

Road Ecology with Ben Goldfarb

Ologies Podcast

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Oh hey, it's your old binder from junior year, with Slipknot lyrics in the margins, Alie Ward. Buckle your seatbelts for a ride through the science of roadkill. People study this so that you encounter it less. So, head's up, obviously, we do talk about accidents with wildlife, that's the episode, but in the context of how to prevent and avoid and survive them. So, if you care about animals or your car insurance premiums, it's worth the listen to learn how to help these critters out, both every day and in an emergency.

So, this interviewee, I have chased down for *years*. I have been tailgating his social media like, "Can we do an episode yet? Can we? Can we? Can we? Can we?" And he has been the most elusive guest in *Ologies* history because he's been writing a book about this very subject for years interviewing road ecologists all over the world about nearly every biome and biological specimen and he wanted to wait until it was done and out to chat... and that time is now. Except that he got COVID. But he's a really dedicated man and we did the interview anyway remotely as he was getting over it.

So, we're going to get right to it but first, thank you to every patron at Patreon.com/Ologies for supporting the show and sending in your questions for this. You can join as an Ologist Pal for a buck a month and submit questions, but the BFF Tier can leave me audio questions, we may even play on the show. Also, thank you to everyone wearing and tagging yourself with #OlogiesMerch for social media and folks who just leave a review for me to read, which you know I do such as this one from WasAnOddChild who wrote:

Five stars. Alie Ward, my father, uncle, and missing wallet is the host of my favorite hyper fixation – the Ologies podcast. Best way to spend an hour. Or two. Okay, let's be honest, three.

WasAnOddChild, thank you for that. I'm glad that you're one of us.

Okay, road ecology, very legit term for a very sad reality. But today's topic, the facet of it we're looking at is the impact on wildlife and human interactions. So, this guest has a master's in environmental management from the Yale School of Forestry and Environmental Studies and his literally award-winning science journalism has appeared in everything from *National Geographic* to the *New York Times* to *Vice*. His latest book is *Crossings: How Road Ecology is Shaping the Future of Our Planet*, and it necessitated talking to so many road ecologists and then packing all that knowledge into this gift that he's giving us in this interview. So, if you have a keen ear, also you're going to hear the mention of Montana more than once. So, I invite you, when you do, to take a sip of the nearest beverage, perhaps do a tiny imperceptible butt dance.

Again, the episode will help you and anyone you talk to about it and hopefully decrease collisions that impact wildlife. We're going to cover bumpy roads, wildlife using crosswalks, skunk stench, moose impacts, deer crossing signs, the most dangerous animals on the planet, laser fences, highway tunnels, lush overpasses, beloved cougars, ocelot facts, what to do if you see roadkill, how to avoid making more of it, and whether it's okay to pick up a dead thing and to eat it, with author, environmental scientist and honorary road ecologist, Ben Goldfarb.

Ben: My name is Ben Goldfarb and he/him.

Alie: I have been waiting to talk to you for *literal* years! Benjamin! It's been so long. [*laughs*]

Ben: I know, I feel like we've been discussing this possibility forever and you guys so patiently waited for this book to wind its way through the publication pipeline. I'm really grateful that you guys didn't find somebody else who knew about this topic.

Alie: There's no one else I'd rather talk fresh road kill or old road kill, so this is a pretty big day for me and for road kill in general. First question off the bat, how does one end up studying road kill? I know that you get asked this at every dinner party: How did you end up writing a book about this?

Ben: Yeah, it's a really good question, I'm not even sure what the answer is. Certainly, part of it was seeing ways to prevent road kill. I had this really formative experience a decade ago in October of 2013. I was in Montana, working as an environmental journalist, looking for things to write about and I ended up getting a tour of these wildlife crossings, these overpasses and underpasses that let animals safely navigate highways, this was on Highway 93, north of Missoula. And that was just such a cool experience. I hadn't really thought a whole lot about road kill and about all the problems that roads create but seeing these structures that were designed to prevent that tragedy from happening just sort of caused me to think about this problem in a new way.

Alie: You know, I know that road well. My dad is from Montana, I've driven 93 many times and one thing that's interesting about roads in Montana is all the white crosses. Are you familiar with those?

Ben: Oh yeah, certainly.

Alie: Yeah, which is really a stark and kind of gutting reminder of how many fatal accidents have been on that road, it really makes you slow down.

Aside: Okay, so if you've never seen these, they are the small white metal crosses planted on the side of the road and there's one to mark each fatality at the site it happened. So, every time you see one... I mean, it's impossible not to imagine the shattered glass and the wrecked metal and the grieving families. I've seen clusters of them at a time and there are memorials near tricky bends in the highway that have crops of markers of just, like, 16 in one place. Some groups are opposed to them for understandable reasons; a cross may very well not represent the faith of the victims, also they're a bummer. But the American Legion has been putting these up in Montana since the early 1950s to do just that, to scare the shit out of me personally, and millions of other people so that they drive more carefully in order to spare more human lives.

Alie: Did that have any impact as well, just knowing that those roads are dangerous to humans as well as wildlife?

Ben: Yeah, you know, it certainly did. They're dangerous for a lot of the same reasons; they're these winding rural highways that people tend to drive too fast on and often, wildlife is probably related to those human fatalities as well. There are something like 400 drivers killed in deer crashes every year. I think Montana is the second-highest state in the country for per capita wildlife-vehicle collisions; there are lots of animals on the landscape. So, certainly that road kill is a danger to humans as well. And I've had state troopers say things like, there were 400 dead drivers every year that we know of but oftentimes, when you come upon a single car accident with a fatality, we don't know why that occurs but that could be somebody who veered for a moose or an elk and hit a tree or flipped, or something like that. So yeah, I think that link between human safety and wildlife safety is a really close one.

Aside: So, there's a September 2023 report about just this, animal impacts, and it was issued by State Farm Insurance and the headline screams, "November is still the most dangerous month with an estimated 297,000 collisions," and they're talking about wildlife. So, over the last year, 1.8 million Americans filed insurance claims apparently because they slammed into a nonhuman creature. But the national odds of hitting an animal annually is 1 in 127. If you'd like to avoid it at

all costs, I guess you could ride a bike, or you could move to Arizona where you have a 1 in 500 annual chance of an animal-vehicle collision. And West Virginia, I am sorry but 1 in 38 for y'all. Montana, unsurprisingly, held the number two spot with 1 in 53 people getting into an accident with an animal.

And if you can't just up and move to Arizona because your spouse and children would feel abandoned or whatever, then you can take other measures. You can be careful in the riskier situations like driving at dusk. You can watch out for herd animals, which tend to travel in posses, naturally. And of course, do not scroll on your ex's social media if the long drive gets boring. As humans driving cages of reinforced steel, our chances of survival are much higher than a bunny's. So, when Ben was writing the book, how did he balance the focus between the impact on humans versus the impact on the wildlife?

Ben: It's a good question. I think that it's hard to separate those things. So much of the history of studying road kill is really about human safety. It's interesting to trace the history of road ecology, this field of science, which really began in the 1920s with the proliferation of the car and early biologists are fretting about all of the garter snakes and groundhogs and woodpeckers being killed by this fearsome new technology. But then the car kind of becomes this accepted fact of the American landscape and people stop thinking about it until the 1960s when deer populations explode.

Deer were almost hunted to extinction in the 19th century and then in the mid-20th century they started making a comeback and people are driving farther and faster than ever and suddenly there are these large mammals blundering onto new interstate highways and really causing a risk to human safety. That's really when road ecology as a field truly takes off. Its origins aren't necessarily in concern for wildlife, although certainly that's a big part of it, its origins are really in concern for human safety, specifically due to deer collisions. So, I find that fascinating, that this discipline is intimately tied to human safety almost from the advent.

Alie: That makes sense. In terms of also westward expansion and American colonialism, I feel like maybe we look at things from a human-centered lens a lot. *[laughs]* Just a hunch.

Ben: Yeah, no kidding.

Alie: Also, did killing off wolves have a lot to do with that explosion of deer?

Ben: That was definitely part of it. Deer were coming back into this landscape that lacked wolves, cougars, and all of the historic predators that would have controlled their populations. I think a big part of it was also the rise of the suburb. Suburbs are amazing deer habitats. So many northeastern suburbs have much higher deer populations than forests did prior to European arrival, which is pretty amazing to think about. Of course, the suburbs are this creation of the car in a lot of ways. In the mid-20th century, the Interstate highways were funneling people away from cities and into suburbs and this whole car culture oriented around the suburb is emerging and sort of beckoning to white-tailed deer which are bouncing back from their own brush with extirpation. So, I find that really interesting too, that cars created a landscape that was primed for deer and then caused collisions between drivers and those same animals.

Aside: And for more on wolf populations you can see the Lupinology episode about wolves and you can prepare to celebrate the finest holiday of the year on November 23rd, which is Wolfenoot. It celebrates the Spirit of the Wolf who brings and hides small gifts around the house for everyone, especially people who have dogs and are kind to dogs, they get better gifts than anyone else. You eat roast meat because wolves eat meat, or roasted veggies if you like, and you make a cake that's decorated like a full moon. And this, according to the 7-year-old New Zealander who invented

Wolfenoot just a few years ago, not realizing that it would become a global November 23rd celebration, one which I myself enjoy. I have hidden new pairs of socks around the house for dinner guests to hunt like Easter eggs and my full moon cake was ugly but delicious.

Now, on the topic of wolves' prey though, we of course have an excellent two-parter deer episode featuring not one but two Cervidologists named Rhiannon, what are the odds? Which addresses all kinds of stuff like whether or not deer eat birds alive.

Alie: I mean, be honest with me. Are deer the ones getting creamed the most?

Ben: Deer, yeah, they're the ones getting creamed the most visibly, I would say. I think between 1 and 2 million deer are killed every year and obviously, the vast majority of those collisions are not fatal to the driver but fatal to the deer. So, deer are definitely getting creamed. But there are also lots of squirrels and opossums and raccoons, all the critters we've all seen by the side of the highway. I think that in part because the animals that we tend to see are the really common ones, we don't really think about road kill as being a true biodiversity and conservation crisis. But there are lots of rarer species as well, Florida panthers and ocelots and tiger salamanders, all of these animals that because they're so rare, we don't see them dead by the side of the road, and yet for these very threatened and endangered species, road kill really is an existential crisis.

Aside: Okay, so first off, ocelots are native to North and Central America? I had no idea! For starters, an ocelot is a bobcat-sized spotted little cutie with a kitten face; it weighs 20 to 30 pounds, it's like the size of a large Maine Coon, which is like having a real hairy toddler with knives in its face. I thought ocelots maybe lived in North Africa or Central Asia... Nope, they live in, like, Texas, south of the Alamo, but not many.

So, 40% of Texas ocelot deaths have been attributed to human traffic collisions and now there are only 60 to 80 Texas ocelots left in the wild. And yes, if you think some people keep them as pets, you are correct. Most notably, surrealist painter and mustache haver, Salvador Dali. But before you decide to dip into *Tiger King* culture, be aware that your friend Wikipedia warns that ocelots might demand a lot of attention and have a tendency to suck on things, and "this can lead them to accidentally ingest objects such as tennis balls," which is so specific I can only imagine that the editor of that page added it in shame after a close call and an exotic vet bill. I don't know what happened. But ocelots, keep 'em in the wild.

Also, Florida panthers, send them good vibes man because a September CBS news headline says it all, kind of with a heaving sigh. [*sighs*] "Another endangered Florida panther struck and killed by a vehicle – the 62nd such fatality since 2021," it reads. Apparently, Florida panthers had the distinct honor of being one of the first critters on the 1973 Endangered Species List after hunting struck a massive blow to their population and now there are less than 250 Florida panthers in the wild. 10% of their entire population is killed each year in crashes with cars. Florida panthers don't deserve this; they should be going on motorboats and getting sun damage at margarita happy hours like the rest of that state. But listen, these are the realities and there *is* hope, which I discuss later. I'm not just trying to bum you out.

Alie: Who comes to your book readings? I've got to ask. You just did a book tour, do the people that you encounter there pull you aside and confess to you like you're a priest about accidental squirrel collisions they've had or hitting a turtle in their teens? Do you get that a lot?

Ben: It's so funny you asked that. I have compared myself to a priest taking confession on multiple occasions [*Alie laughs*] because yeah, everybody's had this experience and they want to tell somebody about it. I think there's something so distressing and disorienting about hitting an animal, you don't exactly know what to do when it happens. I told a friend about the premise of

this book a few years ago, long before it came out, and he told me that he had recently hit a squirrel and was so bewildered and confused in the moment that he just panicked and called 911, which of course is not the right reaction and I think they hung up on him, as they probably should have. But I think that just attests to what a weird and saddening and confusing experience it can be to hit an animal.

Alie: Have you ever hit anything?

Ben: Sure, yeah Alie, I've hit all kinds of critters, I'm ashamed to say. Most recently, I killed an owl [*Alie exclaims*] that was a few weeks ago in Colorado where I live and it just swooped across the highway in the middle of the night and hit the top of the windshield and, you know, I assume it was killed. I did go back to briefly look for it but could not find it. Yeah, so that was really hard. What have you ever hit Alie?

Alie: I hit a deer once.

Ben: Oh, you did.

Alie: In high school, not long after I got my license. I grew up in a suburb with a lot of deer and you'd always hear collisions. I had an AP Biology teacher, [phonetic] Odi, who, whenever someone would hit a deer, they'd call him instead of 911 and he would come out and flay the deer, take the venison, take the hide, and I saw him, there was one that was hit near school, so he took us out to have a look at it. I remember its belly was covered in ticks, but he showed us what to do with it, which was uncommon, and they have to be pretty fresh. But I hit a deer once and the deer hit me; the impact was on the side of the car so when I told my parents, "The deer hit me," they did not believe me at first but then they were like, "Well, it is on the side panel so what are you going to do?" But if you don't have an Odi in your life and you definitely shouldn't call 911, what is the best protocol if there's been a collision?

Ben: Yeah, it's a good question. Certainly, you could call the local sheriff's department out here in the West, or the police department just to report the incident but they're not going to do anything. I think the most common response is that you don't really do anything. If the animal has done damage to the vehicle, there's going to be an insurance claim and then that will become a data point for somebody, potentially. But the most common reaction is probably just to keep driving, which is part of why this problem is so hard to grapple with in some ways and to grasp because these incidents are not being noted, observed, or recorded in any way. As a result, we don't really have a lot of great data about what a significant toll road kill is taking on biodiversity.

Aside: I was curious, since Ben covered so many species and ecologies, if he had to track down possum researchers and deer teams and, like, a click of panther people, a frog squad, et cetera. Did he have to collect a mosaic of data? And is his contact list the best?

Ben: Road ecology, this term that was coined in the 1990s by Richard Forman, an ecologist at Harvard, at first, it was this very niche subject that only a handful of people in the country had heard of let alone practiced. Today, you can go to these road ecology conferences that have thousands of people in attendance. So, it's certainly interdisciplinary, it touches upon a lot of different fields but it's also a distinct discipline in its own right that increasingly has people who self-identify as road ecologists.

Alie: Do any of them come to you like, "Hey Ben, what's the deal with this? Can you hook me up with this person?"

Ben: So, if people do say, "I'm working on mule deer over here in this state, what are people doing about moose over in that state? Is there anything that we can learn from those guys?" I've definitely been

able to put different sources of mine in touch because the field has become so large and dispersed and atomized in some ways that not everybody knows what everybody else is working on and it's nice to be able to play that interstitial role sometimes.

Alie: Did you want to focus on different countries, different species? How did you break it down? And why do I feel like Australia has the most road kill? That's just absolutely a hunch.

Ben: I think you're totally right. Actually, Tasmania is considered the road kill capital of the world.

Alie: [*gasps*] Nooo.

Ben: It has some of the highest road kill rates ever recorded. I know, super sad to think of those wallabies and wombats, those are the coolest critters! That was actually one of the places I went when working on this book was Tasmania, the road kill capital, and there, one of the amazing things is that of course because those animals are marsupials, they're carrying their babies in their little pouch, what happens often is that the mother will be killed by a car but the joey, the baby will actually survive in the pouch. So, there are hundreds of wildlife rehabilitators in Tasmania who just drive around the countryside, looking for dead animals, checking their pouches, and extracting the joeys, the babies within, and then raising them to adulthood over a couple of years which is just this amazing, heartbreaking, beautiful, inspiring practice. We're so used to driving past road kill all the time, it was really incredible to go to a place where people actually notice it and even seek it out.

Alie: Do those animals that are raised by rehabbers, do they ever go back into the wild? Or is it like, they've imprinted and now they're ambassador species?

Ben: No, they do get released back into the wild. I definitely talked to rehabbers, they're actually known as carers in Tasmania, which is a phrase that I love, I talked to carers who said this is a dubious practice in some ways because they're removing these animals from this incredibly dangerous environment and then we're releasing them back into the same incredibly dangerous environment. It's still the road kill capital of the world, is it really humane to reintroduce them into a setting where they're likely to suffer the same fate as their mother did? Because Tasmania doesn't have those wildlife crossings and infrastructural fixes that prevent road kill. The state itself is kind of relying on all of these volunteer rehabbers to deal with this crisis without really addressing it in a meaningful way.

Alie: Did you get to extract any baby wombats or Tasmanian devils or wallabies out of an animal? Did you ever have to do it?

Ben: You know Alie, it's funny, I stopped for so many dead animals while I was there and every single one was a male, it was very strange, probably a dozen or so and they were all males. It was surprising. It's not too uncommon. Lots of species have higher rates of male road kill than female. You know, males tend to have larger home territories than females do in many mammal species especially, and often it's those young dispersing males who get hit, they're setting out for their own territories and looking for females. [*"Hello ladies!"*] So, it's not uncommon that you would see more male than female road kill but to check a dozen or so carcasses and they're all males, that was pretty surprising.

Alie: Did you get to see any baby wallabies in carer centers at all?

Ben: I got to see so many wallabies and wombats and pademelons. [*"I'm sorry, who?"*] I love pademelons, that's an animal that most people haven't heard of but they're almost like if you took a kangaroo and miniaturized it, you would have a pademelon and they're basically as cute as you'd imagine. [*Alie gasps*]

One of the places I went, it was pretty wild, it was this couple, this wonderful couple who have extracted and raised so many pademelons to adulthood and released them into the wild but the pademelons still have this kind of ancestral memory of the place that they were raised. In the evening, this couple actually tosses food out for them and all the pademelons emerge from the forest and congregate in their backyard. It was just this really surreal, beautiful, magical moment to see all of these creatures come out of the bush. It's sort of like, okay, you're feeding them, is that the best thing for them? But in some ways, I think maybe it is, they're giving them a soft entry into the wild in some ways and still meeting some of their needs while not actually having them in captivity.

Alie: Is this couple the happiest couple on Earth?

Ben: They're pretty happy, yeah. They were living in the bush in the middle of nowhere, surrounded by their hordes of pademelons. There are definitely worse ways to live.

Aside: Imagine a life with your love, you're surrounded by animals that look like a less stoned version of quokkas. The pademelon is nature's chimera, it's the size of a small raccoon, or maybe a large bunny, it's got a squirrel face, kangaroo limbs, and a tail like a rat. But most spectacular, if you ask me, is its ass-to-head ratio. A pademelon has got a caboose easily ten times the size of its head but sadly, it's still not enough cushion to soften vehicular pushin'...

Alie: What a life, just critters coming out of the bush to be like, "Hey mom!" Augh, that's the cutest thing ever.

Ben: Yeah, you could move to Tasmania and experience that yourself. That would be a radical change in lifestyle for you, but it sounds like you'd enjoy it.

Alie: I've got to befriend them on Myspace or something.

Okay, so you said males more than females. What animals tend to be most vulnerable? The idea of a panther getting hit, or we have a massive problem with pumas out here in LA which I'm *sure* you're familiar with, P-22 and all of that. We did an episode about P-22 with Miguel and Beth...

Ben: Oh cool!

Alie: And it was so emotional, he was really an LA mascot for so long and the freeways here are so punishing. But you don't think of leopards as not being able to outrun a Kia. So, what species are most vulnerable?

Ben: Yeah, it's a good question. I'm so glad you talked to Beth and Miguel, those guys are awesome and they're in my book as well. Certainly, there's a lot of P-22 stuff in there.

Aside: So, P-22 was this beloved puma that lived in the hills beneath LA's Hollywood sign for years and he died last year. I was able to interview the wildlife biologist who discovered him in this special episode we'll link in the show notes... There is crying.

Ben: There are two main classes of animals that are really susceptible to road kill. The first are those large carnivores, the cougars, the ocelots, the Asiatic cheetahs in Iran, these are animals that patrol really large territories, which means that they cross highways often, and they tend to occur in low densities, they occupy these big home ranges so there aren't a huge number of them on the landscape. So, if you lose just a few to cars, the whole population can really suffer. So, for the Florida panther in the southeast, more than 10% of their population is killed by cars every year. For ocelots in Texas, cars are the leading cause of mortality so it's those carnivores that, again, occur in low densities and patrol large areas, I definitely consider those some of the most road-endangered species out there.

On the other end of the spectrum, you've got the smaller stuff, the amphibians especially. Frogs and salamanders that have to migrate to breeding ponds every spring and cross roads in mass in the process and get crushed in these events that, you know, one ecologist described as "Massive squishings" which are incredibly tragic.

Aside: Okay so sidenote, I needed to know who coined that term because we needed to know. Via Ben's bibliography, it was first used in the textbook called *Road Ecology: Science and Solutions*, which was written by a host of authors, including Dr. Richard TT Foreman, now 88 years old and a professor of landscape architecture at Harvard. He is considered to be the father of landscape ecology and road ecology and helped spearhead urban ecology and town ecology. Truly, a metro-polyologist, this one. But that textbook passage I found reads:

Hundreds of amphibian tunnels in several nations of Western Europe funneled the animals under roads in their seasonal reproductive migration. Massive squishings and associated messy auto accidents were reduced.

So, that's good news.

But on the topic of squishings, here are some pop cultural trivia. Okay, so you know the video game Frogger, right? I love an underdog story and frogs and it was inspired by a true incident, I just found this out. Akira Hashimoto, a designer for this Japanese video game developer was chilling at a stoplight and saw a little frog trying to cross the road, and he got out of his car to help the frog and then he pitched the game, but American executives *hated* it saying only little girls and women would play it and girls and women were a trash demographic. This was in the early 1980s so I'm assuming that was a conversation in a boardroom filled with power ties and cigarette smoke.

But this one American executive for Paramount disagreed and really fought for Frogger saying, "You dicks thought Pac-Man sucked, and look at it now." So, they said, "Yeah, that's true." They bought it and it became this colossal success across all ages and genders and that Paramount pro-Frogger advocate was named Elizabeth Falconer, who was a lady executive in the early 1980s. So, if you've played Frogger, you have enjoyed a road ecology simulation and the fruits of a lady in shoulder pads and a man's world.

Ben: Those amphibian populations too are really being wiped out. So those are two incredibly disparate groups of organisms; these large cats on one end, tiny frogs on the other, and they're both dramatically affected in different ways.

Alie: Do you cry about road kill?

Ben: I think that I cried about road kill once. It was 10 years ago in 2013, my wife and I were driving through Yellowstone National Park early one morning. It was a beautiful morning, there was a mist rising off the pavement, just a gorgeous day and we hit a red squirrel. The poor squirrel had a little pinecone or a nut or something in his mouth, which he dropped when we killed him. My wife took his little body and curled it around the pinecone he'd been carrying and covered him in branches by the side of the road. Yeah, we both cried about that.

I think part of it was that we were in a national park, this place where animals are theoretically safe and protected. And it turns out, they're protected from everything except for cars, right? They're safe from hunting and development and all these other pressures but there are still these highways running through the middle of our otherwise secure, protected areas, and there was something that felt so unjust about that, that you could live in a national park and still be run down by humans. I think that was why we shed some tears over the squirrel.

Alie: [*sad, weepy voice*] I don't blame you. It was carrying a pinecone.

Ben: It was really hard. It was really hard to see.

Alie: I bet it was so excited about the pinecone. Augh!

Ben: Alie, you're trying to make me relive this traumatic incident.

Alie: No, I'm sorry. I'm just processing this for the first time. [*Get it together.*] Well, I mean, okay, you've written also *beautifully* about anteaters and the rainforest. What areas are putting in preventative measures? What's working out there?

Ben: You know, a lot of different countries and states in the US are doing stuff about this problem. If you talk to Miguel and Beth about the P-22 saga, you heard the story of the Liberty Canyon overpass, this giant wildlife bridge that's going to reconnect mountain lion population in Southern California, that's incredibly exciting and I think is galvanizing lots of energy around building infrastructure that helps animals safely cross roads.

I think a lot of cool stuff is happening in countries that aren't the US. We think of ourselves as such leaders in infrastructure and conservation and yet, one of the problems we face is that we have such old, kind of, calcified highway systems. We built all of our major highways in the 1950s and '60s and early '70s, before our understanding of how roads really affect nature and before laws like the National Environmental Protection Act that require environmental assessments. So, as a result, we made these mistakes decades ago and now we're stuck dealing with the consequences. Yeah, we can build wildlife crossings and retrofit highways with fences that keep animals off the road and things like that, but you know, we're sort of stuck in this world we built.

Whereas other countries are doing all kinds of cool, innovative stuff as we build out their infrastructure for the first time. In India, for example, they built a highway through a tiger sanctuary unfortunately, ideally the highway wouldn't go through there at all. But you know, they elevated the entire highway on these giant concrete pillars, so the animals can just wander underneath the highway unimpeded, which is more radical and progressive than anything we've done here in North America.

Aside: But not all corralling efforts are created equal. So, according to this 2015 study, "Mitigating Reptile Road Mortality: Fence Failures Compromise Ecopassage Effectiveness," even with a tunnel under the highway, the fences that border the wilderness and the roads that direct the critters toward their safe route matter. The research found that plastic fences can tear, and they end up trapping reptiles and amphibians on the road side because they can't find their way back onto the safe side. So, rather than keep replacing these failing plastic fences, it's better to just spend the money on more permanent solutions. And this adheres to my husband's stance that instead of skimping on something shitty and then replacing it multiple times, get the good thing that will last, even if it's more expensive initially. And this steep but singular investment is known as "Buy Once, Cry Once." He has yet to purchase miles of reptile fencing, but if he does, I'm going to share that study.

Alie: What about speed limits in Tasmania? Has reducing speed limits helped? I wonder also if the oil crisis in the '70s, when speed limits went down a lot, at least in America, to 55 miles an hour, if that reduced road kill?

Ben: The speed limit thing is an interesting question because certainly driving slower is good, it gives both the driver and the animal more time to react, we know that. The problem is that it's really hard to get people to drive slower. You can lower speed limits, but people generally don't respond very strongly to that signal and their reason for that basically is that we have highways that are designed to be driven fast on; we have these wide, straight freeways that basically make you want to go fast. There's lots of research showing that people tend to drive a road's designed speed rather

than a posted speed limit. How many times have you been flying down a straightaway and you just kind of glance at your speedometer and it says 85 and you're like, "Oh crap, I didn't realize I was going that fast." [*Oops! My bad.*] There have been studies showing that lowering speed limits does not really lead to a meaningful reduction in road kill because people continue to drive fast because that's what our roads want you to do.

One of the really cool roads that I visited while working on this book was actually a road in Brazil in this park where they had deliberately engineered the road to be really sinuous and also to be kind of wavy on the Y-axis, like a roller coaster, basically to force drivers to go slowly for wildlife. So, instead of just changing the speed limit as we do sometimes here in the US, they actually designed a road that you could not speed on, which was a really cool and innovative idea, I think.

Alie: Just, like, giant speed bumps, kind of?

Ben: Yeah, or like, waves. It felt sort of like being at sea. They also closed that road at night which was a great innovation and I feel like we should be doing that as well here in protected areas.

Alie: What about things like sensors and LED lights and solar lights for the evening? Are there any places that are trying at least to illuminate the roads?

Ben: Yeah, you know, one of the cool technological solutions that's out there are these animal detection systems. One of the challenges in road ecology is that our most common innovation or our most common attempted solution for dealing with roadkill is signage, that classic yellow diamond with the leaping black buck that says, "Watch for wildlife next 40 miles," or whatever. And those signs as you'd probably guess are totally useless because drivers just habituate to them. If you drive past a Florida panther crossing 100 times and never see a Florida panther, you're going to stop slowing down and then the one time the panther is there, you've already habituated to the absence of the panther and that's the time that you hit it because you just got that negative stimulus so many times.

So, one of the cool ideas that exists now, one of the cool technologies, is basically responsive animal warning signs that only tell you there's an animal on the road when there's actually an animal on the road. They are these real-time signs along roadsides that are outfitted with radar and other sensors that light up these warning signs, only when the critter is actually approaching the roadside. So, those kinds of solutions that don't let drivers habituate, I think those are more effective. They're not perfect, they have I think a 50% road kill reduction rate typically, which is definitely better than nothing but not as good as a wildlife crossing with fences that keep the animal off the road altogether.

Aside: So, systems using, yeah, radar or laser trip wires can give this technological heads up that says, "Hey, unless you want to think about the time you killed a deer for the rest of your life, maybe slow down because you got one coming up, buddy and you don't want to meet up with it in hell."

Alie: What about myths in road kill ecology? What do you feel like is something that you learned was not true, you didn't know going into it, or most people just don't know?

Ben: There are just so many failed attempted solutions out there. You hear about deer whistles sometimes, these contraptions that you can mount on the hood of your car that make this noise that is audible to the deer and frightens the deer away from the roadside. Or deer reflectors, another really common attempted solution, these roadside reflectors that sparkle when they're hit with headlights and alert the deer to a coming car and frighten them away. Those sorts of things. We've been trying that in this country for decades and they're just not really backed by any good peer-reviewed science. So, I think that the sorted history of failed road kill solutions is something that was surprising to me.

Alie: Aww. I know people asked about those horns and things at the front of the cars and I was wondering, so that's good to know. We did a couple of episodes about ticks and Lyme disease and obviously, Connecticut came up a lot and the Northeast. I was reading a study about how when they gave more hunting permits for deer in those areas, the number of animals that were hunted for venison and buck skin and stuff, reduced the number of crashes by about the same amount. Is legal hunting of non-predator animals, is that becoming more popular?

Ben: Yeah, I don't know if it's becoming more popular. Certainly, that's another thing that's been tried, there are lots of stories of communities in the Eastern US that have actually done these white-tailed deer culls where they hire sharpshooters to control the population, at least partly, as a road kill reduction strategy. [*"Boy howdy."*]

I think a much cooler idea than increased human predation is actually increased wild or natural predation. There are a couple of fantastic studies suggesting that cougars and wolves, by eating lots of deer, dramatically reduce road kill rates, vehicle collisions, damage, and even driver deaths, which is pretty amazing. Wolves in Wisconsin have been shown to save the public millions of dollars by eating deer. There was a great study that estimated the value of reintroducing cougars to the Northeast, and I forget what the figure was exactly, but I think it was in the hundreds of millions of dollars over the course of decades, thanks to all of the deer-vehicle collision reduction that cougars would achieve for us. So, I think that's a pretty cool idea; we could rely on natural predators and collision prevention technologies.

Alie: Yeah, and not Volvos, just get a puma out there. I also imagine that when you hear reintroduced wolves and cougars it's like, the hairs on the back of your neck stand up and you're like, "That's so dangerous!" But you're so much more likely to be killed in a collision with a deer than just torn to pieces by a cougar, I imagine, statistically.

Ben: Absolutely, yeah. That same paper about cougar reintroduction in the Northeast estimated that cougars would save many lives over the course of 30 years. So yeah, these are seemingly dangerous animals when in reality the most dangerous wild animal in the country is the white-tailed deer, responsible for many more human fatalities than sharks and snakes and bees and other animals, and certainly than cougars. Of course, that's not the deer's fault. That's the world that we've engineered in which deer are implicated but there's no question that anything we can do to reduce some of these unnaturally high white-tailed deer densities is going to save some lives.

Alie: I wonder, do you think they're even more dangerous than mosquitoes? In this country?

Ben: That's a good question.

Alie: I've got to look it up.

Ben: Certainly not globally. But yeah, I'm not sure how many Americans are killed by mosquito-borne illnesses. I don't know.

Aside: Okay yeah, I checked this out for us. While over a million people worldwide succumb to mosquito-borne illnesses every year, it is a low percentage in the US. The CDC reported just 79 human deaths last year. But deaths in America from deer collisions are around 450, which is the same number of American fatalities from salmonella or acetaminophen hepatotoxicity, which is the medical term for a Tylenol overdose. But that's still 450 funerals because of deer.

Alie: And you know, they say in Montana specifically, if you've ever been on a hike in Montana, you've been stalked by a cougar in a tree, just looking at ya. Which is like, "Well, I've been on a lot of hikes in Montana, yet to be killed by a cougar," knock on something. So, that's good! I have questions from listeners. Can I lob them at your face?

Ben: Oh please. Yeah, I'm ready.

Aside: But before we do, let's steer some money at a cause of the ologist's choosing, which this week is WildlandsNetwork.org which uses the principles of conservation biology to identify the core native wildlife habitat areas and the corridors that connect them, which they call wild ways. And their work is shaping conservation projects across North America. So, if road kill upsets you, consider checking out WildlandsNetwork.org. Thanks to sponsors of the show for making that donation possible.

[Ad Break]

All right, let's wild out, let's tear through your Patreon questions. To submit questions for the ologist ahead of time, you can just go to Patreon.com/Ologies, it's a buck a month to join and we're going to hit your questions. Specifically, a few audio questions asked by the BFF Tier on Patreon. But this first topic of inquiry was a popular one, it was also submitted by Jenna Breiner, Rachel Jay, Alecia Smith, Cian Verbridge, Mara Schoner, Kyla C, Chandler Witherington, Alena Litin, Alannah Wood, Alyssa Gregory, Nicole Kleinman, Isabelle Newman, Taylor, and [ph] Danoah. Okay, let's hear it. Caller, you're live... You're absolutely not live.

"Not to try to put an ologist out of work but is there any way to avoid running over my little and sometimes not-so-little friends out on the street?"

Ben: Yeah, good question. I think minimizing your nighttime driving is probably the best way to do that, that's just when the critters tend to be more active and also, when your reaction time is the slowest. Yeah, that's definitely something I've tried to be more conscious of. It's obviously hard to avoid altogether but making trips in the daytime when you can I think is one way around that.

Alie: And also, early bedtimes are the new sleeping in, am I right? I love an early bedtime.

Aside: So, a pal and a host of the beauty podcast, *Natch Beaut*, Jackie Michele Johnson Sheehan, calls herself a "Niche over-30 influencer" and she has influenced me. [*"Guess what is so much better than sleeping in? Going to bed early. Going to bed earlyyyyyy. It's sooo much better than sleeping in, take it from me."*] And for that, I am ever grateful.

Alie: So nice.

Ben: It feels so good. It's the best, yeah.

Alie: I used to think, this is so old of me but I'm like, "No, this is luxury, are you kidding?" In bed with a book by 9:00? It's the fuckin' best!

Ben: Your device turned off and in another room, ideally. So good.

Alie: Yes! I got a flip phone recently, a bat phone I call it, for emergencies only, only a few people have the number. So, I can just leave the phone in a corner, I know that if there's an emergency, people can reach me with the bat phone. Highly recommended.

Ben: Alie, I've actually been an exclusive flip phone user for the last five years.

Alie: [*gasps*] No!

Ben: So, we'll have to do a flip phone-ology episode sometime because I could talk about my flip phone all day.

Alie: Oh my god! And you still are able to text people, obviously, you can still take pictures on it. It's just no scrolling. That's amazing.

Ben: Yeah, very pixelated pictures and very slow texts but yes, yes.

Alie: [*gasps*] Good for you, love it. Oh my god, that's amazing. I never would have guessed that about you.

Aside: Some people, some of you out there can just delete an app or you can silence your notifications, and congratulations on that. But I cannot trust myself around a browser because I blink and it's 2:40 AM and I'm learning that the national animal of Scotland is a unicorn. Who allowed that? Don't make me look it up.

But okay, back to a podcast about actual wildlife. So, Ben's biggest tip is avoiding night driving and being hyper-aware, especially during dusk and dawn. Other tidbits from experts on how not to kill an animal or yourself include: don't look at your phone for everyone's sake, stay alert, especially during the peak season, which is now, you are welcome, and especially when you see those animal crossing signs. If you see an animal, you can flick your high beams which is the universal signal for, "Go on, git," you could honk your horn, you could do a little tap dance on the brakes to let anyone behind you know that there's some shit going down on the road ahead.

If an impact is imminent, if it's going to happen, the wisdom is not to swerve because that could land you in a ditch or roll over. So, don't veer off the road. Call 911 if it's a big critter that you hit that could endanger others or if it needs humane treatment. Insurance companies are also like, "Take pictures so that we don't wrap your claim up in a lot of bull shit, or moose shit." So okay, now you know how to avoid it or what to do. I'm just your internet dad here asking you to drive safe, kiddos. Want to have you around for as many episodes as possible.

Okay, this next one is another audio question from the BFF Tier on Patreon, but it was also on the minds of patrons Anna Thompson, Scarlet P, Jen Baker, Katie Murray, Ashlee Dent, Sydonie S, Jenna Congdon, Chris Curious, Jason Lowenthal, BeckytheSassySeagrassScientist, Peta Luck and Emma Dalrymple. Let's roll the tape.

"This is Emily in Michigan, I was wondering who comes and cleans up the road kill and what do they do with the road kill? Where do they go after they scrape them up off the road? Sorry for being so explicit."

Ben: Yeah, that's such a great question. Every road has its maintenance personnel whether that's county staff or state staff or federal highway administration staff, it just depends on the jurisdiction of the road, who owns and operates the road, and there are private contractors as well. Most of those carcasses get landfilled or incinerated. Some just get taken to some random dump site and shoved off the side of the highway. [*Oh dear... Oh dear.*] That definitely happens sometimes. There are a couple of carcass composting programs out there which are kind of cool.

And then some get eaten as well by people. About 30 states now have legalized road kill consumption. Typically, you have to obtain a permit which is usually pretty easy to get, report your salvaged animal via an app. It's a cool program, it's kind of a way of getting free-range organic meat to people who need it. One of the people I talked to working on the book was a woman who used to be a truck driver for the Alaska Moose Federation which was this organization that went around collecting dead moose and taking them to the elderly or poor people who signed up for a moose carcass. There's your protein for the year, those are some pretty hefty animals.

Alie: Right. Gigantic.

Aside: Alaska residents check out the Alaska Wildlife Troopers Roadkill Salvage Database. That alerts eligible organizations to come fetch this hot carcass within 30 minutes of the notification, time's a-tickin'. Now, Wyoming people, as of January 2022, there is a 511 app where if you cleared yourself with Fish and Game first, you can get notifications to salvage a whole edible menagerie

including elk, deer, moose, antelope, wild bison, or wild turkey. So, maybe hold off on just having a flip phone because a bison buffet could be just at the tips of your fingers.

But would you want to? Do you? Will you get a disease that you'll regret for the rest of your life or is it scrumptious? So, patrons Jessamy Ritchie, Elta Sparks, River Canina, Melanie Yakemovic, Shealyn Wippert, Laura Bruner, Jessica Fowler, Rozelyn Hesby, Savannah McGuire, Jen, Andrew McAdams, Tessa, John Mitchell, Gregory Hayes, Margot Louis, Brenna Pixley, Heather Moore, Olivia Kimes who asked: Is it safe to eat? Not talking about rodents.

Alie: And on that note, first-time question-asker Julie Bender wanted to know: Is road kill really safe to eat and if so, how can you tell? RJ Doidge wants to know: Is there a place you can take it to find out if it's safe to consume? You know, is chronic wasting disease with deer a concern? Or how do you know if this one is past its prime or ready for the barbecue?

Ben: Yeah, [*chuckles*] good question. Certainly, there are definitely conditions in which you're more liable to want to harvest road kill than others. I talked to a number of road kill salvagers working on this book and they definitely all said that winter is kind of prime time. In summer carcasses decompose quickly whereas in winter, they're naturally preserved. If you know that an animal has been killed very recently, that's a good sign. I actually just ate road kill for the first time a week ago, it was a friend who lives in Montana and actually saw the elk hit in front of his house and ran out and salvaged it. One thing that a lot of guys check for is they check for bruising. If an animal is badly bruised by a collision, its meat is not as good and, you know, maybe the internal organs have been scrambled, that's certainly not good for the quality of the meat either.

Aside: Head's up, a little warning for details of collisions but this stuff is really good to know from an ecological and a sustainability perspective.

Ben: An animal that's been hit in the head rather than the flank is generally a better one to harvest. As for the questions about zoonotic disease transmission, to my knowledge, and I did plenty of digging because I was curious about that as well, I've never found an instance of road kill to human disease transmission. That's not to say that it never has or will happen. Certainly, there are activists out there who have complained about road kill salvage or raised concerns about it for that reason. But as far as I can tell, there's never been a recorded instance of that actually happening.

Alie: Oh, okay! That's good to know.

Aside: So, there are hunter training programs that advise of, say, a high metal toxicity in certain regions, or how to test for chronic wasting disease in deer or other pathogens in, say, raccoon meat. So, you might want to seek out more local info or take a course for hunters of game meat so you can familiarize yourself with wild animal carcass handling for the purpose of consumption. So, road kill, it's accidental, it's free protein, it's unfarmed animals who may have had a good life; who is not down with a good road kill harvest? Where are the haters? Who's the haters?

Ben: A couple of things. First, I've definitely read concerns that it could lead to intentional road kill and I think that's extremely rare, not to say that it never happens. There actually are, I have heard of a couple of instances of people deliberately running down deer with their cars and then harvesting them. One guy actually served some prison time for that when a security camera caught him doing that. [*"You're dead meat."*] [*Alie gasps*] Pretty wild. That just seems like a really dangerous and expensive way to go about it, right? You don't have a rifle in your car or something? I don't know.

Alie: Yeah. If you're going to do something illegal, make it at least easier, I guess.

Ben: Right, exactly.

Aside: A guy in Wisconsin, 2013, misdemeanor, illegal deer hunting charge. Pleaded guilty, fined a few thousand bucks. But is a carcass on the road worth two in the freezer section?

Ben: I've also read a letter or paper that basically said that it was sort of classist in some ways. In some places, a fair amount of road kill ends up in food banks and the concern there is that again, there's potentially something classist about giving needy people these animals that were hit on the side of the road and could potentially be carrying parasites or other pathogens. I think that those health concerns are generally overblown. As many road kill salvagers pointed out to me, think about how many antibiotics are stuffed into a factory-grown cow or a pig or chicken, whereas road kill is this free-range, organic, wild meat that in some ways, might be healthier than an animal grown in a feed lab.

Alie: Mm-hm. I always wonder about that too because factory farming is so destructive for the environment as well and there's so much meat and protein that goes to waste.

We had great questions from Shaelyn Wippert, Kai Kishimoto, Megan Younce, ConnieConnieBoBonnie, and Jenn 'Squirrel' Alvarez who wanted to know about taxidermied road kill. Connie said: I had a friend who would pick up deer and tan the hides, any reason not to do this? Jenn wants to know: How can I collect skulls from road kill without looking like a serial killer? And is it okay to pick it up and taxidermy it?

Ben: Yeah, it depends on the species and your local or state regulations. I don't want to give any advice that's going to get anybody into any trouble because the regulations are so diffuse and diverse. I'll just say, check with your local or state fish and wildlife agency before picking up and taxidermying any wildlife.

Alie: Mm-hm. Good call. Google it. Google it in your area, people.

Ben: Kind of a cop out but that's what I'm going to go with.

Alie: Hey, you're avoiding people getting arrested.

Ben: I don't want to be aiding and abetting any taxidermy felons.

Alie: [*chuckles*] You're like, "Here's what you do, you get yourself a briefcase, you say it's paperwork..."

Aside: Okay, with all this talk of road kill meals and taxidermy specimens, I'm sure that the animal lovers in all of us feel a little bleugh... a little squicky, blergh, eugh, I don't know. And I wondered how PETA would feel about this whole episode. [*hushed tone*] Like, am I going to get letters? Next time I go to the mall, is someone going to douse me in red paint? People for the Ethical Treatment of Animals weighs in via their website and woo boy, get ready! Okay, this is what they say:

If people must eat animal carcasses, roadkill is a superior option to the neatly shrink-wrapped plastic packages of meat in the supermarket.

Wait, what? Okay.

Eating roadkill is healthier for the consumer than meat laden with antibiotics, hormones, and growth stimulants, as most meat is today. It's also more humane in that animals killed on the road were not castrated, dehorned, or debeaked without anesthesia, did not suffer the trauma and misery of transportation in a crowded truck in all weather extremes, and did not hear the screams and smell the fear or the animals ahead of them on the slaughter line. Perhaps the animals never knew what hit them.

Wow. Okay so, animal activists are like, "Hey man, it sucks but it's un-alived already. So, when it comes to a dead feral pig, go hog wild.

And patron Shaelyn Wippert wanted to remind us of a person who called into Fargo, North Dakota radio station Y94 Playhouse with concerns about deer crossing signage.

[clip from call to Y94 Playhouse]

Caller: Why are we encouraging deer to cross at the Interstate? I don't get it, that's a high-traffic area.

Host: Are you kidding?

Caller: I mean, I understand that deer are wild animals, they need to travel across streets occasionally to survive and of course to find food but it seems to me that so irresponsible of us to allow these deer crossings to be in areas where these deer are so likely to be struck by oncoming traffic. Wouldn't you agree?

To be clear, that was not an *Ologies* patron with an audio submission, that was just some person years ago. But this ologite did want some elucidation on it.

Alie: I thought Alena Litin had a great question: Is there any meaning behind where the signs are placed along a road? Like, is there a deer trail right there or is it just in this general area?

Ben: Yeah, you know it's so ad-hoc in some ways, there's not really... I wish there was a great systematic way in which signs were placed but my impression is that that's not the case at all. It's sort of where crashes have occurred in the past, or where deer have been observed, or a hunter saw some deer tracks at a time or two. It seems like it's often pretty arbitrary and I think that's why signs aren't super effective because there are just so many of them on the landscape, again, we habituate to them, and they kind of become white visual noise. So yeah, those deer signs again, not too effective and they're not generally placed in a really focused, strategic way.

Alie: Hmm, okay. I wondered that too if there was a deer just hanging out behind the sign being like, "Is it safe to cross?"

Ben: Yeah, if we could train them to cross at the signs, that would be really effective.

Alie: Right. As someone who has been hit by a car crossing the street, I trust deer to have better instincts than I do. *[laughs]* I survived, obviously, but it wasn't a fun experience. I was, like, 12.

Ben: Yeah, that's awful. I'm sorry that happened to you.

Alie: I know, a Mercedes sedan hit me and they were like, "Here's the deal, we'll give you 500 bucks not to sue us," and I was like, "500 smackers! That's a lot of money. I'll take it!" So, I guess I benefited slightly and from what I know, I didn't have any lasting traumatic brain injury. *["You sure about that?"]*

We had some great questions. Cian Verbridge wanted to know: How has road kill affected animal behavior? Have some animals started to avoid roads? Or has it changed the evolution of certain species that are learning to, just like, "Uh-uh, I don't cross that."

Ben: That's such a good question. There are some fantastic studies and anecdotes out there about that very question. So, those are really a couple of different questions. There's a question about evolution and then there's a question about behavioral adaptation, learning to live around roads. On the behavioral front, yeah, there's lots of research showing that animals have become road-avoiders. Grizzly bears are one of the archetypal examples of that. There are studies showing that even six cars an hour, one car every ten minutes, a really low-traffic rural road, is enough to prevent a grizzly bear from crossing a road.

But there are other, kind of, bolder animals out there that have really learned to live with these structures that we've built and the traffic we've created. The Chicagos of coyote or... What did I just say? The Chicagos of coyote? [*Alie laughs*] The coyotes of Chicago, a very famous urban animal population, they actually cross at crosswalks, at human pedestrian crosswalks, at red lights, or at least that's been described and reported. They look both ways before crossing the street which not every human pedestrian does. [*"I didn't."*] There are carrion crows in Japan that will drop nuts at intersections, and they'll let the cars crush the nuts for them and then they'll scurry out at the red light and grab the nut meat and if the car doesn't hit the nut, they'll reposition the nut by a few inches, so the car gets it the next time around. So, you know, animals are sort of learning to live with us in some really fascinating ways.

Aside: So, I wondered if this was a common occurrence and our managing director Susan Hale told me that she has seen coyotes crossing LA streets several times and the internet is chock a block with video footage including a bear lumbering about in downtown Asheville, deer on the Japanese island of Nara who have apparently also learned how to bow in thanks to treats... Better than me at avoiding social gaffs. An Alaskan moose waiting for the light to change, there's footage of Middle Eastern boars at crosswalks, a South Carolina alligator just shuffling safely over the stripes, and a small flock of German ducks waiting until the light goes green to waddle through a crosswalk, which I was like, "That's odd because they've got wings... None of my business."

Also noteworthy is this group of elephant bulls in Thailand who can smell the approach of raw sugar cane trucks and they stop them on the road to demand, like, a toll of a few hundred pounds of the goods before they let them continue on. So, if you've been too scared to ask for a raise at your job, just know that there is an elephant somewhere with a sugar high just because it was aware of its own worth and its own power. No raise? Block your boss's car with your body and take their wallet, you can write me from prison.

Now, how much of this is pattern recognition and how much is evolution?

Ben: And then the evolution question is also an amazing question. There's one really iconic study that I talk about in the book about cliff swallows. Cliff swallows are these birds that build mud nests on the undersides of highway overpasses and bridges. Historically, they've built their nests on cliffs, that's how they got their name, but now they've taken advantage of all of this infrastructure that we've built and as a result of that, they do get hit by cars sometimes, they're living over highways in many cases, and they get plastered.

But there is some amazing research that was conducted by a scientist named Charles Brown starting in the 1980s in Nebraska. He basically found that over time, cliff swallows became less susceptible to road kill and the reason is that they were evolving shorter wings. [*Alie gasps*] Having a long wing is good for flying long, straight directions or distances, whereas having a short wing is good for making lots of tight turns and rolls and pirouettes, all of those quick maneuvers that you would use to get out of the way of a barreling 18-wheeler. So, over time, all of those long-winged swallows got weeded out of the population and the cliff swallows became shorter-winged as a result. So, that's evolution happening really in the blink of a geologic eye.

Alie: Oh, that's amazing, I had no idea. I always wondered what those mud nests were too when I pass under them. Like, "Who is living in there?!"

Ben: Those are the cliff swallows!

Aside: Just a fun fact to bring up while everyone chews yams silently. So, cliff swallows build their little domed adobe houses out of over 1,000 individual pellets that they gather from puddles and mud banks. Imagine if you could make ceramics, no hands, using just your mouth. And then also

live in them and not have a mortgage. Next time you're driving along, and you see an underpass turned into a hipster enclave for birds say, "Hey, way to go. I love it. Make me one."

Alie: Erin Burbidge and Emily Staw-fur raised a great point about seasoning the roads. Erin says: I live in Nova Scotia, Canada and we apply salt brine to the roads ahead of winter storms. I've heard that some animals are attracted to the salt and that brings them closer to roadsides. Does that happen? I've heard that with moose too in Maine, they're lapping up the shoulders of the roads. Is that a problem?

Ben: Yeah, that's a great question and that is a problem. Certainly, roads can become these ecological traps. Salt is this super stimulant that animals crave, and our profligate salting of highways does lure them to the roadside and creates trouble as a result. There was one place in Quebec that I read about where basically they'd created all these little artificial salt ponds by the side of the highway, actually in a wildlife refuge. Moose were so often drawn to the highway and hit as a result that they actually had to drain all of those salt ponds and fill them in with rocks so that the moose wouldn't keep coming back to the road over and over again. In Jasper National Park, they put up these road signs in winter that say, "Do not let moose lick your car." *[Alie exclaims]* I feel like if a moose wants to lick your car, it's going to be really hard to prevent it from doing that. *[Alie laughs]* But you know, I guess that's a problem.

Alie: How do you have boundaries with a moose? *[laughs]*

Ben: Yeah, yeah.

Alie: And I've heard too... My dad, who grew up in Montana always used to say that if you hit a moose, it's like hitting a brick wall, you're toooost.

Ben: Yeah, absolutely. There have been lots of studies showing the different costs to hitting various animals, the costs in terms of vehicle repairs, hospital bills, insurance costs, tow trucks, and so on. So now, the average deer collision costs the American public more than \$9,000 and the average moose collision costs more than \$40,000 because they're just such an enormous animal that does so much damage. And I'm sure that per moose crash, I would imagine that they're the most dangerous animal in the country.

Alie: Do halogen lights help at all? I know that there are some new cars that are, like, blinding. But do better bulbs help?

Ben: From a driver visibility standpoint, you'd imagine that any headlight that increases the distance that you can see in front of your car is going to be helpful. There was a cool study done by a guy named Travis DeVault, an ecologist who has done lots of work with road kill and scavenging and collision avoidance. He basically showed that putting these backward-facing light bars in the front of cars, which actually illuminated the car rather than the road itself in front of the car, that helped because it seemingly made the car more visible to wildlife. So, that's one solution. I don't know if we're going to outfit all of our vehicles with these light bars, but it does seem like there are things we can do to our vehicles that might make a difference.

Aside: One possibility? A giant roof-mounted set of fiberglass antlers, maybe just to intimidate other ungulates like, "Dang, that dude's on the juice. See ya! I'm out." Because as patron Tara asked: Are deers part moth for headlights? And in Natalie Rousseau's words...

Alie: Why do deer want to die so bad? And I can't believe I forgot to ask this one, so many listeners wanted to know: Deer in the headlights, what's going on? Why do they freeze?

Ben: Yeah, that's a good question. They have eyes that are incredibly good at absorbing light, essentially. And as a result, they're basically blinded. That's another example of cars hijacking this otherwise

useful adaptation, right? You think about the evolutionary history or the evolutionary defense strategies of all of our most beloved animals, skunks that spray and porcupines that have quills, and turtles that pull their heads into their shells, these are all amazing defense mechanisms that have been honed over thousands of generations when your predator is a hawk or a coyote. But you know, against an F-150 barreling down the Interstate, they're not only useless, they're actually maladaptive. The worst thing you can do is stand your ground and hunker down. So, cars have this really evil way of hijacking evolution and deer freezing in headlights because they have these wonderful eyes that are capable of absorbing light but get blinded by this unnatural brightness. That's just another example of evolution gone awry thanks to automobility.

Aside: I didn't want to keep him, but I had to ask a skunk questions from Jani Rounds and Linea Brink Anderson.

Alie: I swear two more and then I'm letting you go to cough and take more DayQuil. [*I'm so very sorry.*] Julie M wants to know: Is it weird that I like the smell of skunk while driving by? Also, do they spray when they get hit? Or what's the deal there? Is it unrelated? How do you feel about skunk smell?

Ben: Weird that you like that smell, dear listener. [*Alie laughs*] You might be alone in that one. [*Alie laughs*] I don't know for sure, but my assumption would be that when they're hit, the scent gland that they use to spray is just crushed and the scent is released.

Alie: I love it. I love it. It reminds me of home, it reminds me of summer nights. I don't love that there's a skunk that's resting in peace but if I smell it far away, I'm not mad at it. It's like the smell of gasoline, some people are like, "Ah! Love that!" I don't know! Go figure.

Aside: Listen, I'm going to do an olfactology episode at some point, but for now, I needed to know why skunk is music to our noses but not all of us. It turns out that skunks, first off, they have not one, but two anal glands and they can spray up to 15 feet with military accuracy. And what's in them? Volatile sulfur-containing compounds called thiols and you may enjoy it because the olfactory bulb resides in a part of your brain associated with memory. So, if it's a nostalgic scent, you say, "Yum, yum, yum, yum, yum." Sunset drives on warm summer nights, heading to make out with my crush on a park bench. And for more of that, you can see the July 2021 study, "Contextual variation and objectivity in olfactory perception."

Or maybe because it smells like the ganja, according to another recent paper titled, "Identification of a New Family of Prenylated Volatile Sulfur Compounds in *Cannabis* Revealed by Comprehensive Two-Dimensional Gas Chromatography." So, researchers found that it's not cannabis terpenes but rather a 3-methyl-2-butene-1-thiol VSC3 or volatile sulfur compound number 3, that gives weed its skunky aroma and VSC3 is also found in brewskis exposed to UV light, which you might know as skunked beer. So, VSC3, it's in your weed, it's in your beer, it's in the skunk's butt.

I have never been skunked but I understand it's kind of like when you put lip liner outside of your lip, it's better at a distance. Up close, skunk musk smells, apparently, like someone farting garlic near a tire fire. The smell is so bad that it's been used as inspiration for weaponry, such as a yellow mist fired from a water cannon that has the aroma, apparently, of a rotting corpse in an open sewer wearing filthy socks. It's called simply Skunk and has encountered opposition from several human rights organizations. It's considered that cruel.

Alie: I need to do an episode on smell. Last listener question, Erin Ryan wants to know:

"Do you ever cry when you see very special animals that have become road kill? Like, a heron? And then do you also later realize that you cried over a garbage bag that you thought was a heron?"

I think this was a personal question. Have you ever thought you saw road kill and then it turned out to just be a duffel bag?

Ben: Yeah, that's one of those "asking for a friend," questions.

Alie: [laughs] Very much.

Ben: I have definitely stopped for many sticks and tire fragments and all kinds of stuff. Yeah, especially for snakes. I definitely stop for snakes very often and shepherd the snakes off the road. I did that the other day and it turned out to be a rattlesnake which was a little bit more exciting than I'd anticipated but awesome. I was really happy to help that snake off the road even if he just returned to bask on the warm asphalt 15 minutes later. But a snake looks like anything. So, if you're habituated to stopping for snakes, you also end up stopping for lots of ropes and bungee cords [Alie laughs] and branches and all kinds of things.

Alie: And the snake was alive?

Ben: The snake was alive! Which was great.

Alie: Oh! Oh my gosh. I have a rattle from a rattlesnake in Montana that my cousin Boyd, who we've had on in the *Bisonology* episode, cut off of a dead one and he gave it to me and it's a bit of a treasured possession and he was like, "Well, the rattlesnake wasn't using it anymore." He didn't kill the rattlesnake, but he did harvest the rattle.

Ben: That's another example of that evolutionary hijacking. Rattling is this amazing, unique, bizarre defense mechanism that is really good at warning off people and foxes and all kinds of other critters, but your Subaru doesn't care.

Alie: Augh, so true. Last questions I always ask. What was the hardest thing about writing this book? What was the toughest moment for you in this experience?

Ben: Yeah, that's a good question. Look, there are a lot of tough road kill-related moments, certainly seeing a giant anteater or tapir, all of these amazing, majestic, exotic animals dead when I visited Brazil for one of the chapters. I think the toughest thing was writing a book that I hope is enjoyable to read. It's such a dark topic in some ways and yet there are so many inspiring people out there who are working on understanding the problem and devising solutions. All of the real road ecologists that I was just fortunate enough to translate, basically. So, writing a book that dealt with a dark, challenging topic but is still enjoyable on the page and maybe even uplifting in places, that was challenging throughout. I'm not sure if I got there but I was definitely trying.

Aside: Again, his book is called *Crossings: How Road Ecology is Shaping the Future of Our Planet*, which I have, it's beyond wonderful. But don't take my word for it. Reviews of the book have called Ben "The David Attenborough of the asphalt," "The kind of gonzo environmental journalist Hunter S Thompson would have loved," and said that his book is "Surprisingly funny, full of cool stories, and a deeply researched and compelling read." Good job!

Alie: What about a moment that was uplifting or one of your favorite moments in writing this book or researching it?

Ben: Yeah, I loved going back- I think I mentioned at the start of this conversation that I began the journey of this book by visiting one of these wildlife crossings, or a number of these wildlife crossings, these structures we create to help animals cross the road safely. Eight or nine years later, at the end of this process, I got to go back to one of these wildlife crossings, a different one, this one was on I-90 in Washington State about an hour east of Seattle. I got to go on top of this big wildlife overpass, this bridge that's been used by elk and coyotes and little toads and all kinds of

other critters and it was just so cool to see the sensitivity of the ecological design of this crossing in some ways. They were really thinking about every member of the ecosystem, and you could imagine that every member of the ecosystem has different requirements in a wildlife crossing.

Everybody uses slightly different habitats, and you need those different habitat elements up there. You need to rock piles for the lizards and snakes and the little log jams for the toads and the kind of dead trees that are going to entice some of the birds to visit the crossing because actually, birds are often reluctant to fly over highways as well, at least some species are. They'd planted all this native vegetation and they'd even inoculated the soil with native mycorrhizal fungi that are going to grow all of the right plant species.

It was just so cool to see this bridge that wasn't really a bridge, it was really an entire ecosystem that had been designed and engineered by humans. I found that really inspiring and touching in a way, that we would go to such lengths for wild animals. We do so much on this planet to make animals' lives more difficult or more difficult, and dangerous, and harder. And here was this beautiful multimillion-dollar structure that we'd designed to make their lives safer and easier. I thought that was really, really lovely.

Alie: That's gorgeous. And do they find their way over it through scent? Does a cougar say, "I'm going to keep following these tracks... Oh hey, look at that, a bridge."

Ben: Really the most important piece in terms of getting them to actually use the crossing, it's really the fences. You need fences on either side of the wildlife crossing along the road. So, the cougar is wandering around, trying to find a way to cross the highway, he hits the fence, he starts walking the fence line and then he finds the crossing ideally and says, "Oh, here's the way I'm going to get across this thing."

But the really wonderful thing that happens over time, and there's plenty of evidence showing that this does happen, is that animals teach their own offspring. You get a mother grizzly bear who learns to use a wildlife crossing and then her cubs follow her across it themselves and then they become crossers and they teach their cubs which is really cool.

The other wonderful thing is that over time, all of those animals going across create game trails, little animal paths, all of those hooves and paws leading to the crossing and guiding other animals to it. There are so many great stories of these amazing spider webs of game trails that converge on wildlife crossings, it's almost like this form of collective external memory that's leading creatures to these places. I talked to one road ecologist who had worked in Banff National Park in Canada where there are some very famous wildlife crossings and he said it was like "The land itself was learning to use the crossings together," which I thought was the most beautiful sentiment.

Alie: Augh, that's amazing. That's gorgeous. How exciting to know that that's happening in different parts of the country and hopefully will be happening more and more.

Ben: Yeah. That really is happening. There's this really big new pot of money for wildlife crossings in the 2021 Federal Infrastructure Act, \$350 million, which is the most money that's ever been allocated to these sorts of solutions. There's a big effort, led by Beth Pratt who you talked to, to raise \$500 million in private philanthropy for crossings. So, there's a lot more money out there for this sort of thing than there ever used to be. You know, it's not enough yet. We know this problem is such a huge problem for wildlife in this country, more than a million animals are killed by cars every *day*, right? So, even \$350 million in federal funding isn't enough to treat all of the road kill hotspots that we know are out there but we're at least going in the right direction. Whether we're doing it fast enough or aggressively enough to save biodiversity, that's the big question.

Alie: Well, thank you for answering so many questions. We're so excited to finally get to talk to you!

Ben: Alie, thank you so much for doing this. I really, really appreciate it. That was super fun.

So, ask driven people dribbling questions because it's the fastest way you can move forward. And again, Ben's new book has so much more detailed info, it's called *Crossings: How Road Ecology is Shaping the Future of Our Planet*, and of course, it's available wherever you get books so you can probably get it on your lunch break or at the link in the show notes. His social media is really gorgeous as well, full of wildlife photos and it's linked in the show notes.

We are @Ologies on Instagram and Twitter. I'm @AlieWard on both. We have shorter, kid-friendly versions called *Smologies* available at AlieWard.com/Smologies. You can be a patron for a buck a month at Patreon.com/Ologies and submit your questions there. *Ologies* merch is available at OlogiesMerch.com and we have cool shit, if I do say so myself. Erin Talbert admin's the *Ologies* podcast Facebook group. Emily White of The Wordary makes our professional transcripts. Susan Hale is our managing director, literally runs the show, and did additional research on this episode. Noel Dilworth is our scheduling producer. Kelly R. Dwyer makes our website and can make yours. And in the driver's seat of our editing is lead editor Mercedes Maitland of Maitland Audio. Nick Thorburn did the music and he's in a band called Islands.

If you stick around until the end of the episode, I tell you a secret, and this week there are two... I have, like, fifteen I want to tell you this week. The first one is courtesy of Mercedes, the person, not the car. She said:

Heck, you can tell the world my secret if you want. I have eaten road kill deer. We knew exactly when it was hit and there were people on the scene very shortly after. My partner is with volunteer fire and he and another first responder split it. It was fine! No different than any other wild venison. Did it feel kind of weird? Yes. Did I get over it real fast because venison is delicious? Also yes. And bonus, I did not have to shoot it and feel bad.

So, there you have it, a veritable Yelp review from the shoulder of the road from a Canadian and a trusted member of Team *Ologies*, lead editor Mercedes Maitland has eaten road kill. Loved it.

This other secret is my own. Maybe you know this, maybe this came late to me in life, but it wasn't until maybe this year that I understood, "Why did the chicken cross the road?... To get to the other side." I thought it was just this flat shrug of a punch line like a Dadaist joke but getting to the other side means to die. [softly] Why did the chicken cross the road? To die. Which is bleak, but it makes more sense.

Also, this is a sad note, but my dad was going in for this kind of risky emergency surgery, and his last words in the waiting room to me and my mom were, "See you on the other side," which broke my heart that he had to think of the right thing to say in case this was goodbye, goodbye. But we were lucky we saw him on the other side of the hospital that day and he lived another few years. But I always remember that "See you on the other side."

I also don't have a good segue for this, but I didn't understand the bumper sticker "Honk if you're Horny" until recently either. Like, that horns honk. Like honk if you're horn-y. So, there you go. Some automotive confessions for you. Okay, drive safe... Uhh. Yeah, dude. Seatbelts. Berbye.

Links to things we discussed:

[An introduction to the wildlife crossing structures that help animals move over and under Highway 93 in the Flathead Reservation, Montana](#)

[Montana Treasure: The 66-year history of white cross highway markers](#)

[American Legion Highway Fatality Markers](#)

[New State Farm® data reveals the likelihood of hitting an animal while driving in every state](#)

[Fatality Facts 2021: Collisions with fixed objects and animals](#)

[An Environmental History of Roadkill: Road Ecology and the Making of the Permeable Highway](#)

[Fear the deer: Crash data illuminates America's deadliest animal](#)

[Frogger inspiration](#)

[History of the Classic Video Game Frogger](#)

[Numbers of human fatalities, injuries, and illnesses in the United States due to wildlife](#)

[Wolfenoot](#)

[If you build it, will they come? A comparative landscape analysis of ocelot roadkill locations and crossing structures](#)

[Another endangered Florida panther struck and killed by vehicle — the 62nd such fatality since 2021](#)

[Roadkill Rescue Gives Deceased Wild Ocelot a Chance to Be a Father in the Future](#)

[Road Ecology: Science and Solutions](#)

[Richard T. T. Forman, Harvard University Landscape Ecologist](#)

[PETA's stance on eating roadkill](#)

[Elephant Cleverly Steals Sugar Cane off a Truck in Thailand | Secrets of the Elephants](#)

[German ducks stop on red light and go on green light](#)

[Cliff swallows building mud nests](#)

[Superadobe mud houses](#)

[New Lighting System Helps Deer Avoid Vehicles at Night](#)

[Why marijuana smells like skunk: Scientists reveal cause behind unmistakable odor of cannabis](#)

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