Prairie Pod Transcript

Season 3, Episode 5: What's buzzing on the prairie: The Minnesota Bee Survey

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Guest: Jessica Petersen, DNR Invertebrate Ecologist and Nicole Gerjets, DNR Bee Survey Specialist

Podcast audio can be found online at mndnr.gov/prairiepod

Transcript:

((sounds of birds chirping and wind blowing))

Megan: Welcome back to the Prairie Pod! I'm so excited Mike! Are you excited?

Mike: I can't tell. Are you seriously - - I mean you seem so calm and quiet and introverted.

((Laughing))

Megan: Mike.

Mike: Yeah, I am too because my mentor and successor, predecessor, my predecessor, I get those two confused.

Megan: You practiced.

((Laughter))

Mike: She's on the show.

Megan: I know, we got - -

Mike: Inter-colleague.

Megan: Well I mean not only are we talking about bees today, which is very, very exciting, we're also bringing back a throwback to Season 2 and 1.

Mike: A throwback.

Megan: Yeah. ((Laughing)) JP's with us!

Mike: Yep.

Megan: And then we have our partner in crime, Nicole too.

Mike: Yep.

Megan: Do you guys want to introduce your self?

Mike: One at a time please.

Nicole: I am Nicole Gerjets and I am the Minnesota Biological Survey, the bee survey specialist.

Jessica: I'm Jessica Petersen, the Invertebrate Ecologist for the Minnesota Biological Survey. Back, throwback. I don't know. I'm happy to be here. Nicole's really the star of the show though. She's got all the answers to all the questions you might have today about bees.

Nicole: If I don't have the answer, Jessica will then have - -

Mike: We expect you to.

Megan: ((Laughing)) I'm just excited to have, it's like a mini Prairie Pod reunion. It's just nice.

Mike: It is very nice.

Megan: I'm very excited about it.

Megan: Okay, so before we even start jumping in to talk about bees, and all the incredible things that they're doing because they're always busy out there, busy as a bee, one might say.

Mike: Okay.

Megan: I know, I did it, I did it, I did it.

Mike: Please.

Megan: Before we even start, this is a little game we're going to play with the listeners because I read about this in a journal article and I think it's actually a really good exercise to kind of frame the whole conversation today. Jess is looking confused but it's all going to come together, I promise.

Mike: I'm confused.

Megan: Okay, so listeners. We want you to conjure up the image of a bee in your mind. Okay? So think about it. What does it look like.

Jessica: Close your eyes maybe.

Megan: Yeah. Close your eyes. You can draw it too, if that's easier. We'll give you a little bit of time to draw it. What does it look like? Mike's drawing his here right now. Okay. I'm just stalling to give you time to think about it. Think about all the parts and piece of that bee, what it looks like. Does it have stripes? Does it have a stinger? Is it smiling? This is a pretty good picture that Mike's drawing. So the reason why I wanted

you to start with this because overwhelming, the study found that when we think about bees, most people are drawing a fat bodied, single bodied, like just one circle with another circle for a head, all stripes, usually it's smiling, sometimes it has wings, which is interesting because bees definitely have wings, sometimes not, sometimes it has little legs, sometimes not. In Mike's picture, very good, Mike, he drew not only the head.

Mike: Thank you, Ms. Benage.

Megan: He's got the abdomen, he's got the thorax on here, he has antenna. What is this? Oh, is that his proboscis?

Mike: That's his tongue, yes. Or her.

Megan: Okay. It's hard to tell. Mike's bee also - - what is this?

Mike: There's pollen on the, on the leg.

Jessica: On the leg?

Megan: There you go. Well, and bonus points if you guys put pollen on the leg of the bee.

Jessica: Yes.

Megan: So most of the time, and even if you look at your emojis on your phone, it's just kind of this cartoony fat body bee, and so Jess and Nicole are going to help us understand all of the different, different, different, different kinds of bees that we have and that they certainly don't all have stripes, they come in many different shapes and sizes, and I guarantee you they're not all smiling. Only the ones that are hanging out, Jess and Nicole.

Nicole: Yes.

Megan: Pretty sure those ones aren't smiling, either. All right. That's the little game we wanted to play just to see.

Mike: That was fun.

Megan: Yeah, well I really like your bee. I was a little confused because this looks like, the pollen looked a little bit like the bee had a backpack. ((Laughing)) It looked like it had a tiny rucksack it was carrying ((laughing)), which I guess in a way, depending on the species, maybe, but yeah. Anyway. Okay. How does one become an invertebrate ecologist or a bee survey specialist? Jess, you first?

Jessica: Well, you go to school for a real, real long time and you learn all kinds of things, so most of my work has been in very disparate areas of the entomological world, from taxonomy and molecular phylogenetics to community ecology and landscape ecology to agricultural production. So I know a little bit about a lot of things, which comes in handy sometimes when you need somebody that knows a little bit about a lot of things. There's so many insects that not every, most people can't know about all of them, right? I couldn't even necessarily hazard to guess how many insect species we have in Minnesota, let alone the world, so.

Mike: Most of the ranges I've seen are like 10 different, 10 orders of magnitude from the smallest to the largest estimate.

Jessica: Yeah.

Megan: And did you say one time, Jess, that we only even know, like only 1% of the insects species are described that we only know about or is it 5%?

Jessica: It's hard to even estimate that, right? Like how would we even necessarily know what we don't know. There's knowns, known knowns, and known unknowns.

Megan: How do we know what we don't know. But definitely we only know about a percentage of them.

Jessica: I don't know what percentage it is. It's a fraction. I mean, I would say the diversity of insects in Minnesota is somewhere between 10,000 and 30,000, maybe. We're starting to know how many bees we have here in Minnesota and that's just through a lot of work. It's a lot of work to go out there and find all these bees.

Megan: Hey, Megan and Jess here. Quick factcheck update on the percentage of insects that are known and not known. Take it away, Jess.

Jessica: Yeah, I had to look this up because I couldn't let it go. So it's estimated that we know about 20% of the total diversity of insects, so we got about 80% more to go. It's quite a bit.

Megan: Is that across the globe?

Jessica: Across the globe, right. So it would probably vary by geographical. There's places of the world we don't get to probably have more in described diversity but and the groups that we don't get to. That was what this annual review paper that I read talked about. But there's still so much to find.

Megan: And we're going to put that on the website, too.

Jessica: Okay, cool. High five.

Megan: High five. Factcheck update out.

Jessica: That's a really long story to say I became this person that I am.

Megan: Well, that should be a long story, right?

Jessica: Well yeah. Mm-hmm.

Megan: It doesn't happen overnight. I hope it's a long story that continues.

Jessica: Are you saying that I'm old?

Megan: No, I'm saying that I want you to get a lot older than you are now so you'd be around for a long time. That's what I'm saying, we're all works in progress.

Mike: How about you, Nicole?

Nicole: So I was interested in insects, so I decided to go to school for conservation biology and I got student position job at the bee lab, so I started doing bee work and that basically started the whole head dive right into all the bee world and I've learned a lot about the bees the last several years, and that's what brought me here.

Mike: You said bee lab. It's also University of Minnesota bee lab.

Nicole: Yes, the bee lab at the University of Minnesota is where I started my bee career.

Mike: Cool.

Megan: Nice, very cool. And they do lots of really good work. Yeah. Lead us off here, Mike.

Mike: Let's talk about insects, a big picture of you some more. Jess has talked a little bit about it. But there's been some recent media and news, even major national level news discussion about insects and the insect apocalypse and I'd like to hear you guys comment on that and tell us more about what's happening to insects within Minnesota and even broader.

Jessica: Well, it's one of my favorite topics talking about the insect apocalypse because it allows me to say things that I've already said in part that we, there's just so much we don't know. So we don't have a grasp on insect populations in Minnesota. I even cringe kind of using that word because there's very few, the word population that is, there's very few insects that we can get a handle on their population. There's just so many and so few entomologists, so we might have a good handle on some populations of pests but as far as native bees or things that like that, that we might care about, things that are conservation concern, we don't have a good handle on their population, let alone their distribution, their natural history, etc. So really the first step is to do what we're doing, which is to do a survey of the critters that are out there and so that's what we're up to. Hoping to chip away at some of those questions of what are the trends of bees in Minnesota. We won't get there with this first survey project but we can hope to begin that with some of the other work that we're doing in the prairie region looking at monitoring of bees, so we're not there yet, we don't know, we don't have the answer to that question as far as trends, but we're getting there.

Megan: There you go. And we do, we talk about this a little bit. I can't remember all the reasons run together now. It might have been last season where Jess and I brought up these news articles again and they are really good overviews of what we do know. I feel like they have cited a lot of scientific literature, they're working with entomologists all across the globe, they have case studies where they have some sites that were in the rainforest that they've gone back then and visited many years later and they're comparing their plots that they had initially with these later plots, and so we do know some things, but we certainly there's so much like Jess said that we don't know. So I encourage people to read that one, the insect apocalypse is here. It's actually an easy read for being an article that cites a lot of hard science like I feel like it's fairly, it's not, what is it, like five pages or something? It's not that long.

Mike: I didn't mention the specific articles.

Megan: Oh, sorry. I did and we'll put them back up on our website too. But the other one is Plummeting Insect Numbers Threaten Collapse of Nature by The Guardian and kind of both of these articles, while they have very, what do I want to say? Eye-catching titles, they actually have good content within them and it's debatable whether or not we should go to that apocalyptic state. There's definitely things to be concerned about but I don't know like Jess said, if we can say if we're in an apocalypse. Okay, so you already answered our next question, what's the overall trend, we don't really know, so explain a little bit, Nicole, the basics of native bee identification and a little bit about their biology.

Nicole: Mm-hmm. So sometimes it is difficult to be able to tell what a bee is versus a fly or wasp or you look at a flower, there are tons of insects on that flower, so to pick out that one bee when sometimes it's very, very tiny can be difficult. So the first thing you would look for would be it would have two pairs of wings, so all bees have four wings total.

Megan: Hang on, let me look at Mike's picture.

Mike: I'm just going to look at my drawing.

Megan: Okay, so Mike's bee has no wings.

Nicole: No wings?

Megan: He ran out of time.

Mike: It only had one wing. I just drew two on it, okay?

Nicole: The other thing that I think Mike did get correct in his picture, though, is that most bees, almost all bees have pollen collecting hair, so they should have some hairiness to them. Could be on their leg, could be on their belly, but they are generally more hairy, unlike wasps that don't have hair. So those two key things kind of help you pick out the bees that are on that flower and so adult bees emerge sometime in the spring or summer depending on the species and the female - - well, I guess I should start with like about 90% of our bees are basically solitary bees, so they live on their own. It's just the female constructing a nest and collecting pollen, which she's collecting the pollen to put it in a little pollen ball to feed her little egg that she puts in her little cell, and then she just continues that, and that's what makes her nest, so it's just a bunch of little pollen balls with a little egg on it and then she, yeah, just lays all the eggs and then eventually the adults will die during summer, the winter, during the first hard freeze, I guess, but those little eggs, that's what they, the larvae sit underground typically, so about 70% of our bees nest in the ground. And the rest are stem nesters, so you can find some bees creating nests in stems, and it would be the same concept. They put a little pollen ball with their little egg and they make a little cell for it, and those are the bees, those are the little larvae that over winter, and then those emerge in the spring or summer, and then the whole cycle kind of starts again. There's some variations depending on what species we're talking about but generally, that's how it goes. I guess bumblebees would be one that are kind of since they're solitary bee or they are a social bee, the queen does over winter, so over winter, she over winters as an adult, and then in the spring, she emerges and finds a place to make her nest, so that's the only bee that kind of has a different, that over winters as an adult, yes, it goes on hibernation.

Mike: Jess, I think this is something we covered, you guys have covered in other episodes but honeybees versus our native bees is something that needs to probably be clarified for some of our listeners. Can you talk about the differences between the two?

Jessica: Yeah. So as Nicole is alluding to, most bees are solitary. Bumblebees and the honeybees are the exception. Some of those solitary bees can be kind of gregarious where they aggregate their nest together, but honeybees are social bees. They build a nest, they have a queen with workers, all those workers are females, they do produce males at some point during the season as well. But honeybees are not native, which is usually the picture that people conjure in their mind, that or a bumblebee when they think of bees, and a lot of people don't realize that honeybees are not native but they also don't realize that there's bees other than honeybees, which are all the other 450 species here in Minnesota. So yeah, they're introduced. There are some that live feral, there's varying reports about how many feral colonies, so it would be like in a tree stump or something. Hard to say after some of the Nosema and such came through varroa mites, how many feral colonies there are but most people - -

Mike: What were those things you just said Jess?

Jessica: Mm-hmm.

Mike: What were those things you just said?

Jessica: Nosema and varroa mites, so a virus and the mites that harm the bees have thought to have been taken out some of those feral colonies. A lot of beekeepers treat their colonies, if you have a hive in your backyard, they treat them for those kinds of things so that they aren't harmed by them, but a feral colony wouldn't be treated, so it's thought that a lot of those feral colonies have declined but it's hard to know. It's hard to know how many feral colonies are out there.

Megan: Gotcha, thank you. So I'm going to throw this one at you too because I hear you say this a lot and I just want clarification on it. Are bees really the most important pollinator.

Jessica: Mm-hmm.

Megan: You all just go "mm-hmm."

Mike: Is that a leading question?

Megan: Yeah, there was leading question. Okay, why? Explain why.

Nicole: Well, like I mentioned before about those pollen collecting hairs, well they have these special tools that they have come up with to collect this pollen that is so important for them to be able to collect mass amounts of because they have lots of little eggs that they're feeding too. So they have a way to collect a lot of pollen, which a lot of other insects, if it's on a flower, it may collect pollen, but it's kind of mostly by accident. It just happens to stick to it but the pollen collecting hair is what bees have that make them such important pollinators.

Megan: And they're actually collecting and then using that pollen.

Nicole: Yes, and they are actively going out there and they are collecting that pollen to bring back to nest and they run back and forth, back and forth and collecting that pollen just for their little eggs.

Megan: Which means that when they're going to each flower, they're actually, say it with me Mike, pollinating. Oh, gosh. You're behind. Wow. It's not going to fail. ((Laughing)) They're actually pollinating because they also do something called flower constancy, which is where they're going from the same species, like individuals of the same species, the same species, the same species, which means they're not really wasting pollen, either, whereas some of our other pollinators, they may fly to a blazing star and then they'll fly to a goldenrod, and so they're kind of wasting whatever pollen they picked up because they're not actually pollinating cross-species, so. I know. I like it.

Mike: Jess, you started, I think you mentioned our Minnesota bee survey when you're talking about trends. Can you talk more about the origins of that project and how it started, why we're surveying for these bees, what we're focusing on, and the survey techniques that we're using, how the study is distributed across the state?

Jessica: Yeah, I will do my best to answer all of those things, so we've so far received funding from the Natural Resources Trust Fund, the LCCMR, to survey the bees in Minnesota and it started in earnest in 2014 with some kind of preliminary survey methodology piloting before that, and started in the prairie region, so going kind of county by county to prairies and surveying bees. And the goal really was primarily to get a state list of species and start to understand a little bit about their distribution. So going county by county primarily we're using bowl traps, so those are just little cups filled with soapy water that are set out for 24-hour periods, five to seven times throughout the season from April to October, and we also supplement that sampling method with some hand netting here and there as well to get more coverage and to pick up some of the species that we're missing with the bowl traps. The bowl traps are painted blue, UV blue, UV yellow, and white, have been shown through research to attract different species, different groups of bees. And I can't remember any of your other questions, Mike.

Megan: I have a question before Mike fills in all the other questions. They have like 20 questions at once.

Jessica: It was a lot.

Megan: Different species, are they more attracted to the different types of UV paint that you're putting on there?

Jessica: Yeah, so certain color bowls will attract certain species and not all bee species are really attracted to bowls, so that's why we also do the hand netting that Jessica mentioned. Try to capture everything that's there. It's pretty difficult to capture all those little critters that one time you're there for a few hours, but trying.

Megan: Yeah, and then okay. I'm just thinking about how that works. And you sort of have to do it that way because some of the species are so small in order to be able to identify them, you would really need them up close, I'm assuming.

Jessica: Yeah. To be able to identify bees to species, you really have to have a microscope, so we have to try to capture all of those, all the things that we find, which some of them are pretty good hiders. Difficult to find them sometimes around. They're either flying around way too fast, you can barely see them, or they look like an ant or something that you don't notice right away when you look at the flower.

Megan: There's definitely skill involved in this because I remember I helped you all out last year with some of the rusty patch survey and that was just like okay, clearly I do not have the certain set of skills that is needed to capture bees. I was terrible with the net and you guys were both just like you know when you watch somebody who's a master at something, do something, they just make it look so easy and then you take the net from them and it's like you're the clumsiest person on the planet and they've already got like 20 bees and they're like oh it's easy. Here they are all. I'm like I'm still working on one. So I definitely have a lot of admiration for the skills that you guys have in this. Okay, so some of the questions that Mike asked, why survey for bees?

Nicole: So Jessica kind of mentioned before about the goal of this project is to create a state species list because before this project started, we didn't really know what bees were found here and to be able to figure out what habitats we are finding certain bees in or to come up with some kind of pollinator conservation, we need to be able to know what's here first. So the goal is to just kind of rough, like a rough kind of fast pass through at least we have a pretty good idea of what bees are found and kind of within the state, where within the state they are found.

Jessica: We're heading to the forest next, so we're pretty excited about that.

Nicole: Yeah, so we have surveyed the southern part of Minnesota, central, northwestern, and so like Jess said, the northeast, the forested region is the next step in this survey to complete the statewide survey.

Megan: Gotcha. And then that will give you kind of your first look.

Mike: How many species are we talking about now where we have to put in the survey? Did you say this already? I don't think you did.

Jessica: No. I've intentionally avoided that, Mike. But since you bring it up, so part of the first-first step that I didn't really mention but is an incredibly important step is actually going to historical collections like we have here at the University of Minnesota, a wonderful world-renowned collection with over 4 million species now or specimens, big plug for the University of Minnesota Insect Collection. So it's going to those collections where their folks have accessioned Minnesota-collected bees and recording the diversity there. That's really the first step and so we also did that through the Minnesota Biological Survey. And there were about 450 species on that list. From our collection efforts, we have about 200 of those 450 species. We've added three species to the state list or thereabouts, so pretty excited about that. But this, the 200 that we've collected through our Minnesota Biological Surveys are really an indication of a couple of things. And people automatically assume that it's well, it's because all of those other 250 have declined, and that's certainly a possibility. I would suggest that it's also just really hard to get everything. So many species are probably rare anyway, from the

outset, and so detecting them through this kind of broad brush survey is going to be really hard to do. And as we already mentioned, if we rely on those bowl traps primarily, which is a really easy way to collect a lot of bees, they're also going to be missing a subset of the species, so we know from some statistical work that with our current methods that we're using, we might collect about 300, so we're still even missing about 150. So we're getting there and we're excited to go into the forest and see what's up there. There's not been a lot of work on bees done in the forest and so we're interested to see what we can find.

Megan: This brings me to my next question, which you may not have the answer to yet, but we know that in the prairie landscape, it's not just prairie, there's lots of other things going on too. Wetlands, savannahs, those types of things. Are you seeing differences across habitats or is it too soon to try to quantify that because you're just now moving to really the more predominantly forested parts of the state?

Jessica: I think it's pretty early to tell, and the study wasn't really set up, wasn't designed to answer those kinds of questions. I think we'll be able to know a little bit after we finish the survey, if there are groups that are specifically distributed in those parts of the state or not, but mostly we can get that from the biology too, which we're also excited to do in the northeast, where when we, another reason we really like hand netting is that we get that plant association, so when we net a bee off of a plant, we record the plant that it was on, and that stays with the specimen. So then we can begin to understand a little bit more about their biology, which is often lacking and would be for bowl traps too, so we're excited to get up there and to the forest. Yeah. We're just rearing to go, yeah.

Megan: I'm curious to see what you're going to find out because obviously, the prairie parts of the state are very sunny, bees are cold blooded, so I'm just curious to see. I know that you can't tease out the differences but I'm curious to see if any patterns emerge like with much shadier, less sunny habitats. Like I'm just curious to see what happens. I can't wait.

Mike: Right. Nicole, can you talk about how Minnesota bee diversity compares to elsewhere?

Nicole: So I mean, I feel like in Minnesota, we have a very unique state. We have a lot of habitat diversity in our habitats, so I feel that is another reason why we might have a large amount, high number of bee species here. So there aren't many states that have done, have like a list of bee species. Michigan has one and since it's a fairly similar state close to us, I would expect to have somewhere around the number that they have, which would be somewhere around the 450 bee species, roughly maybe 100 bee species per county. I feel like in the Midwest at least in the states around us, we would have either around the 450 mark, just similar to the other states.

Megan: Gotcha. Okay. Tell me a little bit about the different kinds of bees and the most common bees that you might be finding. And I know that this is going to differ depending on where you are, but are there any patterns that are emerging? Like what are things that you would find more commonly than other things?

Nicole: Sure. Like we are kind of talking about how bees are such a diverse group, there are some that nest in the ground, there are some that nest in cavities or like in the stems, and there's some bees, they're called coocoo bees, they don't actually make a nest at all and they just sneak their eggs into some other bee's nest, lays their eggs right where on that pollen ball left for that other egg, and then runs away and then finds another nest to lay some more eggs in, so there's all kinds of bees and there's, like I mentioned before about the pollen collecting hairs, they're not always just on the legs, like you may think, there's some on the belly, and then some of them like those coocoo bees, well they don't need to collect pollen because they're going into these other nests and laying their eggs there, so they don't have pollen collecting hairs, either. So they don't make any nests and they have no pollen collecting hair. They just kind of go steal those pollen balls from the other nests and lay their eggs on it.

Megan: That's kind of cool. Now I'm imagining like parasites.

Nicole: Parasites.

Megan: They're like the cowbird of.

Mike: Well, they're like coocoos, right?

Nicole: Yeah, coocoo bees. So some commonly found bees I would say bumblebees are fairly common, they are larger and they're better known. A lot of people know what a bumblebee is, they're cute little, they look like cute little teddy bears just flying around, bumbling around, flower to flower. The other bees I would say are the most common would be sweat bees. So these, there's a large variety of sweat bees. Some of them are like medium sized and they're green or there are some tiny, tiny little ones, which you might be kind of, or you might have known because they're called sweat bees because they like to land on you and lick up your sweat, so sometimes as you're playing outside or like I've had when I was little, I would under my shorts, like I got a little bee sting, I didn't even know it was a bee because they're so tiny, they don't really look like a bee but they like to land on you and lick up your sweat and so if they - - they don't typically sting you but sometimes if you squish them, they're going to sting you, so it doesn't hurt to like a wasp sting or anything, like sometimes you barely really know what it is, but I would say those are probably the two most common bees that we kind of see.

Mike: What's the USGS bee expert that has all the photos?

Nicole: Sam Droege.

Mike: Sam Droege? So I was looking at his photos and picked what I thought was one of the coolest looking bees, and it turned out that common sweat bee. And I thought that was really - - I mean, just is really bright green cool looking little bee.

Megan: I have a lot of questions for you now. What do you mean you picked it, for what? For like your wall art?

Mike: I made it my screen background.

Megan: Oh, like what did you pick it for? Presentation? He does take pretty amazing pictures. I have to ask Jess this question because this is a question that we get a lot in

the office from landowners, and so I'm asking it to you. Do honeybees compete with native bees? So we hear this a lot because there's 2% of the prairie that's left, we have limited floral resources on the landscape, this is something people are concerned about, and I just want to know how concerned should they be?

Jessica: Yeah. As usual, I'm going to toe the line and say we don't know a lot. There are certainly some suggestions that honeybees could compete from the literature, and I've tried to keep up on this subject because I also get this question a lot. And the jury's really still out. I think if they were obviously competing to a large degree, we could detect it with the science that's been done. My sense of reading the science is that we're not - - it's not a huge problem. Now, that being said, we can't go putting like giant amounts of honeybee hives out on our native prairies, right? That would not be good. But the level at which people are keeping honeybees in the landscape in Minnesota doesn't strike me as problematic.

Megan: And I think it's probably - - I know I set you up for that but it's good to get that context and to try to help understand what we know and what we don't know. I think I like how Marla Spivak answered it, I was listening to one of her talks, and she basically said let's stop putting bees against each other and let's start just planting more flowers. Like getting more resources out there, which I think is a good take-home message. In the interim, while we don't know, there's thresholds of things that we wouldn't want to do because we certainly know they would be harmful, but still, let's just do what's in our control, plant more flowers.

Jessica: Native flowers.

Megan: Yes, of course. Of course.

Jessica: I know, just saying.

Megan: You know, diversity, native flowers, grasses, all the things.

Jessica: All the things, and don't clean up your yard.

Megan: You'd be very proud of me, Jess, I just planted a bee lawn, so of all native species, so my neighbors are going to love it. I cannot wait. It's going to be great. I looked at all of the prairie plants that were less than two feet in height and I just put my whole hillside out as wildflowers. I think it's going to be magical. And I even made a honeybee focused one on the top part of my yard where it's all non-native clovers. I know. Can I even say that? Ecology. But I felt like I wanted to create space for everybody who's using my yard. It's a yard after all.

Mike: Well done. Jess, is there any way you can tell us what you think the future holds for bees in Minnesota?

Jessica: Well, as any good politician, I'm going to flip this question to say something I've been thinking about, in that I think the way in which I like to think about assessing that question, what the future holds, is by thinking about the specialist bees. So one of the things that we haven't touched terribly on is that some bees go to a lot of different plants, other bees, and these are the ones that are the coolest, they go to a very specific plant, maybe a genus or even a species. So the example I like to give are these

Macropus bees that are oil collecting bees on lysimachia, as the common name loosestrife.

Megan: Native loosestrife.

Jessica: Native loosestrife, not the purple one, and so it's those specialists that from a conservation standpoint, we might think about being those that would wink out the quickest. If the resources aren't there, the likelihood of them evolving to choose some other resources low and so those are the ones that I would think we might be interested in looking at from a survey standpoint as well as a conservation standpoint and thinking about what the future holds for bees, so that's where I would put my efforts and those are the, what's the cog? The cog quote from Leopold.

Megan: Every cog and wheel.

Jessica: Yeah. We got to save all the parts, yeah.

Mike: Gotcha.

Megan: Intelligent tinkering.

Jessica: There we go.

Megan: Yeah. That's throwback Season 1, proud of you. Okay, lift us up here before we jump to our next section, Nicole. Tell us a little bit like what are some things that we can do to help?

Nicole: I would say the one huge thing you can do is just to plant a variety of native plants and have a variety of bloom times, so something that blooms from have something blooming from April through October because bees, some bees emerge only early, so they're only out in April and May, but then there's some bees that are out still through October, so it's important to be able to have flowers for all of those bees coming out throughout the whole season. I would say to leave things natural, like undisturbed areas in your yard, some exposed soils, and if you want to clean up your gardens, make sure you still leave some stems cut up high about 12 inches or so, so the critters still can use all of that area for nesting. And then the biggest thing is to just get involved. You can just take some time out of your day, stare at a flower, and see how many insects come to that. There's just so many insects that come to a flower, it's unbelievable unless you spend the time and really see what's there. And there's some resources like iNaturalist or Bumblebee Watch that if you're really interested and have photos, you can always submit them to those websites and you can get some answers about maybe what you are finding, so. It's just fun to get involved.

Mike: I like that stare at a flower advice.

Megan: I do too. It's a great thing to do as a family too. I've never seen kids more calm than when they're observing a flower. Like there's something, it just sort of stills them, so this is a great way to have a calm moment, especially your little kids.

Megan, Mike, and Jess: (Pre-recorded) LET'S SCIENCE: TO THE LITERATURE! Science!

Megan: Okay. I'm really excited because we made our participants do all the work today, so they supplied all of the papers that we're going to highlight for this section, and so that's really nice because we'll just let you guys take it away. Jess, you go first.

Jessica: Well, this paper that shows somewhat goes with the theme of what we've been talking about. So the title is *Historical Changes in Northeastern Bee Pollinators Related to Shared Ecological Traits*. And so it highlights a couple of things that I've already talked about. Highlights the importance of museums because they're this window into the past, so they went into museums and looked at records of bees from the Northeastern United States. Over 30,000 records. And they were able to do that over 140 years because that's there were specimens in the collection that were that old. And so they found that through that time really very few species were found to be declining. So of the 187 species, they analyzed on three declined steeply and most of those were Bombus and they also found that some species were increasing in abundance. The main takeaway for me was that the community composition shifted and so that's an indication to me that although a lot of times folks think about things in terms of a population standpoint, it's perhaps the community that we need to be considering. So communities shifted over time, as you know, so some species became more abundant, some species became less abundant, and the other thing that this paper highlights is what I was just alluding to is that one of the traits that they found to kind of indicate declining abundance was a small dietary breadth, so that means species that are really only going to a small number of plants for pollen and nectar. So it's those specialists, those oligolectic bees, specialists, just a few species of plants that we really need to think about from a conservation standpoint, so.

Megan: I have a follow-up question. So when we think about specialists like monarchs, we're talking about generally their larval forms are specialists on that plant. When you're talking about bees, are the adults specialists on the plant or is it them as an egg and a larvae?

Jessica: No. You remember how Nicole painted that wonderful picture of the bee going to the plant, gathering the pollen, and packing it all in, and taking it back to the little egg, it's on there.

Megan: I don't remember her saying it in that exact voice, but ((laughing)).

Jessica: So it's the larvae. When we think about hosts, what species are host plants, it's for the larvae, it's all for the babies.

Megan: Nice. Got it.

Jessica: Okay. Nicole, you want to talk about your pick?

Nicole: Yeah. So my pick is a book from Heather Holm. It's called *Bees: An Identification and Native Plant Forage Guide*. I just love this book. My most favorite part of it are the pictures, so if you are a person that likes to see up close things, little things such as bees, this would be a great book to pick up and look at. Heather takes amazing photos and it's packed full of all those photos, but besides the photos, she also does a great job at describing the several genre of bees, including the life history, some distinguishing characteristics for identification, and some common forage plants that you

may find these bees on. So it does a really good job at giving an overview of some specific genre bee, while giving you the beautiful pictures of some of like the nesting sites and just up-close pictures of bees too. So it's a great photo to give you an overview of some what bees and what they need.

Mike: Cool, I will check that out. I like how Jess stepped into her old role there.

Megan: Somebody's got to pick up the slack around here.

Mike: Thanks. I was probably supposed to say something but thanks, Jess.

Megan: We're all just staring at you. ((laughter)) Jess is like, "I'll pick up this ball. I'm down on the clock today." Oh, gosh.

Mike: Hey Megan.

Megan: Yeah, Mike?

Mike: I wish you would Take a Hike.

Megan: I wish I would too. Let's all hike together. Oh, my goodness. So we also again made our guests do the bulk of the work here, so we'll go in the same order. Jess, what's your pick? Where are we hiking to today?

Jessica: Well, Mike and Nicole might find this slightly ironic because of my incessant complaining about this place over the past summer.

Mike: I'm kind of surprised, yeah.

Jessica: Statements like I'm never going back there in my life. But it really is amazing. I'm trying to redeem myself is what I'm getting at here. Because it's beautiful, it's really absolutely beautiful place, Mound Prairie SNA in southeast Minnesota. What?

Megan: Scientific and Natural Area.

Jessica: Oh, yeah. Scientific and Natural Area. It's a series of quite a few mounds that you can hike to if you are able, and it's just the views are absolutely fabulous from.

Mike: Views are amazing.

Jessica: Yeah, they're amazing, and the diversity is amazing. We surveyed there this year for bees and butterflies and just it's just amazing. The diversity is amazing because there's bits of forest and it's just beautiful. The plants are beautiful, it's absolutely stunning, so I highly recommend a trip to Mound Prairie.

Megan: I have to ask, why did you not want to go back during the field season? You're describing it now very beautifully, so I'm just curious.

Jessica: It's not for the faint of heart from a hiking perspective. The steepness of the mounds is - - I mean, I suppose it's normal for those mounds but they're very steep and surveying butterflies on them was challenging because of that. I'm used to walking at a relatively slow pace but I found it hard to not only keep my footing but also to survey butterflies at the same time. The brambles, I mean, I can go on but I don't want to make it - - it's beautiful. It's just beautiful.

Mike: I commend you for picking a prairie in the southeast, which I think we too often neglect. That's, the Non-Game Program did some management there and then I helped for a little while in my short tenure down there, and if folks want to see good examples of some successful prairie management, those bluffs are good examples. Including where we browse or graze some goats. Goats were a valuable tool along a very steep landscape that Jess is referring to. It's hard for people to do management on those bluffs but goats are great at it, and some of our more successful goat projects were on those bluffs.

Megan: I like it. Nicole, where are we hiking?

Nicole: It's a pretty hard choice because we have some beautiful places here in Minnesota but my choice is Kasota Prairie Scientific and Natural Area. It's a very small site but it is a beautiful prairie and it is located above the Minnesota River Valley, so it's just kind of a small little area tucked away, but it is just filled with beautiful flowers all the time, and I spent one summer surveying for bees there and I want to go back. It is very beautiful and you find lots of variety of plants and bees, of course. My other second choices, which was really hard to choose from was the Kellogg Weaver Dunes. It's a Scientific and Natural Area and The Nature Conservancy also owns part of it. It is also over on the southeast where Mike loves the prairies over there and it has just really unique landscape. It's very sandy and it has some just unique plants and bees there as well.

Megan: I like it.

Mike: I should mention that, add to Nicole' description of Kellogg Weaver Dunes that there's a big wildlife management area whose name is now escaping me. What is the name of that wildlife management area? Anyway, it's part of that whole complex. I think it's probably, I never read this, but I think it's probably the largest contiguous prairie in Southeastern Minnesota, and so we found a lot of species there that we didn't find elsewhere in the southeast, like grasshopper sparrows and western meadowlarks and some of these birds. I'm sure pollinators as well that really require large contiguous prairies and just a really cool, would you call it a dry prairie or a sand prairie? Certainly sand prairie, yeah, and just really cool and then interesting to walk through it before or after you walk through the more lush tallgrass prairies in the western part of the state.

Megan: I think dry prairies are some of my favorite sites because it's where diversity can really thrive a little bit more because there's a lot more space, I guess, and because the soils tend to be a little bit more nutrient-poor, there's obviously less water, that's why it's dry prairie. And I just, I don't know, those are my most favorite areas. As always, you can check out these areas and any of your public lands by going to the DNR's recreation compass and planning your next hike. So next week, I can't believe we're already done. Like it doesn't even feel like I should say for next week but we're here. Going to catch you on Prairie Tuesday where we're going to be continuing our bee theme. We're going to chat with Karin Jokela with Xerces Society and we're going to shift gears a little bit and talk about how we can do better on the farm, farming for bees.

Mike: I'm really excited about it. I'm into bees now. I could do a whole season on bees.

Megan: We could do a whole season on bees. I feel like we just barely scratched the surface of all the things we need to know about, oh, my gosh. Well, this episode was produced by the Minnesota Department of Natural Resources Southern Region under the Minnesota Prairie Conservation Partnership. It was edited by Dan Ruiter and engineered by Jed Becher. We are going to be back next week and in the meantime, you can find all the resources we talked about today on our website at mndnr.gov/prairiepod. Jess, Nicole. I miss you guys already. I want to just keep extending it. I don't want it to end.

Mike: It was an honor to talk with you two, especially, well, both of you. I'm not going to say especially one or the other, but Jess, since you were in this role last year, it was cool to talk with you kind of switch places here.

Megan: I know and Nicole, have you noticed that her whole outfit is sort of bee themed? So not only is she wearing a bee shirt but she's also got, when we ask people to describe like to draw a bee, it's ones with stripes, yellow stripes and she's wearing yellow stripes.

Nicole: I just think it's appropriate.

Megan: Great job.

Mike: Good job.

Megan: All right. High five all around.

Jessica: Thanks, guys.

Nicole: Thanks.

((sounds of birds chirping and wind blowing))