

TRANSCRIPT

INTERVIEWEE: Dan Aurell

INTERVIEWER: David Todd

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Google Voice [00:00:00] This call is now being recorded.

David Todd [00:00:03] Magic. How about that?

Dan Aurell [00:00:05] I heard that note that notice too. That, that sounds like it's working.

David Todd [00:00:09] OK, well, good. Good. Well, Dan, first of all, how much time can you spare? I feel like we ought to budget, you know.

Dan Aurell [00:00:18] Well, actually, so I've just been sampling up here in northeast Texas and I have three hours and 15 minutes before I arrive in College Station.

David Todd [00:00:30] Oh, my gosh.

Dan Aurell [00:00:32] So really, until, until we get tired of talking, honestly.

David Todd [00:00:38] Well, that's very generous. I'll try to keep you distracted while you roll down the road. I guess you're going to be busy soon.

Dan Aurell [00:00:47] No, I only actually finished a little round of sampling and just headed back home back to home base.

David Todd [00:00:57] OK. Well, maybe you can, as a starting point, tell me where you're from and sort of what your general background is. Always curious.

Dan Aurell [00:01:09] OK. So I mostly grew up in Canada. Atlantic Canada, although I was born in Sweden. Lived there as a kid. But yeah, I went to high school in Atlantic Canada, in New Brunswick, and then ended up going to university in Nova Scotia. Did a biology degree. And I had been working in a, I'd been working in agriculture, vegetable growing, a little bit of mixed farming. And then one of my last summers between years at university, I found a job on a bee farm. And since then, I've been working with bees pretty much.

David Todd [00:01:52] And so how long is your bee career been?

Dan Aurell [00:01:58] It's you know, compared to some of the operations that I go visit, it's pretty short. Like I go and, I go and work for some some guys who've been working with bees for 50-plus years. So I've only been where I've been working with bees for about five years.

David Todd [00:02:17] OK.

David Todd [00:02:19] What got you interested in bees in the first place?

Dan Aurell [00:02:24] Let's see. I think partly it's partly a pretty strong interest in agriculture and now also a little bit learning about them in the school setting, university setting. But what really? Yeah, I guess it wasn't until I started working on a bee farm that I really, yeah, that got me a lot more interested.

David Todd [00:03:00] And can you describe what a bee farm is?

Dan Aurell [00:03:04] Sure. Have you ever opened a bee hive?

David Todd [00:03:08] Oh, I have. Yeah, but I know very little.

Dan Aurell [00:03:13] So you opened a beehive with a beekeeper and so on I guess.

David Todd [00:03:18] Yes. Yeah. Just once.

Dan Aurell [00:03:24] Yeah. So this bee farm that I was working on, they're, for Nova Scotia standards, they're a fairly big bee farm and they keep at the time I was working there, the blueberry pollination crisis work, the demand for blueberry pollination, was pretty high. So they had built up their stock from like fifteen hundred up to seventeen hundred colonies. So that's, you know, fairly, reasonably big bee farm by Nova Scotia standards like the, probably one of the biggest five or five biggest in that province. And but for like American standards or certainly like Canadian prairie standards that's, you know, small to medium bee farm.

Dan Aurell [00:04:14] Yeah, so bee farm, all the beekeepers and all the, all the open space to store boxes of comb, the bee boxes, boxes of honey or honey keepers, you know, it's a couple of all-terrain forklifts on a bee farm that size, a couple of flatbed trucks and another pickup or two. And the equipment that you use to go out and feed sugar syrup at times when they need a boost. The bee suits that are hanging on the on the hooks.

Dan Aurell [00:05:05] Yeah, but you know, you. Even though, even though when you're, really scale up a bee operation a little bit, you get a lot of help. Or it's really helpful to have some mechanization. Compared to other kinds of farming, it's, I would say, difficult to mechanize. Like there's a lot of time just spent with your face looking, looking down into a hive.

David Todd [00:05:39] OK. Got it. Interesting. And ah, so this is a pretty specialized bee farm. This is one that that kind of focused on blueberry pollination, is that right?

Dan Aurell [00:05:53] They did blueberry pollination, as well as as well as honey production and food. And yet, Tom and, Tom and Marianne also did a bit of pollen trapping to sell pollen as a kind of specialty food. And, ah, made beeswax candles. I think that the pollen, pollen and candle making that's kind of more because they like, they really like to do those things. I would say that the honey production and the pollination doesn't really make them an especially specialized bee farm. It's kind of standard to do some, some standard to do both honey production and pollination.

David Todd [00:06:50] Hmm. I see. And it is this, kind of typical bee farm like theirs, is it sort of like a home base, slash truck stop when they're not on the road doing pollination or are they at home and pretty situated in their, you know, local haunts.

Dan Aurell [00:07:17] Sure. So you know that bee farm where I was working, like the trucks rolled out of the, rolled out of the farmyard, which is which is also where where the family, where the family's house is. And so that that's pretty common, I think. But all. But I mean, in the US, the beekeepers tend to do longer distance migrations with their, with their hives than people do in Canada. So a lot of the beekeepers that I go sample for, they, they spend part of the time, part of the year with their families in, for example, North Dakota, Texas and California. Some of them bring, some of them bring their their kids and family along to up to three home bases through the whole year.

David Todd [00:08:21] So they might follow, say, a crop through the course of spring and and through the pollination? Sort of following spring, as it as it rolls northward, is that right, or are they doing a number of different crops? What's, what's typical?

Dan Aurell [00:08:42] That depends on the depends on the area of the US. I can I can give you a few kind of examples. So, and it's it's not necessarily that they're always going to pollinate crops when they migrate, when they migrate to different regions or different states. Often it's that they do pollination in one state and then they truck their bees up north to make honey and then they might truck them back south so that the hives when so that they have them on the Gulf Coast or in the Gulf Coast states for winter, a place with a moderate winter.

Dan Aurell [00:09:30] But yeah, just a couple of examples. Like a you might have a North Dakota based operation. You know, the family's from North Dakota. That's where they're kind of where they're really from. But they've been going down to Texas for 15 years for spring build-up. So and they've been going to California for 5 or 10 years for almond pollination. So their current, their current migration route might be something like, you know, on January 1st, their bees are all down in Texas. And then in late January, they'd send the colony out to California. They would spend all of February out there. And then sometime in March, most of them would get shipped back to Texas, but maybe, maybe a few loads of bees. Maybe they might send them on to do a second pollination event in, to do, like, Washington cherries. And then those couple loads would arrive in Texas a little bit later than than the main cohort of bees. But then in Texas, in the spring, the beekeepers I would say migratory beekeepers use Texas mainly as a state where the colonies have the benefit of early build-up, like warmer weather and early pollen and nectar sources. The colony, and so that they could split the colonies, split their colonies. Yes. You know divide a colony into two or three or four. You can only only divide into four if you've got a really strong colony or even three, you need a strong colony. And then, but then the colonies will build up on that forage. A lot of beekeepers, at least on the Gulf Plains, make massive honey crops, or big honey crops, from the Chinese tallow tree. So Texas tends to have a pretty a lot of areas that tend to have a pretty early, early honey flow, which is when the flora in the area is secreting more nectar than the bees are consuming. So that the bees are gathering nectar, but they're storing more than they're able to eat or that they need to. So that's what the beekeeper calls the honey flow, whereas a nectar flow is what some call it, when some nectar is coming in. But when a nectar flow is so strong that they're, that the bees are putting away a surplus, then we call that a honey flow. And yes, they make honey off the tallow trees. And then this North Dakota beekeeper, for example, would ship the bees up north to their locations where they're going to make North Dakota honey off of plants like sweet clover, alfalfa or canola in some regions. And then in the fall, they are going to send their bees back down to Texas to spend the winter.

David Todd [00:13:11] And it seems fascinating to me that these bees are so versatile, flexible, that they can be in very different kinds of ecoregions and different climates and feeding on different kinds of plants. This seems extraordinary. How do they manage that?

Dan Aurell [00:13:36] Yeah. That is, that is pretty cool. Even, you know, the Canadian and U.S. border is closed to the transport of full-size bee colonies. Think all you're allowed to send back and forth is queen bees. So. When Canadian beekeepers have losses and need to restock their hives, one of the ways they do that, besides splitting their strong hives is actually to import packages of bees, bulk bees in a cage, in a screened cage from New Zealand and Australia. And it's really astonishing that the New Zealand beekeepers or the Australian beekeepers will harvest surplus bees out of their hives in the fall, in the New Zealand fall, and then ship them north. You know, this is in March, March / April, when it's fall in New Zealand. And they'll ship them to Canada and they'll be installed in the Canadian, in the hives in the Canadian spring. And those bees just turn around and adapt. You know, the sun, the sun, which they navigate based on it's going the opposite way across the horizon and they can still figure out how to navigate by the sun. So they are pretty adaptable.

David Todd [00:15:10] Gosh, and they're also, I guess, flexible about what kinds of plants they're pollinating and making honey from. Can you sort of run through what would be some of the major crops that they might be engaged with?

Dan Aurell [00:15:32] Yeah. Do you want maybe overall U.S. perspective?

David Todd [00:15:35] Yeah, or, well, you know, this book, which is kind of where I'll eventually try to use this, is about Texas, but but it would be great to get some context about the other parts of the country. Sure.

Dan Aurell [00:15:48] Sure thing. OK. So, yeah, I mean, I mentioned a few a few crops and plants. I mean, yeah, yeah. Bees will make use of both wild and and cultivated plants. Yeah, so I'll just start with the, I guess major honey-producing plants that come to mind in the US. I mentioned sweet clover, canola, alfalfa, other clovers like. I don't really know my clovers. Other major honey plants would be up in the North, especially the Northeast. You have spotted napweed. It's like a thistle without thorns. In California, you also have a nap weed, but it's known as star thistle, other honey producing plants. So California, again, you have oh what's that tree, tulip poplar. That's a tree. You have manzanita in California. You have in Oregon, you have an invasive blackberry called Himalayan blackberry. In the in the fall in the Northeast, you have these can make a surplus off of goldenrod. In the Southeast, actually, the whole Gulf Coast, you've got Chinese tallow, this invasive tree. You have your yaupon holly, a native shrub. You have monarda, also known as horsemint in the Southeast, like Florida. There's another Holly called Gall Berry Holly. There's some of that in Texas, too. There's a fall nectar source called Chinese pepper. I don't know if that makes a surplus of honey. So those are some wild plants. Some of some of them introduced, some of them native. Should I just go on, go on, go on and talk about the crops?

David Todd [00:18:45] Yes, please. That'd be great. Curious.

Dan Aurell [00:18:47] Sure. The crops that these honeybees make money from would be... They collect nectar from the almond trees, but it's so early in the season that the bees usually eat up all that honey. So that's not really a honey source. The citrus groves, you'll make a surplus honey crop there, though. You can make some honey in apple and blueberry fields. That's more like a, you can harvest that as a specialty, if you're selling varietal honeys. Other crops that make honey. Oh, canola. Big one. All right. Probably. I think I might've mentioned that one earlier. Yeah. Alfalfa crop that makes honey. Cotton actually makes honey, make a decent surplus off of cotton. But when it's really hot, soybeans can make honey. So that's more

in the South than in the. Yeah. Yeah. It's more like Alabama, Mississippi rather Texas, rather than rather than up North. But they make money off the soybean. Sunflower. Yep, that's what comes to mind for crops that they make honey off of.

David Todd [00:20:19] That's fascinating. Gosh. And in most of these areas, would you say that, that honeybees are the chief pollinator, or are ground bees, wild bees, very active as well?

Dan Aurell [00:20:40] Hmm. That I don't think I'm really, I don't have enough to go on to make a guess at the relative importance of wild bees and honey bees in general. In intensive cropping systems, honey bees tend to be, I believe, do the heavy lifting in a lot of intense, intense, yes, intensive agriculture areas Yeah, for it, for example. I mean, the California almond orchards are the prime example of that I guess where I've seen a chart where honey bees are thought to be responsible for I think 90-plus percent of the national almond crop.

David Todd [00:21:41] Wow. Huh. Well, that's, that's fascinating. So say, say you are a commercial beekeeper and you roll up at a farm, let's say in Texas, that has hired you to pollinate their crop. How would that go? What would be a typical visit for the beekeeper?

Dan Aurell [00:22:10] So the beekeepers are, I mean, the beekeepers provide pollination services. They don't, they don't, in terms of the relationship between the crop farmer and the grower and the beekeeper, the grower is not going to be managing the hives. They are not going to be opening them, except maybe to grade the strength of them. So beekeepers do the management of the colonies while they're on pollination contract or, you know, before and after. So. It will be prearranged how, yeah, how many colonies were going to be rented in and there'd be some agreements about how strong the colonies were gonna be. And often I think generally there's a pollination contract drawn up, although in some in some cases it's on a more casual basis where the grower has a location that both needs pollinators for the crop, but it's also a good honey-producing location. So that kind of relationship might be on a more casual basis where, yes, let's say a watermelon grower with some maybe smaller fields where there's a lot of good honey-making potential around the fields. Then it might be a more casual arrangement where there might not be money exchanged. So the beekeeper just gets to put their hives in a location there and they make some money and they also happen to pollinate the crop.

David Todd [00:24:08] Yeah.

Dan Aurell [00:24:09] So that's the density of hives. It's going to be it's going to vary greatly depending on the pollination needs of the crop. Like, for example, there will be lots of factors that play into that. You know, maybe things like the availability of wild pollinators, maybe things like field size, maybe things like the actual varieties of the crop, crop species. So like seedless watermelon needs way more, needs a much higher stocking rate of beehives to to get adequate pollination than seeded varieties. There's something about it that way more pollen grains need to be transferred for complete pollination in seedless varieties.

David Todd [00:25:11] Hmm.

Dan Aurell [00:25:12] So depending on the cropping system and what the farm has found work well enough, and you know, guidelines from from research on pollination, the bees might be placed in locations of, you know, up to up to say 48 colonies in a spot or 64 colonies in a spot, but an in a crop that's really dependent on on pollination, like a lot of orchards, the

bees would be placed more, in much smaller drops, like you'd have a drop of two to four pallets. So 8 to 8 to 16 colonies usually. Maybe, maybe you'll have some drops of up to 10 colonies or maybe maybe you'll have all your bees placed on like every second row through the orchard so that these roads will just have big, long line of pallets of bees or, yeah, or 6 pallets here, and then 50 yards down another 6.

Dan Aurell [00:26:26] Yes so the beekeeper would come in at night. The orchard grower would have given them a map as to where they wanted the bee hives dropped or and or put a flat little piece of flag tape on the tree, something like that. The beekeeper would come in with their, generally, if you're loading into an orchard, then it's like smaller flatbeds, like a 18-foot flatbed and an all-terrain forklift, and lift off the pallets in these spots where you arranged. And during the time in the crop, colonies, they may get graded by a county grader or maybe the grower and the beekeeper will go out to look at them together to make sure they're up to pollination strength.

David Todd [00:27:34] The county grader, that's somebody who works for the local government, or?

Dan Aurell [00:27:41] Yeah, definitely for California for for some of the major pollination events there, for almonds, for sure, there are people hired by the counties that come up to do grading. I think a lot, I think in a lot of other places it's more on a trust basis. Someone brought good bees last year and then you trust them to bring good bees the next year.

David Todd [00:28:17] Yeah.

Dan Aurell [00:28:21] The beekeeper would, so for a colony to be a good pollinating unit, it should be queen, right, and it should be of adequate strength. Yeah. Wha, what is adequate strength? That depends on the time of year. Like really early in the season, it's hard, it's hard to find big, strong colonies. So really strong colonies. Whereas later in the season you, more availability of really strong colonies. But. Yes. So, the colony, you wanted the queen to be a good pollinator unit, have a laying queen not to be starving, to have a big enough population of adult bees as well. You want hives that have a pretty good amount of brood in them, especially when the pollination is affected by bees that are foraging for pollen. That brood is kind of, that developing brood, needs pollen for their nutrition. So all that brood in the hive is kind of like makes the hive hungry for pollen and therefore makes them, makes them, makes the bees go out and work and bring pollen back in.

Dan Aurell [00:30:04] During the pollination events, beekeepers will go check on their hives. Usually mainly to make sure they have enough fresh sugar food, that they have enough honey stored, their honey or syrup stored, but they're not getting light, to feed them sugar syrup if they're starting to get light.

Dan Aurell [00:30:27] And then at the end of the pollination event, they'll get released by the grower. And that'll probably be based on the progression of the crop bloom. You know, once bloom is starting to get, once the bloom starts to be over, they'll come to an agreement that bees can be moved out.

David Todd [00:30:50] So how long would that be in terms of days? Weeks?

Dan Aurell [00:30:56] I can't put a number on that offhand. A lot like the blueberry pollination events back home, I believe that was about three weeks. Yeah, about three weeks. Sitting on, sitting in a blueberry field.

David Todd [00:31:22] And then off to the next farm. Fascinating. Yes. And I think you mentioned watermelons as being a I guess, a crop that you'd see in Texas. Were there's some others that would be coming here that they might rely on the bees.

Dan Aurell [00:31:38] Definitely. Yeah, I suspect that watermelon is, well, one of the top two, and that citrus would be the other, other top one.

David Todd [00:31:49] And citrus fruit would include oranges, grapefruits, lemons, limes.

Dan Aurell [00:31:57] Yeah. Mm hmm.

Dan Aurell [00:32:05] And now the great, the watermelon is in a lot of different areas of Texas, but grapefruit. Yeah. Citrus would mostly be in the Rio Grande Valley and near there.

David Todd [00:32:24] And I think you mentioned that when these bee keepers visit their hives, hey.'re, they're looking for us, I guess, how much sugar they've got, but also whether they might have lice and and one of the things I was very curious about is what's afflicting some of these colonies.

Dan Aurell [00:32:50] Yeah. So almost lice. Well, I think lice are insects.

David Todd [00:32:57] Yeah.

Dan Aurell [00:32:57] But they're are mites.

David Todd [00:32:59] Mites. I'm sorry. I didn't understand what you said. I'm sorry. My apologies. Mites.

Dan Aurell [00:33:06] Yes. Huge, huge problem.

David Todd [00:33:11] What is the source of that? What's the origin story?

Dan Aurell [00:33:16] So the, it's one mite in particular. Well, actually, historically, in the recent decades, there have been two mites that have caused serious problems for the North American beekeeping industry, and actually for bees worldwide - both these species of mites. The first one to make it to the US of these two was known as tracheal mite. And tracheal, it means that it lives inside the trachea. Like the breathing tubes of the bees. That I believe reached the U.S. in 1983 and caused significant losses, and that has not caused significant problems in Europe. Earlier, I believe in the early nineteen hundreds and at that point, it was being called anchoring or a carry disease. But that has, that mite is no longer a major problem in the US.

Dan Aurell [00:34:42] In the late '80s, a second parasitic mite was introduced to the US. I believe it was 1987, and that is called the varroa mite. The scientific name is Varroa Destructor.

David Todd [00:34:58] How do you spell that?

Dan Aurell [00:35:00] V A R R O A. D E S T R U C T O R.

David Todd [00:35:14] And so it arrived in '87,.

Dan Aurell [00:35:16] I believe '87. Yeah.

David Todd [00:35:19] And where was it coming from?

Dan Aurell [00:35:22] So. Right. Originally it came from Asia. So. It's I guess, naturally a ah. Yeah. It's been a longstanding pest of the Asian honey bee, also known as the Eastern honey bee or Apis cerana. But the Western Honey Bee, apis mellifera, which is native to Europe, Africa and the Middle East, did not co-evolve with this mite. So the mite jumped from one species of honeybee to to another. And so jumped from the Eastern eastern honey bee to the familiar Western honey bee. And the western honey bee is, is not adapted to dealing with this mite. So the Eastern honey bee has some strategies that allow it to interrupt the the mite's reproduction. But the Western honey bee, the mite just kind of continue to reproduce until it reaches damaging levels. So while the. Go ahead.

David Todd [00:37:02] No, I'm just going to ask you if there's a good understanding of how either of these two mites got to North America or got within the United States.

Dan Aurell [00:37:14] I don't know where the where the tracheal mite was first detected, the varroa mite. It may have been, if I remember right. The first detection may have been in Wisconsin. But again, if I'm remembering the story. Right. It was detected in an operation that migrates from Florida or Georgia up to, up to Wisconsin. So it likely came into Florida, the varroa mites did, and it likely came on, on container ships, on a container ship from some, you know, regular Western honey bee swarm that had varroa mites came on a container ship from somewhere.

Dan Aurell [00:38:20] And maybe even today, the bee inspection services in Texas, for sure, but I'm pretty sure in Florida as well, they maintain like trap hives near the ports. Definitely the Port of Houston, Texas apiary inspectors maintain trap hives there with the intention that they go check periodically with the intention to be able to pick up if a swarm moves in from the port with with some new some new pests or more pathogen.

David Todd [00:39:08] That's fascinating. So among all the tank farms and tanker ships, fuelers and container ships, there are some trapped beehives right down in the Port of Houston or.

Dan Aurell [00:39:20] Yes, somewhere around there. You have to you'd have to ask the bee inspector.

David Todd [00:39:29] Fascinating.

Dan Aurell [00:39:29] One of them in particular, I'm going to give you as a potential contact, too.

David Todd [00:39:35] Yeah. Thank you.

Dan Aurell [00:39:37] I think the major things that they are, well the major things that I'm concerned about coming in would be the eastern honeybee. So that is trying to kept out and the other one is if a bee hive, if a swarm moves in with there's another parasitic mite that's even worse than the varroa mite called Tropopoleus. But the genus name, Tropopoleus.

David Todd [00:40:16] OK, so many hostile agents for these honey bees.

Dan Aurell [00:40:26] Yeah, yeah.

David Todd [00:40:30] You know, I'm serious. I've been reading a little bit about the bees' immunity to various infections and and that that might be part of the problem, is that a possibility, that their immune systems are somehow compromised?

Dan Aurell [00:40:55] I think yeah, I think that's one of the.

Dan Aurell [00:41:03] Bee health issues are, like the conclusion that we've come to, is that they are multifaceted and there's likely not one. Overall, it's generally the interaction of multiple factors that leads to the high losses.

Dan Aurell [00:41:30] About immunity in specific, I don't know that much except that there that the varroa mite.

Dan Aurell [00:41:42] I know that it comes when it feeds on the on the bees, it compromises their immune function. I'm not sure exactly how that happens, but that's definitely a clear example of one of these interactions between stressors.

Dan Aurell [00:42:01] And that's I don't know exactly how it happened, but it may be because the varroa mite feeds on an organ in the bee body called fat body. Fat body is a lot more important than, you know, mammalian adipose tissue. It is a major site of, I'm pretty sure, like detoxifying functions like.

Dan Aurell [00:42:36] Yeah, yeah.

Dan Aurell [00:42:39] Bees are always exposed to natural and natural and natural and I guess agricultural toxins. But I believe fat body is one of the sites that's there's a lot of natural detoxification. And I believe it's also a site where a lot of the immune response or I guess the immune function of the bees is kind of. I believe that this is somehow dependent on a fat body as well. It's the storage organs for fat and protein. So the varroa feeds on that fat body. So it's not a not strange that it interferes with their nutrition, longevity, immune function.

Dan Aurell [00:43:36] And they also the varroa mite does I think it's called like extra oral digestion.

Dan Aurell [00:43:44] So they not only do they use their front appendages to kind of slice and pull at the fat body issue, but they also inject it like enzymes in their saliva that are that break down the tissue.

Dan Aurell [00:44:12] And then they sit and then they suck. Suck it back out.

David Todd [00:44:18] Well, do you see these as any kind of an indicator species like the canary in the coal mine?

David Todd [00:44:26] Because they're doing this filtering and detoxifying.

Dan Aurell [00:44:34] In terms of pesticide issues,.

David Todd [00:44:36] Yeah. Right.

Dan Aurell [00:44:45] I think I mean, there are pesticide issues with honeybees. And I think. In some ways, they are. That can be a really good, I guess, sentinel, sentinel species.

David Todd [00:45:00] That's good word for it.

Dan Aurell [00:45:04] Because they kind of sample from, you know, they easily forage over a two mile radius. So that's in the neighborhood of eight eight thousand acres. If their workforce is pulling in, pulling it can pull in resources from. So by sampling, you know, by sampling what kind of levels of chemicals you have in a beehive, you're able to kind of sample a large area. That said, in some ways, they're not as good, not as good an indicator species because some of the things about their lifestyle.

Dan Aurell [00:45:51] I have a couple yeah, a couple examples to give.

Dan Aurell [00:45:57] So first, you know, they have they have a division of labor. Where or.

Dan Aurell [00:46:06] Probably at the reproductive division division is responsible for it, normally responsible for all the egg laying. So the queen isn't going out and foraging and. Toxins in the environment. So in that eight thousand acres, foragers decide to go to the, you know, the soybean field that just got sprayed. They might just go die out there in the field and never come back. And the queen or the colony never even gets exposed to those toxins. So it's in contrast, a solitary bee. He left of the female is both the reproductive and forager. She does both tasks, so she'd be going out into that same same field. She might just die on the ground and in that sense, like a wild bee, it would be a less protected from that sort of effect. And also another thing I have in mind is that in honeybees, the foragers bring back pollen and nectar and then nurse bees, young bees that haven't left the hive, yet they still eat that pollen and nectar and transform that into glandular secretions that they feed to the to the young, to developing larvae. And during that process of transforming the pollen and nectar into these secretions from the glands in the head, they have a really good chance for the adult body to detoxify whatever contamination whatever toxins might be in that. Whereas a solitary bee is going to generally lay eggs on or they're going to provision their nests with like a ball or a mass of pollen and nectar and then just lay their eggs on that ball or maybe right beside that ball.

Dan Aurell [00:48:32] Not sure, but.

Dan Aurell [00:48:34] And then those larvae are going to be feeding directly on that pollen. And I believe that the young of bees are not as good at detoxifying dealing with toxins.

Dan Aurell [00:48:53] So, yes, the bees have an advantage in that to see more and more of the canary.

David Todd [00:49:00] So the wild bees turn out to be solitary and they're doing multiple functions and maybe more exposed to field, and the residues out there. Is that fair?

Dan Aurell [00:49:17] Yeah. The third thing I was thinking about is that a wild bee is going to tend to be foraging over a small area.

Dan Aurell [00:49:29] It's only one individual or maybe it's maybe there are, which they don't know my terminology here, but maybe in a small group of individuals that are cooperating. But.

Dan Aurell [00:49:43] Small area. So if you've got patchy pesticide distribution, then the honeybees might be totally fine because they are kind of getting the average dose over over their whole foraging area, whereas some native bee, some native bees or some wild bees right by a field that has a high dose, a toxic pesticide, they'll feel the full effects and maybe some other wild bees.

Dan Aurell [00:50:24] You know, the way they for.

Dan Aurell [00:50:30] That is being where they're not having those tests. So wild bees might have more of a patchy.

Dan Aurell [00:50:42] More from that, I see.

David Todd [00:50:45] OK, I see. So in that case, with the wild bees you might have sort of a patchy exposure that could miss some kind of discreet local applications of pesticides. But the honeybees might give you a more broad exposure where you might pick up more of these residues. Is that so. OK. All right. So if I'm following you right, when you go to check a colony, your first suspicion is not so much pesticides. It's more these parasitic mites.

Dan Aurell [00:51:29] Absolutely.

Dan Aurell [00:51:32] And I see hives in poor shape. I would say that two top reasons would be parasitic mites, these varroa mite.

Dan Aurell [00:51:49] And the other reason then I guess kind of if they have.

Dan Aurell [00:52:02] Quite good animal husbandry so much mites and husbandry, I would say.

David Todd [00:52:13] They're not getting enough sugar syrup. Or, I don't know. Too warm too cold. I don't know what else could be a factor. What would be poor husbandry

Dan Aurell [00:52:24] Yeah, poor husbandry I would mostly think of. Yes, starvation. If they've had an episode where they've run out of run out of sugar. Especially that really sets them back. But then also also kind of more for a little bit bigger picture issues in an operation like say they split their colonies too hard, too late. They split the colonies at a time where they split them down to a size, where where the bees are in where the colony sizes is at a level where where it's kind of precarious, whether they can they might just barely get onto that upward spiral and start growing. But they were split so hard that they're also in danger of going into a downward spiral.

David Todd [00:53:27] Can you give me an idea of when you talk about like a good size hive? How many bees would be in that? And when does it get to sort of a precarious level where it's maybe too small?

Dan Aurell [00:53:43] Great.

Dan Aurell [00:53:45] So that it depends on the time of year and the area you're in. And what kind of challenges is that colony going to?

Dan Aurell [00:53:59] Next few weeks, next few months. That's kind of that's got to be contact.

Dan Aurell [00:54:06] Enough.

Dan Aurell [00:54:09] In general, regardless of those kind of qualifying factors.

Dan Aurell [00:54:16] I would say.

Dan Aurell [00:54:18] Below five frames this colony, that tends to be kind of a precarious level where in line the going is really good then and then they might be a bit iffy.

David Todd [00:54:33] And a frame could hold how many bees do you think?

Dan Aurell [00:54:37] Yeah. So that's a bit of a bit of a squishy measurement.

Dan Aurell [00:54:44] But when I'm talking about a frame of bees, I'm say about 2000 bees per frame.

David Todd [00:54:52] So look, these ten thousand for five frames. What's interesting.

Dan Aurell [00:55:06] But tell me.

David Todd [00:55:10] No, I am fascinated by the the architecture of, and history of beekeeping. And when I've read some of these in the boxes and frame designs go back, I know mid 19th century. Is that right? I read about a fellow named Langstruth, who I guess came up with some of these ideas. Is that accurate, or have there been a lot of changes since his time.

Dan Aurell [00:55:41] Actually, Langstruth So you try the basic design like the dimensions are a little bit different now, I believe. But his basic design is still in use, I think. I don't think Langstruth. I don't believe strongly that the movable.

Dan Aurell [00:56:06] For safety or for something? Yeah.

David Todd [00:56:16] I missed some of that. I'm sorry. What it was you said.

Dan Aurell [00:56:22] Pretty standard.

Dan Aurell [00:56:29] I think there were a few designs earlier, like the leaf hive, where the frames were like on hinges, like the leaf of a book.

David Todd [00:56:40] Oh, really? OK.

David Todd [00:56:43] And that's spelled leaf. Yes. Leaves of a book.

Dan Aurell [00:56:50] I believe I believe that the leaf hive is the one that opens like the leaves of a book.

David Todd [00:56:56] OK. Yeah.

Dan Aurell [00:57:03] I think that was an earlier movable framed hive where the leaf has got.

Dan Aurell [00:57:12] Well.

David Todd [00:57:13] No, go ahead, please.

Dan Aurell [00:57:16] I think so.

Dan Aurell [00:57:20] You'd have to check on this, but I think I think Reverend Langstruth or what's better about his hives and then the precursors is that you can. Not only can you open the open the gates, open the hive to expose the frame.

Dan Aurell [00:57:40] See what's going on. But you can move frames within the colony, but especially you can move that equipment is interchangeable between colonies so that you can hide. You can take resources from one colony and swap them for frames in another colony so they can share resources between colonies or among colonies.

David Todd [00:58:13] This is this may be something quite different from we've been talking about but I remember about a generation ago, there being big concerns about killer bees coming over the Texas border from the South, Asiatic bees.

David Todd [00:58:32] I'm not quite sure what African, African bees, maybe.

David Todd [00:58:38] Yeah, Africanized. There you go. I was. And then in recent years, I have not heard much about them. Can you tell me a little bit about that situation?

Dan Aurell [00:58:48] Sure thing.

Dan Aurell [00:58:51] I mean, it's fair to say that Africanized bees kill people.

Dan Aurell [00:58:58] No, not that many people every year.

Dan Aurell [00:59:01] And the background of that, is that some? So there are several subspecies of the Western honeybee.

Dan Aurell [00:59:16] So there's a there's a named Italian subspecies. There's a named northern European subspecies. There's a named subspecies like from the mountains of Eastern Europe. And then there's a lot of subspecies there that are named from different parts of Africa.

Dan Aurell [00:59:38] And what happened in several decades ago was that some African bees were brought to Brazil by a bee researcher and they ended up escaping out of the out of their

beehives and hybridizing with the with the European stocks, you know, that had been passed all through.

Dan Aurell [01:00:20] It was mostly clear that the honeybees genetics were mostly from like the European parts of the native range.

Dan Aurell [01:00:32] But then with these few hives, there were few yes, a few colonies that were being kept in Brazil.

Dan Aurell [01:00:45] Those African genes just got out into the breeding pool and did really well in the tropical environment that took over in South America, Central America and up to through through Mexico and into the southern U.S..

Dan Aurell [01:01:07] And you'll notice that if you go check on bees like south or west of San Antonio in the rest of Texas, it's not very. Behavioral different is not. There's not really. It hasn't really affected the behavior of commercial colonies in the rest of Texas. And I think that's because these these areas that have really good resources for for bees, commercial beekeepers, just they bring in so many colonies that the breeding pool is is flooded by these more, more gentle genetics.

Dan Aurell [01:01:56] Probably probably the feral population has more more Africanized bees in it.

David Todd [01:02:08] So there's some honeybees that are kept commercially. But sort of, as you said, gone semi wild or feral?

Dan Aurell [01:02:17] For sure.

Dan Aurell [01:02:19] Yes.

Dan Aurell [01:02:21] And those feral bees, there would've been feral bees ever since the honey bees were first brought over to the Americas. They probably took a temporary hit for.

Dan Aurell [01:02:42] But it seems like there is a pretty robust feral population now, again, the.

David Todd [01:03:07] So, so many questions I'd like to ask. I'm curious, when you have bees that are weakened by these colony collapses, what do you, what do you do? Is there any sort of remedy here?

Dan Aurell [01:03:29] I mean, it depends on what.

Dan Aurell [01:03:37] Far along the.

Dan Aurell [01:03:43] Like you were like you were thinking, you know, the the most common reason that I see that colonies are collapsing is because of the varroa mite and the viruses that the mites transmit. So the first thing to do, if your bees are collapsing from viruses is to treat for the mites that transmit those viruses. So get your mite levels back down. So if it if its mites, then get your mite levels back down and.

Dan Aurell [01:04:26] I ideally ideally you still ideally it is important to try to catch that problem early, to notice it happen early, because if it is missed.

David Todd [01:04:44] We may have lost the connection here.

David Todd [01:05:00] Are you still there? Yeah. Yeah. We are here. Great.

Dan Aurell [01:05:10] Definitely get in there and. I'm.

Dan Aurell [01:05:18] And to make sure that you that they have good nutrition and have good nutrition. So. Yeah, make sure they don't run out of their sugar feed. And for probably, you're going to want to feed pollen patties as well to help them get over there. I have an experiment that I am just reading the results of. I said.

Dan Aurell [01:06:08] But set these things aside and let me get back in the truck. Yes. For mite. Sure, they got good nutrition and stimulate further population growth. Yeah. Raise more healthy bees. It's to raise honey because you're going to need these to survive through the winter. And if the bees have got in your hive right now or really compromised by mite damage and then viral damage. He's going to help your cluster maintain its size through the winter, but especially if you can get rid of the mites or get rid of a lot of the mites and then raise a couple more generations of bees that develop unparasitized. They're going to have a longer lifespan through the winter. Longer lifespans to carry your colony to keep your colony alive at a viable size through the winter. You think free from mites, make sure they've got adequate nutrition and encourage, encourage brood size?

David Todd [01:07:52] And. So make sure I understand when you're treating for my twat, what is the course of treatment? What can you do for them?

Dan Aurell [01:08:09] Are you still there?

David Todd [01:08:10] Yes, I'm here. I'm here. I'm just curious how you how you treat a colony for mites.

Dan Aurell [01:08:19] OK. Yes. So if you if.

Dan Aurell [01:08:24] OK, so miticides are the main the main method of mite control is chemicals that control mites, that kill mites. There's a range. There's a number of miticides. There are synthetic chemicals. The current one that's the most effective is called Amatrax. There are two synthetic chemicals that have been in widespread use but fallen out of use because they've lost their efficacy.

Dan Aurell [01:09:07] And those are Fluvalinate and Coumaphos and there are a couple of organic acids. So formic acid and oxalic acid that are as long as you apply them at the right dose. They are more poisonous to the. Yeah. They do more damage to the mites than they do to bees as well. Thymol has that aspect to kill mites without killing too many bees. And then the last one I have in mind is hop acid extracted from like brewery byproducts can kill mites and as well.

Dan Aurell [01:10:06] And in the long term, this is this is the long term goal is to have bees that are able to tolerate a higher mite level. So like a mite tolerance and then resistance, where behaviorally or even physiologically, they're able to suppress the mite reproduction or even

increase the mite mortality, by removing them off their bodies. Pulling out infested, infested brood.

David Todd [01:10:44] Well, this is a typical part of your work, is that you you might visit a beekeeper who's frustrated by losses in his colonies and you'll try to diagnose what's going wrong and give him a prescription or what what to do to make things better.

Dan Aurell [01:11:02] Yeah, absolutely. Yeah, that part of my job in a nutshell.

Dan Aurell [01:11:09] As well, as I would say, trying to promote communication between scientists and beekeepers.

Dan Aurell [01:11:19] So, so...

Dan Aurell [01:11:22] Oh....

Dan Aurell [01:11:27] But also, bringing, taking the concerns of beekeepers and communicating them back to people's land.

David Todd [01:11:40] Well, can you describe some examples of the kind of concerns that a beekeeper might have that an academic might want to learn about?

Dan Aurell [01:11:50] Yeah.

Dan Aurell [01:11:50] So you want one of the real struggles beekeepers that is this is mite control. And one of the biggest gaps is that there are very few mite control options that are that you can use during the honey flow.

Dan Aurell [01:12:21] While the honey boxes are on. So the development of novel food safe miticides is a really high priority for beekeepers.

David Todd [01:12:37] Mhm.

David Todd [01:12:41] And did you say when you were speaking just a moment ago that that you're doing some experiments yourself?

Dan Aurell [01:12:49] Oh, yeah. Yeah. What does that. So that was actually just doing an efficacy assay, a field efficacy assay of Amitraz.

Dan Aurell [01:13:04] You take 300 bees, you scoop them and scoop about three bees into a plastic food container and set it up with a screened lid so that when you turn it upside down, the the screen is on the bottom and a strip that contains this miticide Amitraz in the jar. So the bees are crawling in the jar. I think that the mites that are riding on the bees are also contacting that strip.

Dan Aurell [01:13:42] And then there's kind of a tray underneath that catches any mites that might die.

Dan Aurell [01:13:51] So it was just testing to see how many how good that dose of Amitraz is at killing the mites that are riding on the bees. Are 100 percent of the mites going to die or are just 50 percent? That sort of thing.

David Todd [01:14:09] I see. Looking for a different way of delivering the miticide and then you're trying to see what the efficacy of it is.

Dan Aurell [01:14:18] No, it's actually a standard, standard miticide formulation. But I'm not just a test to see whether the mites are how susceptible they are or if they're developing some resistance to the chemical.

Dan Aurell [01:14:40] I see. OK. So that resistance can grow over time and get to be more of an issue?

Dan Aurell [01:14:48] Yes, there are early indications of Amitraz resistance right now.

David Todd [01:15:02] Hmm. Gosh. So do you see any overlap between concerns about bee problems and colony collapse and insects more broadly of, you know, whether it's butterflies or moths or beetles?

Dan Aurell [01:15:21] Yes. I think one of the major sources of overlap that comes to mind right away, I guess, is overlap. Most overlaps the most with other pollinators, and that is that.

Dan Aurell [01:15:49] The areas into a landscape that really doesn't have very many floral resources in it. They call that a flowerless landscape. So that is that the problem for bees.

Dan Aurell [01:16:09] And along along with that same change that I suppose we've lost, a lot of habitat for certainly other pollinators, but probably also a lot of other insects that just. Yeah. But just live in uncultivated area.

David Todd [01:16:34] The problem is that there are these monocultures where there just aren't a lot of forbs or what's going on?

Dan Aurell [01:16:43] Yeah. I think one thing that changes is the increase in herbicide use, especially with the introduction of herbicide, herbicide-ready, Roundup-ready crops. That reduces the amount of weeds in the fields. Which is good for the efficiency of farming operations. And it's also I mean, it has benefits for soil conservation to be able to do no-till farming. It's a little bit, see it as being a little bit complicated. But yeah, I know. But I think that I think part of why why why weather a lot less flowers in places like the Northern Great Plains.

David Todd [01:17:34] Its just a very evocative kind of term, flowerless landscape.

David Todd [01:17:44] I hadn't heard that.

David Todd [01:17:47] It does give me a vision, I guess.

David Todd [01:17:55] Well, well, you've been very generous with your time. I'm wondering if there are other people that you might suggest I talk to or things I might read about apiculture or you know beekeeping in Texas. Would be helpful.

Dan Aurell [01:18:17] I guess I'd love to hear a little bit more about your interest, actually. Like what? What, what? What's the direction of the book you're working on? I will. I love your

questions. And I think you're right. I definitely think that depending on what you're looking for, set up to give you different names.

David Todd [01:18:43] Well, sure. So I'm an environmental attorney by training and I've run a little nonprofit called the Conservation History Association of Texas for about 20 years now. And we have done a couple of books about environmental history, one which was oral history based and was about people and the environment. And the second was an atlas. It was more about place. And then right now we're working on a third volume that's about animals. And what our kind of framework or relationship with animals can tell us about environmental history. And and I think that bees are such an interesting creature because, you know, they, as a pollinator they have so much to do with agriculture. And so in my view, you know, they can tell you a lot about very big economic and cultural systems, and then their own biology and natural history, is so fascinating, too. And the culture of beekeeping is really interesting to me. So I think that it's a chapter in the book because it, you know, can be a true indicator for lots of other historical issues. And the thing that that, I guess intrigues me, is that there aren't a lot of people who follow insects as closely as beekeepers do. And so. Yeah, but, you know, beetles, I guess, rule the world. And insects are a close second. And I just really wanted to visit with someone like you who's been living that life and can tell me from up close.

Dan Aurell [01:20:48] Yeah. I. I. You know, I've only been to Texas for for three years and I don't have the long, long view, but I factor, but I'm sure there are some really interesting stories even about the development of the beekeeping industry in Texas.

David Todd [01:21:16] Yeah. Yeah. Love to hear.

Dan Aurell [01:21:19] And I mean, isn't it? It's interesting for us through the lens of conservation that the honeybees that we keep are are not native.

David Todd [01:21:32] Right.

Dan Aurell [01:21:32] What do you think about that?

David Todd [01:21:36] It is peculiar, you know. And there's a whole vein in this book about exotics versus natives and that tension. And I guess you've got honeybees and ground bees, you know, what, there hundreds of wild bees from. Are they two very separate worlds or just kind of overlaps their spheres between the native and introduced commercial bees? I don't know.

Dan Aurell [01:22:08] Yeah.

Dan Aurell [01:22:08] I think that they have a lot in common, but also many differences.

Dan Aurell [01:22:16] And just just like you're saying, beekeeping that that's one of the areas where people have a really intense relationship with insects. They have some fascinating, fascinating people who who move their families across the country.

Dan Aurell [01:22:39] I'd be interested to know when those large scale migrations started. Was it with the creation of the interstate system is that when beekeepers started started putting their bees on trucks that could hold, you know, hundreds of hives. A name that I would suggest for the for kind of maybe a view into many decades of Texas beekeeping history would be Morris Weaver. I think it's M O R R I S, I guess. Weaver. I don't think I have any sort

of contact information for him, OK? But I think he was president of the American Beekeeping Federation for some time.

David Todd [01:23:34] I'd be fascinated to talk to him. Is he based in Texas or elsewhere?

Dan Aurell [01:23:38] Yes. The Weaver family is a Texas beekeeping family. I see.

David Todd [01:23:43] You know, it sounds like he's not the first that maybe others in his family have been in beekeeping.

Dan Aurell [01:23:51] Yeah. Yeah. The Weavers have been beekeeping for a long time. The present day Weavers are maybe not representative of, like Danny Weaver, going by the business name Bee Weaver is probably not representative of the kind of, the commercial beekeepers there. They're selling a lot too. Yeah.

Dan Aurell [01:24:27] They're doing more like a lot of retail and raising and raising specialty queens.

David Todd [01:24:43] But I guess Morris's son I guess.

Dan Aurell [01:24:47] I don't know exactly. Maybe grandson even I see or a nephew or I'm not really sure.

David Todd [01:24:56] Yeah, next generation though.

Dan Aurell [01:24:58] Yeah.

Dan Aurell [01:25:02] For, as far as an older migratory beekeeper, Martin Brady would probably be someone to talk to.

Dan Aurell [01:25:17] And then someone else you might want to talk to is one of the bee inspectors who's been doing that for quite a long time. His name is Bill Baxter.

David Todd [01:25:31] Can you please repeat that. I'm sorry.

Dan Aurell [01:25:34] Bill Baxter. Bill Baxter.

David Todd [01:25:40] And I guess he's down in the valley, maybe.

Dan Aurell [01:25:43] No, he's based his base close to Dallas.

David Todd [01:25:48] I see. OK.

David Todd [01:25:56] This is really helpful. Thank you.

Dan Aurell [01:25:59] I think someone has written a book on a fairly recently about the history of American beekeeping.

Dan Aurell [01:26:08] And I want to read that book. But I know I should.

David Todd [01:26:12] I should looked it up on.

Dan Aurell [01:26:18] So I can we can we can connect by e-mail shortly.

Dan Aurell [01:26:25] I can give you some contacts for at least a couple of those people.

David Todd [01:26:29] Lots of great stuff later. Yeah. Well, you've been super kind to share all this with me and a great introduction. Thank you so much.

David Todd [01:26:43] You're very welcome. If anything comes to mind, you know, pop me a note and I will certainly want to follow for you and learn more. Thanks, Matt.

Dan Aurell [01:26:55] Good. I guess just to make sure that I don't leave a gap. I will.

Dan Aurell [01:27:02] I do kind of want to mention that I think what I emphasize is that the varroa transmitted viruses are really a huge issue for bee health. To kind of fill in that picture that want. One point is that when varroa first came over to the US, colonies could handle quite a high level of mites and still, still be relatively healthy. But today. Yes, from '87 until the present day, the viruses have at least the deformed wing virus has evolved to become more more virulent. So the tolerable mite level was fairly high when the varroa had recently arrived. But that level of varroa level that a colony could tolerate has steadily got lower and lower and lower.

David Todd [01:28:07] Huh. That's fascinating to think what might be at play there. Well, I met a really interesting life trying, you know, on the one hand try to help people, but also just the intellectual puzzle, figure out what is going on with these very complicated creatures.

Dan Aurell [01:28:31] It's definitely, definitely fun to work with people who are really rely on these on their beehives for their life.

David Todd [01:28:43] Well, thank you for helping them and helping me. It's been a pleasure talking to you. And let's just keep in touch. I, again, very appreciative of what you've done for me.

Dan Aurell [01:28:56] I know it's been a pleasure. I'm looking for it. I read a little little paragraph about about this book with more of a geographical perspective that you were involved in that I was interested in. And take a look at that.

David Todd [01:29:15] So. Thank you. Yeah. That was fun. And this next book is proving to be really interesting with help from people like you. So thank you. Drive safe. And, you know, take care. Have a good Thanksgiving.

Dan Aurell [01:29:32] Same to you.

David Todd [01:29:33] All right. Goodbye.

Dan Aurell [01:29:36] By David.