

# Mass Die-offs in Saiga Antelope Populations

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

[Sarah Gregory] Hi, I'm Sarah Gregory, and today I'm talking with Dr. Corrie Brown. She's a distinguished professor of veterinary pathology at the College of Veterinary Medicine at the University of Georgia. We'll be discussing two articles about large-scale die-offs among saiga antelopes.

Welcome, Dr. Brown.

[Corrie Brown] Hello, Sarah. Thank you for having me on.

[Sarah Gregory] Well, we're very happy to have you here.

So, many of us probably have never heard of the saiga antelope. What makes it different from any other type of antelope?

[Corrie Brown] Well, first of all, it's ancient. The saiga antelope has been around since the Pleistocene; it was walking around at the same time as saber-toothed tigers. So it's persisted for many, many years. It looks strange. It has a very large droopy nose, more like a proboscis—it's very long and it hangs over, and they think that's because it helps them to breathe the frigid air in the winter and keep out the dust in the summer. It's about the size of a Great Dane. It has kind of a hippity-hop gait. And it currently exists in only a very few areas.

[Sarah Gregory] And where are those areas? Where is it found? What is its habitat like?

[Corrie Brown] Well, there are a few animals in Russia, then the largest population is in Kazakhstan, and a smaller subpopulation is in Mongolia. And this differs from its earlier range, which was all across the steppes, throughout much of Central Asia. It likes a cold, dry grassland—you know, the steppes, which is Russian for, I think, dry, cold grasslands.

[Sarah Gregory] Yes, I think so.

Okay, so, the saiga antelope is critically endangered. Can you tell us about that?

[Corrie Brown] Well, there it's mostly due to human encroachment. You know, it was almost exterminated in the 1920s, mostly because the horns of the male are so valuable. They were largely harvested for traditional Chinese medicine and they're used to make elixirs similar to the elixirs made from rhino horn. So, they were almost wiped out by the 1920s, but then they made a comeback by the 1950s...1950s, and there were about two million present in this large area. Then, after the fall of the Soviet Union when there were, you know, a lot of hungry, poor people walking around, they started catching these animals and harvesting the horns and selling them to China again, and also eating them. They say that the saiga antelope tastes like lamb. And now they are critically endangered.

[Sarah Gregory] One of these studies looked at a mass die-off in Kazakhstan in 2015. Apparently that wasn't the first time this happened. Tell us more about that.

[Corrie Brown] Well, there have been periodic die-offs. Probably the biggest one prior to the one that was described in one of these papers, that happened in 2015, was in 2010 when about 12,000 animals died. And then in 2011, they had a similar die-off, but fewer animals were affected. And that was all in a very specific pasture area, and they attributed it to bloat, as a result of consumption of pasture material that's very high in protein.

So, I'll tell you about frothy bloat. So, animals that...ruminants that eat a lot of protein along with their forage—and alfalfa's very high in protein—they get a lot of little bubbles in their rumen, a lot of froth. And that froth builds up and it inhibits the receptor in the rumen that tells them to belch. So, basically, the rumen just gets bigger and bigger and bigger, and they die of cardiorespiratory compromise. And if you think about that froth that happens in frothy bloat, think about the top of your cappuccino. So, that's also the same kind of froth made from the protein in milk.

[Sarah Gregory] Okay, so that was the previous die-off. What caused this 2015 one?

[Corrie Brown] In 2015, that die-off, which killed about 120,000 animals, that has been attributed to a disease we know as hemorrhagic septicemia. It's caused by a specific strain of a bacteria, *Pasteurella multocida*.

[Sarah Gregory] And what is *Pasteurella multocida*?

[Corrie Brown] Well, there're a whole lot of strains of *Pasteurella multocida* in different animals. One strain will cause pneumonia in sheep and goats, another one causes snuffles in rabbits, which as you would expect, is a respiratory problem. It's also carried in dog and cat oral cavities in their mouth, so people who get a cat bite can get infected with this cat *Pasteurella multocida* that travels up the lymphatics and has to be treated. But this particular *Pasteurella multocida* that causes hemorrhagic septicemia is different. And hemorrhagic septicemia occurs in some areas of the world, mostly in Asia, and it will replicate to very high numbers and cause, basically, an endotoxic shock. It has a lot of lipopolysaccharide around the outside and animals can die very quickly.

[Sarah Gregory] And I think, from these articles, I get the impression that scientists think that an additional pathogen might be at play?

[Corrie Brown] Well, when I first heard that 120,000 antelope had died of hemorrhagic septicemia, I just kind of rolled my eyes and said "No, that's not possible!" Hemorrhagic septicemia doesn't move that...it moves quickly, but that was, like, super quick! So...but after I looked at all the data, I said "Yes, in fact, this *is* hemorrhagic septicemia," and all other potential causes were pretty much ruled out.

[Sarah Gregory] So, there was no other pathogen making this outbreak even worse?

[Corrie Brown] Well, it hasn't been found if there is one, and there was a pretty extensive search.

[Sarah Gregory] Interesting. How did climate and weather play into this situation?

[Corrie Brown] Well, we know that the very worst epidemics of hemorrhagic septicemia happen in the rainy season. And this particular season, as it's kind of in the spring of 2015, it was exceptionally wet and warm. So, that would have allowed the *Pasteurella multocida* organism that causes this to survive longer in the environment and maybe even proliferate. So, we think that that may have been a factor.

[Sarah Gregory] One of the articles theorizes that this bacteria is probably widely present in the antelope population anyway, but doesn't usually cause any illness. How does that work?

[Corrie Brown] About 20% of the surviving animals will actually be carriers. And we think that for the *Pasteurella* that occurs in other species, they often carry this in their oral-pharyngeal regions and then there's some stress that allows it to get to deeper reaches and cause disease. So,

I suspect that *Pasteurella multocida* probably is in this population all the time, but I think it got to much higher numbers. We know that in the early stages of hemorrhagic septicemia, there's lots of exudate, there's a lot of saliva, runny nose—it's full of the bacteria and it contaminates the environment. So, I think probably one or two animals came down with this disease, or they may have already had it, or they gave it to another animal, and then there was enough environmental contamination that all the animals got it and they were probably pretty naïve to the organism.

[Sarah Gregory] 120,000 died. Do we know how many are left?

[Corrie Brown] Oh, I think there are about between 100,000 and 200,000 left in the world.

[Sarah Gregory] So, almost 50%?

[Corrie Brown] Yes.

[Sarah Gregory] Wow! Or maybe even more than 50%—that's tragic.

Another die-off happened in the neighboring Mongolia in 2016–'17. What happened there?

[Corrie Brown] So, that was in the fall of 2016, going over several months into 2017. The population of saiga antelopes in Mongolia is pretty small. It's a subspecies and there are many fewer animals. And during...over that period, about 80% of the animals died. So, there is real concern about this subpopulation actually becoming extinct.

[Sarah Gregory] [*Sigh.*] Was this die-off caused by the same bacteria as before or was this something different entirely?

[Corrie Brown] Well, actually, the animals that they investigated, they found a virus in there. They did not find any evidence of the hemorrhagic septicemia. So, it appears to be two completely different problems wiping out a large swath of the population, which I found very odd. And I had to go to the map and convince myself that it was a high mountain range in between these two areas and there could not have been any crossover of animals between those two areas.

So, the die-off here was caused by a virus that is known as peste des petits ruminants, which is a French name, and the non-Francophone part of the world calls it PPR. PPR is a close relative of rinderpest, which is the only animal disease to be eradicated from the world, and it is currently causing problems in many parts of the world. It has moved extensively from its base in West Africa over into East Africa over into the Middle East through South Asia into China, and now it's down into many of the Central Asian countries, as a relatively new phenomenon.

[Sarah Gregory] And quickly moving, it seems.

So, some experts were hoping, are hoping that we might be able to eradicate this virus. Why is it such a high priority compared to other livestock diseases?

[Corrie Brown] Well, you know, sheep and goats are the...they're the livelihood of the small farmers throughout the world. Small farmers everywhere rely on their sheep and goats for sustenance, for a mobile bank account, for food. And this virus is very damaging to both sheep and goats, both small ruminants, petit ruminants. And there is a vaccine that is very effective at preventing it, the vaccine is similar to the rinderpest vaccine. One vaccination will protect an animal for life. It's only transmitted by contact. It doesn't remain in the body's system once an animal is infected. So, it is...it would be possible to eradicate this, and that would be really

wonderful. There, in fact, is a move by the UN FAO, Food and Agriculture Organization, jointly with the OIE, the World Organization for Animal Health—it's the Global Peste de Petits Ruminants Eradication Campaign. Now, they had a similar campaign for rinderpest, and they were successful largely due to getting plenty of international funding. Unfortunately, sheep and goats don't capture the political will in the same way that cattle do, and so the program is seriously underfunded.

[Sarah Gregory] This virus usually only occurs, as we're talking about, in domesticated animals like sheep and goats. So, how did it spread to the antelope?

[Corrie Brown] Well, it will infect a lot of hooved stocks, small-hooved stocks, so it doesn't surprise me that it would show up in antelopes. We have seen it in wild animals before, especially in zoos and different places. We also believe that this virus is the same as rinderpest in that its main host is the domestic sheep and goats, and when it occurs in wildlife, it's mostly a spillover event from the livestock species, so that eradicating it from the livestock is likely to actually eradicate the disease.

[Sarah Gregory] Seems to be a timeframe issue here, though, if 80% was destroyed by this last outbreak and eradication is looking a little iffy because of the reasons you just mentioned. What do you think the odds are?

[Corrie Brown] Well, they have just gone in in Mongolia and vaccinated most of the remaining animals against this disease. So, there should be some protection now; if they can maintain that, these animals will be safe.

[Sarah Gregory] Okay, well that's good to hear.

This study also looked at other local species who could catch the virus. What were the differences between saiga and other species?

[Corrie Brown] Well, the ibex did not suffer quite as much as the...as the saiga did. Also, it was interesting in that the ibex, they're not migratory, they stay in one spot. And the dead ibex showed up in various localities, but there would not have been any connection between any of those localities. And, so, that indicates that it is a recurring spillover event. I think that was the importance of that—that it did come from the livestock.

[Sarah Gregory] And so, are these antelopes particularly vulnerable to this disease?

[Corrie Brown] Well, they're vulnerable in that this disease has never been present in this area, so they're completely immunologically naïve to this virus, which has only been in Central Asia for the last three to four to five years. Also, in the outbreak in Mongolia, the animals...they did note that they were quite emaciated, perhaps due to lack of sufficient grasslands. And so, that may have also increased the case fatality rate.

[Sarah Gregory] Did climate change have an impact on any of this?

[Corrie Brown] Oh golly, who knows? You know, there's a lot of speculation about that. We do know that, in this area, global warming is supposed to increase the dryness and so, therefore, it will decrease the pasture. However, with the hemorrhagic septicemia episode, it happened in an unusually warm and wet period, due to a severe...what do they call it? ...a severe climactic event, you know, a local storm—a severe weather event, right.

[Sarah Gregory] So, rather than drying out, it was inundated?

[Corrie Brown] Yeah.

[Sarah Gregory] Huh!

Okay. Well, as we mentioned before, saiga antelope are critically endangered. Now how do we protect them from the many threats they face, both infection and noninfectious?

[Corrie Brown] One of the big problems for the saiga antelope are the poachers, the people who come in and take the males...I mean they kill the males just so they can get the horns. And these horns are really not spectacular. They're only about 12 inches long, they look kind of waxy and they have a number of rings in them, but a set of horns can bring in \$5000 in the market for traditional Chinese medicine. So, there's huge incentive there. So, if they have more rangers so that...to protect them from poachers. And there are quite few efforts there. They're probably not as well funded as they could be, mostly because a lot of those efforts are funded by the governments of these countries, which are maybe not as flush as we would like.

For protecting them from disease, since we know that PPR is already established in this area, we probably need to make an effort to do some more vaccinations to protect them. We do know that there is considerable building happening in this area. There's some mining, they're making roads to go into the mines, and so there's quite a bit of habitat encroachment. And to ensure that we can save the animals and along their migratory routes, all of that needs to be carefully planned.

[Sarah Gregory] So, as you said a minute ago, to decrease the population by about 80%, is there hope that we can recover?

[Corrie Brown] Okay, here's the good news: One male breeds five to 50 females—he has quite a harem—and each female usually has twins, occasionally singlets and sometimes triplets, but there's usually two produced for each female every year. So, I think it's possible. And they have been at the brink of extinction before and they've come back. So, I like to be optimistic and think as long as forces are brought to bear to preserve this population and protect them, that they will continue to inhabit the earth.

[Sarah Gregory] I hope so, too.

What do you personally think the future of veterinary medicine holds?

[Corrie Brown] Here in the U.S., our focus in veterinary medicine is really oriented towards companion animals. And we do very high-tech remedies and individual animal care for fairly complicated diseases. It doesn't work that way in the rest of the world. Unfortunately, that makes our graduating veterinarians ill-equipped to deal with livestock diseases in resource-poor countries and to understand the whole issues surrounding global trade in animals and animal products and the importance of staying free of diseases. So, I continue to rally for that and to try to promote educational opportunities for veterinarians in the U.S. to understand public service in a global sense for our profession. We can make great contributions, but we have to make sure our students are aware of these avenues for making contributions and receive sufficient training so that they're quite useful.

[Sarah Gregory] And can you give us an example of how one could make such a contribution?

[Corrie Brown] Yes. We have some programs where we work to take students overseas and have them work in a smallholder setting where they are actually working with farmers—a farmer who may have two goats and ten chickens, no veterinary care—and to help explain to that farmer the

importance of biosecurity, reporting the diseases of the public good that need to be controlled by the government, and how to slaughter and prepare food safely.

[Sarah Gregory] And I know you have some interesting thoughts on the term “One Health”—why don’t you tell us those thoughts.

[Corrie Brown] Okay!! Well, One Health is supposed to be the joining of human health, animal health, and environmental health, but it is really pretty much totally driven by human health. And everybody signs on to it, it’s a little bit like Kumbaya, we all get around the fire and say “Yes—we’re all going to work together!” But in fact, when the rubber hits the road, the animal health issues in One Health are pretty much restricted to the zoonotic diseases. But, in fact, there are so many diseases of agricultural animals that are not zoonotic that are seriously impacting food security. African swine fever, for example, has killed half the pigs in China and it threatens food security for a lot of the other parts of the world. PPR is another one; it’s bankrupting smallholders across Asia. And yet these are diseases that are never highlighted in One Health discussions. Instead, it’s the high profile diseases which maybe are not as important to agricultural factors, such as, you know, anthrax, contagious listeria, Crimean Congo hemorrhagic fever—those are the ones that are getting all of the funding.

[Sarah Gregory] Well, that is interesting and very informative.

And now, tell us a little bit about yourself. What do you like about your job? What do you like to do?

[Corrie Brown] I am a professor at the University of Georgia and I love watching light bulbs go off in the veterinary students as they learn about pathogenesis of disease and mechanisms—how the body operates and what makes it go wrong. I’m fortunate in that the university allows me to do quite a bit of extension work overseas, so I do building animal health infrastructure in multiple countries around the world. And nothing makes me happier than...than interacting with my colleagues from around the world and working with them to sustainably build capacity so that they can improve their own systems.

[Sarah Gregory] Would it be possible, not in an ideal world, but in this world we live in, to switch the planet, basically, from animal-based to some kind of, basically, plant-based?

[Corrie Brown] Well, okay, thanks for that question, Sarah, and it’s one I come up against so often. And you know, I think we in the developed world, we definitely consume way too much meat. And we have the...we have the option of being a vegetarian where we can get everything we need because we have wonderful choices of food so that we can fill all of our nutritional needs.

So, this is not true, though, of the two billion people who live on less than two dollars a day. And most of these people are smallholders. They’re surviving with their one cow and ten chickens or five goats. And for those people, animal-sourced food is really essential. The diet in the developing world largely consists of starches, and you can get enough of your calories that way, but if you don’t get some animal-sourced foods every day, you are deficient in micronutrients. About 20 percent of the women in the developing world are anemic because they don’t have enough iron and cognitive stunting has become a huge concern in the developing world. So, we know that if children between the ages of one and five don’t get a small amount of animal-sourced foods each day—and by that I mean a glass of milk, an egg, or a small piece of meat—that their brain does not develop properly. And they grow up...they are permanently cognitively

stunted. The World Bank estimates that in some countries, some very poor countries, that their entire GDP decreases by ten percent as a result of this cognitive stunting. So, yes, here we eat too much meat, but in many parts of the world, they actually need those micronutrients.

Now, you may say “But micronutrients are present in plants.” This is true, but they are not bioavailable. The phytates in plants inhibit their absorption. So, you could have one egg or you could eat a bushelful of spinach each day. Livestock will continue to be important in the developing world because the children really need this form of nutrition. I think we tend to look at the world through our Western-centric lens, this lens that sees our predominant problem with nutrition as overnutrition and our grocery stores are just loaded with choices. But there are a lot of parts of the world, you go to the market and you can get...maybe you can get bananas today, because that’s all they have, and tomorrow, you might be able to get only potatoes. So, where you don’t have choice, we really need to supply enough micronutrients to ensure a viable lifestyle.

[Sarah Gregory] That’s extremely interesting and I sadly suspected that that was the case. And thank you for that forthright and honest answer.

[Corrie Brown] Um-hmm.

[Sarah Gregory] Thank you so much for taking the time to talk with me today, Dr. Brown.

[Corrie Brown] Oh Sarah, it’s been a pleasure. Thanks for this opportunity!

And thanks for joining me out there. You can read the January 2020 article “Outbreak of Peste des Petits Ruminants among Critically Endangered Mongolian Saiga and Other Wild Ungulates, Mongolia, 2016–2017,” and the June 2019 article “Mass Die-Off of Saiga Antelopes, Kazakhstan, 2015,” online at [cdc.gov/eid](http://cdc.gov/eid).

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

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