



Sarah Beck: You're listing to Garden Futurist. I'm Sarah Beck, here with Adrienne St. Clair.

Adrienne St. Clair: Today we'll be talking with Matt Ritter, who—among other things—has been working to characterize urban tree data across all of California.

Sarah Beck: Adrienne, we hear people use the term “big data.” What are we talking about when we're using this term?

Adrienne St. Clair: Big data is this term referring to large data sets of information that could be analyzed to show us trends or patterns. And it isn't really until the last 10 or 15 years that we've had the computational power to analyze such large amounts of information all at the same time.

Sarah Beck: So in the case of trees—in our towns and cities, in our urban spaces—why big tree data?

Adrienne St. Clair: Collaborative data like Matt's is super exciting. So first, he's illuminating the current state of our urban forests. This can tell us about what trees might work well in an area, or what trees worked well in an area 10 years ago, and where we're lacking in tree canopy and diversity. That's essential when improving equitable access to nature across our urban spaces.

Sarah Beck: So our understanding of what we currently have in our urban forests helps us make informed decisions for the future.

Adrienne St. Clair: Right, and the possibilities for future research are almost impossible to imagine. So current datasets may be used to answer questions that we don't even know we have yet. There's this example of floral data that was taken by Thoreau in the mid-1800s, and it's teaching us now about climate change. So what might our future selves learn about cities from these data that Matt's collected?



Sarah Beck: Let's listen to what Matt has to say about how knowing what trees we have and where trees are can help us understand what trees we want to have in our climate-resilient cities of the future.

Dr. Matt Ritter is a professor in the Biology Department at Cal Poly, San Luis Obispo and director of the Cal Poly Plant Conservatory. He is an author of many books, including *California Plants: A Guide to Our Iconic Flora*.

Welcome to Garden Futurist, Matt.

Matt Ritter: Thanks, Sarah. I'm happy to be here.

Sarah Beck: Oh, I'm so excited. You have been in database mode, lately.

Matt Ritter: Tons.

Sarah Beck: Maybe you always are. I don't know.

Matt Ritter: I'm always sort of in database mode or making lists. I just thought recently, "Matt, what you do for a living is make lists and teach people how to read lists."

Sarah Beck: I like that though, because that actually fits the game where you have to explain what you do to a 10-year-old.

Matt Ritter: Right, right.

Sarah Beck: Maybe even an 8-year-old. My 8-year-old would be like, "I totally get that."

Matt Ritter: I make lists of trees for a living.

Sarah Beck: Well, you have said that a really important question is what trees should be planted and where they should be planted in the future. I



want to point out that you've spent a significant time looking to understand what trees there already are.

The California Urban Forest Inventory is a collection of everything known about what trees are currently growing in California. Why is this inventory so important?

Matt Ritter: I'll mention first of all, the California Urban Forest Inventory project, what we've done is we brought together data from a whole lot of collaborators that are either public or private partners because there are a number of large and important private companies in California that do tree work. And one part of what they do is they do inventories for cities or neighborhoods or municipalities in one way or another, and they agreed a number of years ago to share that data with us. So now we've put together about seven million data points, meaning, "A tree is here, we know what species it is and we know how large it is."

And that is a really powerful database, which we're calling in California Urban Forest Inventory project, and we have created a website in which we deliver it to the public in a way that they can use it to figure out what's growing where and what's growing in cities and so on.

Really, we need to know what is currently successful and performing well in California. If we don't have an inventory, we can't do that. We have no baseline data to recognize change in the future. We don't know what trees are living, what trees are dying, which trees are—in certain parts of California—getting bigger, all the questions. As soon as you assemble seven million data points about trees in California, you can just answer so many questions and ask so many questions about what is growing where.

Certain species of plants become popular, and then they sort of disappear out of the horticulture trade, and we can actually see trends of certain species of trees based on their size, moving through the California urban forest. There's a lot of trees that were popular, let's say in the 1970s and '80s, and they were planted everywhere. Now they're all a certain size and nobody plants them anymore. And where are they? Are they still



successful? Are they growing well? Those are all cool questions you can answer when you have a massive inventory.

Sarah Beck: It's incredible. First of all, the number of data points, that is mind blowing, but there are so many interesting specific metrics in there. I really enjoyed looking at the diameter of trees, the native range, percentage of the trees that have an origin from specific parts of the world, and the water rating distribution.

Could you just walk us through a couple of really specific applications for some of the future decisions that might be made based on a couple of these metrics?

Matt Ritter: Yeah. What you're talking about is that we've taken the inventory, and we've taken each individual species in the inventory, and we've aligned to that with species characteristics.

So you could, for instance, dial up the city that you live in. You could see what are the species that are in the city you live in? What are the characteristics of them? Are the city trees in the city you live in more deciduous or more evergreen, for instance?

Sarah Beck: Right.

Matt Ritter: Are they typically more drought tolerant or less drought tolerant? As considered by this other service we run, which we'll talk about, called SelecTree, which is a database of tree characteristics.

So if you take the database of where trees are and you connect it with the tree characteristics, where do the trees in your city come from? All of these kinds of things are really great information points. And then, who's using this tool and how are they making future decisions?

Well, who's using this tool are usually city arborists, managers of urban forests, anybody interested in what's growing in their cities and what trees



are performing well and what trees aren't. If you're a city manager and you look up your city and you see that, let's say—of the 400,000 trees that are in the city that you have inventory data for—half of them have a high or medium rating with regards to water use, right? Well, that's something to focus on.

In order to make decisions about what to plant in the future, you have to know what you currently have. And people could know how they're doing with regards to diversity with how many different types of trees do we have? Is our urban forest made up of too few number of species of trees? If that's the case, then that's something to address.

Sarah Beck: Oh, absolutely. And that's actually the next thing I wanted to ask you about. I love that within this database, there are these pie charts that show distribution of genus, family, species.

I recently had a couple of people on the show who have really focused on keystone species for California and the West Coast, and the oaks just keep coming up. For good reason, and hopefully this is not just like another one of these '70s and '80s trends, like you talked about, because obviously there's a lot of ecosystem services being given by the oaks.

I do want to ask you, because we're able to look at these data points, I think the dashboard really nicely gives you this visualization tool: might we someday build a formula for what a city needs? Is there the right amount for each of these dashboard points, in order to support biodiversity?

Matt Ritter: Yeah. I hope so, but I also hope that all those decisions are going to be made locally. Statewide formulas or any formulas in general, don't really work for California.

California is so different. The kind of trees that need to be grown for the future of the urban forest in Sacramento are so vastly different than the urban forest in San Diego.



And what species of oaks—if you want to just talk about oaks—should be grown in San Diego are not the same species of oaks that potentially should be grown in Sacramento. And so local formulas associated with, “This is what we as a city or a community or some municipality are looking for for the future,” and making lists, revising those lists constantly, always thinking about what kind of diversity is out there to make our urban forest more resilient, go for a certain target associated with diversity and try to fight against species bias.

I see so much species bias out there, and that is that people want a certain species because they think it's beautiful. They've heard that it's native and they like that aspect to it. They've heard that other people like that tree, so they must like it. All kinds of stuff, right?

What we're trying to do is not care too much about that and care about performance. What is actually performing well? We have 40 million people in California, give or take, and they mostly now are all living in cities, and they need trees. They need shade, they need all the benefits associated with trees.

And we've discovered—along with a lot of other research groups, recently, in mapping projects about canopy cover—that it's not evenly distributed. There are disparities with regards to income and so on with where the canopy cover is.

Sarah Beck: The shade equity concept, right?

Matt Ritter: All of that stuff, right? So these decisions all have to be made at the local community levels about what trees is this community interested in growing for the future and should we be going for diversity in urban forests? I believe we should because diversity is resilient. Diversity's beautiful. Diversity is interesting. Those are all reasons why I think that local decisions are what we should be trying for and not statewide formulas and so on.



Sarah Beck: It would be interesting to hear how you think individual gardeners and community members can contribute to this conversation. Can an individual in a community have impact on the overall tree makeup of their own town, as gardeners, or even as advocates being involved in these municipal decisions in some way?

Matt Ritter: One hundred percent. We are in environmental crisis right now in many parts of California and the world. And you hear about it all the time—biodiversity crisis, climate change, and so on—and people often feel helpless to do anything about that.

I think urban forestry, and planting trees in cities, and getting involved in local politics and nonprofits and volunteering associated with the trees in cities is a great way to make a little bit of change in your area.

And so to your question, can gardeners or people who are interested in plants do anything yet? Yeah. They can plant trees. They can advocate for diversity. They can advocate for helping the city.

Oftentimes in cities—San Luis Obispo, where I live, is probably no different than most cities in California and other places—urban forestry is underfunded, and they need help from the public in most places. Most cities that do really well with their urban forestry often have a nonprofit that helps them. A good example would be Friends of the Urban Forest in San Francisco, or Canopy in Palo Alto, and these types of organizations. They exist in most cities, and they're ready to receive volunteers that are interested in getting out on the weekend and digging a hole and putting a tree in the ground.

It's not always easy work but it's fun and rewarding work to have planted trees. Here's the statistic I've heard recently: that if you are just an average American, and you're going about your business spewing carbon into the atmosphere, how many trees do you need to plant a year to offset the amount of carbon that you put in the atmosphere as an average American?



And the answer is somewhere around 80, and they need to be planted where trees don't exist.

Sarah Beck: And they need to survive, right.

Matt Ritter: Sarah, how are you doing on your 80?

Sarah Beck: Oh my gosh. Matt, I've got to go.

Matt Ritter: Yeah, you've got to plant some trees.

Sarah Beck: It was nice talking to you, but I have some things to do.

Matt Ritter: You can, though. You can go out on a weekend, and you can volunteer for a local organization. And you can do your part to plant the trees that we need.

There is controversy associated with what trees we should be planting and where we should be planting them. There are worldwide organizations that are making massive efforts towards tree planting, but there is no argument out there that should say that you should not be planting trees, or you should not be thinking about where to plant trees, and all of these kinds of things.

There's no solution to climate crises that is not going to involve planting trees, these awesome machines for sequestering carbon out of the atmosphere.

Sarah Beck: And it's a pretty enjoyable pursuit. I mean, it's some work, but we spend too much time at computers anyway. It's good to get the calluses or maintain them.

Matt Ritter: I agree, I agree.



Sarah Beck: Oh, I do have one quick question that occurred to me, because you have all of these data points from inventories. As a citizen, is it possible to find out if your own town has a recent inventory through the system and are some of them still in need of being done? I know for a fact that these are not cheap. Some big labor is involved.

Matt Ritter: On our inventory service, if people look up California Urban Forest Inventory, you could see your city, what you can't see is the date of the inventory. There are reasons why we couldn't put the date. Also, as soon as you do an inventory, it becomes out of date immediately, because change is happening in all cities.

But some cities unfortunately have very old inventories, and they actually have no handle whatsoever on what is growing out in their urban forest. And that's another thing that people can advocate for because there are statewide grants for cities to hire organizations to do inventories for them and all of that.

“Do we have a city inventory? How recent is it? How complete is it?” is questions that I think citizens should be asking for and asking their cities for.

Sarah Beck: Let's talk about another one of your lists, your many databases. You coordinate the California Big Tree Registry. What can tracking our biggest trees tell us about the future? I love the charismatic megafauna conversation.

Matt Ritter: I do, too. So the California Big Tree Registry, just to clarify it, is a list of the largest individual of all the species in California. We have 112 native trees to California, and each of those has a largest known individual. It may not be the largest individual, because obviously our forests are massive and people haven't been everywhere, but there are people who out there who go out there and they hunt for the largest individuals, and they know where many of them are.



It's an impressive list of really cool, massive trees. The largest individual is based on a point score. The diameter of the tree, the height of the tree, and the canopy cover of the tree, all added up give you a point score, and that gives you the largest individual.

The point of doing that, and why I'm interested in that registry and why I agreed to become the coordinator for it is that people love records. People love big, impressive things. You just said it, you love the charismatic megafauna.

We have nominations. Anybody from the public can nominate a tree. There's a form to nominate a tree. And then, either myself or some other forester, CAL FIRE foresters are willing to do this. They go out to the tree, they verify measurements. And we have nominations from elementary school classes, from people who are professional arborists, from people who are just community members and are impressed by this massive tree that's in their community.

It's a really great story that people can rally around: "We have a big, impressive old individual." Some of these trees, obviously, are the largest in the world. We have giant sequoias (*Sequoiadendron giganteum*) on that list, and coastal redwoods (*Sequoia sempervirens*) that are the biggest trees in the world.

It's impressive, and we tell people where they are, some of them. Some of them are private and the owner doesn't want the location known by the general public, but for the most part, people can go and see them.

I love the idea of stoking people out on trees in general, and I think it's a very quick route to doing that.

Sarah Beck: Oh, I totally agree.

So in this prediction mode, I'm curious if you think there are going to be changes in which species become champion trees in the future? I know



this is sort of fraught when we talk about like the coast redwoods. I get that there's a lot to talk about with climate change, but do you think that there is something to be predicted about future champions?

Matt Ritter: Yeah. And I'm going to be honest with you, Sarah, that it's been slightly depressing over the last 10 years being the coordinator of the Big Tree Registry. The reason why is we've had such large fires and we've lost a lot of champion individuals. Things that were incredible.

There was a madrone tree (*Arbutus*) in the upper Carmel Valley that was so much bigger than any other madrone and just so old and impressive. And that thing died in a fire in 2016. We've lost many giant sequoias in fires recently.

When you have massive fires, they burn through forests. And some of the trees in those forests are really impressive, and sometimes they recover, and sometimes they get killed outright. A cool thing about the big tree registry is actually, CAL FIRE sometimes pays attention to it and they know where some of the big trees are and they do some effort to protect some of those trees.

Sarah Beck: They take the foil, right? They've got the foil wrapping that they put around them?

Matt Ritter: Yeah, you know, that's more PR than actual firefighting, to put foil around the big tree.

Sarah Beck: It's really cool, though.

Matt Ritter: No, it's cool, and I think the PR part of it is interesting, that they are trying to make an effort to protect the largest oldest individuals because we value those, and we value them as culturally important resources, and so on.



Change is afoot. Baja California is marching toward Oregon and its only tool to get there is fire, and that's happening all around us with so many fires every summer. We're losing some of our massive trees.

Are we going to get change in the future? Well, Sarah, it's all you can count on, is change in the future. Take a good look around at many of California's forests, because they aren't going to be the same in 50 years.

Unfortunately, some things that are happening in which we're getting regime change with vegetation, in which you get very hot, very intense fires, burning forests, and then trees not recovering there in that spot, and instead you get chaparral or grassland recovering in that area.

Not only does that put a ton of carbon back in the atmosphere that was sequestered in the bodies of the trees in those forests, but it also makes the forests go away. And we, in our deep evolutionary history as humans, love trees and we love forests and it's hard to see it happen.

Sarah Beck: Let's talk about tree selections for the future. I do want to get into the SelecTree tool. What you were saying about that movement from Baja California upward, if there's an optimistic view of that, are we able to dive into some of the tree selection that could have that potential for success? If we think of like, "What's the champion tree of a couple hundred years from now," might we start getting some clues about what those should be?

Matt Ritter: Yeah. There's a lot of people working on that problem, and my research group is one of those. The question is and the problem really is that if the climate in our cities is going to change over the next, let's say 40 to 50 years, in a significant way that affects plant growth, what are the best trees to be growing in those cities so you get success?

The things we've always grown and planted are not going to be successful in the future as California gets hotter and drier. And so, colleagues of



mine have looked at sister cities that are hotter and drier than the ones in California, and what trees are being grown there.

We're doing a lot of modeling of climate in the native range of species to predict how they're going to perform in the future in cities in California. There's a lot of different techniques to figure out, “What's the best trees to select for the future for California?”

It's a complicated question. Soon as you get humans involved in selecting from a group of things, right, which is all the trees that are available. Soon as you get humans involved in that, aesthetics becomes important. How peoples feel about them culturally becomes important. What we hold as culturally important and sacred also becomes important. And the provenance of a tree, where it comes from, is something that people have as an idea of what's important. All these things then get mashed up together in a tree selection model. And that's what's SelecTree is, in a way.

Imagine a database of about 1,800 species of trees. It's an interactive database where you can go onto the website. You can select the trees by characteristics. Say you wanted a tree that doesn't grow any larger than 30 feet, makes red flowers and is evergreen. Now we're starting to be able to put in additional characters, like it is a drought-tolerant tree, it is what we consider—and we put all the metrics on there—a tree important for biodiversity, or a tree important for climate change futures, all those types of things.

You can put those in, and then it queries the database, and it spits you out a list of potential trees that would work for the situation you're talking about.

It works for landscape architects, but it also works for homeowners. A lot of trees get in the landscape in California because people plant them in their front and back yards. We did a project not so long ago in which we connected it to nurseries. So there's a nursery connection project in which you could see nurseries where that tree was available.



Sarah Beck: You bring up a really interesting point about industry. It's hard for a nursery to make the investment in propagating a lot of something if they don't feel like people are going to see it, but then you have this opposite problem of people are all getting excited, using a tool like this, and finding trees and then going, "Oh, nobody around me has that."

Matt Ritter: Yep. Unfortunately, in California and everywhere, this is true. We have a cycle of less and less diversity in trees, and the reason why we have that is because it's not easy to run a nursery and you have to actually sell the things you grow. It's a massive amount of investment of resources for a business to get a tree to the size in which a homeowner would plant it. And the last thing they want is a homeowner not knowing what it is, not caring about it, not wanting to plant it, and then they lose a crop because nobody's interested in it.

If you think about that, that creates a situation in which people's ignorance of what a species is becomes really important for that nursery. Growing trees is easy, selling trees is hard. And so the nurseries are trying to figure out ways to sell those trees.

In SelecTree, we're also trying to break that cycle. The way you break the cycle is you convince people that certain species are good for the future, and then you partner with nurseries to grow those trees and make them available for people to get when they need them, and you point to botanical gardens and arboreta and all that.

That's why botanical gardens and arboreta and university campuses are all so important for tree selections, because places like that, the stakes are relatively low. You can plant a bunch of trees. Some of them will fail. Some of them will succeed and they're experimental grounds for what species are great for the future.



Sarah Beck: I really love how enthusiastic Matt is about how gardeners can get involved in urban forestry efforts

Adrienne St. Clair: Yeah, the conversation made me wonder about my own city's tree inventory, which it turns out was started in 2010 and there's even these virtual tours of trees in city parks.

Sarah Beck: Oh, that's so cool. There are so many ways we can be good advocates for our urban trees—things like knowing whether your town or city has a recent tree inventory or needs one, and he challenged us as individuals to offset our carbon impact

Adrienne St. Clair: Yeah, I feel like once he suggested it, I now have a new personal goal for this year.

Sarah Beck: No kidding. We need to get working on this.

Adrienne St. Clair: Eighty trees, here we go.

Sarah Beck: Here we go, 80 trees.

Adrienne St. Clair: Hey Sarah, I looked up the smallest biggest tree in the database.

Sarah Beck: The smallest biggest tree?

Adrienne St. Clair: Mm-hmm. It's called the littleleaf elephant tree (*Bursera microphylla*) and it grows in the Sonoran Desert. It's only 12 feet high and it has a trunk diameter of 21 inches.

Sarah Beck: So that is enormous for that tree.

Adrienne St. Clair: It's a really big little tree.

Sarah Beck: A giant baby tree. Oh, that's amazing.



If you are interested in how to use the SelecTree tool, check out Pacific Horticulture's recent [how-to video](#) on our YouTube channel with Jenn Yost.

Resources

Follow Matt Ritter through his [website](#) or [@slowplants](#) on Instagram.

[SelecTree](#)

[California Urban Forest Inventory](#)

[California Big Tree Registry](#)

[Cal Poly Plant Observatory](#)

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