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SPEAKERS

Stump The Chump, Amy, Guest, Jamie

Jamie 00:10
Welcome to Two Bees in a Podcast brought to you by the Honey Bee Research Extension Laboratory at the University of Florida's Institute of Food and Agricultural Sciences. It is our goal to advance the understanding of honey bees and beekeeping, grow the beekeeping community and improve the health of honey bees everywhere. In this podcast, you'll hear research updates, beekeeping management practices discussed and advice on beekeeping from our resident experts, beekeepers, scientists and other program guests. Join us for today's program. And thank you for listening to Two Bees in a Podcast. Hello, everyone, and welcome to another episode of Two Bees in a Podcast. Today, we are honored and privileged to be joined by Dr. Christina Grozinger, who is a professor at the Pennsylvania State University. There, she is the Publius Vergilius Maro Professor of Entomology in the Department of Entomology, and also Director for two different centers at Penn State. Those are the Center for Pollinator Research, as well as the Center for Technology and Livings System. Thank you so much, Christina, for joining us on this episode.

Guest 01:17
Great. Thank you, Jamie and Amy. I'm so excited to talk with you.

Jamie 01:21
Well, Christina, before we dive into what we brought you on to talk about, which, by the way, is Beescape, and we're super excited to talk with you about that, we want you to do a little bit of introduction of yourself and how you got into the beekeeping world. How did you discover honey bees? How did you end up where you are?

Guest 01:37
So, I will say, I was not a beekeeper as a child, and I did not have any beekeeping in my family. I discovered bees when I was a graduate student. And I was a graduate student at Harvard University in the Department of Chemistry and Chemical Biology, and I was focusing my work on chemical biology

and chemical genetics. The basic idea behind this is that you have chemicals that you use to treat cells, like human cells and cell culture, and use that to understand how different proteins and genes are working. If you know the protein or the gene that you're interested in is something that's important for human health, that chemical may later on become developed into some sort of cancer-fighting drug or anti-virus drug. But for most of the work that I was doing, it was really just focused on trying to use these chemicals to understand how these cellular and molecular processes were working. And I really loved what I was doing, and it was super interesting. But I wanted, for my future career, to be able to do something broader, and sort of working more with whole organisms, like whole animals, and thinking about animal behavior and neurobiology. And my brother was actually keeping bees at the time, so he had started beekeeping a few years earlier, and he would tell me these stories about bees, and it was so fascinating. And I was like, gosh, somebody should figure out how, at the genetic level, these complex behaviors are programmed into these animals, like, how do they know how to do these things, even in cases where they're not even learning how to do these things? And so this was about the time that there were new technologies becoming available where you could really look at the genes and the genetic processes in animals that were not sort of typical lab model systems, right? So not like fruit flies and mice, which is usually what people have been working with. And so now it was actually becoming possible to do these types of studies in a wild living animal, like a honey bee. And so I was like, gosh, someone should work on this. Maybe I should work on this. Maybe I should try this. So I started reading more and more about bees, and I learned about their pheromone communication systems, and that's basically like a chemical biology or chemical genetics approach where you have a chemical, and you would expose a bee to this chemical, and then its behavior changes. You could probe the genes that were involved in those behaviors by using these chemicals. So same kind of chemical genetics approach, but just on a really different scale. I thought, well, I'm going to give this a try. And I spent a lot of time trying to find the right lab environment where I could bring this chemical biology and genetics approach and integrate that with bees. And so I found Gene Robinson's lab at University of Illinois, and I asked if I could join his lab as a postdoc. And so that was where I made my transition into bees.

Amy 04:41
That is such a fun story. I feel like I love honey bees and getting to know people and how they got into honey bees because it's always a random thing. Sometimes you grow up in a beekeeping family, but for those out there who did not come from a beekeeping family -- I mean, your brother was just keeping bees, and he was just getting interested, and probably just brought it up during a family get together at one point, and all of a sudden, your background was able to connect that to honey bees. And here you are, right? What a fun story. Thanks for sharing that.

Guest 05:08
Thank you.

Amy 05:09
So we brought you on today to talk about something called Beescape. And Jamie's brought this up a couple of times with our listeners, but every week we have kind of a learn in luncheon with our lab here, and there was a paper that you had published, and it spoke about Beescape and what this was. I hadn't

heard of Beescape prior to this paper, and so I bet our listeners are really interested in understanding what Beescape is. And so I was wondering if you could just tell us about Beescape and where this idea originated.

Guest 05:38
Sure. I will try to draw the connection, because it probably does not seem obvious at all between my interest in chemical biology and bee behavior and Beescape, which is really about understanding how the land use and the weather patterns in your location impact bees. My lab focused on trying to understand bee behavior at the genetic level for many years, and then in 2006, Colony Collapse Disorder became a big topic and a crisis for the honey bee community, and then, also, of course, wild bees and pollinators. And so my lab started shifting over to try to understand how, at the genetic level, are bees responding to these different stressors. And part of that was to see, are there common responses to different stressors. If we understand what those responses are, is there a way that we can manage our bees or our landscapes better so that our bees can be more resilient and healthy? One of the things that we found was that the responses to these stressors often were in genes that were associated with nutrition pathways or metabolic pathways. And so then we did follow-up tests, and we found that, if bees were given a better diet, a more nutritious diet, specifically a diet with pollen from diverse floral resources, then they would be more resilient to many different stressors, right? That led to questions of, well, which plants are providing the best nutrition for honey bees and for other bees? And so we did, are still doing, actually, a whole series of studies looking at that. But then, when you think about the individual beekeeper, how does this information help them? And I have to say, I would give talks at beekeeping clubs, and I would tell them about the genes that turned on as their bees were dying, what plants could help the bees, and I realized that a lot of the challenges that beekeepers are facing are coming from a landscape scale, right? They don't necessarily control what flowers are in the landscape around them. They can't control, necessarily, what pesticides are being used. We wanted to make a tool that could help beekeepers and others really understand what are the resources available for their bees in the landscape around them, either the exact backyard that they're in or even several miles out, and then what are the risks that the bees are experiencing in terms of pesticides, for example. Basically, the premise was, can we make an easy-to-use online tool that is a mapping tool that lets you understand at these different scales, right? So Beescape actually works from a 30 meter to a many, many mile resolution to help you get data on what is available for your bees in terms of the resources, and then again, what risks they're facing.

Jamie 08:29
So Christina, I think that's really a nice segue into the next question. And the advantage of being one of the people who gets to do the interviews, and I know what questions are coming up, I can kind of anticipate your answer. So I'm going to say something after you answer this question because I think it's relevant to what you're going to say. But anyway, with that aside, tell us what kind of information Beescape provides. What would a beekeeper go to the website to find?

Guest 08:52

If you go to Beescape, basically, it opens up into a searchable map of the continental United States. So it works across the entire US. You can put in your address, or you can sort of move the map around until you get to your address, and then once you've gotten to your site, you can highlight the region that you're interested in looking at. And again, this can be a very narrow region of just half a mile surrounding your site, or it can be a large region of five miles surrounding your site, or even bigger. And once you've highlighted the location or the section of the landscape that you're interested in getting information about, Beescape will give you, and again, you'll see it kind of like as a satellite view, or just a sort of flat map view with the roads highlighted. Once you select the area that you want to look at and get information about, Beescape will color in that section according to the land use characteristics, and it'll give you information about what is the land use. So in the area that you've highlighted, is it primarily developed land? Is it forest? Is it crops? What kind of crops are being grown there? And then, it takes that land use information and then gives you predictions for the resource quality and the risks in that particular land use or in that landscape. So it gives you information about the seasonal floral resources, right? Are you expected to have really high flowering plant abundance in the spring or in the summer or in the fall, or is it kind of low? And so your bees might be experiencing a dearth during that period. We have information in there about nesting habitat for wild bees. So wild bees, of course, they don't have beekeepers providing homes for them. They're nesting in the ground, or they're nesting in tree cavities or in stems of flowering plants and shrubs. And so, Beescape will give you information about what is the predicted nesting quality for wild bees in that area. We take information about which crops are being grown, and we integrate that with data that we have from the USDA about which pesticides are typically being used on those crops. And that information gets converted into a pesticide toxicity score, which tells you, again, if you're in an area where you have crops that use a lot of toxic chemicals, or typically use a lot of toxic chemicals for bees. You can see that on Beescape. And again, we've made it so that you can spatially change your map to see where these resources and risks are on the map itself. We also have information in there about what the economic value that your bees are providing to the crops in the area. So, I always think this can be handy. If someone is complaining about your bees, you can say, well, actually, given the crops in this region, my bees are providing $200,000 worth of economic value and pollination services to these crops. We also have information on the weather patterns. This is something we've been doing studies to try to see what is really affecting the health of honey bees and the diversity and abundance of wild bees. And we often find that weather is a really important component, and, often, weather from a previous season. So, in Beescape, again, for that region that you've highlighted, we're integrating data from government databases that are tracking weather patterns across the last 30 years. So, in Beescape, you can get information on what was the average monthly temperature and what was the total monthly precipitation for the months of the current year, the months of the previous year, and the 10 year average in that region. So you can see, are you currently experiencing a drought? Did you have a drought in the previous year? Was it unusually hot or an unusually cold? So that information is in Beescape, and there's one more set of information in there, which is, we are taking data from a program called iNaturalist. And so iNaturalist is a citizen science program where people can take pictures of animals and plants and whatever they see when they're out in the world, and then those pictures get identified and then put into the iNaturalist database. And so we pull from iNaturalist and put information on flowering plants and bees that have been found in that

selected landscape in the last month. And so this gives you information about what is flowering and what wild or managed bees are present in your landscape.

Jamie 13:33
Well, shoot Christina, I think the question would have been easier, it would have been nice like, well, what does Beescape not offer?

Amy 13:39
I know, right.

Jamie 13:41
Let me tell you a quick little story. So I've lived in Florida now for about 18 years, and when I moved to the area where I live, someone told me, "Oh, it's terrible for bees. You'll never do anything." At the time, I thought, "I could put bees in the desert and make honey. I'll show you." And so I brought bees to where I live now, 17, 18 years ago, and they did nothing. It's just terrible. And for years and years and years, there's hardly any thing that comes in. I'm like, this place is truly a terrible place to keep bees. And then when we read your Beescape paper some months ago, I'm like, I'm gonna look up my address on this place. Turns out it's a terrible place. So, Beescape, actually, at least with a sample size of one, confirmed what I was seeing on the ground the last 15-20 years. So anyway, I thought that was funny, because if Beescape had been around when I was moving down here, I would have known better.

Guest 14:34
Right. And again, I think it's hard, because you sort of know what you see around you, right? But your bees are foraging very large distances, right? And so trying to understand sort of what's happening at this broader scale, I think, is really important for you as a beekeeper, right? And maybe it is something that you say, "All right, my bees are not going to do well, or I can't have many colonies," or just to recognize that during one particular season, you might be having challenges because there are not enough flowering plants in your area during that time.

Amy 15:07
So, Christina, it honestly sounds like a lot of work has been put into this resource. I can't imagine the amount of time and the personnel and having to update everything for this. So I'm excited to look at my own address to see what I have available. But I was just wondering who can use Beescape? Is it just for beekeepers who can use Beescape? The other question I had was whether this was just information within the United States or whether this was global. And then, you've kind of mentioned this, but how do users use the resources that they're able to find? There's just so much information out there

Guest 15:41
To answer a slightly different question, your comment about how complex Beescape is and how many people have been involved in it, so I just wanted to highlight that, we do have a really big team of people who have been working on Beescape for many years now. I think over five years. There's a

large group of us at Penn State, for example. So we have great collaborators in the Department of Geography and also in the Institute for Computational and Data Sciences. And we also have collaborators at the USDA ARS, some at University of Pittsburgh, and we've worked with people from Emory and Dickinson College as well. So a lot of people have contributed to Beescape, which is why we're able to really pull together all these complex data sets that are typically something really only available to researchers to integrate in this way. And so we're trying to make it available to everyone through our Beescape portal. So in terms of who uses it, we were designing it originally thinking very much about beekeepers using it, and as we were sort of rolling it out and sharing it with people, one thing that we learned was that people who are trying to manage landscapes for conservation purposes or for restoring landscapes, they also really enjoy using Beescape, because it gives them, again, a sense of, like, what is currently present in the landscape. And so then, if you need to improve that landscape, what should you focus your your time and energy and resources on? Is there a specific part of the landscape that could be improved? Is there, again, a predicted dearth of resources in the fall, and so maybe you focus on planting those kinds of plants. And then also, home gardeners. So if you're trying to develop a pollinator garden in your backyard, again, it is helpful to understand what's available in the surrounding area as you do that, and then that can help you understand, maybe you're not getting a lot of bees, but maybe it's because you're in basically a desert for bees. So, the bees that you're getting, you're actually making a big difference through your garden that you've developed, because, otherwise, those bees would have nothing in the landscape. We're really thinking about Beescape, yes, it's great for beekeepers, and we want to make sure that we keep adding more information to help them, but it's also really useful for for all sorts of other groups who are interested in how their landscapes are supporting or not supporting bees, so that they can improve what they have. So at this point, all the databases that we're collecting information from are US-based databases. Again, this is the land use data and the pesticide data and the weather data all coming from different databases that are produced by the US government. And so it is not global. I have talked with people in other countries where they have sort of similar data sets, and I think the basic framework could be adapted relatively easily to other countries. So if anyone is listening and you're interested in this, let me know and we can explore that.

Jamie 18:48
I think that really goes well again with the next question. So how can more people be involved? I mean, obviously people can go to the website, look up their address and see what's in their area. But is there a way to get more partners in this?

Guest 19:00
For beekeepers, there's a couple of ways that would be great to get you involved. So, part of the data that we are getting is coming from this iNaturalist, right? Which is, again, it's a different program that already exists in the world, but the data that's coming from it tells us what plants are flowering and when they're flowering, and then what bees are active and when they're active. And so we're hoping that we can take this information and use it to predict honey flows for beekeepers in the future. We know when a particular honey plant is blooming, and we have that data from many years, then we can map on what are the weather patterns and the seasonal weather patterns that would influence when

and how long that plant blooms for. So, if we, again, can integrate all of that data together, then we can start making these predictions, and that can help beekeepers know when to expect a bloom. So that's something that we're sort of looking for in the future to incorporate into Beescape. But something that adding those type of data to iNaturalist will help us greatly. We also, kind of on the same idea of how do we help people know what plants are available and which plants are good for bees, we did recently open up the Penn State honey and pollen diagnostics lab, where beekeepers can submit samples of pollen and honey, and then we do DNA metabarcoding to tell you what are the flowering plants that the bees were foraging on to collect this pollen or make this honey? It is a service facility, but we're also getting data back to beekeepers, but we're also compiling that so that we can, again, sort of use that to inform any future analyses that we're doing to try to say, well, these are the plants that you should expect in your area, and this is when they should be blooming. That is also another possibility. And then finally, I will say, in Pennsylvania, we have a winter survival survey that we send out to the beekeepers. And the beekeepers were running the survey for many years, and they very generously collaborated with us on this and added some additional questions to help us with our analyses. And then in the last two years, Penn State took over running the survey, and from the survey, we have beekeepers provide their location information, basic information about what their management practices are, especially for Varroa, and then information on how many of their colonies died every winter. So we've been taking that information and using it to understand, again, what are the land use patterns and what are the resources and pesticide risks, and what are the weather conditions that are associated with winter bee survival or death? So we've published two papers on that. We made a little exploratory tool that's within the Beescape website called Bee Winter Wise, where people can take a look at that. But that's again, something where the more data, the better. And at this point, we're only collecting information from Pennsylvania beekeepers. So if you're in Pennsylvania, please be sure to look for that. Again, in the future, potentially, this is something that we can do on a broader scale.

Amy 22:15
Very cool. I want to ask you about that pollen and honey lab that you just mentioned. I think our listeners would be very interested in that. So I was wondering if you could just kind of describe a little bit more about what that is, maybe if you've got fees or costs. I feel like, after this podcast, you will be getting a little bit of a surge of people wanting to submit their stuff. I'd love to hear more about it.

Guest 22:36
Excellent. If you look on our Center for Pollinator Research website, in the sort of research area, you'll find the Penn State Honey and Pollen Diagnostics Lab. And this is a fee for service. So I think it is $85 a sample for honey or for pollen. And that basically just covers -- we're not making a profit on this. This is just covering the cost of processing your samples. The way this works is that your pollen sample or your honey sample, you spin that down to collect the pollen that is in the honey. That pollen is then taken, the DNA is extracted from that, and then we amplify pieces of the genomes of plants that are known to be conserved. So we can amplify them using the same sort of strategy, but then the sequences are different enough that we can use them to identify different plant genera, right? So this is not at the species level, but at the genus level. But usually that's good enough for people because you kind of know what your bees are foraging on. And so we then amplify those pieces of DNA, and we

send it for high throughput sequencing, and then all of the all the DNA that's been amplified gets sequenced. And then we run that through a bioinformatics pipeline, and it will tell you the proportions of sequences that are coming from different plant genera in your sample. So if you look at our website, you can kind of see what these beekeeper reports will look like. And so it'll say something like your bees were foraging 80% of the pollen, or 80% of the pollen in your honey sample came from willow trees at this time of year, came from canola, right? So that's the type of data that you get. And again, we're hoping that we can gather this data on a large enough scale that we can start to see what are the main honey plants and pollen plants that bees are depending on across the US. We do process samples from outside the US as well.

Amy 22:42
That is great to know. Awesome. My last question for you is just, you kind of discussed this already, but what are the future plans for Beescape?

Guest 24:47
So we are in the process where we're finishing up the current grant that's funding this. And so this is funding coming from the USDA data science for Food and Agricultural Systems program. And so we are sort of in our brainstorming process to understand where do we want to take this next? And as I've been sort of hinting at a really, I think, a key thing is really getting more plant information in there, so specific information about which plants should be in your area, and then when are they blooming. We have been talking with people from BONAP, which is the Botany of North America database, and so they have information on which plants are found in each county across the US. So we've been talking with them about trying to integrate that information to Beescape so that, hopefully, at this point you can get a report card that tells you all the information that I just told you in a PDF that you can download. But we also want to be able to have people see which plants should be flowering in your area and when should they be flowering to, again, help people better understand what that floral landscape looks like, so that they can either take advantage of that, if you're thinking about honey flows, or use that to decide if you're finding you don't have a lot of fall floral resources. Well, what plants are appropriate for your area that should be blooming in the fall, and then maybe you can incorporate those into your landscape, especially if you're in a conservation group. So that's, I think, one of the main things that we were thinking about. And then we also have ideas about, again, developing these additional tools that can be used, like Bee Winter Wise. We're also thinking about developing these predictive tools for some wild bees that are really important for crop pollination. Again, their populations are really influenced by the weather they experienced the year before, when they're laying their eggs, right? And so we want to be able to take that information and tell growers if they can predict healthy, abundant wild bee population in a given year, or if they may be facing pollination challenges, because wild bees experienced a severe drought the year before, and so they the growers may want to consider renting honey bee colonies or other managed bees to support pollination in their fields.

Jamie 27:13
So Christina, this all sounds amazing. It offers a lot of information. You guys have future plans. This is all great, but I'm curious, are there any limitations associated with Beescape?

Guest 27:23

Yes. So because we're trying to provide data on sort of this continental scale, a lot of it is based on the land use data that we're getting from the USDA's cropland data layer that is updated every year. It's a sort of a remote sensing developed database. And so what this means is that our information is for that land use category, for your state, right? That's where we're making all these predictions from. So you may have a farm that's near you that is actively using low toxicity pesticides, and is really working very hard to reduce pesticide use or manage it in a way that bees are not going to be affected. Because we don't have information on the individual farm scale, then we're not able to show that in Beescape. The location specific data is location specific, but it's being parameterized by what's going on at sort of a state and a national scale. So again, there may be these sort of specific land use and land management patterns that are happening in your area that we're not able to capture, and that's just because, again, if we try to get everything that precise, we couldn't offer this across the continental US.

Jamie 28:42

Well, Christina, I think that's fair. I mean, all that Beescape is able to offer, and I think probably over time, you'll get better resolution as more data come in. And of course, that's how all these things work. So I'm just grateful that you came on the air with us to speak a little bit about it today. And I know that all of our listeners are going to run and try it, certainly our North American listeners, because it's got a lot of information there. So I really appreciate what you guys are doing, you and your collaborators. So thank you so much for joining us on this episode.

Guest 29:06

Thank you very much. Thanks for having me here.

Amy 29:20

Our listeners don't know this, but while Christina was answering some of the questions, Jamie and I were playing with Beescape in the background. We told her, so it's okay. But what a cool resource, Jamie. It's a really cool tool, and I feel like this is part of the podcast is to share science, but also to share resources that people may not have otherwise known about. So I'm really excited to use Beescape and see how beekeepers use it. What were your thoughts on the episode today?

Jamie 29:45

Yeah, I thought it was really good. Fortunately, we had read the paper about it and discussed it as a lab, and at that time, I went and played around with it. When I told Christina, I rediscovered the place where I keep bees is not a great place to keep bees, but it was very relevant for me. And I did play around with it, think about where I was keeping bees when I was a child, things like that, and it just seems to match what I was seeing on the ground. And I really think it's a potentially powerful tool. Of course, it will get better over time. The resolution will increase as more data are available. And I think our listeners who are in the United States who play around with it are going to really enjoy it. Folks outside the US who might play around with it, they might be envious of this great resource, and might be able to reach out to Christina about expansion. But I do think it's great. It's powerful. It will only get

better. It's cool to hear the plans that they have for it. And I think, like in my case, if I were a commercial beekeeper, like a brand new commercial beekeeper and wanted to make a living, I would actually use it to scout out potential nectar flows and pesticide, all of these things before I was choosing sites where to place my bees.

Amy 30:50
Gosh, if you think about just all the work that goes into it -- that's what I can't get over is just all the data and all the work that gets put into this to make sure that it's updated, right? I mean, my brain hurts thinking about it.

Jamie 31:01
Well, she was, talking about iNaturalist and other things, all of these other websites from which Beescape is pulling data are, by themselves, gigantonormous websites with huge data sets. So really, Beescape is just an integration tool. It integrates the information from all of those websites and provides to us, as bee people, information that's relevant to us. And I think that's just one of the things that makes it really a great and useful and certainly a tool that will be growing in use in the future.

Amy 31:32
Absolutely. So all of the stuff that we talked about in our podcast episode we're linking to our additional resources, which is on our main website, www.ufhoneybee.com. I would love to hear your feedback on this and whether or not you found the resource useful.

Stump The Chump 31:56
It's everybody's favorite game show, Stump the Chump.

Amy 32:06
Welcome back to the question and answer segment. Jamie, the first question we have is about wild, native bees versus honey bees. So I guess there are some posts that are online about honey bee rescues and removals, and people have been talking about honey bees being an invasive species, and that they're really bad for native bees and that they should be killed as a beekeeper. Is there anything that a beekeeper can try to do to help all the pollinators live and prosper in harmony?

Jamie 32:33
Yeah. I mean, this is a really difficult question, and I'm going to answer it quickly and then elaborate. The quick answer is, we just don't know yet the impact, if any, that honey bees have on native bee populations. And let me define a few things here before I get too far. In Europe, the Middle East and Africa, Apis mellifera is native. So those of you listening to us on this podcast, you're like, why in the world would we talk about honey bees and native bees? Honey bees are native bees. Well, in Europe, the Middle East and Africa, that's true for Apis mellifera. In Asia, that's true for the other nine species of Apis. But in Australia, North America, South America, and many island nations around the world, there are no native Apis species. And so here in North America, when we talk about Apis mellifera, the honey bee, it's a non-native species. And so that then precedes this idea, well, there are native species of

bees here. In Florida, there's 320-ish. In North America, there's 4500-ish. What might Apis mellifera be doing to these native species that we don't want them to do to these native species? There's been lots of research on this topic where some folks have shown potential disease and pest transmission, specifically disease transmission between honey bees and native bees. Maybe there's competition for floral resources when you bring in honey bees that are generalist pollinators and foragers and nectar gatherers into an area. Maybe they just simply out compete with sheer numbers the number of native bees, and therefore, still, quote unquote, the resources in the environment to the detriment of native bees. And there's a growing body of evidence to show all kinds of things, no things at all, at everything in between. So it's a very complex picture that's being painted. This is not me trying to escape. It's me just saying the science is really still too new to make broad claims about honey bee impacts, if any, on native bee populations in areas where honey bees aren't native. So there are a few things that I can say with relative ease. I would argue that honey bees in their introduced ranges can be nuisances in some situations. For example, when honey bees nest in areas where people or animals frequent, they can be a nuisance. If they're nesting in your house, in your water meter box, in a barn where a horse is often tethered or caged, etc, they can be a nuisance that can be exacerbated if it's subspecies of African-derived honey bees, like Apis mellifera scutellata. Here in the America, it's called the African or Africanized honey bees because those bees are more defensive. When honey bees are outside of their native range and nesting in areas that people animals frequent, they can be a nuisance, and I don't really lose any sleep over people removing them. Beekeepers are going to remove them and maybe integrate them into their operations. Pest control operators are going to eradicate them, much to the dismay of beekeepers who claim that they need to be protected, or general public who say they need to be protected. I would argue, where they are introduced, feral populations of honey bees don't necessarily need to be protected. So when they are nesting in nuisance situations, removal, pest control, those, to me, are responsible decisions. That might rile up some feathers, ruffle up some feathers, but I think it's okay where honey bees are native to take that stance. So that then leads to the next question. As beekeepers, do we have a responsibility to minimize the impact of our bees on native bees in the environment? We've interviewed, Amy, a lot of people on this topic throughout our podcast tenure, where people are talking about impacts of honey bees in this setting and that setting, etc. I would say if we were to take native bee health in context, we probably wouldn't keep the density of colonies that we keep. We probably wouldn't keep honey bees, necessarily, in, I'll use the word, maybe, sensitive areas, areas where maybe certain species of native bees are on decline or threatened and need to be protected. Their resources need to be available to them. But there's just not a lot of research to support those things now, even if it's things that we feel like might be appropriate to do. So what I generally say when I wade into this arena is we don't really have, in my opinion, enough actionable information. In other words, I don't think we have enough information to make regulatory decisions, like we should ban honey bees from this and this because of what they do. I just don't think we're there yet. I do think we need to gather more information and make wise decisions related to it, but I just don't think we can make much actionable determinations based on what we know at the moment. So we probably should take safe stances, again, using the threatened bees or threatened habitat as an example. But there are clear examples of some cases where honey bees have improved, through their pollination, the volume of nectar or other floral resources available in the environment, much to the benefit of native bees. And so it's just in a predicament right now where we don't have enough

information. It reminds me a lot of the early days of COVID where we just didn't know enough to make actionable recommendations so we had to take the most conservative approaches. Well, here we're kind of in the same boat. While the literature and the data are growing, we're not really at the actionable point. But from a very practical standpoint, to answer the question the questioner was asking, I do feel bee removal and control in areas where honey bees are introduced is a very responsible thing to do for human and animal safety.

Amy 38:24
Sounds good. That actually leads me into the second question, and that is about successful trap outs, just basically trap outs and bee removal. So let's say that a colony is very difficult to access. Let's say that there are honey bees in the home of a homeowner, and they don't really want you to damage the home, but you're able to get the bees out of there. Even if you could get the queen and the colony, the rest of the colony out, are you just creating a bigger mess with rotting brood and honey that would attract other, I mean, I feel like I know the answer to this because I do work with pest control operators and beekeepers that do removals, and we ultimately have seen what would happen if you can't really go in and clean up after yourself, right? What are your thoughts?

Jamie 39:10
Yeah, this is also kind of a messy question because, I mean, in theory, the questioner is right. So, for the benefit of all the listeners, a trap out is essentially where it's difficult to go into the structure and remove the bees in the nest. What you'll see in the situations of trap outs is you'll often see the bee removal specialist develop a screened cone-shaped structure that is placed over the entrance of the original hive that goes from the hive, reduces in size almost like a funnel, and that funnel goes into a hive that you have mounted, maybe a small nuc or a 10 frame box that you've placed near where the bees are nesting. So let me explain, maybe, as an example. Let's say bees are nesting in the wall of a house, and you can't go into there. Maybe it's concrete. You can't burst into it and get the bees out. So they're in concrete, maybe, let's just say, for the sake of argument, six feet off of the ground. So you put a ladder by that nest entrance, and you put a nuc on top of that ladder. The nuc is roughly the same height as the entrance to the bees nesting in the wall. Okay, then you run a cone over the entrance of the bees nesting in the wall into the nuc box that you've placed on top of the ladder. And so the cone is wide enough at the wall entrance so the bees can come into that cone, but it narrows as it goes into the nuc, almost creating a one way valve so that bees that go from the wall into the nuc cannot go from the nuc back into the wall. So over time, the nuc captures more and more of the bees in the nest, and eventually, the queen and everyone leaves the nest and moves into the nuc. So that is a trap out. You have trapped the colony out of the original nest site into something you can manage and move away. Yeah, that's a good way to do it. That's a successful trap out. The downside is you've left everything in the wall to do exactly what this questioner said. If there's brood in there, it's going to rot, it's going to smell, it's going to attract small hive beetles. If there's comb in there, it's going to attract wax moths. It might destroy it. And if there's honey in there, it might get real hot, now that there's no bees thermoregulating. It'll melt or bleed through the walls to the inside of a house. I think trap outs work really well on things that don't matter, maybe like a tree or something like that, and maybe less well on things that kind of do matter, like the wall of the house. I'm sure there are bee removal specialists out

there who can perform trap out successfully in those situations, and it be a minimal problem, but I would say, you really need to have your skill set high if you're going to approach a trap out from a structure that it does matter if the combs and stuff are left behind.

Amy 42:10
All right. So for the third question, I kind of laugh when I read this one. They're wondering why honey bees, especially when they're protecting their hive, can fly so fast and accurately to sting me before I even saw them coming, but when they visit my pond waterfall for a drink, they regularly seem to fly into me by accident and bounce off me and then keep going. Who are these bees? Are these bees assigned to getting water, the older, senile, almost blind bees, versus the guard bees, where maybe they're young? What's going on? How come bees are so smart and so quick, but also they just kind of -- we've seen slow-mo videos of them just running into each other, right?

Jamie 42:49
Yep. So a couple of things to answer that, maybe a funny anecdote to help people appreciate it. So my wife and I have four children, and my wife and I purchased our house when we first moved to Florida. It was going to be our starter home, it's kind of small, and once we paid it off, I'm like, gosh, I can't go into debt for a bigger house just to have a bigger house, right? My kids are going to move out someday. So there's congestion in our house. There's six of us in the house. It's not an overly huge house. And my kids are off to -- I'm a person who who moves with purpose. Everything I do is with purpose. I'm never just kind of lackadaisically walking about, meandering about. So when I'm moving from place to place on the house, my kids might get in front of me, and I'm constantly telling them, it's a Jamieism, "Move with purpose. Don't just move. Do things with purpose. If you're doing something, do it with purpose." It's exactly what I want to say here. Purpose dictates behavior. If you are window shopping, you are going to meander down the street slowly just looking at all the great things in the window. If you are trying to score a layup in the basketball game, you are going to dribble as quickly as you can down the court and get to the goal as quickly as possible. And in both cases, purpose, window shopping or scoring a layup, dictated the behavior meandering or running. And so this questioner is asking a question where behavior is dictating the purpose. Bees that are foraging or going for a drink, etc, are trying to find resources. They are making decisions as they fly. What might appear like meandering to you, is actually purposeful, searching for resources that they need and weighing their options in real time. On the other hand, when a bee has determined that it is going to sting you, it is with purpose, moving quickly towards you, to sting you as quickly as possible, to get you away from where they don't want you to be. So in both of these cases, the behavior was dictated by the purpose, much like what you see in humans. So that's why you see bees kind of casually flying around when they're foraging or purposefully coming at you like a bullet shot out of a gun when they want to sting you.

Amy 45:16
Alright. Well, those are some great questions. Don't forget to send us questions, if you have them, by sending us an email or ask us a question on one of our social media pages. Thanks for listening to today's episode. This episode was edited and produced by our podcast coordinator, Mitra Hamzavi. Thanks, Mitra.

Jamie 45:46
Visit the UF/IFAS Honey Bee Research and Extension Laboratory's website, UFhoneybee.com, for additional information and resources for today's episode. Email any questions that you want answered on air to honeybee@ifas.ufl.edu. You can also submit questions to us on X, Instagram, or Facebook @UFhoneybeelab. Don't forget to follow us while you're visiting our social media sites. Thank you for listening to Two Bees in a Podcast.