

Erin Welsh	"But a far more general plague than the smallpox and a much more general scourge than the locusts, suddenly made its appearance, and dogged our steps. This was the rinderpest. No one who has not lived in Africa can form the least idea of this awful calamity. It mowed down the whole bovine race in its passage. Hundreds of carcasses lay here and there on the roadside or piled up in the fields. In vain did legions of vultures and beasts of prey gather to devour them, they could not overtake the quantity, and the carrion lay there, putrefying everywhere. More than 900 wagons, loaded with merchandise, without teams or drivers, stood abandoned along the Bulawayo road. In a few weeks - a few months let us say - I am assured that 800,000 head of cattle - some say 900,000 - perished in Khama's tribe alone. Never within the memory of man had such a thing been seen. The Government grasped the situation from the beginning. But in spite of all the sanitary cordons, and the severest preventative measures, the scourge pursued its course relentlessly."
TPWKY	(This Podcast Will Kill You intro theme)
Erin Allmann Updyke	Whoa.
Erin Welsh	Yeah.
Erin Allmann Updyke	800,000-900,000?
Erin Welsh	Oh that's like in one area, like in one person's herd, yeah.
Erin Allmann Updyke	One herd? Oh my.
Erin Welsh	Yeah. It was very challenging to pick just one firsthand account.
Erin Allmann Updyke	I bet.
Erin Welsh	There are so many.
Erin Allmann Updyke	Oh my gosh.
Erin Welsh	And I managed to sprinkle a few more in there. So that was from someone named Francois Coillard in 1897 about the arrival of rinderpest in South Africa.
Erin Allmann Updyke	Wow.
Erin Welsh	Hi, I'm Erin Welsh.
Erin Allmann Updyke	And I'm Erin Allmann Updyke.
Erin Welsh	And this is This Podcast Will Kill You.
Erin Allmann Updyke	And today we're talking about one of the most serious and intense diseases that you may have never heard of.
Erin Welsh	It's amazing how much more devastating it is than I thought it was going to be. Like I knew it was a big deal but holy cow, the sheer devastation and loss of life and the impact through history is...yeah.

Erin Allmann Updyke

I always try so hard to not get any of the history in my readings but it was kind of hard to not see little glimpses and oh my god.

Erin Welsh

Oh yeah.

Erin Allmann Updyke

So what disease is it, Erin, that we're talking about today?

Erin Welsh

We're talking about rinderpest.

Erin Allmann Updyke

Rinderpest!

Erin Welsh

Which is the German for 'cattle plague'. So it's a disease of cattle, surprise, surprise.

Erin Allmann Updyke

But really it's as intense as anything you would ever want if you're like, 'I don't care about cows', you're gonna care about these cows.

Erin Welsh

Yup. So Erin, what are we drinking for rinderpest?

Erin Allmann Updyke

We are drinking Udder Delight.

Erin Welsh

(laughs) Excellent.

Erin Allmann Updyke

Oh my goodness gracious.

Erin Welsh

Another milky one, Erin?

Erin Allmann Updyke

It's milky but not milky milky, you know?

Erin Welsh

Sure. So it's 'melk'.

Erin Allmann Updyke

Exactly! This is basically a piña colada but we've used coconut ice cream instead of cream of coconut.

Erin Welsh

Yeah.

Erin Allmann Updyke

So you could make it how you want it.

Erin Welsh

Yeah, I mean if you are lactose intolerant like our friend Katie, you can use something else besides coconut ice cream.

Erin Allmann Updyke

Right. Like those coconut cream ice creams that they have.

Erin Welsh

Yeah, exactly, exactly. Yum, those are good.

Erin Allmann Updyke

They're very good. And with post the full recipe for this quarantini as well as our nonalcoholic placeborita on our website thispodcastwillkillyou.com and our social media, of course.

Erin Welsh

Of course. Erin, do we have any business to take care of?

Erin Allmann Updyke

I really don't think so. 52 episodes. Keep counting.

Erin Welsh

We're starting to keep track again.

Erin Allmann Updyke

Yeah for like another episode until I forget.

Erin Welsh

Awesome. Erin, can we just dive in? Cause I really wanna know how this virus works.

Erin Allmann Updyke

Oh I'm really excited to tell you about it. Okay, let's take a quick break first.

TPWKY

(transition theme)

Erin Allmann Updyke

So this might be a new disease that we're talking about, I mean not new, it's really old, you'll tell us that. But it's also not going to be too new for some long time listeners, okay? Okay.

Erin Welsh

I think I know why.

Erin Allmann Updyke

You do know why, Erin. So rinderpest is the disease caused by rinderpest virus, RPV, which is in the genus Morbillivirus which happens to be the same family of viruses as one of our favorite human pathogens, measles. Ta-da! So I'm gonna likely throughout the biology and especially in the current section do some compare/contrast with what we already know about measles when we talk about this disease and its effects, okay?

Erin Welsh

Yeah.

Erin Allmann Updyke

And it turns out there's actually a lot of viruses in this family that are worthy of our concern. Measles we've talked about but there are also a couple of other important Morbilliviruses, PPR or Peste des Petits Ruminants virus, that means the plague of small ruminants, that affects sheep and goats. There's also canine distemper virus which if you have a dog, your dog has had to be vaccinated against canine distemper.

Erin Welsh

Right.

Erin Allmann Updyke

And then there are also a lot of marine Morbilliviruses that cause illness in dolphins and whales and seals which is super sad.

Erin Welsh

It's also really fascinating. Is it direct contact transmission?

Erin Allmann Updyke

That's a really good question, I don't actually know. One of the papers or one of the books that I read had a section on them but I had too much reading to do so I skipped over it. So I don't actually know how they're transmitted but I had that same thought. Yeah, I don't know.

Erin Welsh

It's really interesting to think about aquatic marine transmission of infectious disease.

Erin Allmann Updyke

I know. Aquatic viruses. Yeah. Okay so speaking of transmission, much like measles rinderpest virus is a highly infectious virus. I saw reports that it's spread via the respiratory route which is how measles virus of course is spread but really what it boils down to is that this is a virus that's spread by close contact with sick animals. So once a sick animal enters a herd, close contact with that animal is how that virus will spread. So it's not just through airborne transmission.

Erin Welsh: And can it also be transmitted by let's say a person traveling from herd to herd or farm to farm?

Erin Allmann Updyke: Potentially yeah because this virus is contained in a lot of the bodily fluids from animals, then if that person had that fluid then potentially. It doesn't live for very long outside of the body though so it would have to be pretty immediate contact I think, like maybe a veterinarian or someone moving from a sick animal directly to another herd or something like that.

Erin Welsh: Okay. Right. Yeah, okay, that makes sense.

Erin Allmann Updyke: Yeah. All right so importantly, while we talked about cows and this is often called cattle plague, this is a virus that infects a huge range of animal species, not just cows. Essentially it can affect pretty much the entire order of Artiodactyla which is the even-toed ungulates. I had to google a lot about ungulates, Erin, to do this episode.

Erin Welsh: I love ungulates.

Erin Allmann Updyke: I had no idea that there was even-toed ungulates and odd-toed ungulates, didn't know that was a thing.

Erin Welsh: Oh yeah.

Erin Allmann Updyke: You knew that already.

Erin Welsh: Well just from camera-trapping and having to do all the...

Erin Allmann Updyke: Oh, that makes sense.

Erin Welsh: Yeah.

Erin Allmann Updyke: So for those of you who aren't familiar with the even-toed ungulates, this includes water buffalo, wildebeest, yak, zebu, hippos, gazelles, impalas, the greater kudu, oryx, oribi, warthogs, pigs, goats, sheep. Pretty much all of the ungulates except the odd-toed ones which are horses, zebras, rhinoceroses, and tapirs. Okay?

Erin Welsh: Cool.

Erin Allmann Updyke: All right. But one thing that's really important is that although rinderpest virus can infect all these different species, there are a lot of different strains of rinderpest virus that differ greatly in their virulence, so how sick they make the animal, as well as their ability to actually infect these different species. So it's very possible to have an outbreak in for example a herd of water buffalo that seems like it doesn't infect the giraffes that are sharing the watering hole even though giraffes in general are highly susceptible to rinderpest virus. Okay?

Erin Welsh: That explains a lot about some of the reports and firsthand accounts that I'll talk about it.

Erin Allmann Updyke: I bet. Yeah, yeah. So there's definitely times where there's outbreaks that seem like they're only in a certain group of animal and it's likely just because of the strain of that particular virus.

Erin Welsh: Gotcha.

Erin Allmann Updyke

All right. So since this is a virus we know that it has to infect host cells in order to multiply and in the case of rinderpest virus, there are two different types of cells that this virus infects and you'll see that the cell types that this virus infects result in the symptoms of disease that we see. So first it infects the epithelial cells which we've talked about a lot on this podcast. Epithelial cells are those that line the tubes of your body and ungulate bodies also. So like your mouth, our respiratory tract, your digestive tract. And then also the lymphoid tissue, so that's like tonsils, lymph nodes, spleen, the intestine also has lymph tissue that are called Peyer's patches, those are really important in this infection. And lymphoid tissue is where basically mammalian bodies fight off infection, that's where our white blood cells congregate and so that's how animals fight off infection. Okay?

Erin Welsh

Gotcha, yeah.

Erin Allmann Updyke

All right. So in this case the damage that we see and the symptoms that we see from this infection are from direct viral damage to these cells. A lot of times when we talk about virus infections we are like are the symptoms because of the virus or are they because of your body's reaction to the virus? And so in this case it really is a ton of damage from the virus that are causing these symptoms. Okay?

Erin Welsh

Gotcha. Yep.

Erin Allmann Updyke

All right let's talk about the symptoms.

Erin Welsh

It's bad.

Erin Allmann Updyke

It's gnarly. It's really gnarly. Okay. There are 4 or 5 stages of disease depending on which textbook you read but they're really similar. So they are incubation, prodrome, mucosal phase which is sometimes combined with the diarrheal phase, and then the convalescent phase or death.

Erin Welsh

Which the 'or death' is...

Erin Allmann Updyke

Not funny.

Erin Welsh

If you get to the convalescent phase you are an extremely lucky ungulate.

Erin Allmann Updyke

Or you had a very non virulent strain.

Erin Welsh

Fair. Yes, yes.

Erin Allmann Updyke

Okay. So let's go through these phases. The incubation period we know is the time from when you first get infected until you start to show symptoms. So in the case of rinderpest virus, most reports say this is between 3-9 days but it really depends on the strain, so it can be as great as 11 or even 15 days if it's a less virulent strain. But in general 3-9 days.

Erin Welsh

Do these strains have any pattern in geographical distribution? Rinderpest virus comes from Asia so are strains less virulent there? Is that one of the drivers?

Erin Allmann Updyke

Good question. I'm not sure strains are less virulent in Asia as compared to Africa for example but they definitely do vary geographically and really it's about the species which they infect. So a strain might be really virulent in wildebeest but then less virulent in a giraffe if they even can get infected at all.

Erin Welsh	Why?
Erin Allmann Updyke	Great question. It's such a good question and I don't also know how many different strains are there. Are there dozens, are there hundreds? I don't know but there's a lot. There's more than a couple.
Erin Welsh	Interesting, yeah. I knew that there were a bunch of strains but now I have so many questions.
Erin Allmann Updyke	Well we'll see if I answer any of them. All right. Then you'll begin the prodromal phase. The prodrome we've talked about a lot on this podcast but it's basically nonspecific symptoms before you get to the real symptoms of disease. And so this prodromal phase usually lasts about 3 days and the symptoms start with - wait for it - a fever.
Erin Welsh	A fever? (laughs)
Erin Allmann Updyke	I love it. I mean I don't love it. Generally it's a very sudden onset of fever which can get as high as 41.5 C which is 106.7 Fahrenheit.
Erin Welsh	What is the normal body temperature for an ungulate?
Erin Allmann Updyke	Oh Erin I'm so glad that you asked! (laughs) Because I looked it up and I found one paper, this was looking at gemsbok and wildebeest. So for them the average body temperature varied depending on environmental conditions between 37.5 and 39 C, so that's 99.5 Fahrenheit and 102.2 Fahrenheit.
Erin Welsh	Okay so it's really not that... I mean it's a high fever but it's not like in humans, it's not as concerning as that temperature would be in humans.
Erin Allmann Updyke	Right.
Erin Welsh	I mean but still it's rinderpest so it's bad news.
Erin Allmann Updyke	It's really high I think no matter what. In humans that fever could kill you easily but even for an ungulate, even at their high end of temperature range of 102, 106 is 4 full Fahrenheit degrees higher than that, that's high.
Erin Welsh	Yeah. No it's definitely a high fever.
Erin Allmann Updyke	So anyways. So then this prodromal phase also has some other nonspecific symptoms. Restlessness, anorexia, so the animal might stop eating, always I've seen the descriptions their muzzle gets dry, so the hairs around their muzzle get really dry, if they are lactating their milk yield will drop, their breathing will become fast, it will become shallow and more rapid, and then their mucus membranes start to get congested with secretions, so their mouth, their nose, their eyes start having purulent secretions coming out of them.
Erin Welsh	Sounds pretty terrible.
Erin Allmann Updyke	Pretty terrible.
Erin Welsh	And that's just the prodrome stage, just stage 2.

Erin Allmann Updyke: Just the prodrome, just stage 2.

Erin Welsh: Cool.

Erin Allmann Updyke: Then you enter the mucosal phase. This starts about 2-5 days after the first onset of fever and it starts with tiny little pinhead spots of necrosis, so tissue death, in those epithelial cells in the mucus membrane which looks like little pinpoint gray or white spots in the mouth of the animal. Does that sound familiar to you? Because it should.

Erin Welsh: Sounds like measles?

Erin Allmann Updyke: It sounds like Koplik spots which are pathognomonic for measles in humans.

Erin Welsh: That's exactly what I was gonna say, I totally had those words right there. I hadn't forgotten that at all. (laughs)

Erin Allmann Updyke: You did remember though measles, that's pretty good.

Erin Welsh: Well only because they're very similar.

Erin Allmann Updyke: I know, literally the same.

Erin Welsh: I'm like, 'Measles has spots!'

Erin Allmann Updyke: I know. But isn't that so interesting? Oh I think that's so interesting.

Erin Welsh: It's interesting and all I can think of is I picture owning cattle and then doing a check and seeing those spots and being like, 'Oh god...'

Erin Allmann Updyke: Just terrified, yeah.

Erin Welsh: Knowing what's ahead of you is horrible.

Erin Allmann Updyke: It's not good, it just gets worse. Let's keep going. So in the affected animals, the spots appear in the mouth and then they tend to extend. So whereas in measles they just tend to be those pinpoint spots, here they're going to start to enlarge, they're going to involve larger and larger areas of epithelium, the tongue, the pharynx, and these spots are not only contained in the mouth. These mucosal erosions are happening throughout the entire digestive system as well. Okay. So that leads into the next phase which is sometimes combined with this and that is the diarrheal phase.

Erin Welsh: That makes sense. Your body just basically can't digest anything.

Erin Allmann Updyke: Exactly, yeah. So this diarrheal phase, if you separate it out, tends to start about 4-5 days after the onset of fever, 1-3 days after the first spots appear in the mouth. And it's basically uncontrolled profuse diarrhea, liquid, explosive, green-yellow-gray at first and then with a lot of mucus and blood. And that's because those erosions have extended to most of the digestive tract.

Erin Welsh: Oh my gosh.

Erin Allmann Updyke: I know, it's horrific. Yeah. And that's kind of the biggest, animals often die from dehydration from just the massive, massive amount of diarrhea.

Erin Welsh: Okay.

Erin Allmann Updyke: You can also see a maculopapular rash which is the same type of rash that we see in human measles on areas of soft skin of the animal that don't have a lot of hair covering them, so like the udders or in the groin or the axilla, the armpits and leg-pits. And then you'll still have the discharges from the eyes and the nose. These animals are very, very sick even though the fever tends to subside by this time, they're wasting away, right.

They're not eating because these erosions are throughout the pharynx, they can be in the respiratory tract as well, so they're not eating a lot, they're salivating a lot, they're not moving, they often have coughing and grunting with exhalation suggesting that breathing is painful or difficult, they become severely dehydrated. And they often adopt this characteristic stance that's called milk fever posture which I looked up what it looks like. This is not milk fever, that's something entirely different, but it's basically where they put their sternum onto the ground and then they kind of flop onto their side and their head turns to one side and their legs are kind of slumped underneath them. And most often they'll die within 5-14 days after the first onset of illness.

Erin Welsh: This is so sad.

Erin Allmann Updyke: It's really, really sad.

Erin Welsh: When are they first infectious?

Erin Allmann Updyke: Great question. They're most infectious after the onset of symptoms.

Erin Welsh: Okay.

Erin Allmann Updyke: So there have been in a lot of experimental studies, you can swab an animal and then infect another animal before those symptoms first start but really it's once the symptoms start, once those spots appear and they're symptomatic, that's when they're most infectious.

Erin Welsh: Okay so in the mucosal phase/stage.

Erin Allmann Updyke: Yes, the mucosal and diarrheal phase, yeah.

Erin Welsh: Gotcha.

Erin Allmann Updyke: And that diarrhea: full of virus.

Erin Welsh: I was gonna say.

Erin Allmann Updyke: Yeah, absolutely.

Erin Welsh: Well I was just imagining being a vet before you knew what rinderpest was and how it was transmitted and walking in your boots on one farm and going to the next farm, walking on your boots. Like it's so easy.

Erin Allmann Updyke: Yeah. The good thing is it doesn't live for very long in the environment.

Erin Welsh: Do you know how long?

Erin Allmann Updyke: Most of the things I saw were like 48 hours max.

Erin Welsh: Okay.

Erin Allmann Updyke: Yeah.

Erin Welsh: That's long enough.

Erin Allmann Updyke: I mean it is but they mostly were suggesting that you would need really high concentrations of the virus in the environment for an animal to get infected just from environmental exposure.

Erin Welsh: Okay.

Erin Allmann Updyke: So yeah. If the animal doesn't die, so if they had kind of a less virulent strain for example or if they somehow happen to survive this infection, the convalescent phase is the last phase, it's quite prolonged. While the lesions, those mucosal lesions tend to heal within a week or so, there's often secondary bacterial infections on top of those and the diarrhea takes a really long time to resolve, like 4-5 weeks.

Erin Welsh: Yeah I can imagine it would have to come with long term health effects.

Erin Allmann Updyke: Absolutely, absolutely. Speaking of long term effects, you remember in our measles episode we talked about how much measles wrecks our immune system.

Erin Welsh: Immune amnesia.

Erin Allmann Updyke: Mm-hmm. Measles causes immunosuppression immediately after the infection that can persist for a long time as well as causing that immune amnesia that you mentioned where we can no longer fight off infections we had previously been exposed to. Rinderpest also absolutely wrecks havoc on the immune system of these animals. So it's very common that even if an animal survives rinderpest infection, latent infections can become activated after, so things that they maybe had some bacteria kind of growing somewhere or a parasite of something that their body was just low-level taking care of, now can become reactivated and they can become more ill from a second infection afterwards. And it's because remember that this virus infects your lymph tissue, right. So it's actively causing depletion of your immune cells, that's one of the hallmark kind of lab signs that you would see if you were to draw a cow's blood while it's infected, they'd have almost no white blood cells.

Erin Welsh: Yeah. Makes sense.

Erin Allmann Updyke: Yeah. It's really, really depressing. Overall mortality rates are often over 90%, approaching 100%.

Erin Welsh: It's unreal.

Erin Allmann Updyke: Yeah.

Erin Welsh: I mean it's very real but it's hard to believe.

Erin Allmann Updyke: I know, it's absolutely horrific. I mean that's the disease in a nutshell.

Erin Welsh: It's a really bad one.

Erin Allmann Updyke: It is a really bad one. So should I say the good news right now just so that people don't get too depressed before we start on the history?

Erin Welsh: Sure!

Erin Allmann Updyke: We eradicated it!

Erin Welsh: Yeah. It's the second disease to be eradicated.

Erin Allmann Updyke: Ever in the history of diseases.

Erin Welsh: It's so cool, it's so cool.

Erin Allmann Updyke: It's very, very cool. So this disease no longer exists in the wild, in domestic animals, it doesn't exist except in laboratory vials.

Erin Welsh: Yep. And a lot of labs, not all, but some have destroyed their stocks which is great.

Erin Allmann Updyke: Yes, they sure have which is thrilling. So yeah. So Erin, what the heck?

Erin Welsh: I can't wait to tell you.

Erin Allmann Updyke: I wanna know everything. Where did it come from? How bad has it been? I wanna know it all.

Erin Welsh: Okay. Let's take a quick break first.

TPWKY: (transition theme)

Erin Welsh: Even though rinderpest is highly related to measles as you mentioned, I think that one appropriate comparison is that rinderpest is basically the smallpox of the cattle world even though there's also cowpox.

Erin Allmann Updyke: But this is much worse than cowpox, right?

Erin Welsh

It's much worse than cowpox. And so the reason I say that is because if you think about our smallpox episode or just think about smallpox, you may remember it is a horribly devastating, super contagious, fatal disease and there have been massive epidemics that have killed huge numbers of people and paved the way for colonialism. And then just as with smallpox there's this happy ending with the eradication of the disease. So all you have to do in thinking about smallpox is replace people with cattle and there you go.

Erin Allmann Updyke

So story over, just listen to our smallpox episode? (laughs)

Erin Welsh

There you go, there you go. And my work here is done. Nope, not really. But yeah, so as you talked about Erin, rinderpest is a horrible disease and has had a huge economic impact in affected areas. And it's obviously been eradicated but I think to understand why there was such an effort made to eradicate this disease, because eradication requires a lot of resources, a lot of time, a lot of money, and it's also not possible for all pathogens. And so why this one? Why did we choose to eradicate rinderpest? And to understand that I think it calls for talking about its massive history.

Erin Allmann Updyke

Yes!

Erin Welsh

Cause it is so massive and so interesting and I had no idea, so I'm very excited. Okay. Where did rinderpest come from? Well it's very, very, very old. Like measles, so as we talked about in the measles episode - there's gonna be a lot of that - measles requires a certain size of a population, a population density, in order to be sustained otherwise it just burns itself out and then it's gone. And that's the same thing for rinderpest virus. And cattle and other ungulates are herd animals and they probably reached that critical mass before humans did. So it's thought that rinderpest may have evolved with bovines since the Pleistocene, so like 2 million to 12,000 years ago, somewhere in there, but domestication probably facilitated its transmission and allowed for it to be sustained within these populations.

And then once humans grew in large enough populations, rinderpest jumped species and evolved into the measles virus maybe 5000-7000 years ago, maybe as recently as the 11th century. If you wanna hear more, listen to our measles episode. Rinderpest probably had its geographical origins in Asia and was probably restricted to that part of the world until around 370-ish current era, at least as far as we can say for sure, as far as there is universal agreement, mostly universal agreement. Is there universal agreement in anything in science?

Erin Allmann Updyke

No, no. Gravity maybe.

Erin Welsh

So there are some mentions in papyri from Ancient Egypt that might be rinderpest dating back to 3000 BCE describing an ill bull with labored breathing, runny eyes, inflamed gums, and a swollen neck. And the treatment was either to submerge the bull in water or cover it with cucumber slices if that didn't work.

Erin Allmann Updyke

Wait, what?

Erin Welsh

Yeah, to cool it down cause they think it was indicating that it was like a fever, that's why you had to cool it down.

Erin Allmann Updyke

Cool as a cucumber?

Erin Welsh

Yeah, exactly. (laughs)

Erin Allmann Updyke Oh my goodness. That would take a lot of cucumbers.

Erin Welsh I know, I don't know how many you would need. How many cucumbers would you need to cover an average size bowl?

Erin Allmann Updyke Should we ask Siri?

Erin Welsh We'll ask the internet. The listeners.

Erin Allmann Updyke Okay.

Erin Welsh Someone do the math for us. Just kidding. And also rinderpest may have been the 5th plague of Egypt mentioned in Exodus.

Erin Allmann Updyke What?

Erin Welsh So from Exodus, this is a line from Exodus: "This is what the Lord, the God of the Hebrews says. Let my people go so that they may worship me. If you refuse to let them go and continue to hold them back, the hand of the Lord will bring a terrible plague on your livestock in the field, on your horses and donkeys and camels and on your cattle and sheep and goats." Horses are in there too so maybe not, could have been anthrax, we don't know.

Erin Allmann Updyke Yeah.

Erin Welsh And some researchers point to a description of a cattle disease in Ireland from around 2048 BCE but it's debated whether that's actually rinderpest.

Erin Allmann Updyke Okay.

Erin Welsh Because the challenging this about tracing back these early mentions of rinderpest is trying to distinguish it from all of the other horrible diseases that affected cattle and livestock.

Erin Allmann Updyke Right.

Erin Welsh So namely foot and mouth disease and also as I said, anthrax. But usually you can tell between an anthrax epidemic and a rinderpest epidemic in historical texts. If the descriptions are of just cattle being affected then it's probably rinderpest but if it's cattle and humans and dogs and other animals then it's probably anthrax.

Erin Allmann Updyke That makes sense.

Erin Welsh Okay. So that brings us to the first recognized description. Around 370 CE the Huns began their invasion of Europe starting in the Southeast. They brought with them gray steppe oxen which happened to be remarkably resistant to rinderpest, so about a 25% mortality rate instead of the 95-100% experienced by other cattle.

Erin Allmann Updyke Okay.

Erin Welsh

But even though these oxen were resistant, they could still spread the disease and spread it they did. And so after the invasion by the Huns, a combination of drought and rinderpest led to the deaths of nearly all the cattle in Europe around this time, especially Southeast Europe.

Erin Allmann Updyke

Whoa.

Erin Welsh

Yep. And this plague raged for nearly 10 years from 376-396 CE, impacting Rome, Belgium, Hungary, Austria, France, etc.

Erin Allmann Updyke

Wow.

Erin Welsh

It was big, yeah. And from this first epidemic the disease basically became established, it became endemic in Europe with epidemics occurring every few years, just like we see with measles. Once you get enough susceptibles back into the population, then you get another outbreak, and then there aren't enough to sustain it, and so on and so forth.

Erin Allmann Updyke

Right.

Erin Welsh

And the length of these epidemics varied based on how many susceptible cattle there were, the movement of the cattle, whether there were any control measures enacted, how politically stable a region was, it varied. So even though the length varied, what they did was perpetuate it enough so that rinderpest kind of slowly spread throughout the rest of Europe, finally reaching England, Ireland, Scotland, and Wales around 694-707 CE.

Erin Allmann Updyke

Wow.

Erin Welsh

And that was another horrific outbreak which led to famine in which people reportedly had to resort to cannibalism in order to survive. And there it was called steppe murrain because it was thought to have come from the steppe country around the Caspian basin, so like between Southern Europe and Asia, just a little side note. But if you remember from our lactose intolerance episode, different parts of Europe relied on pastoralism to different degrees.

Erin Allmann Updyke

Right.

Erin Welsh

And so the impact of rinderpest may have varied based on that. And so in a place like England which had a higher reliance on cattle, like it was really devastating.

Erin Allmann Updyke

Right, that makes sense.

Erin Welsh

And that very first rinderpest epidemic following the invasion of the Huns started a long, long period of rinderpest rule in Europe and Asia and a few patterns emerged. So like I said, there was a cyclical pattern where epidemics would occur every few years and they were often associated with drought. Drought seemed to actually be a trigger for rinderpest because the stress and malnutrition weakened the immune system and also if you have a drought then your water sources tend to be more concentrated, so you get congregation.

Erin Allmann Updyke

They congregate. Oh gosh, double triple whammy, man.

Erin Welsh

Oh yeah, oh yeah. And another pattern was that rinderpest became known as a disease of war. If you were heading a warring army or whatever you had to bring a ton of equipment with you like weapons and food and tents and clothing. And so oxen were in super high demand, you had to have huge teams of oxen and you're bringing these oxen from one place to another, allowing for pathogen mixing basically.

Erin Allmann Updyke

That's not good.

Erin Welsh

And also armies would travel with cattle as a food source, as a portable food source. And not just food but also for materials like leather. You can do a lot with one cow.

Erin Allmann Updyke

Yeah, you sure can.

Erin Welsh

It's amazing. And so there's no doubt that rinderpest changed the course of history by impacting warring armies and who made it where and when and who could actually leave.

Erin Allmann Updyke

Wow.

Erin Welsh

So for example Charlemagne's campaigns in Central Europe around 800 CE were slowed down by rinderpest. Quote, "So great was the pestilence of oxen in this expedition that scarcely in the whole army did one remain, but all perished. And not only there but a plague among animals causing a dreadful mortality broke out in all the provinces conquered by the emperor."

Erin Allmann Updyke

Wow.

Erin Welsh

So it happened, it happened a lot, and it was devastating. And just the rise of trade and increase in human movements also led to a rise in rinderpest. Makes sense. And because I mentioned Ancient Rome I also have to then attribute the fall of the Roman Empire to rinderpest in this episode.

Erin Allmann Updyke

Of course! You know we haven't gotten to do that in a while on this podcast.

Erin Welsh

With really haven't.

Erin Allmann Updyke

It's about dang time.

Erin Welsh

This might be less of a stretch than the other ones, not rinderpest but at least the invasion of the Huns into Rome along with the Goths is thought to be one of the major contributors to the fall of the Roman Empire according to some source that I read. And so basically rinderpest became this enormously dreaded disease because its arrival in a region meant that the next few months to years would be extremely difficult. There was economic devastation, loss of an important food source, loss of crucial materials. If something, anything had the slightest chance of reducing the disease or preventing its spread, people tried it out. So people had long recognized the contagiousness of the disease, so they would slaughter cows that appeared infected, etc. But no cure could be found that was effective but that didn't stop people from trying. It's outrageous ancient cures time, Erin!

Erin Allmann Updyke

Yes! Another thing we haven't done in far too long. This is just full of everything we love.

Erin Welsh

I know. It is. Okay so we already know about the practice of covering the cow in cucumbers, that didn't work. Well in Ancient Egypt you were also advised to cut the cow's tail and nose and cover its eyes with burnt linen.

Erin Allmann Updyke

What?

Erin Welsh

I'm just reading what I read, Erin.

Erin Allmann Updyke

Cut their tail off or just like put a little cut in it?

Erin Welsh

You would cut it to bleed it.

Erin Allmann Updyke

Okay. That's weird, all right.

Erin Welsh

I mean of course. And in Ancient Rome a preventative was to quote, "give to the cattle a mixture of salt, laurel leaves, onions, cloves of garlic, incense, powdered rue, and burning charcoal made up with a little wine." Just a little cocktail.

Erin Allmann Updyke

Little quarantini.

Erin Welsh

Cattle quarantini. And if that didn't work and the cow became infected then you'd quote, "make it swallow an egg whole and then the next day give a clove of garlic beaten up in wine." I don't know how you make a cow swallow an egg whole.

Erin Allmann Updyke

A chicken egg or like what? Be more specific here.

Erin Welsh

Yeah I guess there's a lot of loopholes in these ancient cures.

Erin Allmann Updyke

There are. You could do a quail egg or fish egg, I don't know.

Erin Welsh

Could be a quail egg. Ostrich egg? And then of course purgatives and bleeding were super popular cures. A whole market around snake oil cures for rinderpest sprung up, so one of these from 18th century Germany was a bacon and flax enema for the cow. Little bits of bacon you'd put up the cow's butt after it's had its whole diarrhea fest.

Erin Allmann Updyke

With also flax and bacon?

Erin Welsh

And then if it became constipated you put an apple up there, a small apple.

Erin Allmann Updyke

A small apple, not a large apple? (laughs)

Erin Welsh

No, just a small apple.

Erin Allmann Updyke

You can cut it up first or do you just...?

Erin Welsh

No, no, no. Of course not. You would diminish its curative powers that way.

Erin Allmann Updyke

Wouldn't wanna break the skin. Oh goodness, okay. For constipation that'll do it.

Erin Welsh

Oh yeah, for sure. And if these preventatives or cures didn't work and they never did, ever, they never did, there was always prayer and ritual. And so sometimes cattle were branded with a cross between the eyes, sometimes the head of the first cow to die was cut off and then displayed or a cow skull was buried under the house. Those were all widespread practices.

Erin Allmann Updyke

Okay.

Erin Welsh

And other times there were slightly more elaborate rituals to protect a village from rinderpest. Until the late 1800s people didn't know what caused rinderpest and theories ranged from the typical miasma to punishment by god to maybe witchcraft. And outbreaks of rinderpest were often accompanied by accusations of witchcraft and many villages employed annual rituals to protect them from the disease. So I wanna read to you a couple of these rituals from Russia because I think it's so fascinating, like they're intricate and specific. Okay so first confine all the men and cattle and make sure they don't escape.

Erin Allmann Updyke

Together or...?

Erin Welsh

It didn't mention that so maybe not as specific as I was hailing it to be.

Erin Allmann Updyke

Okay. All right, they're confined.

Erin Welsh

And then the women should wear their shifts and let their hair down. Then the oldest woman should be yoked to a plow which is then drawn around the village three times while the rest of the women follow behind her carrying shovels and tongs and sing.

Erin Allmann Updyke

You make the oldest woman yoke around the town three times? Alone?

Erin Welsh

Well she's followed by the rest of the women in the village.

Erin Allmann Updyke

Yeah but are they helping hold the thingy?

Erin Welsh

I think they are, I think they are.

Erin Allmann Updyke

Okay. I would hope.

Erin Welsh

I would hope. Alternatively, still with the men and cattle locked up, old women with fir like the tree, fir tree torches, circled a widow who was naked with a horse collar around her neck. Right? And then they had to go to each farmyard and cry out, 'Aye! Aye! Cut, hew the cow death! There she goes!' And if a cat or a dog ran out, that was taken to be the cattle plague, like the spirit of the cattle plague, and it was killed.

Erin Allmann Updyke

So is this not witchcraft?

Erin Welsh

That's what I was thinking too. A lot of these rituals that protect the village from witchcraft sound a lot like witchcraft.

Erin Allmann Updyke

Right?

Erin Welsh

Like what people would think of as witchcraft, I don't know.

Erin Allmann Updyke

Yeah. I don't know either. But a naked lady in a field being surrounded by burning fire torches sounds a lot like what I think of as... That is what Practical Magic has led me to believe witchcraft is.

Erin Welsh

It really is. (laughs) That's my touchpoint. And then this was the song that was often sung to get the plague to leave: "Death, oh thou Cow-Death, depart from our village, from the stable, from the court! Through our village goes holy Vlasy," which is the saint who was the protector of rinderpest, "with incense, with tapir, with burning embers... Come not to our village! Meddle not with our cows, nut-brown, chestnut, star-browed, white-teated, white-uddered, crumple-horned, one-horned." You sing that. Put that to music.

Erin Allmann Updyke

Now can you sing that in Russian for us?

Erin Welsh

(laughs) I cannot. And throughout Europe, this wasn't restricted to Russia, throughout Europe fire festivals were often held to try to protect villages and a lot of these included just marching the cattle in a certain direction around a fire.

Erin Allmann Updyke

Fire festivals?

Erin Welsh

Fire festivals. I know, I had to put that in there. Fire festivals. And these cattle protection or purification rituals were not restricted to Russia and Europe of course. So for example in Western Africa, Fulani pastoralists would often build an arch at the mimosa tree and drive the cattle through them as a protective measure. But in some of these rituals however the opposite of the desired effect was achieved. So for instance, if you're gathering all the cattle in the village together to then march around the fire, there's gonna be more interaction, there's gonna be more potential transmission. And one of the other practices was that priests would travel from farm to farm to bless the cattle and then that often ended up being basically transmitting the disease from farm to farm. So this wide variety of cures as well as how geographically distributed they were shows just how important this disease was considered to be. But let's put some numbers to that. So Erin, you talked about the extremely high mortality rate, so we already know in theory how devastating it could be.

Erin Allmann Updyke

Right.

Erin Welsh

And often the death toll was made worse by those secondary bacterial infections or by the very common practice of slaughtering a herd to try to prevent its spread, so like the preemptive killing. Even if a cow was suspected to be sick it was often killed.

Erin Allmann Updyke

Culling the herd.

Erin Welsh

Culling the herd. All right so let's check out rinderpest in Europe in the 18th century during which time there was essentially a panzootic, like a pandemic but for animals. Between 1711-1769 an estimated 100 million cattle in Europe died from rinderpest in like 50 years.

Erin Allmann Updyke

Whoa.

Erin Welsh

And by the end of that century, so from 1711-1800, it was around 200 million cattle that had died. Which like imagine the economic toll. Imagine the loss of food.

Erin Allmann Updyke

Oh my goodness.

Erin Welsh

And in India and other parts of Asia, cattle deaths would run into the hundreds of thousands every single year, basically up until the time when vaccination became more widespread and available. It's really bad. So if your livelihood was livestock, you could go from wealthy or comfortable or surviving to abject poverty within 10 days as rinderpest swept through your herd.

Erin Allmann Updyke

Ugh, god.

Erin Welsh

And you would think that given this much time, the disease may have decreased in lethality a bit in those places where it had been endemic for a very long time. But it didn't really seem to all that much or at least as much as you would expect which is very interesting. So for instance that panzootic in Europe in the 18th century, that had an overall mortality rate of around 90%.

Erin Allmann Updyke

Wow.

Erin Welsh

Yeah. And certainly in some parts it wasn't as deadly or certain breeds of cattle or oxen were more resistant but still not great.

Erin Allmann Updyke

Yeah.

Erin Welsh

This was like the Black Death or smallpox of cows and it's extreme lethality of course earned it the name that we call it today, rinderpest, which is German for cattle plague like I said. By the late 19th century, rinderpest had been a feared disease for centuries and that fear had led to strict policies about cow movement and importation being implemented all over Europe and Asia to try to prevent these outbreaks. But obviously they didn't always work and soon the world would see the devastation that rinderpest could cause when released into an immunologically naïve population of susceptible hosts.

Erin Allmann Updyke

Oh no.

Erin Welsh

Yeah. Up to this point, so up to the late 19th century, rinderpest in Africa had been limited to the Nile River Valley with occasional outbreaks occurring from trade with Europe and the Middle East. But its movement south of that area had been restricted fortunately. But that all changed when in 1887 or 1888 infected cattle were brought to Ethiopia by an Italian military campaign who was invading to try to take control. And what followed would be one of the most devastating panzootics ever to be witnessed. From Ethiopia, rinderpest spread south rapidly, leaving corpses in its wake. I have another quote here and I have a few more quotes in this section because I couldn't resist.

Erin Allmann Updyke

Give them to me.

Erin Welsh

Never before in the memory of man or by the voice of tradition have the cattle died in such vast numbers. Never before has the wild game suffered. Nearly all the buffalo and elend are gone, the giraffe has suffered and many of the small antelopes, the bushbuck and reedbuck I believe especially. That was from Lugard, 1893. East Africa fell victim to the cattle plague, its enormous herds of wild ungulates and cattle herded by the Maasai nearly all killed.

Erin Allmann Updyke

Oh my gosh.

Erin Welsh

South Africa watched helplessly as rinderpest continued its spread and was given a brief reprieve when it was temporarily stopped by the Zambezi River. But it wouldn't hold for long and in March 1896 the cattle plague cross the Zambezi and basically sealed the fate of the entire continent. In some parts of the continent, rinderpest arrived alongside a severe drought.

Erin Allmann Updyke

Oh no.

Erin Welsh

Like a really, really horrible one followed by late rains which led to huge swarms of locusts that ate all the crops. And when the rains did finally come they arrived in such intensity that the crops that had survived the drought and the locusts and the rats and the caterpillars were destroyed.

Erin Allmann Updyke

Oh my.

Erin Welsh

The loss of cattle and crops brought on an extreme famine and in East Africa there was still one more horseman of the apocalypse to arrive, this time in the form of a massive smallpox epidemic that swept across the region.

Erin Allmann Updyke

Are you kidding, dude?

Erin Welsh

No, I know. It is awful, just devastating. The loss of human life from famine, from smallpox, from other diseases that were happening was incredible with an estimated death toll of up to 1/2 to 2/3 of the population in parts of East Africa.

Erin Allmann Updyke

What?

Erin Welsh

Yep. And the death toll of livestock and wildlife was something no one had witnessed before. Across the continent an estimated 80-90% of cattle, buffalo, elend, giraffe, wildebeest, kudu, and antelopes died. Like of all of them, not just of the ones infected but of all of them. In South Africa alone about 2.5 million cattle died within a couple of years. Even though the Great African Panzootic which was 1887-1897, even though it occurred after the development of germ theory, help arrived too late to do much. So a team largely composed of veterinarians had started in 1896 to try to develop an immune serum as a treatment and Robert Koch arrived that same year to work on a vaccine. Oh and a side note that I forgot to mention earlier, veterinary education and veterinary schools were started in large part due to rinderpest and trying to understand, yeah.

Erin Allmann Updyke

I did not know that.

Erin Welsh

Isn't that cool?

Erin Allmann Updyke

Yeah.

Erin Welsh

Yeah, yeah. So Robert Koch discovered that the bile from an infected ox was generally noninfective and could actually induce immunity to rinderpest but it also wasn't perfect and ended up causing a certain degree of death or active infection which was of course problematic. Giving both immune serum and virulent blood did seem to work however to produce longer term immunity but in any case they methods of immunization arrived a bit too late to have any effect on the Great African Panzootic but they were helpful in advancing veterinary knowledge and slowing down future outbreaks. So this massive outbreak kind of more or less just died out on its own after there were no more susceptible animals to perpetuate the disease. And the impact wasn't just that it killed millions upon millions of cattle and wild ungulates and led to widespread famine and poverty, it also had an incredible amount of cascading effects both sociopolitically and ecologically and in many, many other parts of life.

And I wanna talk about those, wanna do a little bit of a magnifying glass on some of those because I think this is where it gets very connections-y. You get to see the widespread implications of a pandemic or a panzootic. So as in many other places, cattle played an extremely important role in the daily life for many people in Africa. They served as a food source but also as plow animals for land cultivation, travel and transport of goods, materials for the goods themselves so like cowhides used as clothing, sleeping mats, leather, etc. Dung was used as fertilizer or as a fuel for heating and this last bit, dung is fuel for heating, became especially important at the end of the 19th century when the European colonial rule was kind of booming and they had taken over forests and commercialized them, outlawing the collecting of wood for fires.

Erin Allmann Updyke

Oh my gracious.

Erin Welsh

So yep. Cattle also played a huge role in trade and as a form of currency. They were often used in arranging marriages and also as a punishment, if you committed a crime you may have had to pay in cattle. And so the death of 90-100% of your cattle herd for many people meant instant poverty and no food. The rinderpest panzootic came at a time when European countries were scrambling for control over the continent, particularly the southern half of the continent, and many countries were already under European rule but these colonial governments were always afraid of an uprising and did whatever they could to stomp out any signs of rebellion. In European reports at the time there was a belief that the massive loss of cattle would lead to unrest and rebellion and so they decided to arm themselves heavily to preempt any signs of an attack.

Erin Allmann Updyke

What?

Erin Welsh

I know, I know.

Erin Allmann Updyke

That's their reaction? Oh dear.

Erin Welsh

So when rinderpest began killing cattle, early rumors began circulating that the rinderpest was a deliberate poisoning by white European colonists. According to reports from the time, it actually does seem that the cattle owned by Africans died at a much higher rate than those owned by Europeans. And while Europeans may not have been deliberately poisoning the cattle, there is a lot of evidence that shows that they used rinderpest as an opportunity for further oppression. For instance prior to the panzootic, there had been in these reports these huge complaints about a shortage in laborers to work in mines or other European-headed industries. And rinderpest coming to wipe out the livelihoods of so many Africans was viewed as a blessing in disguise by Europeans.

Erin Allmann Updyke

Oh-

Erin Welsh

Yeah. Because with no cattle to rely on they had to find money elsewhere, such as in the mines, that was sometimes the only option left.

Erin Allmann Updyke

Why can humans be so evil to other humans? Like I just...

Erin Welsh

It gets worse.

Erin Allmann Updyke

It always does Erin, it always does.

Erin Welsh	It gets worse and worse. In the midst of the panzootic, the mine owners were like, we're gonna use this time to reduce the wages by 30% and increase hours that somebody had to work. Okay so this is a quote by the president of the Mine Managers Association: "The natives here have to work because they cannot obtain food otherwise and therefore I think we have a splendid opportunity to bring this change into operation." That was about reducing the pay and increasing the hours.
Erin Allmann Updyke	Oh my god.
Erin Welsh	I know. I have one more.
Erin Allmann Updyke	Go.
Erin Welsh	I have one more quote because just to further illustrate the outlook of a lot of people who were in charge at the time. Quote, "The ravages of the rinderpest, although reducing the natives to poverty, have not been without beneficial results and the native has now learnt humility to those to whom he is subordinate and also the lesson that by work only can he live. And having learnt to work, he is now a happy and contented man instead of the discontented, indolent, lazy and besotted being he was when the numerous cattle he possessed provided his every want."
Erin Allmann Updyke	There is so much there to just boil your blood.
Erin Welsh	I know, yeah. What it was was seen as this opportunity to decrease self-reliance of those that they wanted to subjugate and oppress.
Erin Allmann Updyke	Right and because if they're not working for you then they're just lazy slobs, just herding cattle cause that's just like the easiest thing to do.
Erin Welsh	Yeah. I mean it really is revealing about the mindsets and the priorities of the people who were in charge at this time.
Erin Allmann Updyke	Wow.
Erin Welsh	Yep. And so European colonists further exploited rinderpest to impoverish Africans such as in South Africa, like when only Africans had to be dipped in a solution of carbolic soap at quarantine stations but not white Europeans.
Erin Allmann Updyke	What? This is to try and quote "combat" rinderpest supposedly?
Erin Welsh	Uh huh.
Erin Allmann Updyke	No, no.
Erin Welsh	And rinderpest was claimed to be spread only by wagons owned or ridden by Africans so that only their movements were restricted which meant no trade opportunities, deepening their poverty.
Erin Allmann Updyke	That's logical.

Erin Welsh

And then there was the fencing land. So fences were put up to try to restrict cattle movement and create cordons where cattle would not interact but fencing has long been recognized as paving the way for colonial incorporation and land alienation. And then there was the militarization of the South African government's anti-rinderpest campaign which places armed guards along fences and quarantine stations. And finally one of the biggest problems with this rinderpest epidemic was that the only epidemiological control measures that were employed were extremely crude, I mean there was no really other way to do it. You either had to kill the cattle that were infected or suspected to be infected or you create these cordons like I mentioned to restrict movement. But of course there was no compensation if you had to slaughter your cattle and so farmers often hid infected cattle which worsened the outbreak. And then the slaughter of cattle itself also carried some very problematic aspects since it was usually a white veterinarian going out to tell these black farmers that, 'Hey, I know best.' Right?

Erin Allmann Updyke

I know best, I'm here to kill all your cattle.

Erin Welsh

Mm-hmm.

Erin Allmann Updyke

With no compensation and rob you of your livelihood, it's fine, you'll work in the mines, don't worry about it.

Erin Welsh

It's fine, it's fine. Yep, yeah. You'll be fine. This is good for you. And there were times where it appeared that the preemptive slaughter of cattle was extreme and designed to impoverish the owners and drive them to the labor market and increase their dependence on the colonial state. And then there was the aspect of missionaries who would seize upon this opportunity to show those that they were trying to convert that their sins and refusal to follow whatever religion they were preaching had led to this plague upon their cattle. So it's like let me strip you of your culture and of your livelihood and of any food and security and so on and then this way I'll have complete control over you.

Erin Allmann Updyke

It's your fault by the way cause you didn't pray to the right god.

Erin Welsh

Right, you brought this on.

Erin Allmann Updyke

Way to go.

Erin Welsh

So yes. So rinderpest was exploited for further exploitation and subjugation of so many of the peoples of Africa.

Erin Allmann Updyke

Geez.

Erin Welsh

By 1896 almost all African communities had lost their independence and I think it's reasonable to say that this period, the combination of rinderpest and drought and smallpox definitely played a role in that.

Erin Allmann Updyke

Yeah.

Erin Welsh

All right. So now let's shift to the ecological side of things.

Erin Allmann Updyke

Ugh, just like depressing on depressing.

Erin Welsh

Yeah. It's depressing on depressing, I think for the sociopolitical part we can look at it as like hey, let's remember how this happened and never do this again and identify when people are trying to do this and make the future better.

Erin Allmann Updyke

Yeah.

Erin Welsh

And for the ecological side of things I think this is a very fascinating lesson in how interconnected of course an ecological landscape can be.

Erin Allmann Updyke

Yeah.

Erin Welsh

Okay. So this sheer loss of wildlife was on a scale that could barely be believed, I barely believe it. One more quote: "The buffalo were chiefly affected and they had come down to the river in thousands to die. Apparently when attacked by the disease, they had become consumed by thirst and so congregated at the river which provided the only water supply for many miles. It was a tragic sight to see all these great creatures dead and dying, the stench was nauseating and once could not have believed that there were so many carrion birds in Africa as were collected for the feast. Upon our arrival at Ngomeni we found the people in a terrible state of depression for the rinderpest epidemic had recently attacked their cattle. This area had up to then been probably richer in cattle than most of the Kamba country. The fell disease had spread with such rapidity that the disposal of the carcasses of the cattle was a task beyond their powers and the desiccated remains of tens of thousands of beasts were piled up in the form of a wall a few yards from the villages and the air night and day was pervaded by a sickly odor of putrefaction. The people appeared to be overcome with a hopeless apathy and the elders sadly produced a small bunch of about 20 head, the sole survivors of the great herds."

That's from 1891, written by Hobley. The death of so many animals had incredible cascading effects on the ecosystem and I found a paper that traced these impacts by closely examining an area in the Serengeti after rinderpest had been eliminated. And so in this region 95% of the cattle buffalo, and wildebeest populations died during the panzootic. Here's the cascade. First came the massive die-offs of game animals, livestock, and human populations. After a brief boom period where prey mortality was super high, predator populations declined when they could find no more food to eat. And then there came reports of lions, leopards, jackals, hyenas, other predators attacking humans and dragging them off to be eaten. Scavenger populations stayed pretty high throughout this whole experience. Without livestock and wild ungulates to browse and graze, fires then rapidly increased due to the excess of tinder and they grew to such high levels that they destroyed trees that would become part of the canopy, turning wooded areas into Savanna grasslands.

Erin Allmann Updyke

Man.

Erin Welsh

Alternatively what happened in some other places was that the death of browsers like giraffes that would keep those seedlings and saplings small enough to be killed by fire had almost all died and so then the canopy first grew and then became overcrowded, resulting again in self-thinning and an even more open canopy in arid areas is what would happen and then a more closed woodland in wetter areas.

Erin Allmann Updyke

Whoa.

Erin Welsh

These heavily shaded woodland areas helped along the recovery of some game animals and that led to a recovery also in the tsetse fly populations which made it extremely difficult for humans to resettle in those places. Yeah. So rinderpest is often linked to the decline of trypanosomiasis and then as soon as animal populations rebounded, so did trypanosomiasis and tsetse fly populations.

Erin Allmann Updyke

Yeah. Oh my gracious.

Erin Welsh

Mm-hmm. Depopulation of humans in Lake Victoria basin and then a resistance to move back in due to trypanosomiasis may have led to elephants moving into these areas of the park and then as the ecosystem there has recovered and humans have once again moved into that space it creates this conflict between humans and elephants. Recovery of wildebeest and browser populations since the elimination of rinderpest has led to a decrease in fires now because more grassland is being eaten from 100% of the grasslands in the north being burned after the panzootic to 25% in the recovery years. The recovery of wildebeests has also changed the range sizes of smaller grazers like gazelles and zebras. When wildebeest populations were low, those smaller grazers had smaller ranges because they didn't have to travel as far to find food but now that the wildebeest are back, researchers finding that they now have to go and travel even more extensively to find grazing.

Erin Allmann Updyke

Oh man.

Erin Welsh

Since the elimination of rinderpest, the lion and the hyena populations have steadily increased but on the other hand - and I find this fascinating - the African wild dog population has decreased due to canine distemper. And it has been suggested, yep, that the increase in canine distemper might be due to the elimination of rinderpest because dogs, these African wild dogs, may have gotten partial immunity by eating rinderpest-infected flesh of those ungulates.

Erin Allmann Updyke

Oh my goodness, we're gonna talk more about that later.

Erin Welsh

Ooh!

Erin Allmann Updyke

Yeah. So cool.

Erin Welsh

Cool! So rinderpest reshaped the landscape of so many parts of Africa and its eradication is allowing us to get a glimpse of what it was like before the disease swept through. It's very interesting.

Erin Allmann Updyke

Wow.

Erin Welsh

I don't know if it'll go back to what it once was, so many other things have changed.

Erin Allmann Updyke

Probably not. Yeah.

Erin Welsh

But it's really interesting.

Erin Allmann Updyke

It is. That is really fascinating. It's incredible that it had such wide ranging effects, you know what I mean?

Erin Welsh

Oh yeah.

Erin Allmann Updyke: Literally changing the physical landscape. Wow.

Erin Welsh: Physical landscape, the social landscape, the political landscape. I mean this is why I say it's like the smallpox of cattle. The Great African Panzootic of rinderpest was not the last time that rinderpest would be an issue, not there, not in the rest of the world, not by a long shot. Throughout the 20th century, outbreaks continued to occur and the disease also popped up in Brazil after infected cattle were imported but nowhere else in North or South America.

Erin Allmann Updyke: Okay.

Erin Welsh: The development of an effective vaccine and large scale immunization campaigns led to the last big outbreaks occurring periodically in the first half of the 20th century and then turning into small, more isolated instances with a few larger epidemics into the 80s. The last confirmed case of rinderpest was reported in Kenya in 2001. And on May 25th, 2011 rinderpest was declared to be the second disease eradicated.

Erin Allmann Updyke: Wow.

Erin Welsh: Yeah.

Erin Allmann Updyke: Why did it take 10 years before they declared it eradicated? Were they just like waiting and surveilling to make sure?

Erin Welsh: Yeah, that's what I can tell. I would imagine because it's different than in human eradication, like even with human there was a delay.

Erin Allmann Updyke: Yeah, right.

Erin Welsh: But the surveillance I think is easier than with these massive herds of wild ungulates that don't readily come to immunization stations.

Erin Allmann Updyke: Right. Right, you can't just call their doctor's office and be like, 'Any cases of rinderpest this year? No? Great.'

Erin Welsh: Well Erin, that's all I've got for the history.

Erin Allmann Updyke: Oh wow. So wow, it ended.

Erin Welsh: That's it, it ended.

Erin Allmann Updyke: We eradicated it.

Erin Welsh: I know. I breezed through the whole vaccine thing because I wanted to focus on the panzootic.

Erin Allmann Updyke: Okay well great. With talk a little bit about the vaccine then, that's great.

Erin Welsh: Awesome. All right so catch me up. What's going on now with this eradicated disease?

Erin Allmann Updyke: I'd love to. We'll take a quick break first.

TPWKY

(transition theme)

Erin Allmann Updyke

Okay. So we've eradicated rinderpest.

Erin Welsh

We have.

Erin Allmann Updyke

Which means we don't have to worry about it anymore technically. And like you mentioned Erin, while this is now a virus that exists only in laboratory stocks, many labs including in 2019 a UK lab that had the largest stocks of rinderpest virus has destroyed their stocks. So in theory if everyone destroyed their stocks, this virus would be eliminated from the earth which is great. Let's hope that that happens. It's really, really interesting that it appears that infection with one of these Morbilliviruses, for example measles, actually confers protection to all the other groups of Morbilliviruses for the most part.

Erin Welsh

Which is super cool.

Erin Allmann Updyke

Yeah! There was a study where they injected a cow with a measles vaccine and then that cow didn't get rinderpest when they challenged it. So you could've protected cows with the measles vaccine instead of the rinderpest vaccine in theory. So there is not just a potential increase in canine distemper virus, I actually didn't even read about that in wild dogs, that's fascinating. There's another ungulate Morbillivirus that is the PPR, Peste des petits ruminants.

Erin Welsh

Oh yeah, I just think little cute little ruminants.

Erin Allmann Updyke

Cute little ruminant plague.

Erin Welsh

Aw.

Erin Allmann Updyke

Okay. So this is very closely related to rinderpest virus that causes disease in sheep and goats. It does not appear to cause disease in cattle or other ungulates even though it is possible that they can get infected, at least experimentally. But they don't tend to have clinical disease even if they could potentially then transmit it. So there has been an increase in PPR spread documented since the eradication of RPV, rinderpest virus. And because the surveillance systems for RPV were so in place already, we've been able to actually detect this where we might not have otherwise.

Erin Welsh

That's very interesting.

Erin Allmann Updyke

Right? Yeah. And so it's thought that it is this eradication of RPV and not just the eradication but the cessation of the vaccination campaigns which had to happen in order to finish the eradication campaign of rinderpest virus, they actually stopped vaccinating early so that they could detect if there were outbreaks. And so it's thought that that cessation of vaccination meant no more protection even in cattle from PPR, so then that facilitated the spread. Isn't that fascinating?

Erin Welsh

That is very fascinating.

Erin Allmann Updyke

Yeah, yeah. So let's talk a little bit about some of the lessons that we can learn about this eradication especially because since rinderpest is so closely related to measles virus, it shares a lot of commonalities. A lot of people and there are several papers that kind of say, 'What lessons can we learn from the rinderpest eradication that we could maybe apply to trying to eradicate measles?' So a few things really facilitated the eradication efforts to actually kind of come to fruition, right. First is that we had a really good vaccine. So I didn't dig into the history of how this vaccine was developed, it was made in cows I know, it was a live attenuated vaccine and here are some of the things that were really great about it. First is it was extremely effective in a single dose, it was never associated with any adverse reactions supposedly and one single dose in a cow was immunogenic and provided essentially lifelong immunity. And that's all that it took.

Erin Welsh

Wow. That's the unicorn.

Erin Allmann Updyke

Right? It's a unicorn vaccine. But the very first vaccine, the biggest challenge with it was that it was a live virus vaccine which meant that it required cold storage and it had to always be transported in cold storage in order to be effective essentially, right, to keep it alive. So eventually they developed a shelf-stable formulation and that was honestly super important in these eradication efforts because it meant that you could keep it I think for one month at ambient temperatures and that means that you could transport it a lot more easily even in places where you didn't have access to refrigeration.

Another thing that became really essential in the eradication efforts was involvement of community stakeholders and I think that that makes a lot of sense in the context of the history that we just heard about, right? This is a disease that historically was very fraught politically, right, and caused a lot of issues. And so eventually people figured out that you couldn't just have veterinarians come in and kind of take over and tell people what they had to do with their cattle herds, right, that didn't work very well. So eventually they involved community-based animal healthcare workers and that proved to be really essential, so training people from the community to be able to go out and give these vaccines essentially rather than relying on government vaccination programs.

Erin Welsh

Awesome.

Erin Allmann Updyke

Yeah. And then the last thing was good epidemiological or epizootological studies to monitor, surveil, and model what outbreaks could look like to be able to get a handle on surveillance and reducing the overall spread. And so some of these things we can do for humans and some of them are a little bit more difficult, right. So with surveillance in cattle, once you would identify in a population, quarantine, and vaccination or in some cases culling of the herd would be effective in reducing the spread of that illness. With human diseases like measles that's a lot more difficult to do, right, not only because you can't cull humans.

Erin Welsh

Oh my god, Erin.

Erin Allmann Updyke

Sorry. Do I have to say that? I don't know. But it's more difficult to quarantine humans for so many reasons but we also just move a lot more than cattle do, right. Cattle, we put them in herds and that's kind of where they remain. It's a little bit more complicated with wildlife that come in and out.

Erin Welsh

Right.

Erin Allmann Updyke

But with humans we can get on a plane and travel and now measles is in three different countries.

Erin Welsh: Right.

Erin Allmann Updyke: So it's a lot easier in that way to target an animal disease like this. But that doesn't mean it's impossible and I think especially this shelf-stable vaccine which as far as I know we still don't have for measles, it still is a cold storage vaccine, and involvement of community stakeholders I think are the things that are gonna be most important in trying to eradicate any human illness. And I think these are lessons that we can learn from rinderpest.

Erin Welsh: Perfect. I loved it.

Erin Allmann Updyke: Yeah.

Erin Welsh: Loved it. Well I for one am very glad that we A) did this episode and B) that rinderpest is eradicated.

Erin Allmann Updyke: Ugh, same.

Erin Welsh: Man. Okay.

Erin Allmann Updyke: All right, time for sources?

Erin Welsh: I guess so. Sources. So I relied on a few different sources and I'll post all of these on the thispodcastwillkillyou.com website. I read 'Cattle Plague: A History' by C. A. Spinage. One of the other ones that I really liked was a book called 'Rinderpest and PPR: Virus Plagues of Large and Small Ruminants'.

Erin Allmann Updyke: Erin, that's the book I used!

Erin Welsh: It's so good.

Erin Allmann Updyke: It's great.

Erin Welsh: Yeah I saw that you had downloaded it and I was like all right. Cause I had downloaded it separately and I was like oh wait, it's in there twice, okay. Yeah it's good, it has so much information.

Erin Allmann Updyke: It's great. Yeah, it was really phenom.

Erin Welsh: And there are two more that I wanna briefly shout out. One is by McNaughton in 1992, 'The propagation of disturbance in savannas through food webs' and finally by Phoofolo 1993, 'Epidemics and revolutions: the rinderpest epidemic in late 19th century Southern Africa'.

Erin Allmann Updyke: Awesome. Yeah I loved that book that you recommended. I'm sure we read different chapters. I also used heavily another book that you downloaded, Erin, the chapter Rinderpest Virus in the book - we're not gonna say the title, it's too long but it's by Walter Plowright who's one of the big names in RPV research in general. And then a few papers that we will post on our website thispodcastwillkillyou.com. You can find the sources for this episode and every single one of our episodes there.

Erin Welsh

You sure can. Yeah, Walter Plowright was one of the biggest leaders in the eradication campaign and he died just before it was declared eradicated. But it was in 2010 so he kind of knew, he was like, 'I did it.'

Erin Allmann Updyke

He knew.

Erin Welsh

We did it, we did it.

Erin Allmann Updyke

We did it. Group effort for sure.

Erin Welsh

Thank you to Bloodmobile for providing the music for this episode and all of our episodes.

Erin Allmann Updyke

And thank you listeners for sticking with us. I hope you enjoyed this cattle but not only cattle episode.

Erin Welsh

Yes. Thank you, thank you always. And until next time, wash your hands.

Erin Allmann Updyke

You filthy animals!