Dan Seed:

Hello and welcome to Big Ideas, a podcast from Texas State University in San Marcos, Texas. I'm your host, Dan Seed, from the University, School of Journalism and Mass Communication.

Dan Seed:

In this month's episode, it's October, we're talking bats. But the tie in, not to Halloween, but really to a particularly deadly disease that is greatly affecting bats across North America. And for this episode, we're joined by Dr. Sara Fritz and Dr. Ivan Castro-Arellano, from the biology department here at Texas State, and Dr. Sara Weaver, senior ecologist with Bowman Consulting, who received her PhD from Texas State, which included her dissertation on wind energy and its impact on bats. Thank you all for joining us.

Dr. Sara Fritz:

Thank you.

Dr. Sara Weaver:

Thank you for having us.

Dan Seed:

So the focus of our discussion on this episode is, how this group of researchers is helping to prepare a response to the deadly White-nose syndrome that's devastating bat populations across North America. This research is funded by a $500,000 grant from the Texas Parks and Wildlife Department, and is one of the largest grants ever awarded by Parks and Wildlife to study non-game animals. We'll get into the specifics of the grant in your research. But let's start here. What got each of you interested in studying bats?

Dr. Sara Weaver:

Well, I can tell you, Dan, when I was in junior high, my father took my sister and I to Austin for a visit and we went to the Congress Avenue Bridge to watch the bat emergence. And I remember being in such awe of these animals living in such close proximity to people in the city with the hustle and bustle of the cars, the bridge itself, and it was just such a wonderful display that I knew at that point in time, that I was hooked. I wanted my future to involve some type of work with bats. I didn't know at the time what that would be, but, I knew I always wanted to work with them from that point forward.

Dan Seed:

Dr. Fritz, Dr. Castro-Arellano?

Dr. Sara Fritz:

Sure. I started working with bats while I was an undergraduate, and of course, just on field trips when we went out to trap various types of vertebrates. And I always loved catching bats and actually, my best friend got her first technician job working with bats in the Eastern, United States. So I went out with her several times and helped then we worked in Yellowstone National Park, doing a bat inventory. But I did not do my graduate degrees on bats, but instead, focused on reptiles, amphibians, and mostly rodents.

Dr. Sara Fritz:

So at North Carolina State University, though, I was part of the USGS Climate Science Center. I was a fellow there for two years, that was during my PhD. And then when I went to Texas Tech, I was also part of their Climate Science Center. My PhD focused on how harvesting woody biomass for energy production influenced ground dwelling vertebrates. So here, in Texas, instead of using harvested wood for bioenergy, we're using wind energy. We're the biggest producers of wind energy in the United States. So here it's the same type of questions that I had as a PhD student at North Carolina State University, but instead focused on bats and wind energy.

Dr. Ivan Castro-Arellano:

In my case, just like, I consider myself a mammalogist and an ecologist, for most of my career, I have studied mammals. My dissertation was in rodents. But then at the end of my dissertation, I started working on diseases that are in wildlife and that passed to humans, that are zoonotic, we call those zoonotic diseases. Bats are a very important group for the transmission, they carry many of these diseases and that's where my interest fall.

Dr. Ivan Castro-Arellano:

Another part of my research at this particular interests in bats activity patterns of animals and battery. I find that speaks to the system, or that [inaudible 00:04:02] there are very different reasons why animals have [inaudible 00:04:07] these parts of the questions that we're asking.

Dr. Ivan Castro-Arellano:

It's asking for the most activity of these animals in the landscape. That's my interest. That's why I like getting into these [inaudible 00:04:20]

Dan Seed:

Before we get into the main focus here, in the study that you're doing on this, I want to keep it kind of in that general concept with this idea of bats. Earlier this summer, my family were out in our yard and lo and behold, there was a bat clinging to a tree in our front yard, the next day we're outside and the poor little fellow was dead on the ground.

Dan Seed:

Thankfully, it tested negative for rabies. I had an experience in college with a bat coming into our apartment when I lived in Boston and people just have these conceptions about bats. That they're hairy and this, that, and the other, but tell us why ,for just the general public to better understand what you do, but also to better understand the importance of this research that you're doing on White-nose syndrome. Why are bats so important? How are they so important just to the environment overall?

Dr. Sara Fritz:

Bats provide a lot of services, both for the ecosystem and for humans. They're very important pollinators and also very important for pest control. They are estimated to save Texas cotton farmers $74 per acre and reduced pesticide use and pest control. So $75 per acre for cotton farm adds up to a lot of money. In fact, it's estimated that saves about $53 billion annually.

Dr. Sara Fritz:

Does that sound right? Sarah? I don't have the numbers in front of me, but I think $53 billion annually worldwide for pollination and pest control. So in terms of agriculture, they are extremely important.

Dr. Sara Weaver:

Yeah, those numbers, the billions are for North America, to my understanding. It's even likely more, it's upwards in the billions across the U.S. in North America for pest control. They're also really important seed dispersers, they help to regenerate the forest. And you're right, they are misunderstood. A lot of people think that bats are blind and that's actually not the case. They actually have very good vision. They're very important for the ecosystem, not only for what they do for us, but, they're also important to other organisms as prey species.

Dr. Sara Fritz:

Right.

Dr. Sara Weaver:

So it's important to keep both ends of the spectrum in mind.

Dr. Sara Fritz:

Yeah, if you've ever been to a large pack colony before emergence, it's pretty common that not only birds of prey, but mammals, snakes, they all come around and start gathering. Then as they fly out and emerge, they're getting picked off as prey, which is incredible thing to watch, but also just shows their importance in the trophic level interactions.

Dan Seed:

Highlighting that importance, I think puts it into perspective and context for people out there, why this research that you're doing is important, not only in a research aspect in, within your individual interests, but to the environment as a whole. So let's start here. What is White-nose syndrome?

Dr. Sara Fritz:

Sure. So, I know syndrome is a fungal infection that's been affecting bats in North America since. There's evidence of it since 2006. It is saw that this fungus was brought over from Europe and introduced into our cave systems in New York. Since 2006, what was found in 2007 however, there are photos that show that, that's probably had the fungus in 2006. Since then, it has gone from a very localized issue for New York and spread all throughout from New York, all the way to Texas now. As of March of this year, we had our first die off of that due to White-nose syndrome and what it does, it's a fungus that gets on their face and it also gets on their wing membranes and wakes them up during hibernation. So the fungus itself doesn't, as far as we know, kill the bat, instead the bats wake up multiple times during hibernation.

Dr. Sara Fritz:

When they wake up and it spends a lot of energy and also a lot of water resources. They wake up during a time, also when there's no food and water available so they end up dying from starvation and dehydration. It's estimated now that, it's been years since I've heard the figure 6 million bats have been killed by White-nose, but we really don't know because a lot of the bats that are dying obviously do far away from humans where they live. But we do know that it's upwards probably at this point into the double digit millions of bats, and it's even caused some bats to become endangered. It's completely wiped out entire populations.

Dan Seed:

What are we seeing? And maybe this is a purpose of the grant that you have, but what are we seeing here in Texas in relation to White-nose syndrome with the bat populations here?

Dr. Sara Fritz:

So far, as far as we know, it's only affected one species, which is a cave Myotis, and our cave Myotis is a pretty abundant bat here in Central Texas. There were several cave Myotis found dead in central Texas in February and March of this year, due to White-nose syndrome. So far, we don't really know. Part of that is because we don't have a good baseline idea of what occupancy and abundance bats are, in the area.

Dr. Sara Fritz:

They're super hard to study. If you've ever tried to catch bats, it's not that easy. They're high flyers, they can see nets and they're out obviously at night. They're pretty difficult to study. We just don't have a good idea of how it's affecting that population and bat community. But, we do know that it has affected the cave Myotis. We also know that there's many species that live here in Texas, and that hibernate here in Texas, that have had population crashes and other States due to White-nose syndrome.

Dr. Sara Weaver:

I was going to say that's right. We also have species in West Texas that are naive to have never been introduced to the fungal parasite. So, we don't really know how they're going to respond, but they're closely related to other species that have been impacted and we've seen declines. So there's some worry as to what's going to happen with those populations.

Dr. Ivan Castro-Arellano:

There's another point to add, we have a migratory species here in Texas that they [inaudible 00:09:53-56]. There's a likelihood that it's going to get affected by the fungus but they [inaudible 00:10:03] migratory movements [inaudible 00:10:05] is my take. These fungus spread farther into Mexico, and there's higher diversity of bats in Mexico that has never been exposed to these pathogen. Again we don't know, because [inaudible 00:10:21] how these pathogen is going to affect these species. But we have colleagues in Mexico, that are monitoring potentially the spread of the disease. These species are important [inaudible 00:10:35] to spread out because of the movements it has of the migratory behavior.

Dr. Sara Fritz:

I think this is an important point. So bats here in Texas have two options for the winter, they either hibernate or they migrate to a warmer area. Here, in Central Texas our most [inaudible 00:10:49] bat the Brazilian free-tailed, Mexican free-tailed bat that everyone knows about under the Austin bridge or the Congress bridge in Austin and also some of the caves around here, those are migratory bats for the most part. However, the fungus has been found in the caves that they are in currently when they're here in Central Texas. They have the fungus, will it affect them? We don't know, because if they don't hibernate and they don't go to sleep, then they're not going to be continuously woken up, which leads to starvation and dehydration.

Dr. Sara Fritz:

But, as Dr. Castro mentioned, they might be spreading it even to a whole new continent on their fur and that could be taking it to more susceptible bats, to other places that are also naive that have not been introduced to the fungus before. The fungus does live in Europe. It has been found also in Asia. In Europe, it doesn't affect the bats, the bats there have a tolerance to it, they evolved and adapted with the fungus. So, it was just really these new places that it's being introduced as what is causing the problems.

Dan Seed:

So let's talk about the grant itself, and what it is that, that you're doing with this grant in terms of identifying this here in Texas. What is Parks and Wildlife looking for with this study?

Dr. Sara Fritz:

Sure. So there's a lot of experts all over the United States, North America, and probably the world that are studying White-nose syndrome. We all have our different areas of expertise. For us, we are basically researching the abundance and distribution of bats through Texas and hopes that we can provide some baseline data so that after this winter, we can have some idea of how it's affecting our bat populations here.

Dr. Sara Fritz:

We're not actually going out and looking for the actual fungus, or for cures for the fungus, but instead of trying to understand how it's affecting the overall populations and communities of bats here in Texas.

Dr. Sara Weaver:

Right, and that will help Texas Parks and Wildlife Department understand where they need to focus our management strategies. If we don't know where the impacts are occurring, then we can't appropriately manage for them.

Dr. Sara Fritz:

Right, and it could give us some indication, as well as Dr. Weaver mentioned before of new species that are being affected,if we keep these detectors up long term, which we're hoping to do, then we can basically understand some population trends and see if there are die-offs in the future.

Dr. Ivan Castro-Arellano:

Let me also comment in there, just to put into context or perspective for people that are outside, not that even outside that, we're just like, we're basically going to call it. The project is doing or sitting all over the state, there's what we call these bat detectors. Bats produced on sounds that we humans, cannot hear.

Dan Seed:

How is it?

Dr. Ivan Castro-Arellano:

Technology I mean, I work for Leaks and there has been a lot of work in this area. Now there are devices, new devices, what they do, they have these very sensitive microphones and when a bat passes by and it produces a sound, these devices, detect that and we can record. Now, for some species it's possible to determine the species or if not, at least we know that there's bat activity in the area. For [inaudible 00:13:42-43] This is species A or species B, I mean, it's not possible for all of them, but at least we get some idea.

Dr. Ivan Castro-Arellano:

In order to have these baseline data that Dr. Fritz mentioned, we have to sample all over the state, which creates a very unique program because gigantic state, it's a very, very large state tour, the traditional way to come back to reconfigure our use, we put nets and we trap them into those nets and within there we have the animals in our hands and we release them. That is not practical at the level of the state.That's simply not practical.

Dr. Ivan Castro-Arellano:

So we use technology, if you know that you're putting these devices, there's a whole design for how these, we start putting the landscape and then we just [inaudible 00:14:31] those to sample all throughout the year. They are going to be sampling throughout the year to get these calls from bats and that's going to provide that first baseline information. It's a very interesting mix of technology, a lot of logistical effort and it's like getting the calls from the bats. So we actually, we're not catching the bats we're just getting the sounds that they produce. These devices, we know that the geographical location, and we also know the hour, we can also then take another part that [inaudible 00:15:02-04] time of the day. I mean, just putting into context what's their real, main activity of the [inaudible 00:15:12]

Dr. Sara Fritz:

These devices pick up their echolocation calls, and with these echolocation calls, we can get activity levels. We can see, we can't count the bats because we don't know if it's one bat hovering over one of the detectors or if there's a hundred flying over, but we can get activity levels. Then we can also often determine the species, identify the species based on the call patterns. So we take the sound profiles and put them in software programs, and then look at the sonograms of the shape of the calls. Through those shapes and frequencies, we can sometimes, not always, identify bats to species. We will get some act, some idea of the abundance or relative abundance, activity levels and distribution of bats throughout the state. I think technology is really important here. It's an important component, not only because of the bat detectors, but also historically, and this goes for all work, probably everywhere with any animal or even non animals.

Dr. Sara Fritz:

But there's been a lot of researchers that have been working on bats for a long time and all of us have our different methodologies. So it's difficult sometimes to compare research and results over state lines, or even from university to university or researcher to researcher. In 2015, some biologists got together and they formulated what's called the NABat protocol. This protocol is a way for bat biologists across the United States to have similar methodology, so that we can combine all of our data in databases, then look at long-term and overall trends in order to conserve bats. I think that's an important component as well. We are following these guidelines and methodologies through NABat program, the North American Bat monitoring program to facilitate this research.

Dan Seed:

It's very interesting, the technology that you're describing, the way that you're going about doing this, and of course its critical work, as you all mentioned with the environment here in the state and with the kinds of bats that we have. Dr. Castro brought up the idea of the sound. One thing that I did want to kind of segue to is a study, actually, the dissertation that Dr. Weaver did on the effect of wind turbine with that. So, Dr. Weaver, I guess I'll start with you on that,what did you find?

Dr. Sara Weaver:

Sure, well, Texas is the largest producer of wind energy in the nation. We have the most wind turbines on the landscape, and unfortunately, we also have the highest abundance of bats. If anywhere in the world, we have the largest bat colony, just about 30 minutes South of us in Bracken Bat Cave, which houses 10 to 20 million Mexican free-tailed bats, again, is the largest known in the world. That combination is not great for bats, because bats are killed by wind turbines. It's actually estimated that it's the largest cause of direct fatality for bats in the world. So here in the U.S., there bats are dealing with kind of a multi-front system, they're dealing with this disease. Those that hibernate, are typically the ones that are affected by the disease, but those that migrate are affected by wind turbines. For my dissertation, I was looking at the impacts of wind energy on bats in Texas, and, and despite having all these wind turbines and all these bats, Texas has very little data that have been produced looking at this issue.

Dr. Sara Weaver:

Most of the companies here do some type of effort. They do studies, but it's usually proprietary and it's not made publicly available. We found that my study site in South Texas, we did see some moderate to high bat fatality rates. One of the components of my dissertation was looking at trying to reduce those impacts by using an ultrasonic acoustic deterrent to dissuade bats from flying around wind turbines. Thereby reducing fatalities, and it uses sound as well. So like we were talking about bats echolocate, and they produce this high frequency ultrasound, they use this for navigation as well as for forging and socializing in the airspace. If we can create a device that could go on wind turbines, that produces a sound that makes it difficult for them to hear their own echolocation so they can no longer orient or forage, then it would make it difficult for them to be in the airspace around a wind turbine flyway, thus decreased fatalities.

Dr. Sara Weaver:

The detectors that we were testing, did have positive results for two species in particular, the Mexican free-tailed bat, the one that we've been talking a lot about, that's migratory and forms such large colony, but also it showed significant reductions for the Hoary bat. Hoary bats been one of the most highly impacted species by wind energy. Some have even predicted that if we do nothing at all, the species could decline by as much as 95% by 2050, due to wind energy alone.

Dan Seed:

Wow.

Dr. Sara Weaver:

It's a high priority species for conservation efforts with wind energy impacts. We were very successful and excited to see that, but it wasn't positive for all species. We did not see an effect for Yellow bats for the Northern Yellow bat in particular. So we're excited about those results, but we're continuing our work, we want to improve.

Dr. Sara Weaver:

I actually have another project with Dr. Fritz, where we've built as far as we know, the world's largest outdoor bat flight cage specifically for bats at Texas state. We have those deterrents there operating under different treatment settings. In this situation, we're able to observe the individual bat's behavior and response to the deterrence directly. With my study we didn't have ability to do that, we could count bats the next morning and determine if it was effective or not, but we couldn't observe the behavior.

Dr. Sara Weaver:

Now we're working to try to increase the effectiveness by using that species specific behaviors in those flight cage. Dr. Fritz has two master's students who are working on that project currently. We're really excited about that and hopeful that we're going to be able to increase those reductions.

Dr. Sara Fritz:

She mentioned the flight cage, it's pretty cool. It's out at, like she said, the Freeman center, it's about 62 meters long and 10 meters wide, and we're using thermal cameras. We have thermal cameras mounted on high posts to track back flight behavior under the different treatments. Then also using the same devices that we're using for the White-nose syndrome project, the acoustic detectors throughout the flight cage. So we can also listen to their echolocation calls because we think it's possible that if we try to jam their echolocation at one frequency, they might shift to another frequency just as we would on a walkie talkie, right?

Dr. Sara Fritz:

We're actually tracing their behavior both through thermal cameras and through echolocation detectors. If you think about it, we put one bat in and at a time, so we have individual results, but one bat in there at a time is a tiny little fleck and then we have to catch them after the trial. It was actually quite funny to watch people go in, and try to catch this little needle in a haystack bat so that we can get ready for our next trial each night.

Dan Seed:

I want to leave just with this question here, we've talked about White-nose syndrome, we've talked about the wind turbines, and clearly climate change is something that we could spend a whole another podcast discussing, but in terms of bats, how critical is this time? I know that their species is long, it's old. I get that we're just a small sliver of it, but how critical is this time period that we're in for the future of bats, between climate change, between advent of new technology that affects them between diseases that are spreading from continent to continent.

Dr. Ivan Castro-Arellano:

Every mammal group or vertebrate group, [inaudible 00:22:41] very different sights from human activities. I mean, we're, destroying the forests [inaudible 00:22:48], the pesticides that we use and all that gets into the system. We have to make some choices as humans. We really need to change. Go away from fossil fuels and [inaudible 00:23:02]. But also, we know that we're going to have to fix. That's the reason [inaudible 00:23:09] the dissertation of, how we can make compatible use of the generation of green energy because we need that. We need that. But also we know that it kills wildlife. We have to make those compatible as much as possible. Still, even with [inaudible 00:23:28] But the potential effect of not using green energy, is going to have a much wider impact.

Dr. Ivan Castro-Arellano:

It's a hard time for bats and [inaudible 00:23:45-47] Imagine that these are way more lethal, in so much species of bats. We introduced these pathogen in these populations of bats. They are having their own [inaudible 00:23:57] like epidemic that we cause.

Dr. Sara Fritz:

I would like to echo that. For bats obviously, this is a time that we need to be concerned, but this has been going on for a while, right? Not, White-nose syndrome here in Texas, but just threats all over for all of our vertebrate species. It's been estimated that about a million species are of threat of extinction right now, due to anthropogenic threats and fungus's are affecting frogs and they're affecting snags. We have snake fungal disease and chytridiomycosisis going on as well, habitat fragmentation, climate change. All of our wildlife are struggling. I agree with Dr. Castro that humans need to kind of wake up and see what's happening and make some very important decisions in the next coming years about how we can serve our wildlife populations.

Dr. Sara Weaver:

We're kind of in the middle of a perfect storm right now. Where as you touched on climate change is kind of the bigger wave that's about to eat all the little waves underneath it. With that like Dr. Castro highlighted wind energy is a very important component to being able to combat climate change. In my experience, the industry is very interested in finding ways to reduce their impact. Bats being killed at wind turbines was an unintended consequence. They didn't expect that to be an issue, but now that we know that it is ,they're partnering with researchers, NGOs agencies, government agencies, to try to find ways to fix the problem. We all recognize that we need wind energy because climate change is really the bigger picture here with all this and a lot the spread of disease it's going to increase with climate change as well. There's a lot of changes that need to be made by people in order to ensure that we are able to conserve these populations for our own benefit, for our own health, for the ecosystem, for the planet as a whole.

Dan Seed:

I want to thank all three of you for joining us today. This has been really interesting to learn about bats, to learn about some of the perils that they're facing. Hopefully it's a wake-up call for people out there to have a little bit more appreciation for bats and to realize the actions that we do affect not only them, but then of course trickle down through our environment as a whole. Dr. Sarah Fritz, Dr. Sarah Weaver, Dr. Ivan Castro-Arellano thank you so much for joining us here on the Big Ideas and thank you, our audience for joining us again for another episode of Big Ideas here at Texas State.

Dan Seed:

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