether the current literature provides data pointing to domestic sheep as one potential risk factor to big horn sheep under experimental conditions; the issue is that of the actual risk which domestic sheep present to big horn sheep under natural-range conditions. As is summarized below, *Pasteurella* spp. require physical contact for efficient transmission and the threshold (infectious dose and other factors) for transmission of Pasteurella under natural conditions of range are not known. Furthermore the risk of disease transmission from other animals such as wild cervids, bison, cattle, and other wildlife to big horn sheep health is present but not yet defined. Also, the contributions of big horn genetics in terms of their susceptibility to disease and or carrier status of pathogens are also not known. The current outcome of enforcing buffers between domestic and wild sheep populations is based on limited surveillance of a multitude of potential risk factors with the focus and current recommendations intended to minimize an unknown degree of risk presented by domestic sheep to bighorn sheep. These recommendations have not taken into account well-established knowledge concerning the need for extreme close contact between an infected and naïve animal for effective transmission of *Pasteurella* spp. under natural range conditions. Neither do they take into account the numerous management techniques which are applied by range sheep operations to prevent contact between domestic sheep and wildlife.

Historically there are numerous examples where conclusions, based on limited data and personal bias, have been drawn concerning causal infectious disease relationships. Decisions were made and press releases issued which had significant economic and/or emotional impact only to find years later that the information used to make these decisions was incomplete and the conclusions reached did not hold up to the test of time and research. Examples include:

- the conclusion that scrapie was the cause of BSE;
- canine distemper virus was the cause of multiple sclerosis;

- domestic sheep were the source of scabies (mites) in big horn die-offs, and
- adenovirus was the primary cause of deaths in Arabian foals.

All attempts to reproduce BSE in cattle with scrapie from domestic sheep have failed; canine distemper virus and the measles virus of humans are closely related and able to induce cross reactive antibodies (which led to the initial conclusion and confusion), however careful molecular studies have shown the presence of measles virus components in patients with multiple sclerosis, but components of canine distemper virus have not been found; attempts to transmit scabies (*Psoroptes* spp.) mites among different species have failed to show domestic sheep were the source for big horn sheep, and the true underlying cause of the susceptibility of Arabian foals to adenovirus was shown to be a genetic deficiency in immune response. Analysis of each of these examples show historical economic and/or emotional loss and pain which could have been avoided by careful examination of the basic principles of causation in infectious diseases and transmission.

The literature (some peer reviewed and some not) regarding management concerns of big horn sheep populations in the Western United States is voluminous. There are many opinions as to the cause(s) of the inability of big horn sheep to thrive in some locations. Whether a group or individual believes that domestic sheep are part of the decline experienced by some big horn sheep populations or not, a survey of the literature allows one to find a statement or statements in support of their bias. There is general agreement as summarized by the Desert Bighorn Council that the difficulties big horn sheep apparently face in enhancing their populations fall into the following areas. (1) Comparatively lower tolerance to poor range conditions; (2) Interspecific competition (competition between two or more species for limited resources); (3) Excessive hunting; (4) loss of habitat, and (5) enhanced susceptibility to diseases, especially pneumonia, relative to domestic sheep and to other wildlife species in the Bovidae family.

There is no disagreement that infectious causes of pneumonia, in particular bacteria such as *Pasteurella haemolytica* (recently renamed to *Mannheimia haemolytica*) and other bacteria such as *Pasteurella multocida* and *Pasteurella trehalosi* are isolated from diseased big horn sheep. Recent discussions call into question the frequency or epidemiological importance of *Mannheimia haemolytica*. Often left out of the discussions is that these bacteria don't form spores and are extremely labile (easily broken down or rendered non-infectious) in the environment and therefore require close contact both in terms of distance and time for transmission. In fact in Foreyt, et. al. the authors state "*Pasteurella haemolytica* is a relatively labile bacterium and generally requires direct physical contact between animals for transmission".

- ❖ While it is known that this bacterium and some related strains can be isolated from domestic sheep, the role of the domestic sheep, if any, under natural range conditions in the transmission of these bacteria to big horn sheep is not known. The importance of this point can not be over emphasized. Important to this point as quoted in references by Martin and Ward "Evaluation of samples from Idaho and Alaska bighorn sheep has conclusively demonstrated that free roaming

bighorn sheep which have not had contact with domestic sheep are not free of *P. Haemolytica*". To date only one report has been published which found that BHS and domestic sheep shared the same *Pasteurella* isolates (Ward et al., 1997), all animals sampled in this study were healthy. In the Hell's Canyon BHS disease outbreak in 1995-6 a domestic goat was initially implicated because she shared a *Pasteurella* isolate with several BHS. This die-off involved BHS herds in 3 states and a variety of different Pasteurella were subsequently isolated, none corresponding to the very localized, goat associated Pasteurella strain. Not one single report from any disease investigation has established a direct link to domestic sheep as the origin of the pathogen, be that viral, bacterial or parasitic.

- Secondly, and of equal importance the possibility of other animal sources, including big horn sheep, of these bacteria or other infectious diseases for transmission to big horn sheep under natural range conditions is also not known. Research published by D. K. Onderka and colleagues in 1988 within the Canadian Journal of Veterinary Research shows this point clearly. Bighorn sheep were inoculated with *Pasteurella haemolytica* unique to wild bighorns, with *Pasteurella haemolytica* isolated from clinically normal domestic sheep or with *P. haemolytica* through a cattle vaccine. All three inoculations caused bronchopneumonia within the bighorn sheep; even the cattle vaccine.

Summary:

In summary it is premature and inappropriate based upon the complete body of literature and current research investigations to allow domestic sheep to be the focus as a major cause of Big Horn disease and herd decline. Critical to the point are the other parameters found in multiple documents which indicate that there are bighorn sheep die-offs due to pneumonia that have occurred without any association with domestic sheep (quoted in Martin et. al.) and other factors with potential involvement are the presence of bacteria such as *P. haemolytica* and *P. multocida*, types indigenous to bighorn sheep, the presence of stress from sources such as depleted forage or human disturbance, the presence of lungworms, and the presence of viruses. Several BHS population management practices should also come under review; 1) the practice of transferring animals from one herd to another without a complete diagnostic work-up, 2) including a genetic profile of the transplants; 3) the occurrence of BHS disease and major die-offs are often associated with BHS herds reaching peak population (Monello et al., 2001). 4) Stagnant BHS populations in the presence of other 'protected' or 'desirable' wildlife such as wolves or mountain lions. All of these factors affect BHS populations permanently, not just temporarily, like domestic sheep in an adjacent allotment. It is time to allow research to continue and to remove domestic sheep from the focus of bighorn sheep health issues and to make land use decisions based on what is really known under natural conditions and not what is believed to be true.

References:

Apple, M. J., Glickman, L. T., Raine, C. S., and Tourtellotte, W. W. (1981) Canine viruses and multiple sclerosis. Neurology. 8:944-949.

Boyce, W., Elliott, L., Clark, R., and Jessup, D. (1990) Morphometric analysis of Psoroptes spp. mites from bighorn sheep, mule deer, cattle, and rabbits. J. Parasitol. 6:823-828.

Cosby, S. L., McQuaid, S., Taylor, M. J., Bailey, M, Rima, B. K., Martin, S. J., and Allen I. V. (1989) Examination of eight cases of multiple sclerosis and 56 neurological and non-neurological controls for genomic sequences of measles virus, canine distemper virus, simian virus 5 and rubella virus. J. Gen. Virol. 8:2027-2036.

Cutlip, R. C., Miller, J. M., and Lehmkuhl, H. D. (1997) Second passage of a US scrapie agent in cattle. J. Comp. Pathol. 3:271-275.

Cutlip, R. C., Miller, J. M., Hamir, A. N., Peters, J., Robinson, M. M., Jenny, A. L., Lehmkuhl, H. D., Taylor, W. D., and Bisplinghoff, F. D., Resistance of cattle to scrapie by the oral route. (2001) 2:131-132.

Desert Bighorn Council. (1990) guidelines for management of domestic sheep in the vicinity of desert bighorn habitat. Desert Bighorn Council 1990 Transactions 34:33-35.
Foreyt, W. J., Snipes, K. P., and Kasten, R. W. (1994) Fatal pneumonia following inoculation of health bighorn sheep with Pasteurella Haemolytica from healthy domestic sheep. J. Wildlife Dis.2:137-145

Lange, R. E., Sandoval, A. V. and Meleney, W. P. (1980) Psoroptic scabis in bighorn sheep (Ovis Canadensis Mexicana) in New Mexico. J. Wildlife Dis. 16:77-81.

McChesney A. E., England, J. J., Whiteman, C. E., Adcock, J. L., rich, L. J., and Chow, T. L. (1974) experimental transmission of equine adenovirus in Arabian and non-Arabian foals Am. J. Vet. Res. 8:1015-1023.

Martin, K. D., Schommer, T., and Coggines, V. L. (1996) Literature review regarding the compatibility between bighorn and domestic sheep. Bienn. Symp. North. Wild Sheep and Goat Counc. 10:72-77.

McGuire, T. C., Poppie, M. J., and Banks, K. L., (1974) Combined (B- and T-lymphocyte) immunodeficiency: a fatal genetic disease in Arabian foals. J. Am. Vet. Med. Assoc. 1:70-76.

Monello, Murray, Cassierer (2001). Ecological correlates of pneumonia epizootics in bighorn sheep herds. *Can. J. Zool.*, 79: 1423-1432.

Onderka, D. K., Rawluk, S. A., and Wishar, W. D., (1988) Susceptibility of Rocky Mountain Bighorn Sheep and domestic sheep to pneumonia induced by bighorn and domestic livestock strains of *Pasteurella haemolytica*. Can. J. Vet. Res. 52:439-444.

Ward, A. C. S., M. R. Dunbar, D. L., Hunter, R. H Hillman, M. S. Bulgin, W. J. Delong and E. R. Silva (1990) Pasteurellaceae from bighorn and domestic sheep. Bienn. Symp. North Wild Sheep and Goat Council 7:109-117.

Ward, A. C., Hunter, D. L., Jaworski, M. D., Benolkin, P. J., Dobel, M. P., Jeffress, J. B. and Tanner, G. A., (1997) *Pasteurella* spp. in sympatric bighorn and domestic sheep. J. Wildlife Dis. 3:544-557

Wright, F. C., Guillot, F. S. and Meleney, W. P. (1981) Transmission of Psoroptic mites from Bighorn sheep (Ovis Canadensis Mexicana) to domestic sheep, cattle, and rabbits. J. Wildlife Dis. 17:381-386.

Attch. #3

July 12, 2006

To: Pattie Soucek
Forest Planner
Payette National Forest
P.O. Box 1026
McCall, ID 83638

From: Glen C. Weiser, Ph.D.
Research Scientist
University of Idaho, Caine Veterinary Teaching and Research Center
1020 E. Homedale Rd.
Caldwell, ID 83607

Re: Risk Analysis of Disease Transmission Between Domestic Sheep and Bighorn Sheep on the Payette National Forest (2006).

I have been asked to review and comment on the scientific accuracy of the above referenced document.

SECTION A
OVERVIEW:
Bacteria in the family Pasteurellaceae, mainly the genera *Pasteurella*, and/or *Mannheimia*, have been found in every bighorn sheep herd tested by the Caine Veterinary Teaching Center. This includes hundreds of herds from at least 13 western US states, and Alberta and British Columbia, Canada, from 1988 to present. These organisms have been found in herds regardless of no, known, or suspected contact with domestic sheep.

The potential for transmission of bacterial pathogens or other organisms or viruses between domestic and bighorn sheep is certainly recognized. However, confirmed, large-scale die offs of free-ranging bighorn resulting from contact with livestock have not actually been documented. Documented deaths have only occurred following bighorn exposure to domestics in confined or controlled environments.

Ward et al., 1997 tested one hundred-twenty bacterial isolates from bighorn sheep in four Nevada ranges where domestic sheep had been sighted various times over a four-year period. They demonstrated sharing of only one bacterial strain (*Pasteurella haemolytica* biotype 3 biogroup 11) between the bighorn and domestic sheep. The direction of transmission, i.e. from domestic to bighorn sheep or vice versa, was not verifiable within the constraints of the study. Respiratory disease was not observed in any of these bighorn populations. Changes in populations of bighorn sheep were not found to be correlated to the presence of any one strain of bacteria.

A study in the Hells Canyon National Recreation Area indicated possible transmission of *Pasteurella* spp. bacteria from feral goats to bighorn sheep (Rudolph et. al., 2003). The exact direction of the transmission, i.e. from goat to bighorn or vice versa, could not be determined conclusively, but the general conclusion was the former. The shared bacteria studied included strains of *Pasteurella haemolytica* biovariants 1 and U^{β}, and *Pasteurella multocida multocida a.* Another study of *Pasteurella multocida mult. a, mult b, mult. gallicida, and biotype P. mult.* U^{6} from the same area and group of animals confirmed sharing of some strains of *P. m. mult. a* (Weiser et al., 2003). However, it is essential to note that in both studies the shared forms were found only in a small number of bighorns in immediate proximity to the goats. No evidence was found to implicate these organisms in the entire die off from which other *Pasteurella* spp. were isolated. See section D for complete citations.

The above information has been summarized from refereed journal articles, citations below. The Risk Analysis document, however, relies heavily on non-refereed sources and misinterprets much of the information. I have gone back to several references cited in the Risk Analysis and have noted significant discrepancies.

SECTION B
SOME SPECIFIC POINTS:

1. Page 2, 2nd paragraph states: "The combined effects of overharvest, habitat loss, competition for forage caused by livestock overgrazing, and diseases transmitted by domestic livestock resulted in precipitous declines in abundance and distribution of bighorn sheep during the late 1800s and early 1900s."

This is a broad generalization not fully supported by statements made in the Goodson paper, which is cited as a reference to the statement. The Goodson paper is also not peer reviewed. For example, scabies is mentioned as a disease that may have been transferred from domestic to wild sheep, but Goodson states in his paper the experimental evidence is "inconclusive." Goodson also states that uncontrolled hunting for sport and market, encroaching civilization with its associated roads, fences and settlements were factors. Goodson also states that "Changes in public and private land management have provided examples of the reduction, removal and introduction of domestic sheep on bighorn ranges and the responses of bighorn herds. Goodson further states: **"These were not experiments, however, and it is important to note that other variables were not controlled."** (direct quote from Goodson, emphasis added)

With regard to pasteurellosis, Goodson relies heavily on a paper published by Foryet and Jessup, (1982). This reference cites two case histories where domestic sheep were introduced into enclosed areas where bighorn had been placed. No experimental evidence was presented to show that pasteurellosis was transmitted, and Goodson acknowledges this fact by identifying the evidence as "circumstantial."

Goodson concludes with the statement that "Declines and die-offs have occurred in bighorn populations without any known association with domestic sheep" and discusses the bighorn's lack of tolerance to poor range conditions and competition with other wild species. Goodson recommends that domestic sheep be excluded from bighorn range "if enhancement of bighorn status is a management goal." I interpret this statement as one

made as an insurance policy, as Goodson doesn't present any strong scientific support of his recommendation.

The other reference (Valdez and Kraussman, 1999) used to support the original statement is unavailable to this reader, although it too appears to be in a non peer-reviewed publication.

The last paragraph on page 2 contains at least two misleading assumptions.

First, Smith (1954, page 21) is cited in support of bighorn declines coinciding with the introduction of domestic sheep to the range. A plain reading of Smith (1954, page 21) shows that scabies was considered to be the main cause of decline, and competition with domestic livestock for forage and space was also involved. No mention of respiratory disease was made, probably because it was never noted.

Further, on page 53 of Smith (1954), in a section entitled "Inter-relationships with other species" a situation is described where a bighorn ram grazed and was corralled with a band of 60 domestic sheep for 10 days. The ram went back to the woods, appearing very restless, on the tenth day. But, no mention of any signs of respiratory disease was made.

This paragraph concludes with a citation to Toweill and Geist (1999) This concluding sentence is misleading, because while Toweill and Geist (pages 84-85) indicate that disease was a cause of bighorn declines, no specific cause, e.g. contact with domestic sheep, respiratory disease, etc., is mentioned.

2. On page 3, last sentence of paragraph 1, the statement is made that "Because they are so closely related, bighorn sheep are thought to be highly susceptible to diseases carried by domestic sheep."

This may be a thought, but it is not supported by any scientific reference. An equally interesting thought might be that if the two species are so closely related, the bighorn should be able to adapt readily to the pathogens that domestic sheep have been able to live with without disease development. However, this statement is preceded by a comment, unsupported by scientific reference, indicating that "Domestic sheep, an Old World species, has likely evolved resistances to important diseases as a result of domestication and intense artificial selection."

To find support for this statement, I conducted a PubMed (the National Institutes of Health scientific publication service) search of the refereed scientific literature using the key words "sheep pneumonia *Pasteurella*." There were 136 journal articles in the PubMed database, 21 dealing with bighorn sheep, leaving 115 dealing with domestic sheep pneumonia *Pasteurella*. Fifty-eight (50%) of these 115 journal articles were published from 1990 to present. Therefore, respiratory disease in domestic sheep has apparently not demonstrated many resistances or the need for these scientific studies would not exist.

I found the first full paragraph on page 5 to be extremely interesting. The statement "Schommer and Woolever (2001) presented guidelines for and examples of management solutions to domestic sheep/bighorn sheep conflicts." I looked up the Schommer and Woolever reference, and while disappointed that it was not a refereed

report of research, the first sentence of the Introduction was exciting. It stated, "Scientific research has proven that when bighorn sheep intermingle with domestic sheep, large numbers of bighorn sheep die (Ashmanskas, 1995)."

Finally, I thought there was the experimental data to support this idea of definite transmission of disease from domestic sheep to bighorn sheep under range conditions. Unfortunately, the Ashmanskas 1995 reference is a Summary Judgment from the United States District Court in Portland, Oregon, Judge Donald Ashmanskas presiding, and not a journal article. This document was requested from the Court, and we were told that it had been archived and will not be available to us until after the comment period deadline. Therefore, this portion of my review will be supplemented when this document is received.

SECTION C
CONCLUSION:

The Payette National Forest Risk Analysis is an interesting essay on numerous aspects of bighorn sheep biology laden with misinformation. It attempts to convey the dangers of commingling domestic sheep and bighorn sheep under any conditions.

After careful scrutiny of this document and its references, I was not able to find one scientifically verifiable instance in which domestic sheep were found to be responsible for a pneumonia outbreak in bighorn sheep under range conditions. The Payette National Forest Risk Analysis seems, for the most part, to rely heavily on conjecture, theory and supposition.

The potential transmission of bacterial pathogens from domestic sheep to bighorn sheep, resulting in bighorn pneumonia, certainly exists and has been empirically determined under non-range, confined conditions. However, large-scale pneumonia episodes have not been shown experimentally under range conditions. No doubt, the reason for this lack of this data is that the risk of large-scale transmission is low. If the risks were high, more definitive examples, rather that circumstantial ones, would be available and scientific data generated from these situations would be available.

SECTION C
REFERENCES FOR SECTION A:

Rudolph, K. M., D. L. Hunter, W. J. Foreyt, E. F. Cassirer, R. B. Rimler, and A. C. S. Ward. 2003. Sharing of *Pasteurella* spp. between free-ranging bighorn sheep and feral goats. Journal of Wildlife Diseases 39:897-903.

Ward, A. C. S., D. L. Hunter, M. D. Jawarski, P. J. Benolkin, M. P. Dobel, J. B. Jeffress, and G. A. Tanner. 1997. *Pasteurella* spp. in sympatric bighorn and domestic sheep. Journal of Wildlife Diseases 33:544-557.

Weiser, G. C., W. J. DeLong, J. L. Paz, B. Shafii, W. J. Price, and A. C. S. Ward. 2003. Characterization of *Pasteurella multocida* associated with pneumonia in bighorn sheep. Journal of Wildlife Diseases 39:536-544.

Attch. #4

UNITED STATES ANIMAL HEALTH ASSOCIATION – 2007

RESOLUTION NUMBER: **15 Combined with 64** **APPROVED**

SOURCE: COMMITTEE ON WILDLIFE DISEASES

COMMITTEE ON SHEEP AND GOATS

SUBJECT MATTER: COOPERATIVE RESEARCH AND MANAGEMENT OF WILDLIFE/LIVESTOCK DISEASE INTERACTIONS

DATES: RENO, NEVADA, OCTOBER 18 – 24, 2007

BACKGROUND INFORMATION:

The significance of diseases involving wildlife and livestock has increased opportunities for conflict between natural resource and livestock interests. The concerns are valid for the potential for disease transmission in either direction between wildlife and livestock. Domestic and wild species frequently share the same habitat and may share several pathogens. This interface creates many complex problems. Unfortunately, these problems are not always easily solved scientifically and so remedy is sought through political and/or legal channels.

Agriculture and wildlife interests share common risks and threats such as foreign animal disease introduction, loss of land/habitat to urban sprawl and land developments. It is imperative that we work together to preserve our common interests. Working together will require extensive cooperation, coordination, communication, and collaboration between several agencies and interest groups. It will also require respect for the responsibilities, authorities, skills, and livelihoods of all partners, and will help to develop trust.

Of immediate concern is domestic sheep/bighorn sheep (*Ovis canadensis* spp.) disease interactions. Bighorn sheep are currently at just 1-2% of their historical numbers with the majority of them inhabiting public lands in the western United States (US) managed by federal and state agencies. In recent years, some but not all bighorn sheep die-offs and declines have been temporally and spatially associated with domestic sheep contact. The complete range of mechanisms/causal agents that lead to epizootic disease events are not fully understood. Separation of wild and domestic sheep has been practiced to reduce the potential for additional bighorn sheep die-offs. Consequently, bighorn/domestic sheep disease interactions and their management impact the domestic sheep industry as well as bighorn sheep conservation.

The United States Animal Health Association (USAHA) Committees on Wildlife Diseases and Sheep and Goats are establishing a working group comprised of representatives of

state and federal animal health agencies, wildlife and public land managements, the American Sheep Industry and Foundation for North American Wild Sheep (FNAWS) to develop best management practices for raising domestic sheep (and goats) on public lands where contact between domestic sheep and bighorn sheep may occur.

RESOLUTION:

The United States Animal Health Association (USAHA) urges the United States Secretary of Agriculture and the United States Secretary of the Interior to seek resources through the President's budget to fund research to better elucidate the epidemiology and pathogenesis of bighorn/domestic sheep disease interactions so informed and effective management decisions can be made.

ATTACHMENT #5

CAST Commentary
QTA2008-1 August 2008

CAST
The Science Source for Food, Agricultural, and Environmental Issues

Pasteurellosis Transmission Risks between Domestic and Wild Sheep

Authors:

Michael W. Miller (Chair)
Colorado Division of Wildlife
Wildlife Research Center
Fort Collins, Colorado

Donald P. Knowles
Animal Disease Research Unit
USDA–ARS
Department of Veterinary Microbiology and Pathology
Washington State University
Pullman

Marie S. Bulgin
Caine Veterinary Teaching and Research Center
University of Idaho
Caldwell

Reviewers:

Billy R. Clay
Adjunct Professor
Oklahoma State University
Stillwater

Walter E. Cook
Wyoming State Veterinarian
Cheyenne

Subramaniam Srikumaran
College of Veterinary Medicine
Washington State University
Pullman

CAST Liaisons:

A. David Scarfe
American Veterinary Medical Association
Schaumburg, Illinois

Dale Layfield
Department of Biological Sciences
Clemson University
South Carolina

Introduction

Disease has contributed significantly to the decline of bighorn sheep (*Ovis canadensis*) populations throughout much of western North America, decreasing many native herds to less than 10% of their historical size and imperiling some populations and subspecies.

Disease has contributed significantly to the decline of bighorn sheep (*Ovis canadensis*) populations throughout much of western North America, decreasing many native herds to less than 10% of their historical size and imperiling some populations and subspecies (Valdez and Krausman 1999). According to historical accounts (e.g., Grinnell 1928; Honess and Frost 1942; Shillinger 1937; Warren 1910), epidemics in some locations coincided with the advent of domestic livestock grazing in bighorn ranges, suggesting that novel pathogens may have been introduced into some bighorn populations beginning in the 1800s.

Native North American wild sheep species—bighorn sheep and thinhorn (Dall's and Stone's) sheep (*O. dalli*)—are very susceptible to pneumonia and particularly to pasteurellosis (Miller 2001). The generic term "pasteurellosis" is used here for disease (often respiratory) caused by bacteria in the family *Pasteurellaceae* but now classified in the genera *Pasteurella*, *Mannheimia*, or *Bibersteinia*. In some recent pneumonia epidemics in bighorns, the cause has been attributed to endemic respiratory pathogens or strains of *Pasteurellaceae* (Rudolph et al. 2007), and in other epidemics the cause has been attributed to *Pasteurellaceae* strains or other pathogens introduced via interactions with domestic sheep (*O. aires*; George et al. 2008). This Commentary reviews current knowledge on pneumonic pasteurellosis in domestic and wild sheep, the risks of transmission between these species, and approaches for lowering the overall risk of epidemics in wild sheep.

This material is based upon work supported by the United States Department of Agriculture under Grant No. 2007-31100-06019/ISU Project No. 413-40-02 and Grant No. 2008-38902-19327. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture or Iowa State University.

Pneumonic Pasteurellosis in Domestic Sheep

Respiratory disease is a serious problem in domestic sheep that can result in substantial economic losses. Pneumonia in domestic sheep is more common in lambs than in adults, and affected animals often die if not treated.

Pasteurellosis in domestic sheep often is described as a disease complex (Alley, Ionas, and Clarke 1999; Donachie 2007; Gilmour and Gilmour 1989) and generally is thought to result from invasion of the lung by *Pasteurellaceae* following a compromise of the respiratory tract. The initiating insult can be from respiratory infection by mildly pathogenic agents such as parainfluenza-3 (PI-3) virus, adenoviruses, respiratory syncytial viruses (RSV), *Chlamydia pecorumi*, and *Mycoplasma ovipneumoniae*, as well as from mechanical irritants such as dust (Alley, Ionas, and Clarke 1999; Brogden, Lehmkuhl, and Cutlip 1998; Donachie 2007) and lungworms. In most instances, these insults alone do not result in significant epidemics with high morbidity or mortality; however, when these and other stressors are compounded by infection with *Pasteurellaceae*, the result can be increased disease and death.

Pasteurellosis in domestic sheep generally is thought to result from invasion of the lung by *Pasteurellaceae* following a compromise of the respiratory tract.

The effects of psychological, physiological, and physical environmental stressors are believed to be important components of pasteurellosis in many domestic ruminants (Brogden, Lehmkuhl, and Cutlip 1998; Carroll and Forsberg 2007; Donachie 2007; Gilmour and Gilmour 1989). Although the effects of stressors are difficult to measure, some indicators including increased body temperature, heart rate, and plasma cortisol have been correlated with disease (Carroll and Forsberg 2007; Knowles et al. 1995). Physiological response to stressors (collectively called "stress") includes suppression of the immune system; consequently, prolonged stress may increase susceptibility to pathogens and to morbidity and mortality. Environmental stressors most commonly associated with pasteurellosis in livestock include heat, cold, wind chill, crowding, mixing with new animals, poor ventilation, handling, and transport (Brogden, Lehmkuhl, and Cutlip 1998; Carroll and Forsberg 2007; Knowles et al. 1995). Other predisposing factors, such as lack of sufficient energy or protein, inadequate colostrum consumption, specific vitamins, or certain minerals, also may compromise immunity further (Carroll and Forsberg 2007).

The effects of psychological, physiological, and physical environmental stressors are believed to be important components of pasteurellosis in many domestic ruminants.

Pasteurella multocida, *Mannheimia haemolytica*, and *Bibersteinia trehalosi* (all formerly in the genus *Pasteurella*) are the three most commonly isolated bacterial agents from pneumonias that result in high rates of illness, morbidity, and mortality in domestic sheep (Brogden, Lehmkuhl, and Cutlip 1998; Donachie 2007; Gilmour and Gilmour 1989). Early treatment with antibiotics effective against *Pasteurellaceae* generally stops a pneumonia outbreak, suggesting that these bacteria are important in the disease process. *Pasteurellaceae* are common inhabitants of the tonsils and oropharynx of a variety of healthy domestic and wild species (Gilmour, Thompson, and Fraser 1974; Jaworski, Hunter, and Ward 1998). In domestic sheep, *Pasteurellaceae* are believed to be opportunistic bacteria that colonize the lung after some predisposing insult (Brogden, Lehmkuhl, and Cutlip 1998). Some *Pasteurellaceae* strains make products (including leukotoxin and endotoxin) that exacerbate disease in the host after colonization of lung tissue (Ackermann and Brogden 2000; Gilmour and Gilmour 1989) and result in increased morbidity and mortality.

Early treatment with antibiotics effective against *Pasteurellaceae* generally stops a pneumonia outbreak, suggesting that these bacteria are important in the disease process.

The diversity of commensal and disease-associated *Pasteurellaceae* further complicates the epidemiology and control of pasteurellosis. Serotyping and phenotyping based on variations in fermentation patterns (Angen et al. 1999; Frank 1982; Jaworski, Hunter, and Ward 1998) and gene sequencing (Angen et al. 1999; Jaworski et al. 1993;

The diversity of commensal and disease-associated *Pasteurellaceae* further complicates the epidemiology and control of pasteurellosis.

Kelley et al. 2007) have been used to distinguish among *Pasteurellaceae* strains. Studies using these approaches have shown that domestic sheep may carry numerous strains of *Pasteurellaceae* (Jaworski, Hunter, and Ward 1998; Ward et al. 1997).

Most *Pasteurellaceae* of sheep are obligate bacteria that die rapidly in the environment outside a living host (Dixon et al. 2002). Environmental sources such as water and soil are not thought to be important in maintaining or spreading these bacteria; consequently, transmission is most likely to occur through direct contact among animals. Because many healthy domestic sheep carry strains associated with disease (Jaworski, Hunter, and Ward 1998), transmission of a specific pathogenic *Pasteurellaceae* strain may not be necessary for a disease outbreak to occur. In some instances, however, mixing individuals from different sources and possibly carrying different strains of *Pasteurellaceae* seems to precipitate outbreaks (Gilmour and Gilmour 1989).

As in domestic sheep, *Pasteurellaceae* commonly are associated with pneumonia epidemics in bighorn sheep, and pasteurellosis frequently results in both all-age die-offs and persistent high rates of pneumonia in lambs.

Pasteurellosis in Wild Sheep

As in domestic sheep, *Pasteurellaceae* commonly are associated with pneumonia epidemics in bighorn sheep (Miller 2001), and pasteurellosis frequently results in both all-age die-offs and persistent high rates of pneumonia in lambs (Cassirer and Sinclair 2007; Monello, Murray, and Cassirer 2001). Thinhorn sheep also are susceptible to pneumonia (Black et al. 1988; Foreyt, Silflow, and Lagerquist 1996; Jenkins et al. 2007), but epidemics have not been reported in free-ranging populations.

Pasteurellaceae alone seem to have a more severe effect on wild sheep than on domestic sheep in experimental situations. Wild sheep experience high morbidity and mortality after being intratracheally or intradermally inoculated with relatively high doses (10^4 organisms) of field strains or attenuated strains of *M. haemolytica* from domestic sheep or cattle (*Bos taurus*), or with *B. trehalosi* strains originating from other wild sheep (Foreyt, Silflow, and Lagerquist 1996; Foreyt, Snipes, and Kasten 1994; Onderka, Rawluk, and Wishart 1988). The resulting pathology from experimental inoculations of wild sheep varied among strains used, but all strains caused some form of pneumonia. The observed differences in susceptibility to experimental and natural pasteurellosis between domestic and wild sheep are thought to result from differences in pulmonary host defense mechanisms and greater vulnerability of phagocytes to leukotoxin that apparently increase overall susceptibility to pasteurellosis (Foreyt, Silflow, and Lagerquist 1996; Silflow, Foreyt, and Leid 1993; Silflow et al. 1989).

The observed differences in susceptibility to experimental and natural pasteurellosis between domestic and wild sheep are thought to result from differences in pulmonary host defense mechanisms and greater vulnerability of phagocytes to leukotoxin that apparently increase overall susceptibility to pasteurellosis.

Pasteurellaceae have been isolated from both healthy and pneumonic wild sheep (Jaworski, Hunter, and Ward 1998; Jenkins et al. 2007; Kelley et al. 2007; Rudolph et al. 2007). Although field investigations often are complicated by delays in detecting cases and by sample availability, two broad epidemic patterns in bighorns have emerged. In some bighorn epidemics, endemic respiratory pathogens including *Pasteurellaceae*, PI-3, RSV, and *M. ovipneumoniae*, as well as lungworms (*Protostrongylus* spp.), with or without other environmental stressors, are believed to have contributed to disease (Rudolph et al. 2007; Spraker et al. 1986). These outbreaks resemble the patterns described in some pasteurellosis epidemics in feedlot lambs (Gilmour and Gilmour 1989). Other epidemics, however, are believed to have been initiated by introductions of novel respiratory pathogens into bighorn populations (Foreyt and Jessup 1982; George et al. 2008). These patterns resemble some pasteurellosis epidemics reported in domestic sheep, particularly feedlot lambs, after transportation and mixing of different groups in confinement settings (Gilmour and Gilmour 1989). Thus, both endemic and introduced pathogens are believed to contribute to contemporary pasteurellosis epidemics in bighorn sheep.

Both endemic and introduced pathogens are believed to contribute to contemporary pasteurellosis epidemics in bighorn sheep.

Based on evidence from empirical studies and field observations, interactions between wild sheep and domestic sheep increase the probability of mortality and reduced lamb survival in wild sheep populations, primarily because of respiratory disease.

Pneumonia in wild sheep developed after contact with domestic sheep in captive conditions.

Quantifying the risk of interspecies disease transmission between wild sheep and domestic sheep in a natural setting is problematic.

Further work is needed to understand better the magnitude of potential risk to wild sheep arising from interactions with domestic goats, cattle, and other wild ruminant species, as well as potential influences of seasonal and environmental factors on these risks.

The most practical approaches identified thus far for minimizing risk involve preventing interspecies interactions that could result in respiratory pathogen transmission.

Risks to Wild Sheep Associated with Domestic Sheep Interactions

Based on evidence from empirical studies and field observations, interactions between wild sheep and domestic sheep increase the probability of mortality and reduced lamb survival in wild sheep populations, primarily because of respiratory disease (USDA–FS 2006). Interactions between wild sheep and domestic goats (*Capra hircus*), although not as widely reported, seem to pose comparable risks (Garde et al. 2005; Jansen et al. 2006). Similarities in social behavior and physiology between wild and domestic sheep (and, to a lesser extent, goats) probably create a natural attraction that fosters intimate contact between these species.

Pneumonia in wild sheep developed after contact with domestic sheep in captive conditions (Black et al. 1988; Callan et al. 1991; Foreyt 1989; Onderka and Wishart 1988). Moreover, relationships between the onset of some pneumonia epidemics in wild sheep and the concurrent presence of domestic sheep on bighorn ranges have been described (George et al. 2008; Monello, Murray, and Cassirer 2001). Whether introduced *Pasteurellaceae* strains, introduced virulence factors, or other introduced pathogens contribute to precipitating these epidemics remains unclear (Besser et al. 2008; George et al. 2008; Kelley et al. 2007).

Quantifying the risk of interspecies disease transmission between wild sheep and domestic sheep in a natural setting is problematic. Movements of wild sheep may influence the potential for pathogen introductions and transmission from domestic to wild sheep, as may the proximity, duration, movements, management, seasonality, reproductive status, and straying rates of domestic sheep grazing in occupied wild sheep habitats. The increased risk of a pneumonia epidemic in a wild sheep population associated with domestic sheep interaction seems to be the product of the probabilities of multiple events, namely: interactions of sufficient duration and proximity to transmit one or more pathogens; pathogen shedding by the domestic sheep; the ability to transmit an infectious dose to one or more wild sheep; the survival of newly infected wild sheep; and, further shedding and secondary transmission. Seasonal or environmental factors also may somehow modulate the probability of epidemics occurring (Cassirer and Sinclair 2007; George et al. 2008), and the risk attributable to interactions between these species probably is additive and may vary widely among wild sheep populations. Indeed, a common *Pasteurellaceae* strain or other agent directly linking bighorn epidemics to either domestic sheep interactions or to emergence of endemic pathogens has not been demonstrated to date, and thus unequivocal evidence for either process remains elusive. Consequently, the magnitude of such risks may be assessed best on a case-by-case basis (Clifford et al. 2007; Garde et al. 2005). Further work is needed to understand better the magnitude of potential risk to wild sheep arising from interactions with domestic goats, cattle, and other wild ruminant species, as well as potential influences of seasonal and environmental factors on these risks.

Strategies for Minimizing Risk of Interspecies Disease Transmission and Managing Wild Sheep Health

Available data suggest that interactions between wild and domestic sheep carry some inherent risk of precipitating pneumonia in wild sheep under range conditions (USDA–FS 2006). Given the limitations of today's tools, the most practical approaches identified thus far for minimizing this risk involve simply preventing interspecies interactions that could result in respiratory pathogen transmission between wild and domestic sheep (WAFWA 2007). Incomplete knowledge about the epidemiology and some details

of processes contributing to the risk of interspecies disease transmission, however, remains an obstacle to consensus on acceptable and "best" management approaches.

To achieve "effective separation" (i.e., separation sufficient to minimize opportunities for pathogen transmission [WAFWA 2007]), herdsmen and wildlife managers can actively discourage wild sheep from approaching or commingling with domestic sheep, and vice versa. Domestic sheep should be monitored closely and herded to prevent straying and should not be left unattended in wild sheep habitats. In some instances, truck transport may be the best means for moving domestic sheep through critical wild sheep habitats. Similarly, wild sheep that have contacted domestic sheep should not be left to commingle with other wild sheep. On common public lands, land management agencies, wildlife agencies, and domestic sheep producers with grazing leases should develop and agree on plans for handling interactions between the species, with emphasis on preventing interactions that could result in respiratory pathogen transmission between domestic and wild sheep. Ideally, similar plans also should be established between private landowners and wildlife managers where wild sheep may stray onto private land.

To achieve "effective separation" (i.e., separation sufficient to minimize opportunities for pathogen transmission), herdsmen and wildlife managers can actively discourage wild sheep from approaching or commingling with domestic sheep, and vice versa.

The risk of interspecies pathogen transmission may be decreased further by ensuring that domestic sheep grazing in wild sheep habitats are healthy and by removing ill sheep of either species. As vaccines and therapeutics for the prevention and control of infection or disease caused by *Pasteurellaceae* in domestic or wild sheep become available, producers and wildlife managers should seek practical ways to use them. In some instances where these approaches are not effective, one species or the other may need to be given management priority in, or excluded from, a particular range (WAFWA 2007). Although seemingly simple, the latter approach has several potential consequences, including lack of rangeland available to one or the other species, economic impacts, and limitations on restoration efforts.

The risk of interspecies pathogen transmission may be decreased further by ensuring that domestic sheep grazing in wild sheep habitats are healthy and by removing ill sheep of either species.

Not all pasteurellosis epidemics in bighorn sheep can be attributed to contact with domestic sheep (USDA–FS 2006). Because some potentially pathogenic *Pasteurellaceae* and other pathogens are endemic in some wild sheep populations, wildlife managers should examine the implications of interactions between different herds of wild sheep. In doing so, the benefits of outbreeding and genetic diversity must be weighed against the increased risk of disease transmission (WAFWA 2007). In certain instances, wild sheep may need to be maintained at herd densities that minimize dispersal to help lower the risk of pathogen spread.

Not all pasteurellosis epidemics in bighorn sheep can be attributed to contact with domestic sheep.

Augmenting wild sheep herds with individuals from other herds also poses a risk for moving pathogens. Consequently, wildlife managers should recognize the potential for moving pathogens via translocations and should monitor wild sheep herds routinely for pathogens of concern, using only healthy herds as source stock. Protocols for sampling, testing for transplant, and responding to disease outbreaks should be standardized to the extent possible and reviewed and updated as necessary. Moreover, data should be shared and interagency and interdisciplinary communications should be encouraged to develop better strategies for improving overall herd health.

Wildlife managers should recognize the potential for moving pathogens via translocations and should monitor wild sheep herds routinely for pathogens of concern, using only healthy herds as source stock.

Research Needs

Current understanding about causative agents and the factors allowing these agents to lead to pasteurellosis epidemics in wild sheep is incomplete. Previous work, however, provides some clarity for future research directions. Further study of mechanisms underlying the increased susceptibility of wild sheep to respiratory diseases, as compared with domestic sheep and cattle, could aid in developing and refining approaches for improving

and maintaining herd health. For developing better disease prevention and control strategies, more information is needed concerning host genetics and immune responses, virulence mechanisms, pathogen transmission dynamics, and the epidemiology of the diseases. The full influence and potential for control or mitigation of other factors such as environmental stressors and nutrition, which seem important in pasteurellosis epidemics in domestic ruminants, also need to be understood better for wild sheep.

Developing methods that decrease the occurrence or severity of pneumonia and pasteurellosis in either domestic or wild sheep might lead to advances in managing all impacted species.

Developing methods that decrease the occurrence or severity of pneumonia and pasteurellosis in either domestic or wild sheep, including the development and use of vaccines, immunostimulants, or long-acting therapeutic agents, might lead to advances in managing all impacted species. Outcomes of such research could help decrease risks posed by interspecies interactions, or decrease wild sheep susceptibility to pathogens. In developing biologic and therapeutic agents as tools, the research should focus not only on safety and efficacy of the products, but also on the potential for practical use in free-ranging populations.

A broad approach to population health management currently may be the most practical way to decrease the overall likelihood of epidemics in wild sheep populations. Such an approach includes, but does not rely solely on, practices that prevent interactions between wild and domestic sheep that could result in respiratory pathogen transmission.

Conclusions

Although the authors acknowledge that the current understanding about pasteurellosis in wild and domestic sheep is incomplete, respiratory disease clearly is a serious problem in both. Because the onset of some pneumonia epidemics in bighorn sheep has been associated with the presence of domestic sheep on native range, and because other outbreaks seem to have resulted from pathogens already endemic in affected wild sheep herds, accurately quantifying the risk of interspecies disease transmission in range conditions is problematic. Consequently, a broad approach to population health management currently may be the most practical way to decrease the overall likelihood of epidemics in wild sheep populations. Such an approach includes, but does not rely solely on, practices that prevent interactions between wild and domestic sheep that could result in respiratory pathogen transmission. Preventing contact between wild and domestic sheep, better monitoring of exchanges and interactions between wild sheep populations, and managing population and habitat quality all have some value in improving and maintaining the overall health of wild sheep populations and preventing pneumonia epidemics. Ongoing and planned research also is likely to provide a better understanding and new tools that may further improve approaches for wild and domestic sheep health management on native ranges.

Literature Cited

Ackermann, M. R. and K. A. Brogden. 2000. Response of the ruminant respiratory tract to *Mannheimia (Pasteurella) haemolytica*. *Micro Infect* 2:1079–1088.

Alley, M. R., G. Ionas, and J. K. Clarke. 1999. Chronic non-progressive pneumonia of sheep in New Zealand—A review of the role of *Mycoplasma ovipneumoniae*. *NZ Vet J* 47:155–160.

Angen, Ø., M. Quirie, W. Donachie, and M. Bisgaard. 1999. Investigations on the species specificity of *Mannheimia (Pasteurella) haemolytica* serotyping. *Vet Microbiol* 65:283–290.

Besser, T. E., K. A. Potter, E. F. Cassirer, J. VanderSchalie, A. Fischer, D. P. Knowles, D. R. Herndon, F. R. Rurangirwa, G. C. Weiser, and S. Srikumaran. 2008. Association of *Mycoplasma ovipneumoniae* infection with population-limiting respiratory disease in free-ranging Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*). *J Clin Microbiol* 46:423–430.

Black, S. R., J. K. Barker, K. G. Mehren, G. J. Crawshaw, S. Rosendal, L. Ruhnke, J. Thorsen, and P. S. Camran. 1988. An epizootic of Mycoplasma ovipneumoniae infection in captive Dall's sheep (*Ovis dalli dalli*). *J Wildl Dis* 24:627–635.

Brogden, K. A., H. D. Lehmkuhl, and R. C. Cutlip. 1998. *Pasteurella haemolytica* complicated respiratory infections in sheep and goats. *Vet Res* 29:233–254.

Callan, R. J., T. D. Bunch, G. W. Workman, and R. E. Mock. 1991. Development of pneumonia in desert bighorn sheep after exposure to a flock of exotic domestic sheep. *J Am Vet Med Assoc* 198:1052–1056.

Carroll, J. A. and N. E. Forsberg. 2007. Influence of stress and nutrition on cattle immunity. *Vet Clin Food Anim* 23:105–149.

Cassirer, E. F. and A. R. E. Sinclair. 2007. Dynamics of pneumonia in bighorn sheep metapopulations. *J Wildl Manage* 71:1080–1088.

Clifford, D. L., B. A. Schumaker, T. R. Stephenson, V. C. Bleich, M. Leonard-Cahn, B. J. Gonzales, W. M. Boyce, and J. A. K. Mazet. 2007. *Modeling Risks of Disease Transmission from Domestic Sheep to Bighorn Sheep: Implications for the Persistence and Restoration of an Endangered Endemic Ungulate.* University of California-Davis Wildlife Health Center, Department of Fish and Game Resource Assessment Program Final Report. 47 pp.

Dixon, D. M., K. M Rudolph, M. L. Kinsel, L. M. Cowan, D. L. Hunter, and A. C. S. Ward. 2002. Viability of airborne *Pasteurella* spp. *Biennial Symposium Northern Wild Sheep and Goat Council* 13:6–13.

Donachie, W. 2007. Pasteurellosis. Pp. 224–235. In I. D. Aitken (ed.). *Diseases of Sheep.* 4th ed. Blackwell Publishing, Oxford, U.K.

Foreyt, W. J. 1989. Fatal *Pasteurella haemolytica* pneumonia in bighorn sheep after direct contact with clinically normal domestic sheep. *Am J Vet Res* 50:341–344.

Foreyt, W. J. and D. A. Jessup. 1982. Fatal pneumonia of bighorn sheep following association with domestic sheep. *J Wildl Dis* 18:163–168.

Foreyt, W. J., R. M. Silflow, and J. E. Lagerquist. 1996. Susceptibility of Dall sheep (*Ovis dalli dalli*) to pneumonia caused by *Pasteurella haemolytica. J Wildl Dis* 32:586–593.

Foreyt, W. J., K. P. Snipes, and R. W. Kasten. 1994. Fatal pneumonia following inoculation of healthy bighorn sheep with *Pasteurella haemolytica* from healthy domestic sheep. *J Wildl Dis* 30:137–145.

Frank, G. H. 1982. Serotypes of *Pasteurella haemolytica* in sheep in Midwestern United States. *Am J Vet Res* 43:2035–2037.

Garde, E., S. Kutz, H. Schwantje, A. Veitch, E. Jenkins, and B. Elkin. 2005. *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.* The Northwest Territories Agricultural and Policy Framework and Environment and Natural Resources Government of the Northwest Territories, Canada. 139 pp.

George, J. L., D. J. Martin, P. M. Lukacs, and M. W. Miller. 2008. Epidemic pasteurellosis in a bighorn sheep population coinciding with the appearance of a domestic sheep. *J Wildl Dis* 44:388–403.

Gilmour, N. J. L. and J. S. Gilmour. 1989. Pasteurellosis of sheep. Pp. 223–254. In C. Adlam and J. M. Rutter (eds.). *Pasteurella and Pasteurellosis.* Academic Press, London.

Gilmour, N. J. L., D. A. Thompson, and J. Fraser. 1974. The recovery of *Pasteurella haemolytica* from the tonsil of adult sheep. *Res Vet Sci* 17:413–414.

Grinnell, G. B. 1928. Mountain sheep. *J Mammal* 9:1–9.

Honess, R. F. and N. M. Frost. 1942. *A Wyoming Bighorn-Sheep Study.* Wyoming Game and Fish Department Bulletin No. 1, Cheyenne. 127 pp.

Jansen, B. D., J. R. Heffelfinger, T. R. Noon, P. R. Krausman, and J. C. deVos, Jr. 2006. Infectious keratoconjunctivitis in bighorn sheep, Silver Bell Mountains, Arizona, USA. *J Wildl Dis* 42:407–411.

Jaworski, M. D., D. L. Hunter, and A. C. S. Ward. 1998. Biovariants of isolates of *Pasteurella* from domestic and wild ruminants. *J Vet Diagn Invest* 10:49–55.

Jaworski, M. D., A. C. S. Ward, D. L. Hunter, and I. V. Wesley. 1993. Use of DNA analysis of *Pasteurella haemolytica* biotype T isolates to monitor transmission in bighorn sheep (*Ovis canadensis canadensis*). *J Clin Microbiol* 31:831–835.

Jenkins, E. J., A. M. Veitch, S. J. Kutz, T. K. Bollinger, J. M. Chirino-Trejo, B. T. Elkin, K. H. West, E. P. Hoberg, and L. Polley. 2007. Protostrongylid parasites and pneumonia in captive and wild thinhorn sheep (*Ovis dalli*). *J Wildl Dis* 43:189–205.

Kelley, S. T., E. F. Cassirer, G. C. Weiser, and S. Safaee. 2007. Phylogenetic diversity of Pasteurellaceae and horizontal gene transfer of leukotoxin in wild and domestic sheep. *Infect, Gen, Evol* 7:13–23.

Knowles, T. G, S. N. Brown, P. D. Warriss, A. J. Phillips, S. K. Dolan, P. Hunt, J. E. Ford, J. E. Edwards, and P. E. Watkins. 1995. Effects on sheep of transport by road for up to 24 hours. *Vet Rec* 136:431–438.

Miller, M. W. 2001. Pasteurellosis. Pp. 330–339. In E. S. Williams and I. K. Barker (eds.). *Infectious Diseases of Wild Mammals,* 3rd ed. Iowa State University Press, Ames.

Monello, R. J., D. L. Murray, and E. F. Cassirer. 2001. Ecological correlates of pneumonia epizootics in bighorn sheep herds. *Can J Zool* 79:1423–1432.

Onderka, D. K. and W. D. Wishart. 1988. Experimental contact transmission of *Pasteurella haemolytica* from clinically normal domestic sheep causing pneumonia in Rocky Mountain bighorn sheep. *J Wildl Dis* 24:663–667.

Onderka, D. K., S. A. Rawluk, and W. D. Wishart. 1988. Susceptibility of Rocky Mountain bighorn sheep and domestic sheep to pneumonia induced by bighorn and domestic livestock strains of *Pasteurella haemolytica. Can J Vet Res* 52:439–444.

Rudolph, K. M., D. L. Hunter, R. B. Rimler, E. F. Cassirer, W. J. Foreyt, W. J. DeLong, G. C. Weiser, and A. C. S. Ward. 2007. Microorganisms associated with a pneumonic epizootic in Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*). *J Zoo Wildl Med* 38:548–558.

Shillinger, J. E. 1937. Disease relationship of domestic stock and wildlife. Pp. 298–302. In *Transactions of the Second North American Wildlife Conference*. American Wildlife Institute, Washington, D.C.

Silflow, R. M., W. J. Foreyt, and R. W. Leid. 1993. *Pasteurella haemolytica* cytotoxin-dependent killing of neutrophils from bighorn and domestic sheep. *J Wildl Dis* 29:30–35.

Silflow, R. M., W. J. Foreyt, S. M. Taylor, W. W. Laegried, H. D. Liggitt, and R. W. Leid. 1989. Comparison of pulmonary defense mechanisms in Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) and domestic sheep. *J Wildl Dis* 25:514–520.

Spraker, T. R., J. K. Collins, W. J. Adrian, and J. H. Olterman. 1986. Isolation and serologic evidence of a respiratory syncytial virus in bighorn sheep from Colorado. *J Wildl Dis* 22:416–418.

U.S. Department of Agriculture–Forest Service (USDA–FS). 2006. *Summary of the Science Panel Discussion on Disease Transmission between Domestic Sheep and Bighorn Sheep on the Payette National Forest*. Boise, Idaho. 24 pp., http://www.fs.fed.us/r4/payette/publications/index.shtml (30 June 2008)

Valdez, R. and P. R. Krausman. 1999. Description, distribution, and abundance of mountain sheep in North America. Pp. 3–22. In R. Valdez and P. R. Krausman (eds.). *Mountain Sheep of North America*. University of Arizona Press, Tucson.

Ward, A. C. S., D. L. Hunter, M. B. Jaworski, P. J. Benolkin, M. P. Dobel, J. B. Jeffress, and G. A. Tanner. 1997. *Pasteurella* spp. in sympatric bighorn and domestic sheep. *J Wildl Dis* 33:544–557.

Warren, E. R. 1910. The mountain sheep. Pp. 9–12. In *The Mammals of Colorado: An Account of the Several Species Found within the Boundaries of the State, Together with a Record of Their Habits and of Their Distribution*. G. P. Putnam's Sons, The Knickerbocker Press, New York and London.

Western Association of Fish and Wildlife Agencies (WAFWA). 2007. Wild Sheep Working Group, Initial Subcommittee. *Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat*, June 21, 2007. 27 pp., http://www.mwvcrc.org/bighorn/wafwawild-sheepreport.pdf (30 June 2008)

Citation:

Council for Agricultural Science and Technology (CAST). 2008. *Pasteurellosis Transmission Risks between Domestic and Wild Sheep*. CAST Commentary QTA2008-1. CAST, Ames, Iowa.

#6

FRED FULSTONE, JR.
MARIANNE F. LEINASSAR
Phone: 775-465-2381
Fax: 775-465-1200

F.I.M., CORP.
Farming and Livestock

P.O. BOX 12
SMITH, NEVADA 89430

-7

May 29, 2009

Affidavit

I, Pep ~~Partrich~~ PanTridge, do here by swear, that in the seven years, from 2001 to 2007, in which I had been contracted by the California Department of Fish and Game to observe and verify Sierra Nevada Bighorn Sheep locations in the Northern Recovery Unit of the greater SNBS Recovery Area, I have never observed or located, via in-flight telemetry with coordinates or visually, a single Sierra Nevada Bighorn Sheep in the Bodie Hills and Dog Creek areas (Please see enclosed map). Locations of SNBS were collected and recorded by the use of in-flight telemetry and coordinates and the verified. I have never registered a single signal, or "ping" from a collar on our telemetry receivers in the Bodie Hills and Dog Creek areas while attempting to locate SNBS during my seven year contract with the CDFG.

P Shelp E PanTridge — 06/09/09
Pep ~~Partrich~~ PanTridge — Date
401 Sky Rock Drive
Bishop, CA 93514

nancy PanTridge — 6/9/9
Whiteness #1 Signature — Date

Name: Nancy Pantridge
Address: 401 Skyrock Drive
Bishop, Ca 93514

#7

FIM Corporation statement of Sierra Nevada Bighorn Sheep management failures October 20, 2014

Mono County is in the unique position to provide CDFW and USFWS with the factual information that forms the County policy. Since our the County completed Resolution No. R07-81, F.I.M. and a number of highly qualified experts in Epidemiology, Microbiology, and Veterinary Sciences have more clearly explained the deficiencies, errors, and even fabrications that are found within decisions regarding SNBS and provided those statements to the US Forest Service. Our statements are provided here for the use and reference of Mono County:

(1) There is no scientific record of disease transmission from domestic sheep to bighorn sheep in natural habitats, yet disease transmission is used by the agency biologists to urgently "prevent contact" between the species;

(2) Actions to prevent contact between the bighorn sheep and domestic sheep are regulations that are vigorously enforced to solve a problem that does not exist (disease transmission);

(3) Actions to completely prevent contact between bighorn sheep and domestic sheep are a waste of Taxpayers' money, destructive to both F.I.M. business interests and the local economy, and will not result in more bighorn sheep;

(4) All of the area from Mammoth Lakes to Sonora Pass is too high in elevation to provide year-round habitat for bighorn sheep – there is no dependable winter habitat;

(5) Because there is no dependable winter habitat, no location within this area constitutes "suitable habitat". This was recently documented with veterinary diagnosis of bighorn sheep dying from malnutrition (starving to death) in an area labeled as "suitable habitat" in the winter of 2008;

(6) Agencies including US Fish and Wildlife Service (USF&WS) are fully aware of the 2008 winterkill as well as winter die-offs in 1995, 1998, and 2005, but neither agency has altered their position that the Northern Recovery Unit is suitable for SNBS. Because of winter weather, the Northern Recovery Area or Unit is clearly hostile and dangerous for bighorn sheep;

(7) Agencies have certified that something called "suitable habitat" for Sierra Nevada Bighorn Sheep (SNBS) exists within the Bridgeport Ranger District but fails to provide technically sound objective measures of habitat attributes that prove that suitable habitat does exist.

(8) Allegations that "suitable" habitat occurs within the Mono County are false. Each agency has been provided with information that would justify removing the Northern Recovery Area from the Recovery Plan on the basis that it is not suitable habitat for these bighorn sheep. Based on scientific information, Mono County now is in a position to tell the USF&WS that the Recovery Plan goals for the Northern Recovery Area are not attainable;

(9) Bighorn sheep in the area north of Mammoth Lakes are indistinguishable from Nelson's bighorn sheep (aka Desert bighorn sheep) based on nuclear DNA analysis;

(10)The best available scientific data proves that the bighorn sheep in the vicinity of our grazing allotments and leases are Desert bighorn sheep that do not warrant Endangered Species Act protection and the HTNF failed to insist that the US Fish and Wildlife Service agree with that science;

(11)FIM Corporation and others have provided an abundance of scientific information to the agencies, all of which is backed up and well documented. Much of the information and data provided demonstrates that the USF&WS Recovery Plan is based on faulty information and subsequently the regulatory decisions by the HTNF are in error. The HTNF has failed to question the veracity of the USF&WS statements;

(12)When the agencies simply ignore scientifically sound reference material it is, at best, ignoring the specific requirements of the Endangered Species Act (ESA) that require every federal agency to use the best scientific data available;

(13)There are very few surviving SNBS in the Northern Recovery Unit, less than 4% of the 400-600 total numbers reside north of Mammoth Lakes. Loss of any or all of these animals would not jeopardize the continued existence of the species. HTNF has placed very excessive value on this population and failed to adhere to the ESA requirement that actions that will jeopardize the continued existence of the species (all of the animals) are prohibited -- any other level of effect can be managed through the incidental take provisions.

(14)See the current USFWS direction for jeopardy in the Memorandum to the Director of the USFWS from the USFWS Solicitor dated March 16, 2007 with subject of "*The Meaning of 'In Danger of Extinction Throughout All or a Significant Portion of its Range*." File code M-37013. USFWS is in violation of this ESA policy and has put the HTNF in jeopardy of violating this policy too.

(15)The agencies are failing to follow the standards of the Forest Service and BLM for objective decision making that includes determination of the credibility of reference material used to support regulatory decisions, regardless of whether the authors are University professors, state agency employees, or other federal agencies such as the USF&WS:

(16)The federal employees have every appearance of violation of 5 CFG 2635 "Standards of Ethical Conduct for employees of the Executive Branch" as well as related Presidential Executive Orders, regulations, and laws. HTNF personnel have failed to perform their jobs with objectivity and impartiality and they have violated the standards that prohibit waste, fraud, and abuse by choosing to ignore scientifically sound and factual information;

(17)The failure to correct erroneous biological data that now limits management decisions is an immoral and unethical way to conduct Forest Service business.

(18)Agencies have failed to follow the mandate to "Contribute to the economic and social well being of people by providing opportunities for economic diversity and by promoting stability for communities that depend on range resources for their livelihood."

(19)Federal and State failed to coordinate their decision with Mono County in accordance with the policy of Mono County.

(20)Federal agencies have failed to complete NEPA and has failed to account for detrimental economic effects in accordance with various federal court decisions, one of which is the 2001 Court of Appeals decision New Mexico Cattle Growers Assoc v US Fish and Wildlife Service. Federal agencies are now

required to complete NEPA including genuine analysis of economic affects for any ESA related actions except for the original listing and the HTNF has failed to modify its actions based on the combined detrimental economic effects and limited or no benefits to a listed species.

(21)Mono County now has been given compelling factual information by F.I.M. Corp and a number of highly qualified experts in Epidemiology, Microbiology, and Veterinary Sciences. Those credible experts clearly explained the deficiencies, errors, and even fabrications that are found within the agency reference materials. CDFW failed to validate or otherwise determine the credibility of the information they cited.

Disease transmission has been accepted as a fact by theCDFW and the CDFW is in error:

Dr. Anette Rink has explained, beginning June 2004, that there are a multitude of strains *Pasteurella sp.* and *Mannheimia sp.* (both referred to as *Pasteurella* below), the bacteria that causes pneumonia in domestic sheep and wild sheep. Specific bacteria must be identified by use of sophisticated microbiological techniques including DNA analysis in order to know if domestic sheep and bighorn sheep carry the same bacteria. It is well known that most mammals have these pathogens in their respiratory tract but they do not become diseased until some stress event weakens the animals immune response. The available information indicates that it is possible for domestic sheep and nearby wild sheep to both exhibit symptoms of respiratory disease (pneumonia), but the respective animals are infected with a taxonomically distinct pathogen.

California Department of Fish and Game Veterinarian Dr. Ben Gonzales reported in 2005 that samples (swabs) from every SNBS that the CDFG has captured, is cultured for respiratory bacteria and *Pasteurella* has been present in every single bighorn. Those animals only had contact with other bighorn sheep or other wildlife which means the source of infection was from wild animals not domestic animals.

Mono County Agritourism

Potential Sites

- Mono County
- Hunewill Guest Ranch
- Conway Ranch
- DeChambeau Ranch
- The Goat Ranch
- Banner Springs Ranch
- Simis Ranch
- Mono Lake Produce
- John Mattly Ranch
- Cain Ranch
- June Lake Brewing
- Mammoth Lakes Brewing
- Sierra Bounty
- Arcularius Ranch
- Lee Vining Community Garden
- Crowley Lake Community Garden
- Mammoth Farmers Market
- Jake Mattly Ranch

Historical and Current Farm and Ranches in Mono County

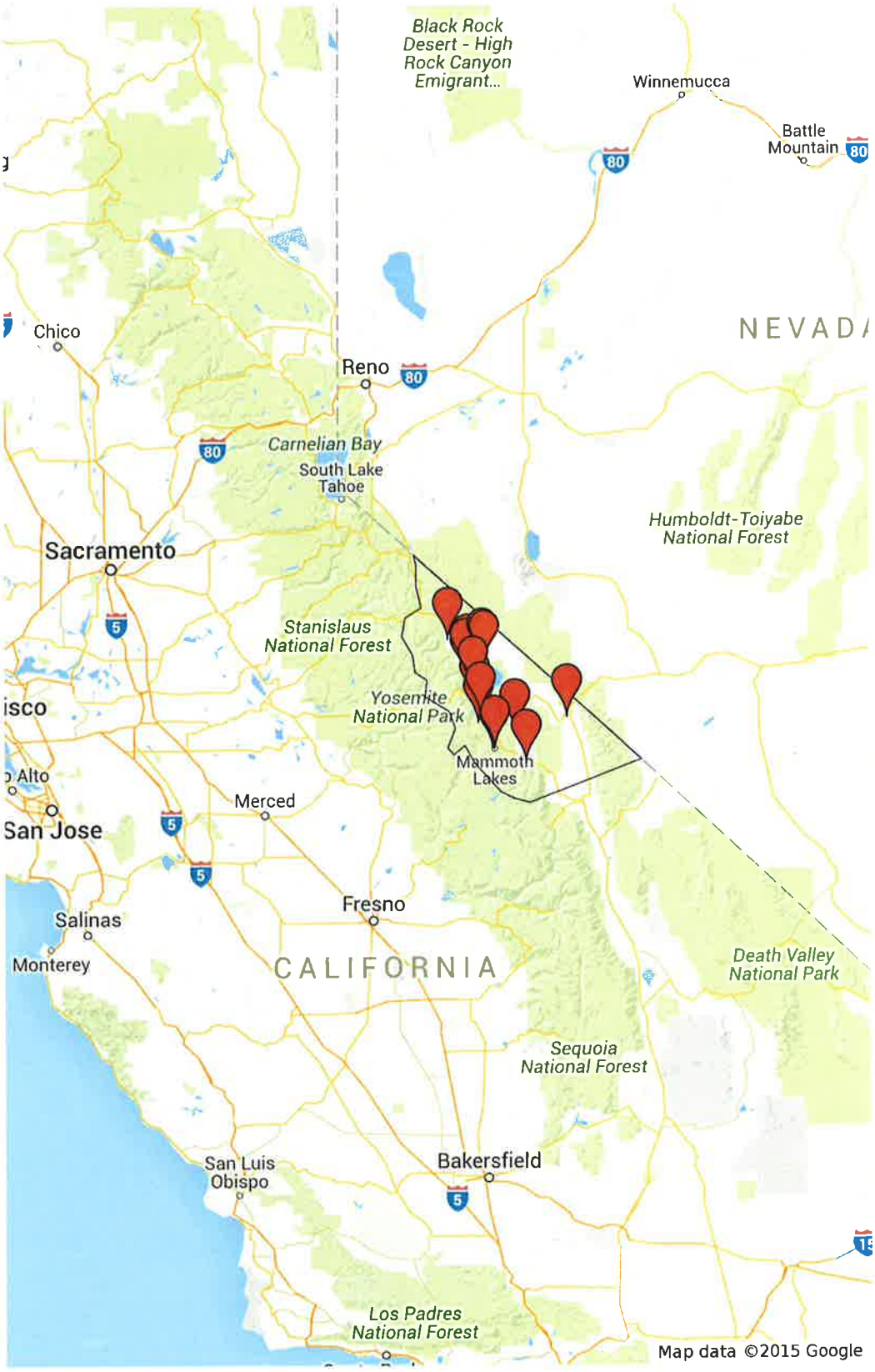


Table 2. The Percent of Farm Operations Engaged in Listed Agritourism Activities

Agritourism Activity							
Year-round activities	Percent participation	Dining and accommodation	Percent participation	Seasonal activities	Percent participation	U-pick	Percent participation
Dairy, milking, cheese-making	4	Bed & breakfast	6	Christmas tree stand or U-pick	28	Berries	24
Guide services (hunting, fishing, rafting, etc.)	4	Guest house, cabin rental	10	Cider press	14	Flowers	22
Historic farm demonstrations	13	Restaurant	8	Corn/hay maze	17	Other fruits	24
Horse rentals, rides, or lessons	10	RV park	1	Egg hunt	4	Vegetables	18
Onsite hunting, fishing	8	Special dining events	24	Pumpkin patch	29		
Performances	19	Working farm, ranch vacations	8	Roadside stand	45		
Petting zoo	17						
Ranch or farm tours	54						
Sheep (goat, alpaca) spinning, shearing, etc.	4						
Wagon, hay rides	25						
Weddings and special events	34						
Wine tours, tasting	27						

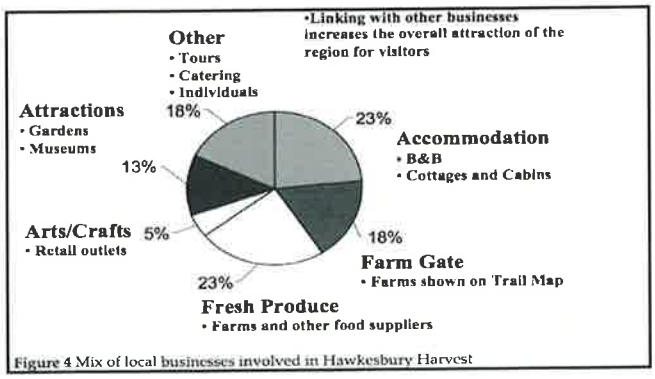
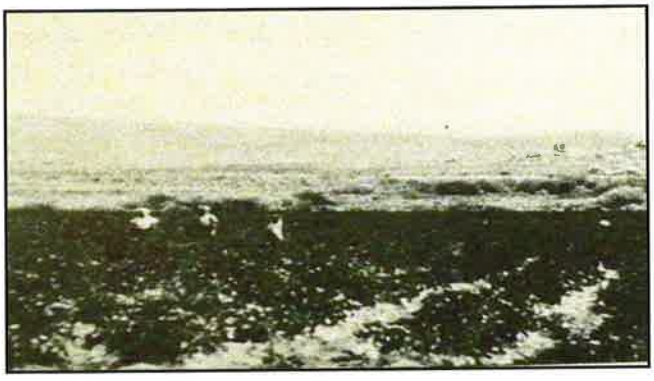
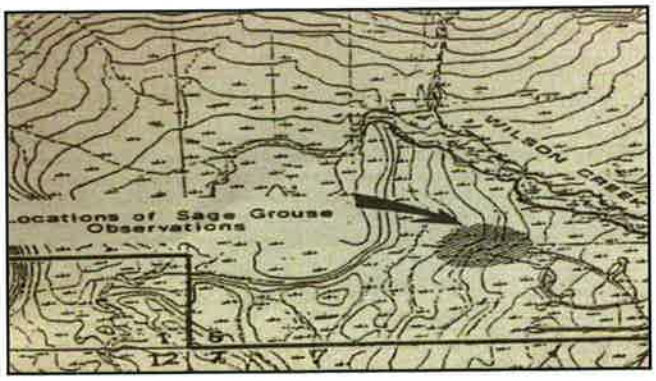


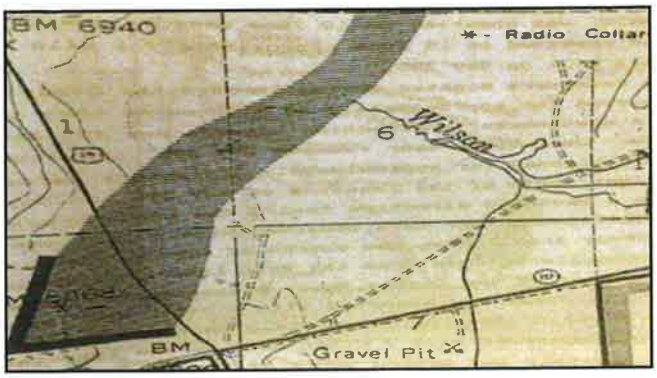
Figure 4 Mix of local businesses involved in Hawkesbury Harvest

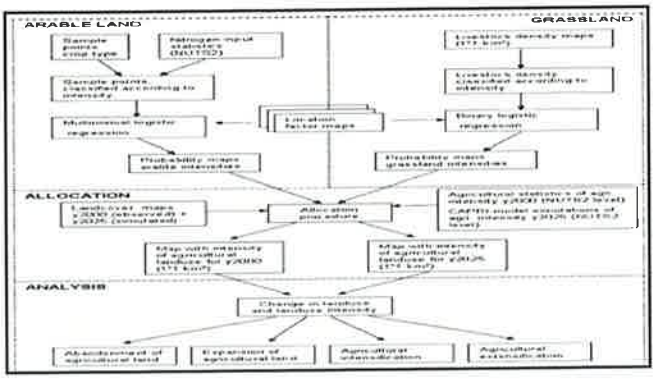
Table 2
The objectives and characteristics of policies A and B

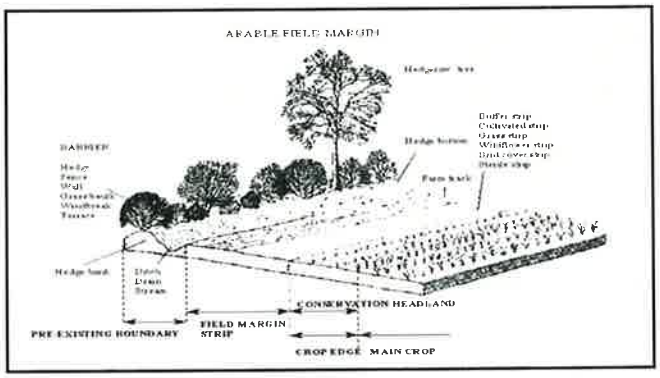
Policy	A (the current agritourism policy)	B (the alternative policy proposed.)
Objectives	Agritourism development is based on rural environment combination with agricultural production, farm activities, and special culture of agricultural village to provide tourists and recreation opportunity to all citizens.	Agro-ecotourism development is based on organic agriculture combination with ecotourism to provide acceptable recreation opportunity without destroying the natural rural environment.
Characteristics	1. Agritourism is one of the important elements in rural diversified economy. 2. Increase income of local people. 3. Provide new employment. 4. Rural environment and agricultural activities are regarded as tourism resources. 5. Tourists can experience agricultural life.	1. Agricultural activities are based on organic farming. 2. Tourism and recreation activities are managed according to the principles of ecotourism. 3. Emphasis on environmental protection and natural conservation. 4. Respect traditional culture of local village. 5. Protect diversity of ecosystems, agricultural activities and traditional culture. 6. Local benefit. 7. Provide more health, safety food and nutrition services. 8. Promote organic agricultural activities as a most effective means for landscape conservation. 9. Offer an additional economic resource for environmental protection.











Aquaculture Agriculture Integration

TABLE 5 Growth Parameters (mean •} SE), Yield, and Water use Efficiency (WUE) of Maize Plants Irrigated with Different Sources of Water (Fish Effluent and Well Water and Fertilization)
Plant height; Number of leaves; Plant weight; Yield; WUE; WVI
Treatment (cm) per plant (g) (kg/m2) (kg/m3) (S/m3)
T1 276.3 •} 0.73a 18.7 •} 0.16a 870.3 •} 2.30b 6.96b 1.91b 0.50b
T2 244.9 •} 0.71c 17.2 •} 0.14c 769.1 •} 2.22c 6.15c 1.69c 0.44c
T3 262.3 •} 0.86b 17.8 •} 0.12b 884.0 •} 2.91a 7.07a 1.94a 0.51a
T4 213.9 •} 1.32d 16.4 •} 0.11d 526.2 •} 3.25d 4.21d 1.16d 0.30d
T1 = drip irrigation with fish tank effluent/fertilized: T2 = drip irrigation with well water/fertilized: T3 = drip irrigation with fish tank effluent/unfertilized; T4 = drip irrigation with well water/unfertilized. Values in the same column sharing the same letter are not significantly different from each other ($\alpha = 0.05$).

Mycofiltration of Contaminants

There is a growing belief in the environmental science community that mycorestoration is the answer for cleaning environmental contamination. This is the basic science behind mycorestoration: microscopic cells called "mycelium"--the fruit of which are mushrooms--recycle carbon, nitrogen, and other essential elements as they break down plant and animal debris in the creation of rich, new soil.

" Mycofilters around farms, watersheds, urban and industrial areas filtering pathogens, silt, organic debris, and chemical toxins from water run off"

" Increased fungal biomass is a cause of reduced nitrogen and phosphorous losses to the environment"