PLANT PEOPLE Season Three Episode Three "The American Chestnut with Michael Goergen" Transcript

Jennifer Bernstein Narration: Chestnut trees once covered much of the wilderness of America's Appalachian range numbering an estimated 4 billion at their height. And those trees, which grew edible nuts that you might know from a famous holiday tune, were at the center of a thriving industry. But, an uninvited fungus tagging along on an imported tree landed in the United States in the early 20th Century and kicked off a catastrophic blight that would utterly decimate the chestnut population in North America.

More than a century later, chestnut blight still lurks in our forests, making it nearly impossible for saplings to live long enough to produce fruit. Some say the species is effectively extinct, but can it be saved?

Welcome to Plant People. I'm Jennifer Bernstein, CEO, and the William C. Steere, Sr. President of the New York Botanical Garden.

On today's episode, how The American Chestnut Foundation led by our guest, Michael Goergen, is using clever advances in breeding and plant science to give this majestic icon of American forests a second chance.

Jennifer Bernstein: Michael, welcome. We're so happy to have you.

Michael Goergen: Oh, I'm thrilled to be here. Thank you, Jennifer.

Jennifer: And I'm glad that you've had an opportunity to spend some time on our grounds today.

Michael: Spectacular place.

Jennifer: That's great. So, Michael, more than 120 years ago, the American chestnut tree population was nearly wiped out by a fungus.

Can you take us back to 1904 when the blight was discovered? How did it all happen?

Michael: Yeah, it's really interesting. And of course, this is not necessarily ground zero, but it's where the science started. That's the most exciting thing about being here today at the New York Botanical Garden.

In 1904, a forester across the street at the Bronx Zoo discovered a strange canker on a chestnut tree. And he took a sample of that canker and brought it over here, to a scientist named Dr. Murrill. And he was able to identify the parasite that was infecting the chestnut tree and causing this tremendous damage. And what's really interesting is because of the science that was produced here, we actually tried to stop it. Of course, it wasn't possible because it was such an aggressive parasite, but it gave birth to organizations like The American Chestnut Foundation that are here to try to change the trajectory of this particular species.

Jennifer: Yeah. By the time Dr. Murrill discovered the fungus and named it as a new species, it was already pretty well established in the forest.

And so it was far along. We actually have the herbarium specimen of the original that was used to identify the species. It's one of the important historical artifacts we have in our records.

Michael: I'm so looking forward to seeing it, it's *Cryphonectria parasitica* that was named by a scientist here at the Botanical Garden.

Jennifer: That's right. So, you're relatively new to The American Chestnut Foundation, I think you started this past August. Is that right?

Michael: That's right. Yep.

Jennifer: Tell us a little bit just about yourself, your career, and how you're thinking about this next phase at the Foundation.

Michael: So, I come to the Chestnut Foundation from a long path in forestry. Grew up in Buffalo, New York, right along Lake Erie and was obsessed with water quality. And realized so much of water quality really begins in the forest. And I was hooked and got involved in trees and really found myself at the Chestnut Foundation because we are embarking on a science called recurrent genomic selection. And RGS, it's not a novel technique. This is how we've been able to do so much in agriculture to be able to produce the kinds of gains that we've seen for our food systems. Whether that be corn, of course, we all know the story of the breeding that occurred thousands and thousands of years ago to get us corn. Or even to some of the modern advances we're seeing today for example, Loblolly pine, a really important species in the southeast United States.

We used recurrent genomic selection for that tree species. In addition, to being able to fend off diseases better and insects better, we're able to produce a 50% volume gain on the same acreage from those trees. You think about that from a carbon sequestration standpoint, what a wonderful tool that we've got at our disposal to make sure that these are super trees that meet our super problems of tomorrow, and we can start today to make that happen.

Jennifer: Can you explain for a lay person, how does RGS work?

Michael: Yeah, so we're doing a…it's a little bit more than the traditional RGS program. RGS is best on best breeding, where we're looking at the parents and really doing some analysis of understanding what these parents can contribute to the offspring so that we're getting that next generation to be stronger, better, and more fruitful.

And so, you know, this has been used in agriculture. I'm not gonna judge it, but this is how we get a chicken in three months, right? This is the kind of science that went into the production that we're able to really improve our systems. So in the tree world, what we're doing, particularly with Chestnut, is not only are we looking at those parents, but we've got a problem, right?

Chickens breed pretty quickly, trees don't. It takes at least seven to 10 years for us to get pollen from some of these trees. So, what can we do to accelerate that process? Well in our RGS program, we actually look at the DNA of these trees and try to understand what their resistance is going to be before we do anything with them.

And so, before we're planting, we understand what their genetics are and we're able to predict their resistance to blight and put them in the ground. And the worst thing is this species is so hard, and like I said, it's seven to 10 years.

We're dealing with chestnut blight that was identified here, but we also have Phytophthora in the south, which is causing us problems with the roots that we've got. This is a species that doesn't self-pollinate and is very difficult to graft, so we can't bring a fruiting branch down to the ground to actually make our life easier. We're bucket trucks. We gotta get up there and do the work up in the canopy. It's a very challenging tree, but it's worth every moment.

Jennifer: Well, that's a good bridge to why should we focus on the American chestnut? American chestnuts have been described as a keystone species with outsized impact on their ecosystem. So, tell us a little bit about just how

important the American chestnut was to native wildlife as well as human communities when it was prevalent.

Michael: The chestnut is an incredible story because it's really provided food for humans and wildlife. That's kind of rare from a tree species. We don't often find that. And what's really exciting about it too is that it provided that food at a time when it was difficult, right.

Fall, when we're overwintering. And if you look at our Native American communities in the United States, the Haudenosaunee, formerly known as the Iroquois. The Seneca Nation is very close to where I grew up. They called the tree a cousin. It was that important to them.

It was family. It nourished their entire system, that chestnut tree. And in addition to that community, if you look at turkey and bear and deer, all of those species were using chestnut constantly in the fall. Blue Jays, and believe it or not, passenger pigeons were relying on chestnut trees too.

And so, if you look at population declines and wildlife, you can actually track it. There's what I call a math gap because when we lost the tree, there were probably seven to 10 years or so before oaks really could fill that niche or hickory, where we got some other seed mass that those animals could rely on.

Of course, humans could never rely on that math. And you look at turkey populations and deer populations in the twenties and thirties, and that's when the decline really started to happen in a big way. Now, there's other pressures, traditional habitat loss, and other problems associated with hunting, but at the end of the day, this contributed to that, and it was critical for Appalachia.

So, for a region that wasn't necessarily wealthy, to be able to go out and harvest food from the earth and be able to have that as winter stores for your family was incredibly important. In Appalachia, they called it a “cradle to grave” species because in addition to the food supplies, it offered wood for their cradles and wood for their coffins.

Jennifer: So, really a critical species and it makes sense why there's been such energy around reestablishing it. We can't restore the forest of the Eastern U.S. back to what it was in 1904, of course. But, chestnut restoration today would have a lot of benefits. So, can you talk more about why and how introducing chestnuts could improve today's forest ecosystems?

Michael: Yeah, absolutely. So, what we're trying to produce: an enduring chestnut will last out there in the woods, and you're exactly right. Today's ecosystem is not what it was. Climate change is impacting us and we need to be preparing for all of those changes in our forest management systems. And so, the work that we're doing is gonna benefit other species too.

But, why is chestnut so important for the environment? You can look at what it does on mine land to really understand its potential. So, in really beat up mine land areas, we go out and we plant chestnut in a mixed hardwood system. And the chestnut is an incredibly fast growing species. Fastest growing hardwood that there is.

And then once we start getting burrs and fruit…The burr is the protective shell that's around the chestnut itself. And that burr leaves a tremendous amount of litter on the ground. So, between leaf litter and burr litter, you're getting a wild amount of soil production on land that's incredibly degraded.

And chestnuts, for whatever reason, love that sort of bad, mine, rocky soil, and were improving soil quality. And here's the interesting thing from a forestry perspective, you know, chestnut's hard. I tell folks, please don't name your trees because there's a potential that some of them are gonna die.

We're producing really, really good blight resistant trees, but they're not all gonna be able to survive the blight. But, the thing that's exciting about it is they will die and those oaks will come up into the canopy around them too.

So, we're releasing the oaks at the right time because the chestnuts will spend 10, 15 years doing their thing, creating great soil, and then the oaks will come up and fill the space and be able to provide that mast for animals as well, because the soil's improved from the work that the chestnuts were doing for us.

It's a great tree. I can't wait to get it on the landscape.

Jennifer: Yeah. We don't talk enough I think about ecosystem function and we think about the way that we relate to a tree or the way that, maybe animals relate to a tree, but they're affecting every layer of the ecosystem in ways that aren't always perceptible to us.

Right now we have a program in our science division called Plans for Climate Resilience. And part of that is about looking at how we can restore degraded landscapes. And, of course, it's gonna depend on where you are in the world and

what's available. And there are a lot of issues having to do with the nursery trade and how to get stock and all sorts of conundrums to overcome.

But in the end, right now, one very basic human problem is that we have a lot of degraded land, and how are we gonna address that? And looking to species like the chestnut to be part of the answer, I think is really very exciting.

Michael: Everyone talks about moonshots and that they're really hard to achieve and that it's a dream. Well, the fact of the matter is we have our moonshot, we know how to do this work.

We've got recurrent genomic selection. We've got DNA analysis. We've got the scientific tools to make the progress that we wanna make and do something about climate change. The challenge is the funding that we've got and you and I both know this, lifeblood of our organizations are our donors, our volunteers, the people that are doing the work for us, the time and talent that our volunteers give to us in addition to their donations.

My goodness, we are so fortunate to be plant people. But, could you imagine what would happen if we weren't obsessed with places like Mars and spending money on rockets and all of those kinds of things when we could spend that same kind of money on Earth and make it a livable place right now?

Jennifer: That’s right. I think a lot of the time we want to find some sort of magic, technological solution to weave our way out of our problems that we've created on earth. And, we can look to nature for a lot of the answers and we should. There's a lot of energy around natural climate solutions and we're really encouraged by that. But we need more people at the table for sure. And, definitely more funding as well.

So, beyond the impact on ecosystems, are there economic, cultural...You talked a little bit about some of the identification of Native peoples to the chestnut. Other benefits of introducing the tree that you see, beyond the ecosystem?

Michael: So, I mentioned where I grew up, my grandfather had a chestnut tree in the yard. And I remember at about probably five or six years old. And I don't know if it was an American chestnut or a European chestnut. But I've presented a couple of chestnuts to you earlier in, in our conversation, and kids play with them. You can drill a hole in it and tie a string in there, and you play a game called conkers, and you’d swing one conker into the other chestnut, and you try to break it open. Whoever breaks it open wins.

Jennifer: Right. Yeah. It's that familial connection to plants, that generational connection to plants.

I think reknitting that is part of how we bring everyone together around these ideas of restoring nature and protecting nature.

Michael: It's been incredible to see how many families are part of that lineage. We have people out there today that their parents were involved in the American Chestnut Foundation. Their kids are out there working with us today too. You know, when I was in forestry school, people would challenge us saying that it's very hard, harder than rocket science.

And I'm not sure that that's entirely true necessarily, but it's a funny way to think about it, because the complication in our natural systems is oftentimes more from people than the systems.

Jennifer: Yeah, it's the people. We're the ones bringing the…

Michael: Well, we're the ones bringing the solutions too. Right? So, you know, we can work with nature. That's the thing. We don't have to work against it.

Jennifer: That's right. Well, I think that starts with seeing ourselves as part of nature and then understanding how nature has influenced our own family stories, I think is part of coming to that understanding. I appreciate you bringing me the chestnuts. They really are beautiful. They're so smooth and the color is so rich and beautiful.

Michael: And they're one of the few true nuts. They're a true nut. Acorns are a true nut and hazelnuts are a true nut. But, most of the nuts we eat are drupes.

Jennifer: Are what?

Michael: Drupes. The seed of a fruit. So, the way that this works is a nut cannot naturally open itself.

So, it actually has to force its way out through its…sort of like a chicken egg…where it actually forces its way out. That's why they're so starchy. So, the chestnut is super starchy because it's getting all that energy so it can burst out through the shell and actually become a sapling. But, like a cashew hangs on a fruit.

That's a really weird one. It hangs on the outside of a fruit. Stone fruits like peaches….that is the same thing as a walnut. It's just the walnut has that exterior shell that is hard and we don't eat, but it opens up naturally by itself. And so that's why it's a drupes as opposed to a nut.

Jennifer: A drupe.

Michael: A drupe. Who knew?

Jennifer: I probably should already know what a drupe is, but I have to say, today's the day that I learned and I'm going to be working it into other conversations.

So, okay. The chestnut blight fungus was the first of many introduced species to decimate our native forest trees. We've got Dutch elm disease, which is a fungus. The emerald ash bore, which is a beetle. Beech leaf disease, which is nematode. So, as you're engaged with this work on chestnuts, how do you think we should be thinking about protecting our remaining forestries from future epidemics?

Michael: I'm so glad you asked, because my mission is the chestnut, of course, but the technology that we're developing is replicatable. The RGS model that we've go, the idea that we're gonna look for the best pairs. We're gonna look at DNA analysis to figure out their resistance ahead of time.

We can use that in every one of the species that you mentioned. So, we have the restoration engine that we can utilize to make sure that these plants are resilient, that they can survive in the landscape. There's no doubt we're gonna continue to get invasive species. We cannot control…It's…world trade, it’s just what it is.

We have to accept it. We have to figure out how to manage it and how to manage it is through science, like recurrent genomic selection, where we're producing trees that can be super trees and really work against all these diseases.

Jennifer: Yeah, we have an invasion ecologist who works here, Dr. Eve Beaury, and she looks at invasive species and their spread and how we can learn from the historical spread of invasive species to predict what might happen in the future, and she's engaged with colleagues all over the northeast and beyond. And, what she will tell you and what she's told me is that, the early action is really critical, to just stop the prevalence spread that you get.

So, we're gonna have to bring all of our tools to the table because we are going to continue to confront invasive species and, of course, the mix of species is gonna be changing over time. So, it's really about identifying those problems that are going to be destructive in a material kind of way.

Michael: Well, and treating 'em ahead of time.

Jennifer: And there is growing public awareness, which is great.

So, climate change, which we've talked about a bit, air pollution, invasive plants, of course…They're all having a profound effect on the ecological health of forests. How would the reintroduction of the American chestnut or restoration efforts more generally be impacted by these anthropogenic changes that are affecting the existing forests?

Michael: We have to be diligent about all of this. We really need to make sure that we're producing the kinds of trees that can survive, and so the reintroduction of the chestnut in this capacity…We're gonna beat Phytophthora.

We're gonna beat chestnut blight. We're not gonna eliminate it. We're gonna build a tree that can resist it, through technology, through understanding, through terrific breeding. And you look at the range of the chestnut tree, it survived from Georgia to Maine and actually all the way into Michigan and Wisconsin.

Jennifer: That's encouraging from a climate perspective.

Michael: Absolutely. And the trees are so resilient, even if the range gets limited in the south…which is already limited by Phytophthora anyway, we'll see it move further north. And listen, I can cry about climate change. I don't wanna do that right now. But, the fact of the matter is, trees are one of our only solutions right now. And so, let's do everything we can to get these trees in the ground and producing carbon storage.

I mean, we're talking about the ability to store between one and 3 million tons of CO2 per acre.

Jennifer: Yeah.

Michael: Trees are natural climate solutions beyond anything else that's out there. It's wonderful that we can develop really high end technology and I want people to continue to develop that technology to get CO2 out of the air.

But, I've got a technology I can use right now.

Jennifer: That's right. That has all sorts of other benefits…the joy we take…

Michael: Just looking at them.

Jennifer: Among them, you know.

We've talked a lot about the science that you're using and obviously the foundation is doing really exciting work in that arena for a non-science audience. What do you think is most exciting about the work of The American Chestnut Foundation?

Michael: For me, the most exciting thing is watching people light up. It is really the greatest thing to be with our volunteers and to watch them sweating, working hard, planting trees, dealing with poison ivy, looking out for snakes. And at the end of the day, everybody laughing and celebrating the fact that they worked really hard to bring this tree back.

I've never seen people putting up with more for free. I mean, when you grab a chestnut burr...Have you ever held a chestnut burr? I've got some…

Jennifer: I have not.

Michael: I'll, I'll make sure you handle one before we leave, but they're so spiky, it hurts your hand just to hold them. And these people are out there shucking them, opening 'em up, getting nuts, you know, doing everything they can.

I mean, Jennifer, I have unbelievable volunteers.

Jennifer: Good insurance, I hope.

Michael: Oh, thank God we have insurance because they're 80-year-old men climbing orchard ladders. It's amazing.

That's why I do this work. I love trees. Yeah. But, it's the people that light me up.

Jennifer: Yeah. How many sites are you working at?

Michael: Oh, there are, uh, so many. So, we have chapters all over the country. They all have orchards. We have progeny test sites. We're gonna wind up building out multiple of these RGS orchards all across the country.

And we've got partners all across the country. Various universities, private companies, lots of folks are willing to chip in and work with us on this.

Jennifer: So, are you planting outside of the original range?

Michael: No. Not at all. I mean, I'm sure there are some test plots, some…I can't really think of where they might be that are slightly outside of it. We tested quite a bit in places where the blight isn't quite as strong too, so that we're looking a little bit there…Indiana, but that's within the range.

Jennifer: Okay. Yeah. Well, it's a big range.

Michael: Yeah, it is. Yeah, huge.

Jennifer: You've got a lot of ground to cover.

Michael: We should be testing in Canada though.

Jennifer: Yeah. So, there's lots of opportunities for people to engage.

Michael: Yes.

Jennifer: No matter where they are.

Michael: No matter where they are, I can find a place for them.

Jennifer: That's great. So, maybe my last question is: What's giving you the most hope right now?

Michael: What gives me the most hope is that we understand what the science is. We have very little federal dollars. You know, when the federal government cut back funding earlier this year, we weren't impacted because our volunteers and our donors are largely the ones who are making our model work. I'm happy to get federal money. I'm gonna work for it for sure, but at the end of the day, it's volunteers who have kept this passion going.

That's an incredible thing. Forty years of work, all fueled by the dollars of Grandma who just thinks chestnuts are cool.

I mean, it's mostly small donors. And, that's why I look at this work and think we have hope because people believe they're willing to do the work. And even when they plant 50 trees and 30 of them die, and they're looking at the 20 that survive with pride, that is the most wonderful, hopeful message you can possibly experience.

As a forester I had never ever walked into his chestnut orchard until I took this job and the first time that I was surrounded by those trees. It's a different kind of magic. It's like you're walking in something that it's not prehistoric, but you would never expect to see, and we're bringing back an extinct species. Wow. What an incredible thing. And I'm so fortunate.

Jennifer: That's wonderful. Yeah. Well, Michael, thank you so much for joining today and talking about your work at The American Chestnut Foundation. We really appreciate it.

Michael: Thank you, Jennifer. What a pleasure to be here.

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