



**Domestic Small Ruminants & Bighorn Sheep
Respiratory Disease Research
Animal Disease Research Unit, Animal Research Services**

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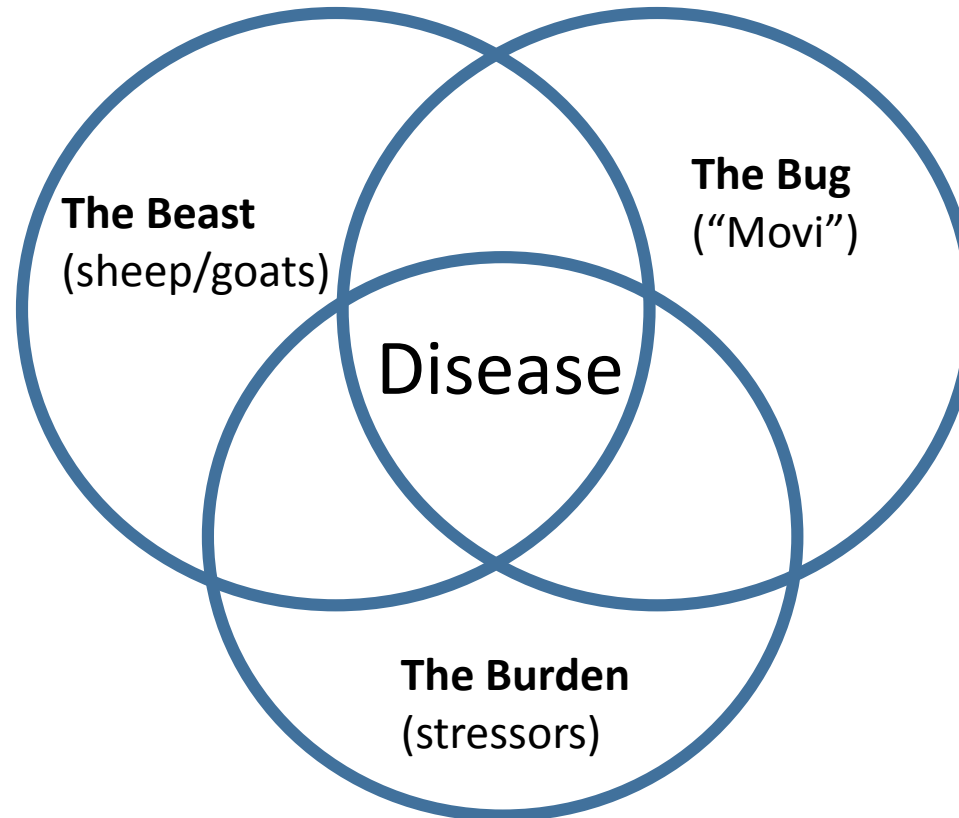


The etiology of pneumonia in lambs is considered to be extremely complex and relates to synergistic effects of both management practices and infectious agents. A wide variety of microorganisms have been recovered from the respiratory tract of pneumonic sheep (Stevenson, 1969) but the etiological significance of many of them is in doubt. *Pasteurella* sp. and mycoplasmas were the most common organisms isolated from pneumonic as well as normal sheep. Challenge experiments indicated that these organisms alone have limited ability to induce pneumonia and require predisposing factors.

Excerpt from "Respiratory infection of lambs with *Mycoplasma ovipneumoniae*"
(dissertation author: Mumtaz Ahmad Khan, Iowa State University)

The foundation of infectious disease

Diseases are not “transmitted”, infectious agents are transmitted
Disease is the outcome of transmission and is dependent on.....



Overview of current and upcoming research

National Project Plan

(next 5 year budget cycle beginning this year)

“Identification of Host Factors and Immunopathogenesis
of Pneumonia in Domestic and Bighorn Sheep”

Mycoplasma ovipneumoniae (“Movi”)

- Discovered in the last decade to be highly associated with the complex phenomenon of bighorn sheep pneumonia
 - Impacts adults and lambs, but not consistently (infection ≠ disease)
 - “Pasteurellas” and other mixed bacteria found but not consistently like “Movi” is reported
- Known for decades to be associated with domestic sheep/goat pneumonia
 - Associated with suboptimal environmental conditions (poor passive transfer/nutrition, environmental stressors, etc.)
 - Primarily affects lambs/kids
 - Infection → lowered production in lambs (report from New Zealand)
 - Present in many flocks across U.S. (endemic bacteria in U.S.)
- Believed to be species specific
(members of subfamily Caprinae: goats/sheep)

Overview of current and upcoming research

- Host genetics of infection and shedding of *M. ovipneumoniae* in domestic and bighorn sheep
- Innate and adaptive immune factors associated with susceptibility of domestic and bighorn sheep to *M. ovipneumoniae*
 - Immunopathogenesis (how each species responds to “*Movi*”)
 - Innate and adaptive responses to infection
 - Vaccine development

Overview of current and upcoming research

Additional research:

- Nasal/respiratory microbiota
- Surveillance of non-Caprinae species for carrying/shedding “*Movi*”
(send me samples!)
- Surveillance of pack goats and non-packing domestic goats for “*Movi*” and agents of keratoconjunctivitis (pinkeye) that are considered a risk to BHS
 - Samples collected April-October, 2016
 - Analyses underway on ocular swabs
 - Most of the testing complete on nasal swabs

Nasal swabs tested for the presence of *Movi* by independent laboratory and within ADRU laboratory:

Independent laboratory (WADDL)

# goats tested	Detected	Indeterminate	Not Detected
468 (83 premises)	18 (5 premises)	20 (9 premises)	429
	3.8%	4.3%	91.7%

ADRU-ARS-USDA Laboratory Results

- Standard PCR and sequencing has confirmed positive: 3 premises
 - Positive goats on 2 premises restricted to kids <12 weeks old (adults negative); subsequent testing on 1 premises: negative
 - 7 (+) goats, 1 premises: housed adjacent to “open” herd of Boer goats
 - Other 2 premises: unable to confirm positive results on these 2 goats
 - All other goats negative by testing performed in ADRU lab thus far
- Working to further test the discrepant results/samples



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The following statement is an explanation of the effects of Division G, which makes appropriations for the Department of the Interior, the Environmental Protection Agency (EPA), the Forest Service, the Indian Health Service, and related agencies for fiscal year 2016. Report language contained in House Re-

TITLE I—DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

MANAGEMENT OF LANDS AND RESOURCES

The agreement provides \$1,072,675,000 for Management of Lands and Resources. In addition to the funding allocation table at the end of this explanatory statement, the agreement includes the following instructions:

wildfire. The Bureau also is directed to follow the directive herein for the Forest Service regarding bighorn sheep conservation.

Bighorn Sheep Conservation.—In order to ensure the Nation does not lose its domestic sheep industry or bighorn sheep conservation legacy, the Service and the Bureau of Land Management shall implement a variety of solutions, including the following directives: The agencies are directed to complete risk of contact analyses using appropriate data sources, such as from the Western Association of Fish and Wildlife Agencies, and to share the findings with the public. The Service is expected to engage the Agricultural Research Service to ensure the best scientific understanding of where disease transmission occurs and the degree of that risk and to assist the Forest Service with identifying all allotments that are suitable for sheep grazing. The Service and Bureau of

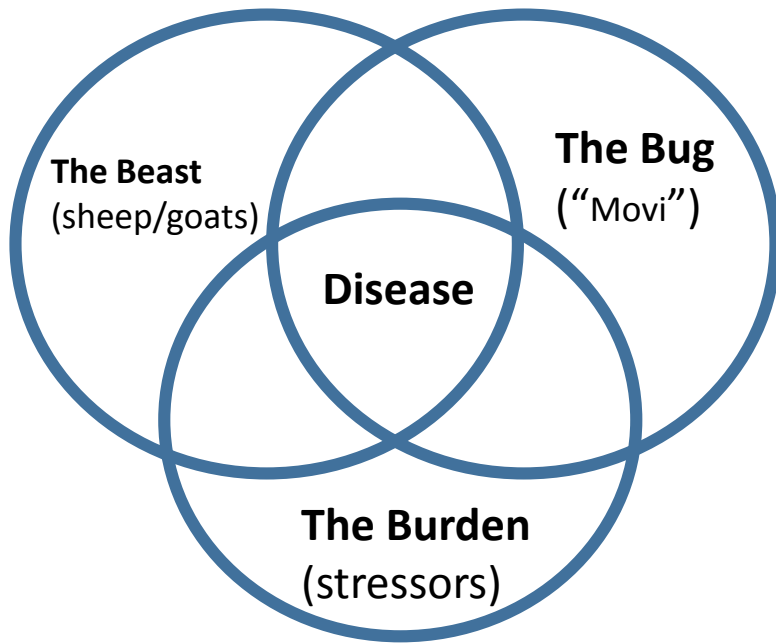
Land Management also are directed to identify and implement actions to resolve issues on allotments with a high risk of disease transmission, including, if agreeable to the directly affected stakeholders, the relocation of domestic sheep to allotments with a low risk, pending any site-specific environmental analysis. Together, the agencies are encouraged to convene a meeting of stakeholders interested in collaborating on strategies and solutions to address the risk of disease transmission and to report to the Committees on implementation of these directives within 60 days of enactment of this Act.

ADRU-ARS-USDA looks forward to continued and new interactions and collaborative efforts to fulfill that set forth in these appropriations.

Current collaborations and those underway:

- Washington State – Forest Service (waiting FS signature)
- Montana – Fish Wildlife and Parks (MOU signed, samples expected 2/2016)
- Colorado – San Juan National Forest (Weminuche Monitoring Project)

Thank you Anthony Madrid and Lindsey Hansen for reaching out to ARS



Objective 3: Examine environmental factors in relation to animal health and disease.

Justification: Infectious diseases have 3 components that must all be examined in order to understand the process, particularly in complex and multifactorial disease entities such as small ruminant (wild and domestic) pneumonia. The first two (host and infectious agent(s) are addressed above. The following addresses the third component: environment.

Along with samples, we request information pertaining to the individual animal and herd health status for the last 5 years and annual updates for the next 5 years, which are relevant to health/disease:

1. Animal's home range location (for bighorn herds, include anything that would identify the herd, such as location or herd name, if applicable). How many bighorn sheep are radio-collared in each herd?
2. How many bighorn sheep are currently in each herd, what is the ewe:ram ratio?
3. List dates of all capture events (specify herd, reason for capture, how many captured).
4. List of all medications/drugs given at time of capture, particularly if steroids (ie. dexamethasone) was administered and whether the capture was by tranquilization or net capture.
5. Translocations either in or out of each herd, include number of bighorn sheep moved in/out
6. Results from microbial screenings for bighorn sheep herds, including *Mycoplasma ovipneumoniae* and Pasteurellaceae spp. (include dates of sample collection) performed over the last 10 years.
7. Overall health of bighorn sheep herd
 - a. Dates (beginning to end) of respiratory disease and/or die-off events that have occurred since herd was established (include number of animals involved, number of deaths).
 - b. lamb recruitment each year since herd was established (lambs born versus number that live to be 1 year old)
- 8 Date and cause of death for each deceased bighorn sheep; number of bighorn sheep affected (this should include non-respiratory disease causes)
9. Other environmental factors
 - a. Hunting (number and age of bighorn killed, date killed, and number of bighorn sheep in the herd at the time of hunt)
 - b. Non-human predation
 - c. Feeding stations bighorn sheep use and what other wildlife species observed at stations
10. Dates of all reported (observed) contacts between domestic small ruminants and bighorn sheep

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