

# ***Mycoplasma bovis* Outbreak in Pronghorns—Wyoming**

[Announcer] *This program is presented by the Centers for Disease Control and Prevention.*

[Sarah Gregory] Hello, I'm Sarah Gregory, and today I'm talking with Dr. Kerry Sondgeroth, a veterinary bacteriologist at the Wyoming State Veterinary Laboratory and an associate professor at the University of Wyoming. We'll be discussing a high-mortality outbreak of *Mycoplasma bovis* in free-ranging pronghorn.

Welcome, Dr. Sondgeroth.

[Kerry Sondgeroth] Thank you, Sarah. I'm really excited to be on your podcast today.

[Sarah Gregory] And we're really happy to have you. So, let's start with what is *Mycoplasma bovis*?

[Kerry Sondgeroth] *Mycoplasma bovis* is one of the smallest bacteria that is known. It is found on mucous membranes of mammalian and avian hosts. So when I say mucous membranes, I mean those membranes that are surrounding your respiratory tract, genital tract, intestinal tract, or mammary glands. This bacterium lacks a cell wall, so many of the antimicrobials that are typically used to treat bacterial infections are not effective against this bacteria.

[Sarah Gregory] Okay, that sounds bad. Are there different kinds of *Mycoplasma* infections?

[Kerry Sondgeroth] Yes. There are a lot of different species of *Mycoplasma*, and these cause specific diseases in their hosts. So, there are certain *Mycoplasma*'s that affect dogs, there's some that affect cats, there's a few that affect pigs, there are some that are found in poultry, there are some that affect bighorn sheep, and then of course there's *Mycoplasma bovis* that affects primarily cattle but also pronghorn and deer.

[Sarah Gregory] Ok. What are the symptoms, and is it fatal?

[Kerry Sondgeroth] So, the symptoms vary depending on the species of *Mycoplasma* that we're talking about and its given host. So, most of the *Mycoplasma*'s can cause pneumonia, but some can also cause arthritis. So, you would have swollen joints or lameness, you'd have...you could have mastitis, ear infections, abortion, and then depending on the severity of the pneumonia, yes it can be fatal.

So in cattle, you might have no clinical signs. The infection just might be there but not causing anything severe enough that we would notice, or it could cause a severe pneumonia and death. In bison, and these are typically farmed bison, you would see a severe pneumonia and death. And then in pronghorn and other wildlife, usually we would just find them dead. But when you do further investigation on those animals, you would see that their death was caused by a severe pneumonia.

[Sarah Gregory] Ok. So your study was about *Mycoplasma bovis* in pronghorns. So, what are pronghorn versus, say, any other kind of steer?

[Kerry Sondgeroth] Ok. So, pronghorn antelope aren't cattle, but although the name implies that they're antelope, they're not antelope either. They're kind of a cross between an antelope and a goat. Their scientific name is *Antilocapra americana*. And what's kind of cool about these animals is that the closest living relative is a giraffe or okapi in Africa. So, they have large eyes

just like a giraffe does, and these large eyes provide about 360 degrees of vision so that they can see predators. They are free-ranging ungulates that are found in North America (and by ungulate, I just mean a hooved animal). They are native to the western United States, but they can also be found in southern Canada and northern Mexico. The other really cool thing about pronghorn is that they are the fastest hooved animal in North America. So, their speeds can reach up to 50 miles per hour over a short distance. They are smaller ungulates. Their average weight is about 100 pounds, versus when we talk about cattle, we're talking about 1,200 pounds. And both males and females can have horns. However, the male horns are much larger and they are forked, and one of those forks has a prong. So that's where they get their name pronghorn. They are herbivores and they graze the western plains alongside cattle and bison.

[Sarah Gregory] Alright, so these are sort of basically wild animals. Do we...are we concerned about this because we're concerned about all animal species? Or are we concerned because it infects domesticated cattle and goats and sheep? Or...why do we care about this?

[Kerry Sondgeroth] So, I think there's a couple reasons why we care about this. In regards to the pronghorn themselves, there's about one million pronghorn left in North America. The only place they're found in the world is basically in the western United States. And as far as economically speaking, it's one of the species that contributes to Wyoming's tourism industry but it is also a meat source for hunters. So, the population of pronghorn is in decline, this is due to population, roads (they're not the most savvy when it comes to highways), fences (pronghorn don't typically jump over fences, they have to go underneath). And so, as their population slowly declines, we look for reasons why they might be declining even faster. And so this disease is one of the factors that can contribute to their population decline.

Now in respect to *Mycoplasma bovis* in pronghorn, we're concerned about *Mycoplasma bovis* because as I mentioned, pronghorn graze side by side with cattle and bison. And although cattle aren't typically severely affected by *Mycoplasma bovis*, bison are. It can kill bison, and farmed bison is a pretty big industry. And so we want to make sure that we're protecting not only the pronghorn but other food sources for our nation as well, and that includes bison. So, it's important to understand this bacteria and the implications it might have for the health of other species including pronghorn, but also cattle and bison.

[Sarah Gregory] I see, okay. So, is this *Mycoplasma bovis* something that all ungulates get?

[Kerry Sondgeroth] So, not that we know of. There have been a few reports of *Mycoplasma bovis* causing mortalities or fatalities in white-tailed deer. We have seen it in a few mule deer and free-ranging white-tailed deer. And then there's been reports of it in also farmed bison causing death in up to 50% of the bison that acquire the infection.

[Sarah Gregory] What are the symptoms in the pronghorn?

[Kerry Sondgeroth] So for the pronghorn, as I mentioned before, most of it is just people noticing that there's just dead pronghorn laying in a field. Because it's a very acute infection, meaning it kills these animals pretty quickly, once we know that we're looking for it and people might be watching the pronghorn more carefully, they might see a couple of the pronghorn off to the side of their herd—so, not mingling with the others; might be laying down; not getting up because they're weak; they might be coughing; they might have drool or discharge coming out of

their nose and mouth because they're having difficulty breathing. But most oftentimes what people notice is just death, and they're seeing a lot of bodies in one area of dead pronghorn.

[Sarah Gregory] I'm not clear here. Is there a treatment or...for this or...or a vaccination?

[Kerry Sondgeroth] So, there isn't a treatment when we're talking about wildlife. It...there isn't really an easy way to, you know, distribute a treatment to these ungulates and particularly because we've only noticed this problem in one small area of Wyoming. Now, there are vaccinations available for cattle and now bison. However, there's work being done that is trying to develop an even better vaccine for bison. As far as treatment goes, if you catch the infection quickly enough (and this pertains more to cattle than bison), you can treat it with antimicrobials. You just can't use antimicrobials that target a specific area of the bacteria called the cell wall. *Mycoplasma* are so small, they do not have a cell wall. And so your penicillins, for instance, are antimicrobials that work by targeting the cell wall. And so, if you're trying to treat these infections with a penicillin for instance, it wouldn't be effective. Bison are a little bit different because they're harder to handle. Even though they're farmed bison, typically they're only handled once a year. And again, the infection is so severe (their pneumonia is so bad, so quickly) usually they die before any treatment can be effective.

[Sarah Gregory] I see, okay. And this is specific...this one is specific to ungulates as you said, so we don't have it crossing over to infecting people yet, correct?

[Kerry Sondgeroth] So as far as we know, *Mycoplasma bovis* is not zoonotic. The interesting thing about *Mycoplasma bovis* is that it is able to infect multiple species—so, cattle, bison, pronghorn, deer (both white-tailed and mule deer). But we haven't had any infections in humans. And most *Mycoplasma*'s typically just infect one host. And so that's what makes *Mycoplasma bovis* unique and interesting to study because it...it can cross over into other species.

[Sarah Gregory] So, what time period did your study cover?

[Kerry Sondgeroth] So our time period for this particular outbreak was in the spring of 2019. However, we did collect some samples (we called those our historical samples) that covered the years 2007 to 2018.

[Sarah Gregory] What there anything unusual about this outbreak in your study?

[Kerry Sondgeroth] So, I guess the most unusual thing is that *Mycoplasma bovis* has traditionally been thought of a cattle or livestock disease with occasional reports of it causing severe losses in bison. And so, when we figured out it was *Mycoplasma bovis* in this wildlife species, that was a red flag. That's really unusual, and it was something that had never been documented or observed before to our knowledge.

[Sarah Gregory] Okay. So there have there been other outbreaks of *Mycoplasma bovis* in the U.S. Are there any notable ones?

[Kerry Sondgeroth] So, there's a couple of published reports. There was one report in bison in Kansas, and then there was...these bison were farmed...and then there was also a report of some farmed white-tailed deer in Minnesota. And those are the only published reports. And again, they were associated with these farmed or ranched animals. For the free-ranging animals (meaning wildlife not associated with a particular producer), there's been scattered reports and these have

just been, you know, a few die-offs here and there. But no one has kind of connected the dots to link *Mycoplasma bovis* in all cases.

[Sarah Gregory] Help us to understand what this outbreak means for public health.

[Kerry Sondgeroth] Okay. So, *Mycoplasma bovis* (to our knowledge) is not zoonotic. So it doesn't directly infect humans. But when we think about public health we think about it as more of a One Health approach, meaning the health of humans is linked to the health of the environment and the health of animals. So when animal health is impacted, that inevitably affects the health of humans. So in this case, the death of pronghorn could eventually lead to a food supply issue. The *Mycoplasma bovis* (if it's infecting multiple species) could also lead to a food supply issue if we're talking more about bison and cattle. But I think the biggest implication would be the *Mycoplasma* itself. So, for so long the understanding was that mycoplasma affects one species. And so now we know that this species (*Mycoplasma bovis*) can infect multiple host species, and so it's important to understand why it is able to infect multiple species and if other *Mycoplasma*'s eventually might be able to cross species as well.

[Sarah Gregory] It sounds like there's probably an economic impact to these herds getting this disease. Is...is that right?

[Kerry Sondgeroth] So as far as the economic impact (at least for us in Wyoming), I think it comes back to 1) it's a food source for a lot of hunters here, and also 2) just the general population decline of the species and its link to the tourism industry.

[Sarah Gregory] So I have to ask you here, is there a conservation group that is working for these animals?

[Kerry Sondgeroth] No, there is not. Though, we work closely with the Wyoming Game and Fish, and there's other conservation groups that are interested not only in pronghorn but our other big game species in Wyoming. But there's not one group that is for "save the pronghorns," for instance.

[Sarah Gregory] So how did you go about doing this study? What kind of data did you use?

[Kerry Sondgeroth] So, we approached this problem in two different ways. The first way was to use historical samples that had been previously received at the Wyoming State Vet Lab, and these were samples that were from pronghorn that had died that we still had lung tissue for. And we went back through these old reports to find as many as we could. We only went back to 2007 because we don't have the storage space for anything previously. But our first concern when we saw this happening was, "Wow. Has this disease been here this whole time and we've just missed it?" Because *Mycoplasma bovis* isn't something that you typically consider wildlife getting. So we were able to find 20 samples from 20 different pronghorn, 13 of those had been diagnosed with pneumonia and seven had no evidence of pneumonia. And none of these 20 samples had ever been tested for *Mycoplasma bovis*. So, we were able to use those samples to test for *Mycoplasma bovis*. And then the second approach was to use the *Mycoplasma bovis* bacterial isolates that we were able to culture from the samples in this 2019 outbreak. And from those bacterial isolates, we were able to perform whole-genome sequencing. So, we were able to get genomic data from the entire *Mycoplasma bovis* isolate from a couple of different animals related to this outbreak.

[Sarah Gregory] So, do you want to keep going with that and tell us a little bit more briefly about your study?

[Kerry Sondgeroth] Sure. So in regards to the whole-genome sequencing data, we wanted to characterize those isolates and see how similar they were in comparison to other cattle and bison isolates that had previously been evaluated. And the way the genomic characterization occurs is through a method called MLST (multilocus sequence typing). And basically what MLST does is take a few genes from each isolate and compare them to genes from other isolates. And so, the best analogy that I could come up with was to think about each of these *Mycoplasma bovis* isolates as being a 500-piece puzzle. So, we have 500 pieces in this puzzle. Each puzzle piece represents a gene. And so if we want to compare puzzle A to puzzle B, we would take maybe the four corner pieces of the puzzle (puzzle A) and compare them to the four corner pieces of puzzle B. And that tells us some relationship between the two. If it's an identical puzzle, then those genes will match and will be able to tell us that. If it's a puzzle of a mountain versus a puzzle of a beach, then we can see the differences in our comparison.

So in this study, we were able to test nine of the pronghorn from the 2019 outbreak. From those nine pronghorn, we were able to get sequences from four of them. And when we compared those four sequences by that MLST typing scheme, we found that they were identical. And then when we went back to those historical samples (the 20 from 2007 to 2018), we found that there was no evidence of *Mycoplasma bovis* infection. And so, that told us that it wasn't something that we had missed historically, that this *Mycoplasma bovis* outbreak was a new something that we had figured out.

[Sarah Gregory] Okay. So, did you find anything else?

[Kerry Sondgeroth] Yeah. So when we did our typing scheme of those genes that I mentioned, what we found is that all four of those pronghorn samples were the same but they were all missing one gene that had been traditionally used to categorize these isolates. So this one gene...we don't know why they were missing it. We did find out that of other bison and cattle isolates, 20% are also missing that gene. So, it was something that was more of a "gee whiz" at the time. Obviously it's not a required gene, but it did make us think what else could we potentially be missing by only selecting a few pieces of the puzzle.

[Sarah Gregory] That's really interesting. Is there a way to stop this from increasing?

[Kerry Sondgeroth] So in regards to wildlife, we're not sure at this point. We're still trying to figure out how the pronghorn are becoming infected, why pronghorn in just that certain region of Wyoming are infected, because we see pronghorn mingling with bison and cattle all over the state and there's not a problem. We don't see deaths in other regions. We only see deaths in that particular corner. And although today we're focusing on the 2019 outbreak, we did see another outbreak in 2020 in that same area, this time affecting over 500 pronghorn. So, we're still trying to figure out what is so unique about the population in that area or unique about *Mycoplasma bovis*. And as far as a vaccine, they are very difficult to give to wildlife. So, a vaccine isn't possible for pronghorn. And I did mention before a vaccine is available for cattle, and there's a limited vaccine available for bison. And so, that's a possibility. But when we think about protecting our food source (and this comes back more to the cattle and bison, primarily), most management happens by just decreasing stress of the animals, decreasing overcrowding and making sure that the animals are provided adequate nutrition, particularly in the winter months.

[Sarah Gregory] Were there any challenges or limitations to doing this study?

[Kerry Sondgeroth] Yes, there's a lot of challenges. So, wild bison in and of itself is challenging to work with, obviously we just don't like waiting around for outbreaks and deaths to occur, but we were just taking samples based on what we were seeing in the field. And then during this outbreak, it happened during the winter months, it happened on private land (a lot of these animals aren't dying next to roads that can be easily accessed). We know about most of the deaths because the Wyoming Game and Fish fly over in their airplanes to look for carcasses. And so that's how we tally our numbers of how many are actually dying. And so, all of those factors (wildlife, winter, private land) and just the vastness of the state of Wyoming, it takes about four and a half hours to get from our lab up to where these pronghorn were dying. And so when you think about sample transport and those types of things, the logistics are crazy, and so there's many challenges. However, we have built some great collaborations with not only the private land owners to give us access to the carcasses on their land, but also our state agencies such as the Wyoming Game and Fish and local veterinarians who can assist us with that sample collection. And so we actually feel really lucky that so many moving parts came together in order for us to be able to tell this interesting story.

[Sarah Gregory] Do you have any recommendations to help alleviate this from increasing in herds?

[Kerry Sondgeroth] So at this point, no. We're still in the data gathering phase. We're still analyzing those sequences of *Mycoplasma bovis*. So now we have samples from the 2019 outbreak plus the 2020 outbreak. And we're currently working on gathering cattle and bison isolates from across the state of Wyoming that may be in proximity to where those pronghorn died, plus other geographic regions that we can do the comparison. And there were limitations in how we initially evaluated our data. So with the puzzle pieces, when you're just comparing the four corners, you're likely to miss some things. And so now we're gearing up to look at all the puzzle pieces from each puzzle to make a more robust comparison between all those different isolates. And once we do that, then we should have a better picture of what's going on—so, how are the pronghorn becoming infected, can they give it to other species such as cattle or bison or are they getting it from the cattle or bison, can they give it to other free-ranging ungulates like deer? And so, we have so many more questions to answer, and until we do we're not able to provide any suggestions on how to stop the transmission.

[Sarah Gregory] Well, tell us about your work and what you enjoy most about it.

[Kerry Sondgeroth] So, my work is very filling. I have a combined appointment with the University of Wyoming and the Wyoming State Veterinary Lab. I was most recently appointed the Riverbend Endowed Professor of Wildlife and Livestock Health. And so this appointment allows me to keep conducting research on diseases that are important to us in Wyoming, such as *Mycoplasma* in pronghorn and pneumonia in bighorn sheep. But I'm also the only veterinary bacteriologist in the state of Wyoming. And with that, I get to oversee the bacteriology section of the Wyoming State Vet Lab. So this provides me an opportunity to see cases and potential outbreaks or emerging bacterial disease in all of our animal species—so, our companions like dogs and cats, wildlife like the pronghorn or bighorn sheep, and livestock such as cattle. But then I also get to teach and mentor both graduate and undergraduate students. And this is exciting for

me because these students will become the next generation of scientists. So taken together, I just like the variety that these aspects provide me every day in my current job.

[Sarah Gregory] How is it that you're the only veterinary bacteriologist in Wyoming?

[Kerry Sondgeroth] So, part of it is just because of my specialty. So I went to vet school, but then I specialized in bacteriology. And so at the Wyoming State Vet Lab, we only have one bacteriologist. We also have other specialties at our lab, including pathologists and virologists and parasitologists, but I'm the only bacteriologist. And Wyoming is a very small state, so we only have one diagnostic lab. We keep ourselves busy, but our population in Wyoming is about 500,000 people. So, we're not a big state. We just have a lot of land associated with it, and a lot of animals too.

[Sarah Gregory] I hadn't realized that the population of Wyoming was so tiny. That's amazing. What do you enjoy doing in your personal time, then?

[Kerry Sondgeroth] I love the outdoors. So I guess that makes me well suited for Wyoming. There's a lot of land and not very many people. In my free time, I love to mountain bike, trail run, ski, and go whitewater rafting with my husband, two kiddos, and dogs.

[Sarah Gregory] Sounds like a good life. Well thank you for taking time to talk with me today, Dr. Sondgeroth.

[Kerry Sondgeroth] Thank you Sarah, I really enjoyed my time with you today.

[Sarah Gregory] And thanks for joining me out there. You can read the December 2020 article, *Mycoplasma bovis* Infections in Free-Ranging Pronghorn, Wyoming, USA, online at [cdc.gov/eid](https://www.cdc.gov/eid).

I'm Sarah Gregory for *Emerging Infectious Diseases*.

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