

## Valley 101: Bees transcript

**Kaely Monahan** [00:00:01] Bees. For some, they instill a primal sense of fear.

**"The Bees" movie clip** [00:00:12] Billions of dollars have been spent to make these nuclear plants safe failsafe. The odds against anything going wrong are astronomical, doctor.

**"The Bees" movie clip** [00:00:21] I appreciate that, doctor, but let me ask you, in all your failsafe techniques, is there any provision against an attack by killer bees?

**Kaely Monahan** [00:00:34] For others, they are delicate pollinators who need our help.

**TEDTalks** [00:00:39] Pollinator decline is a grand challenge in the modern world. Last year alone, we lost 40% of all beehives in the United States.

**Kaely Monahan** [00:00:48] Then there's the occasional swarm that just happens to take up shop where humans work and play.

**AZ Diamondbacks announcement** [00:00:53] Due to a bee colony forming on the protective netting behind home plate. We ask that you please be patient. // We are moments away from the start of our game, but first we would like to welcome our ceremonial first pitch.

**Kaely Monahan** [00:01:14] And I'm here to tell you the truth about bees. They're more than just black and yellow, stinging and winging insects. And there's far more to bees than the honey bee, which is so ubiquitous that whenever anybody thinks of a bee, they imagine that black and yellow honey making insect. Welcome to Valley 101, a podcast about metro Phoenix and beyond. I'm producer Kaely Monahan, and I'm positively buzzing with excitement for today's episode on Arizona Bees. Okay, so the fact of the matter is, the whole save the bees fervor is predominantly for only one type of bee, and it's technically an invasive species to our continent.

**Tanner Bland** [00:02:22] Western honeybees.

**Kaely Monahan** [00:02:29] Also known as the European honeybee; these are your classic black or actually technically brown and yellow striped bees that build hives and live communally. They make honey and have a queen they cater to, and these are typically the bees most people encounter, like the swarm that took up residence behind home plate at Chase Field.

**Tanner Bland** [00:03:00] There was a huge focus in the last 10 years on protecting honeybees as a economic resource, rather than focusing on saving our native solitary bees, which provide a and I would say, even more essential ecological resource.

**Kaely Monahan** [00:03:16] This is Tanner Bland.

**Tanner Bland** [00:03:18] I'm the Tucson Bee Collaborative program coordinator, and I'm a grad student and the Moore Lab at the University of Arizona.

**Kaely Monahan** [00:03:26] I connected remotely with him to nerd out on bees. And boy, did we. Now I want to make it clear I'm not an above average bug lover. I respect insects

and all the small things to a point. Honestly, I'm dealing with an infestation of fungus gnats and I'm about ready to lose my mind. But I'm all for supporting pollinators, particularly our local ones. And when I read some headlines that said Arizona has more bee diversity than anywhere else in the world, I just had to fact check that.

**Tanner Bland** [00:04:17] We have so many different habitats. For instance, if you look up in Flagstaff, just in the San Francisco Mountains, you have about 400 species. So just and I'd say 3000 square miles of forest up in northern Arizona. So there's about 400 species. Compare that to a recent study done on the border. And you've got about 600 species per square mile. So the density just shoots up as you come farther south. And that's what makes it really hard to estimate. According to our work so far, genetic work, we have about 800 species just in the Tucson region and the whole state, probably about 2000 to 2500. We for sure know that Arizona holds at least 15% of all the species in North America.

**Kaely Monahan** [00:05:19] Let's put this into context. Research shows that there are about 20,000 known bee species worldwide. More than 4000 of them live in North America and Arizona. The Sonoran Desert, to be exact, is a hub of biodiversity. And that takes into account both described and undescribed species. And even at a conservative estimate, our region seems to be a bee Paradise. Now you, like me, might have read headlines that say there are 1300 bees species in the state of Arizona. And most of these are nonliving, independent bees.

**Song lyrics "Booked and Busy"** [00:06:21] I'm booked and busy, busy, busy...

**Kaely Monahan** [00:06:24] No, not like that. I mean to say, they are solitary insects. They are just out there doing their thing without a community or hive. Now I didn't make Tanner list all 2000 ish Arizona species. But here are some you might see in the Valley.

**Tanner Bland** [00:06:54] In Phoenix a really common bee would be our Carpenter Bees, Xylocopa. You'll see them all the time. The big black, people call them menacing, buzzing sounds that whiz by your head while you're probably in your garden weeding or something. Those are carpenter bees. They nest in soltol stocks and agave stocks. Another really common one are our Megachile. So these are leafcutter bees that specialize on roses. Some specialize on mesquite leaves and palo verde leaves. And they're using those leaves to line the insides of old beetle burrows that they use as their nests. Other common ones would be Osmia. These are metallic leafcutter bees, so look very similar to Megachile. But they are these fantastic colors. They come in all shades reds, purples, greens. We also have our sweat bees. They're very common. These are things like Agapostemon, Lasioglossum, Augochlorella -- There are these really small bees that you'll usually find lapping up sweat on your arm, hence their name, sweat bees. They're attracted to the scent of salty water. And they're also in these beautiful metallic colors, blues and some species have black and yellow striped abdomens with green thoraxes. Really wild morphologies.

**Kaely Monahan** [00:08:21] As I said earlier, there are no Arizona bees that live in hives. A lot of them actually live solitary lives. Others might form small, loose communities, but it's not on the scale of honey bees.

**Tanner Bland** [00:08:40] So we have some bees that are completely solitary. They're going out. They don't have any contact with their mother. Only their sisters in the nest go out, forage for flowers, and the males will typically either smell for females. So they typically give off pheromones in their adult stage, or they're simply looking for the flowers

they know the females will visit. So those are solitary bees. A single mom collecting pollen, going into the ground, digging a nest, and provisioning each of her larvae with what's called a pollen provision or pollen ball.

**Kaely Monahan** [00:09:11] These bee moms will lay an egg on top of the pollen ball, and the larvae will live off of that until it's mature. And these eggs and pollen balls are sealed off. And what is called a brood cell. Again, don't think of a hive. These cells can be in the ground or in a piece of wood, anywhere safe, where the baby bees can have a good chance of starting life.

**Tanner Bland** [00:09:45] What's really cool is that some of these larvae can stay in the ground for years and years and years on end without parental care, going into what's called a diapause. Now, this extended period of time that they have on the ground with their other brood mates can lead to social like behavior. So you have some bees that will occupy the same nesting entrance, who will provision their own nests within that greater nest. So let's say there's one hole that they all enter into, but each female has its own set of brood cells that it will care to. And so they aren't really interacting with each other simply using the same resource. Oh, almost like stealing a nest from another female to use as their own. And that's what we call a communal bee. So bees that don't seem to exhibit any sort of interpersonal behavior, right? They aren't communicating with each other in any way, but are simply using the same nest resource to take care of their offspring. Going further than that. You have some bees that are some social, semi social, some bees that are only going to be social during different parts of the year.

**Kaely Monahan** [00:10:59] This might seem like an obvious question, but what do bees eat? Like, really? It's not honey. If you guessed nectar, you'd be correct. But bees aren't restricted to just one type of food.

**Tanner Bland** [00:11:15] Bees will largely feed on nectar throughout the entirety of their lives. And that's actually true for most adult insects, at least in our area. So if you see wasps visiting a flower or butterflies, most of the time they're feeding on exclusively nectar and picking up pollen, at least in the bees case, they're picking it up because they need it for something else, or because it happens to just stick to them when they visit the flower. However, that theory has been kind of shaken up recently because we've found that adult bees at the end of their foraging time. So it's usually happens in the early to mid morning, right when the flowers are blooming, they will venture out of their nest and find a plant and consume a small amount of pollen just after the course of their foraging period. And when you think about that, it makes total sense, because nectar is really rich in things like amino acids and sugar, but it's not really rich in things like protein. But pollen is one of the densest foods for protein that you can get. That's why so many insects evolved to eat pollinate such a readily available protein source. And it's much easier than having to hunt down a caterpillar for your meal, right?

**Kaely Monahan** [00:12:35] Now you might be thinking, okay. Bees eat nectar and sometimes pollen. But at least half of Arizona endures blazing temperatures. And let's not forget that it can dip below freezing in the winter. That's not exactly the best environment for flowers and wildflower season here always seems to be brief. So how are native bees surviving year round?

**Tanner Bland** [00:13:01] So during our hot season we will see much bee activity. However, the bees that are around are the ones that are specially adapted to dry seasons during the drought period. Especially, bees are so tuned in to the amount of moisture in

the air and the amount of rainfall that comes to the soil. They can tell when a good bloom year will happen before they even emerge out of their pupae to become adults. But we don't really know. The mechanisms behind this is an area of really active research. But somehow, and it probably varies across species of bees. They know when flowers are going to bloom. I love this analogy from a paper by Brian Danforth, who is like the bee guy. If you read any bee paper, he's like the author. That's on every single one of them. But he said that bee larvae beep are almost identical to the angiosperms, seeds that they pollinate in terms of life cycle. So when you think of a seed in the desert, sitting in the soil for years and years and years on end, the same environmental cues apply to that seed being able to germinate that would apply to a bee being able to emerge out of its nest as an adult. They're waiting for monsoon rains. They're waiting for the humidity to rise. And as soon as it does, they're taking their chance. Now it's really interesting if some of these bees can stay in the ground for what seems to be decades. There's an example of an Australian bee, *Amegilla dawsoni*, that's been recorded as staying in its pupal stage in the ground for up to 20 years. We have some bees here that participate in a behavior called bet hedging. And bet hedging essentially means that some of your brood will emerge and others will stay behind the nest. And it's a way of ensuring that year to year, at least some of your adults will make it to reproduction and be able to build a nest to have their own offspring. So instead of putting all your eggs in one basket and having everything reverse the same year, only half the brood full immersion one year, and then the following year only half the original brood will merge again, and so on and so on. And that's a really unique adaptation to desert bees.

**Kaely Monahan** [00:16:44] Okay. That's really cool, actually. So it sounds like our bees are similar to our cicadas, at least in this sense. So when you hear that familiar whine in the summer, you can also look for local bees. Going back to the 'Why are there so many bees?' question. It all has to do with evolution and specializing in certain niches.

**Tanner Bland** [00:17:24] People tend to think evolution can happen over very long periods of time, but evolution can also happen in very short periods. A good example of this are the invasive Western honeybees. Right. So all these European honeybees are bringing over from Europe. There are now dozens of subspecies that have evolved just in the course of a few hundred years, that are a direct result of humans bringing them to new places. And you develop new cultivars, basically of honeybees. Right. So that's an example of how evolution can happen very quickly with native bees. It happens a little slower, but we can still see those kinds of patterns arise. So the bees I study for instance, the bees in the genus *Perdita* are known as the fairy bees, smallest bees in North America and some of the smaller cities in the world, which is really cool. They're the most diverse group of bees in North America. There's about 700 species and there's tons of undescribed diversity. But this group is only about 15 million years old. Now, that may sound like a long period of time, but 15 million years to get over 700 species is incredible. I mean, that is actually the fastest diversification of any bee group that we know of today. These can evolve relatively quickly and they respond very quickly to things like habitat change. So we know like for instance, very specialized pollinators are very fragile when their host plant maybe is removed from their ecosystem due to maybe land degradation or agriculture or human development. And that's because they've evolved with that given pollen type for such a long time now that they've developed a close reliance with that plant. So yeah, I'd say shifts and bee populations can happen really rapidly. But bees can also be pretty resilient to our knowledge of plants that bees visit, the habitats they occupy, what their restrictions are. It's still a pretty active area of research, and we don't really know the lines between, you know what soil types bees like, what plants bees visit. It's a

really open ended question, but it seems to be that these can be pretty resilient in some cases. But specialized pollinators seem to be really reactive and pretty fragile.

**Kaely Monahan** [00:19:40] After hearing this, it makes it even more clear that saving bees and really all pollinators is truly important. Arizona has so many specialized species that any loss in habitat could end up endangering some species. But that's not the only potential problem. Honey bees might also end up pushing out native bees.

**Tanner Bland** [00:20:16] The data is still. It's kind of wishy washy, but what I'll say is it has been shown that honey bees will prevent other bees from visiting floral resources. So especially out here with so many specialist pollinators. If a honey bee finds a good patch of, say, creosote, or after that another bee specialized on and has to visit to care for its offspring, it's been shown that those honey bees will fight for the small resources and kick other bees essentially out of patches. The degree to that. You know how it is reflected in the greater solitary bee community if it's having a pretty substantial effect? The jury's still kind of out, but it definitely seems that with the colony forming behavior of honey bees, how resilient they are, how long lived their hives can be, how drought tolerant they are. They could very much prove to be a pretty, pretty and perilous invasive species, especially for native bees. And I will say this to our native bees have a foraging distance of a few meters to maybe a few hundred meters from their nest when they visit flowers. That's usually a patch of flowers. It's very, very close to their nest entrance. If a honeybee hive happens to locate around a bee nesting site, they are going to push those bees out. And I think that's the real danger, not necessarily competing for floral resources, but competing for available nesting habitat.

**Kaely Monahan** [00:21:51] Again, Tanner was quick to add that the jury is still out on whether or not this is a real issue. There's still a lot more research that needs to be done. Speaking of which, the study of endemic bees has only really taken off fairly recently, all things considered.

**Tanner Bland** [00:22:09] The diversity of native bees has been pretty under the radar for the last 30 years. We knew it was there, but there hasn't really been a lot of research looking into the taxonomy and diversity of this group until relatively recently. And so as a result, conservation strategies have been sort of put on the backburner, especially in light of colony collapse disorder with honey bees.

**Kaely Monahan** [00:22:36] In the early 2000s, the focus has been on saving the honeybee rather than local species. After all, honey bees have economic benefits, aka honey production. But over the last decade or so, there's been more research happening on native bee populations, and we're learning how to better protect them.

**Tanner Bland** [00:22:57] If anybody wants to promote bees in their backyard, learn about bees. First of all, learn about what flowers they visit, what things they nest in, and what habitat they prefer. The great, great book, a fantastic resource, is this book by Joe Wilson and Olivia Messenger Carroll "The Bees In Your Backyard."

**Kaely Monahan** [00:23:35] I couldn't leave this conversation without touching on the buzzworthy headlines we sometimes see plastered around media outlets now and then.

**ABC News clip** [00:23:43] Frightening images from Arizona, the landscaping crew surrounded by bees, hundreds of thousands of them. ABC's Clayton Sandell with The

Warning tonight. These firefighters are not fighting a fire. They're spraying foam and pesticide where swarming bees attacked a landscaping crew. One person was killed.

**Kaely Monahan** [00:24:03] Killer bees.

**Tanner Bland** [00:24:09] You know, I've, I've heard a lot of things about killer bees going one way or the other. Essentially, these bees were an attempted cultivar in a Brazilian laboratory. So they were breeding the classic European honeybee *Apis mellifera*, with another subspecies in Africa that was known to be fairly aggressive, really drought tolerant, because it was living in the deserts in Africa and was a bit larger and built larger colonies. And so they saw this opportunity as a potential boon for the beekeeping industry. You know, if you had larger hives of bees that were more water tolerant, then beekeepers didn't have to put as much labor into caring for their hive year to year. The story goes that these bees escaped the lab or were set free. The details are sort of wishy washy, and eventually made their way north into Mexico and now into the southwest United States. Now, these are just honey bees. They're not different from honey bees. They're just a hybrid between a couple species. And so to say that they have increased aggressive behavior or are more prone to attack people. That's hard to say, especially because these bees are pretty much indistinguishable from any other honey bee in North America. So there's no real way to tell them apart. They aren't bigger. The colony sizes are a little larger, but there's really no behavioral or morphological difference between these things. And so I have a feeling that a lot of the data that we have about swarming honeybees and the dangers of honey bees probably comes from misidentification of a regular honey bee hive as an Africanized one. That's not to say that they aren't dangerous. I mean, feral honeybee hives have been known to kill people, especially if someone's stepping on them or, you know, it poses some sort of threat, the bees see. And so I won't say to not be careful around these hives, but just keep in mind that any honeybee will probably react the same way that the so-called Africanized ones will.

**Kaely Monahan** [00:26:20] In the end. Treat bees with respect. And if you come across a honeybee hive, call a professional to handle it. If you want to learn more about how to protect bees and encourage them to your gardens, Tanner recommends this.

**Tanner Bland** [00:26:36] So my organization that I work with, the Tucson Bee Collaborative, we are focused on promoting urban pollinator diversity in Tucson and are really looking for people to take on the responsibility of monitoring bees in their backyard and getting a more vested interest in learning about the diversity of the store in desert. I really am for people to join our iNaturalist project, so any photo you upload, once you join our project of a bee or of a pollinator will automatically be uploaded and allow researchers to look at your photos, identify them to species, and potentially use it to better understand our diversity here.

**Kaely Monahan** [00:27:24] Thank you for listening to this episode of Valley 101. If you enjoyed this episode or learned something new. Share it with your friends. Keep up with Valley 101 by subscribing to us wherever you get your podcasts. And if you love what we do and want to support us, why not consider subscribing to the Arizona Republic? Just visit [Easycentral.com](http://Easycentral.com) to learn more. This episode was written and produced by me, Kaely Monahan. Amanda Luberto lent her ear to make sure it sounded great. Joan Miners, our climate reporter, provided fact checking help. Kara Edgerson provided episode oversight. Special thanks to Tanner Bland for sharing his bee expertise with us. Music for this and all our episodes comes from universal production music and additional sound bites are from the 1978 film "The Bees." The Arizona Diamondbacks, Ted Talks and ABC News. You can

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