SUNY College of Environmental Science and Forestry Campus Conversations: The Podcast
Season 2, Episode 6
Dr. William Powell, E S F Professor, and Director, American Chestnut Research and Restoration Project
Linda McGuigan, Lab Manager, and Researcher, American Chestnut Research and Restoration Project
Kyra LoPiccolo, a senior in the undergraduate Biotechnology Program at E S F
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Bill Powell: Well, we're trying to make a tree that we actually want to put back into the forest. And they're so used to having a crop, they're just trying to keep on the field. But we actually want this gene to go out and rescue other trees.

Linda McGuigan: We've researched this. We've done a lot of work on it. We've tested this. It's 39 years of research, so it's not something that they should be scared of.

Kyra LoPiccolo: It's my job to keep track of around 5000 trees that we're responsible for taking care of.

Bill Powell: But it's not going to happen fast. I should mention that chestnut's not a weed. It will not spread quickly. This is restorations, what I call a hundred-year project.

Kyra LoPiccolo: Dr. Powell is a real-life Lorax. And he does speak for the trees.

Joanie Mahoney: Hello, this is E S F President Joanie Mahoney back for our campus conversation, the podcast. And I am joined by Dr. William Powell, Linda McGuigan, and Kyra LoPiccolo. And we are talking today about tree restoration and resiliency with a focus on the American chestnut. This has been a series of fascinating conversations with E S F faculty, staff, and students about research that's done here at E S F. And one of our most popular projects is led by you, Bill. So, can you introduce yourself to the audience?

Bill Powell: Yes. I'm Bill Powell. I'm the director of the American Chestnut Research and Restoration Project started here in 1989, so quite a few years. And that's actually the year we started the project. Myself, and Dr. Charles Maynard. Charles who has since retired, but the project goes on and made great progress over these years.

Joanie Mahoney: Tell the audience about the American Chestnut Tree and its historical importance to us in the United States in particular.

Bill Powell: So, the American chestnut once was a very common tree, especially in the Appalachian Mountains and all the way up through into central New York. It was a was called a keystone species. It provided food and shelter for many different wildlife species. Also for people it provided a very rot-resistant wood. It provided a annual nut crop that people would sell. In fact, our first dean of the College of E S F—Bray Hall's named after William Bray—used to write about trees. And one of the things he said about the American chestnut was that some farmers actually got more income from their chestnut harvest than some any other farm product. And that's because on their land, they had all these wild trees. They had to go out, collect the nuts, bring them in and sell them. It's like manna from heaven, you

know, just free crop and provided them an extra income. But we lost all that and we lost all that because of an exotic pathogen that was introduced a little over a hundred years ago that basically wiped out three to four billion of these trees.

Joanie Mahoney: I had chestnut trees around where I lived in the 1970s and eighties. They probably weren't American chestnut, is that right?

Bill Powell: That is true. Most people confuse the American chestnut with the horse chestnut and there's a lots of horse chestnuts out there. Very nice tree. It's great for things like hummingbirds and of course, they produce those nuts. Everybody fights what's in the fall, you know, all the kids do, but that is a different species. The tree is not the one that we are trying to restore.

Joanie Mahoney: I think that's important because many times when I've talked to people about the American chestnut tree, they mistakenly think that it's that horse chestnut tree. So, you came here to E S F. Was this project already started or are you and Dr. Maynard responsible for starting that project?

Bill Powell: Well, Dr. Maynard and I did start the project here, but we do have a history with the American chestnut. Back in the 1950s, there was a collaboration with the Connecticut Experiment Station where they were planting hybrids and Chinese chestnuts and seeing how they would do in our forests. And, actually, at our Lafayette Road Experiment Station was one of their planting sites. And so, we had chestnuts there in the 1950s. There might be one or two still surviving today, but pretty much they have not survived.

Joanie Mahoney: So, this American chestnut tree suffered blight, but it didn't completely ruin the tree genetics because, at a certain point close to the ground, the blight wasn't affecting it?

Bill Powell: Yes. So, the blight basically enters a wound in the tree. The chestnut blights are caused by a fungus and it forms a canker, kills everything above that canker. But when it gets down to the ground, the microbes in the soil can outcompete that fungus and therefore it protects the roots. And the chestnut has this ability to sprout from the root collar. So, it gets killed down to ground. It sprouts and the root collar. It will grow for a while, but then gets killed back down again. So, it's like a Sisyphus cycle. Where you're kind of going through these cycles of killing and renewing and killing and renewing. So, there's still probably a few million stumps in the forests and that's a good thing because that allows us to have enough genetic diversity to bring this tree back.

Joanie Mahoney: And the killing off of the tree happens before it is viable for the hardwood that you described or the feedstock or that crop that farmers were getting wealthy selling.

Bill Powell: That is true. Most of the time these sprouts die before they ever reach maturity, so they did not produce nuts. , they don't get big enough to make a wood product anymore, but at least they're surviving. They haven't gone extinct. We call it functionally extinct because they're not having all the benefits they had in the past, but they are still around.

Joanie Mahoney: What did you start with when you were trying to see if you could rescue this American chestnut tree?

Bill Powell: The American Chestnut Foundation, they came to us in 1989 and asked, Can we produce a blight-resistant tree? And Dr. Maynard and I looked at our backgrounds and stuff like that and then we said, well, probably could take over ten years to do that. And it did. So, they kind of initiated, it was kind of like a public request to work on this tree. So, what we did was we looked at first of all what kind of genes might confer resistance to the blight, and then how do you actually get these genes in the tree? I always say we had to build a ship before we went fishing, so we had to actually develop the techniques to get the genes into the tree and then start testing genes.

Joanie Mahoney: So, you looked at the existing gene pool of the American chestnut. You knew what the fungus was that was causing the blight and then you went to work to try to find genetic material that could make that tree resistant to the blight so it could thrive.

Bill Powell: Yes. So, we understood how the fungus attacked a tree. And one of the major ways it attacks is by producing this acid called oxalic acid. And so, what we look for is some kind of gene that can neutralize that acid. And we actually found it in an unusual place, we found it in wheat. And this is actually a ubiquitous gene, as in weeds in a lot of different plants. But this gene will detoxify that acid that the fungus makes and therefore removes that weapon and therefore the tree can survive. So, all we had to do is take that gene and then put it in a chestnut, have it make that enzyme, and then the tree would coexist with the fungus.

Joanie Mahoney: And you found this about ten years into your research.

Bill Powell: Might have been a little bit more than ten years because again, we had to first develop all the techniques. And this was done mainly in Doctor Maynard's lab, all the techniques that it takes to regenerate a tree from a single cell, but a lot of work went into that. And then once we could do that, then we had to test genes and we tested lots of different genes and finally came to this one for the oxalate oxidase.

Joanie Mahoney: It's interesting and important to note that this is a gene that is in the wheat that we're eating in our bread.

Bill Powell: Absolutely. It's in, we eat it every day. In fact, it's in a lot of different plants, in bananas. So, if you had bananas for breakfast, you ate some oxalate oxidase. It's in almost every grain you can find. The problem is the chestnut did not have that. So, we gave that chestnut its ability to now detoxify that acid.

Joanie Mahoney: And I think that becomes important later in the story too. So back now to where we are. So, you and this team that you have here with you, you can't just take one of these stumps and figure out how to get the gene in there and then that thrives.

Maybe this is where you come into the story, Linda? How do you take that and then end up with a seedling that we can plant?

Linda McGuigan: So, we start with American chestnut embryos and we have to get them into plant tissue culture. So, we go to the field and we get immature nuts from wild-type trees and we bring them into the lab and we sterilize them using a bleaching process. We cut open the nuts and then we extract the embryos. We put them on a medium that has nutrients for the embryos to grow and multiply and it's a clonal process. So, once we have them multiplying, we use a bacterium called agrobacteria. And this is a natural genetic engineer. It's in the soil by plants. It normally causes galls in plants and scientists have been able to unarm it and take that gall-producing gene out and we've put the oxalate oxidase gene into the bacterium and the bacterium is mixed with the embryos and then the bacterium will actually transfer the gene over to the plant cell.

Joanie Mahoney: It's fascinating you were able to find a nut. So where did that nut come from?

Linda McGuigan: Not all chestnut trees are dead and some of them are able to get big enough to produce flowers and pollinate and, and produce nuts. So, we have a bunch of wild-type trees in our orchards and we're able to collect the nuts from there.

Joanie Mahoney: And then you cut that open and get this embryo. And that's the process where you add the gene from the wheat.

Linda McGuigan: Right.

Joanie Mahoney: And what happens after it does what it's supposed to do in your lab?

Linda McGuigan: We grow the agrobacterium up in a liquid medium. So, it has nutrients for the bacterium and it grows up. We mix it together with the embryos. We let it sit for a few days together and then we will put it in another medium that has antibiotics that will kill off any non-transformed cells and it also kills off the agrobacterium. Once we know we have one of these cells that survives the process, we will regenerate it into a new shoot and we will test to make sure the gene is in there, test to see how many copies of the gene was put in there, because sometimes there's more than one gene and we want to see the expression level. So, we'll check to see how much relative expression that it's making and then we root it and do some more testing.

Joanie Mahoney: I can't imagine the eureka moment when you realized this is working. What was that point?

Bill Powell: Well, it actually started when we first discovered the oxalate oxidase gene. It was one of our post-docs from E S F had just returned from a plant physiology conference and back in those days they still had those books of abstracts that you got from the conference. And so, he lent it to me and I was just leafing through it and I came across this abstract where these people were using this gene called oxalate oxidase in tomatoes. And I thought, you know, this is an interesting gene because I remember as a graduate student working on the chestnut blight that

oxalic acid was how the blight attacked a tree. And it's just like putting one and one together to get to Eureka. And I said, that's a gene we need to go after! So, we contacted the person who wrote that abstract. They sent us a copy of the gene. We started putting them in vectors that we could put into the chestnut and went through and didn't work as well at first. So, like we had lots of different versions. The first ones we put in, we say the tree died slower, OK, but that was showed us we were on the right track. Then we had some that we had intermediate levels of resistance, which means that they were more resistant to the American chestnut, but not as resistant as Chinese chestnut, which is our standard control for resistance. And then later we finally had some that were just as resistant as the control trees.

Joanie Mahoney: I can't imagine what that feeling must have been. And Kyra, what an opportunity for you! So, you're an undergraduate student here, is that right?

Kyra LoPiccolo: Yes, I'm a senior in the Biotechnology program, but my time with Doctor Powell and his team started in 2016 and I was a high school student.

Joanie Mahoney: How did that come about?

Kyra LoPiccolo: So, my A P biology teacher is an E S F alum, and every summer he sends a couple of students from his biology classes to work with Dr. Powell and his team as interns for the summer. And I asked him every day, I said, please pick me up, please, please. I just want to get the opportunity to be in a real science lab. And me and another student got to spend the entire summer being almost real scientists.

Joanie Mahoney: And what an opportunity. And that's one of the things E S F is known for is research opportunities at every level, including undergrads. So that I would imagine whet your appetite to become a student here at E S F.

Kyra LoPiccolo: Absolutely. I still remember standing and looking at the quad with my dad, who is also an E S F alum, and him describing that you're not allowed to walk across it before we went up to meet Dr. Powell. And yes, I still remember my first moment walking through the doors of the molecular biology lab and feeling like, wow, I've found my place and what I want to do. And that absolutely led me to E S F to continue learning and growing as a scientist.

Joanie Mahoney: Wow, what a good spokesperson you will be for us. We got to get that out to the to the folks that are considering their college options. So, what is your role then? You've spent all four years in Dr. Powell's lab.

Kyra LoPiccolo: Yes, I have. And in Linda's lab and as well, I have done a little bit of everything. I started washing glassware and autoclave and transgenic waste, which is not as glamorous as what you see in National Geographic. But everyone starts somewhere. And over time, my role has really grown into being our database manager, so as Linda mentioned, we have orchards with wild-type American chestnut trees out at Lafayette Road Experiment Station and it's my job to keep track of around 5000 trees that we're responsible for taking care of. And I work

with our collaborators from Maine down to Georgia, who also have plots of wild American chestnut trees. And they send us nuts to grow at our orchards, and we keep track of all of their pedigrees and genetics and where these trees actually came from to try and preserve that genetic diversity.

Joanie Mahoney: That is so important.

Kyra LoPiccolo: Yeah, so important for a restoration effort.

Joanie Mahoney: And I understand that you are going to head to grad school when you finish here. And I don't know how you are going to replace that work that we're getting from Kyra, so please don't go far away.

Kyra LoPiccolo: Oh, no. And I don't think I'll be away forever.

Joanie Mahoney: OK, good. That's good to hear. So, you then came up with what was a blight-resistant seedling and where does the story go from there?

Bill Powell: Well, there's two things we needed to do. One, as was just mentioned, we needed to increase genetic diversity because when you make this from a single cell, make these trees from a single cell, basically you have clones and you definitely don't want to use a clone for restoration. So, we've been using those trees to outcross to survive, surviving what we call mother trees, these wild trees that Kyra just mentioned, and going to generation after generation to recapture that genetic diversity that's normally found out in the population. We've gone through that to four outcrosses so far four generations. Our goal is five so we have one more to go, and then we're pretty much going to be ready for restoration. But there's another trick there, and that is the methods we use are highly regulated by the US government because we do use genetic engineering. So, we had to first go to the regulators. We did this way back in 2014 and this was totally new to them because they never worked with a restoration tree or plant of any kind. What they have done is always worked with agricultural crops, so we had to first tell them that, well, we're trying to make a tree that we actually want to put back into the forest and they're so used to having a crop, they're just trying to keep on the field. We actually want this gene to go out and rescue other trees. So, we had to kind of get them thinking differently and show them that this is OK. So, we worked with them a long time with that, and then we actually have submitted our application for the tree that we want to get out. It's called Darling 58. The Darling name comes from one of the T A C F members who came to us asking us to actually do this, Herb Darling. these trees are going to be the ones that will be the first trees ever approved by the U S regulators. And there's actually three groups there. There's the E P A, there's the U S D A, and there's the F D A. All these regulators have to approve these trees before we get them out. And our target right now is August of 2023 to get these to the public.

Joanie Mahoney: Out to the public so I'll be able to go to a tree nursery and buy an American chestnut perhaps as early as next year.

Bill Powell: And we're going to, we actually have a workshop coming up next year to figure out how to go up from producing a few thousand of these a year to 100,000 or more a year of these trees. And that's where we're going to have to collaborate with nurseries and stuff like that to give them seeds so they can produce trees and get them out to the public.

Joanie Mahoney: And then you'll be able to plant an American chestnut on your own property and the hope is that it will start acting like every other tree and the chestnuts will drop and they'll seed by themselves and they'll be blight resistant. Do we know for sure that the chestnuts that are then going to be for the next generation of tree are also blight resistant?

Bill Powell: Yes, because we've actually done this and this is where we've gone through several generations of outcrossing and the only reason we can go through these generations so quickly because normally it just that would take five to eight years to mature enough to produce nuts. But we actually developed a method in the lab where we treat the seedlings with high doses of light and we can actually have them form the male catkins that make the pollen in less than a year. And so, we can actually take nuts that we harvest, put them in, highlight growth chambers, have them produce pollen, take that out the next year and pollinate more mother trees and keep going through generation and generation. So that was a big advance also that was developed right here at ESF.

Joanie Mahoney: I was wondering about that high-light chamber. That's something that you had to develop in order to keep your research moving along?

Bill Powell: Yeah, and it's kind of interesting because you never know where serendipity comes into your research because we actually developed that by having some visitors from the Forest Health Initiative come to our labs. And our initial trees when we were growing them were kind of tall and lanky kind of whippy. And what he suggested as well, increase the light and they'll make thicker stems. And so we tried that, but when we increased the light, we also found again by accident that this also produced catkins. And we since we saw that, said, oh, we have something here. And then we started optimizing those conditions.

Joanie Mahoney: To be able to take what is probably the most important tree naturally here in North America, decimated. And then you play such a significant role in bringing it back and we're on the verge now of being able to plant that and people will just watch it spread. I want to go back now to where we started in the beginning and why it's important. I know that there has been fear along the way that I'd love for you to address. You know, when you go to the grocery store and you buy food, sometimes you'll see non-G M O and people don't want genetically modified food. How is your process different from the thing that people are afraid of?

Bill Powell: OK, so here's the interesting thing. It's not different, but people should not be afraid of those. And the reason why is because we are actually using a method that's more precise than the old methods. And in fact, chestnut is a great example because for the past hundred years, people have been making hybrid chestnuts and when you make hybrid chestnuts, you're actually combining whole genomes,

not just genes, but whole genomes from different species. And when you combine those, they really rearrange and mess things up in the genome quite a bit. And some weird things have happened from people making hybrids, things like male sterility is a very common thing you see. There was a thing called internal kernel breakdown where 40% of the nuts would just disintegrate in the shells by certain combinations of parents. But with genetic engineering, you are not mixing these whole genomes, you're not having all those extra side effects. You're putting in precisely one gene, and that gene is conferring the trait that you want.

Joanie Mahoney: And it's a natural gene that's in the food. We take that material and we are adding it to the chestnut tree and it's making all the difference for the chestnut tree to be able to resist this blight.

Bill Powell: Right. And even the method we use, Linda described, with the agrobacterium transformations? Agrobacterium is a natural genetic engineer, and we live in an age of genomics. We're sequencing everything, and we're finding that probably about 7% of the plants in the wild have been genetically engineered by this bacteria. So, these are already out. They're not done by humans, but done by nature. I always like to say that scientists don't do new things. We kind of mimic nature. We learn from nature. You know, nature's already figured these things out. And once we can figure out what nature figured out before us, then we're golden instead of being kind of random, we're kind of directing it.

Joanie Mahoney: And so how about, Linda, your time here? How long have you been here with E S F?

Linda McGuigan: I actually am a Ranger school grad. I graduated from the Ranger School in 1999, and then I came to the college and I started working on the Chestnut project in 2000.

Joanie Mahoney: So, you must feel the same satisfaction then that you're right on the precipice here of seeing this. So, let's talk about the benefits of the chestnut tree. You have mentioned that it was a food source and that it was a source of income for farmers and that lumber is rot-resistant but there's an important part of the ecology in the forest that is missing because we lost the American chestnut.

Bill Powell: Absolutely. I mean they have been kind of displaced by oaks and hickories, but they're not the exact same tree and therefore the forest has changed slightly. We actually did a study as part of the regulatory process when we fed leaves of chestnuts to wood tadpoles, one of our current postdocs, Andy Newhouse, did this, and what we found was that the wood tadpoles did better on the chestnut leaves than they did on other trees like beech or maple, and others. So that even though the chestnuts were gone, they still had that genetic memory of, well, this is what our food should be. So, it does provide this benefit to the environment that has been lost. And in fact, there are actually some insects that were so specialized on chestnut when the blight went through they went extinct. They've found that at least five species of insects went extinct with the chestnut.

Joanie Mahoney: And I know you know here, but the folks listening to this that aren't in the scientific world probably don't fully appreciate how much losing five insects can affect the entire forest ecology. So, what did the squirrels and the other animals that were eating the American chestnut when it went away? What did they start to eat?

Bill Powell: One thing when the blight went through, there was always this drop in populations because those trees weren't there. But as the oaks came back, they could eat acorns. And the thing about acorns is that they don't have a consistent crop. Oftentimes they'll have a really big crop one year and then another year they won't. And so, you know, it goes up and down where chestnut was very consistent from year to year. But there is still crops out there, mass crops for wildlife, you know, so they're not all dying away, but chestnut would be a slightly better one.

Joanie Mahoney: That's the key point to make. Have you been able to follow that through and to see what effect it had on some of the larger species in the forest?

Bill Powell: Things like wild turkeys, their numbers did plummet with chestnut going down because they used to feed on that. But they're coming back. They're finding other sources of food. And you can actually see a lot of wild turkeys nowadays.

Joanie Mahoney: It'll be interesting to have a postdoc or grad student then test with the turkeys the way you did with the tadpoles and to see what the nutritional value will be of that American chestnut when it comes back.

Bill Powell: Right. So, it's really interesting how, you know, the ecology has these webs that all kind of interlink. So, let's say you brought the chestnut back, and you had more of these nuts every fall. You probably have more rodents, OK? And it turns out that these white-footed mice actually eat gypsy moth larvae. And so, if you have more of them, you're going to have more of these to eat the gypsy moth larvae, which will protect other trees. But on the other hand, if you have more of these rodents, you also have more ticks and therefore maybe more Lyme disease. So, there's always this interaction between everything that can be very interesting to see what happens when these come back. But it's not going to happen fast. I should mention that chestnut is not a weed. It will not spread quickly. This is restorations, what I call a 100-year project. So, this is a project for our grandchildren and our great-grandchildren.

Joanie Mahoney: I gotcha. So I was reading a little bit about your work and can you talk a little one of you about the biomass potential of the American chestnut tree?

Bill Powell: So, the American chestnut is a very fast-growing tree. You know, when it's let's say, released in a forest because of the open canopy, it can grow, you know, six, seven feet in a year. It can grow up to an inch in diameter a year. Of course, its wood is very rot-resistant, so it locks that carbon in for long periods of time. It has a very extensive root system. So, you can put a lot of that carbon underground. And there have been people who studied it and it seems to be as good or slightly better than any of the other hardwoods.

Joanie Mahoney: And then there's also something about the conditions that it can grow in that are different than some of those other fast-growing trees, like the willow.

Bill Powell: Chestnuts have certain habitats they prefer. They love slopes, they can grow and very rocky ground, and they do like kind of acidic soils. So, there's certain places they'll grow that the willow will not grow. And they are more tolerant to the more drier conditions than like willow would be.

Joanie Mahoney: So, it's complimentary.

Bill Powell: Yes.

Joanie Mahoney: They're not going to fight with each other. They want to be in different places.

Bill Powell: That's right. Yeah. If thing about, you know, planting trees for carbon sequestration, you actually have to do a lot of different trees because they have different habitats and they're going to benefit the if you plant in different places.

Joanie Mahoney: When I hear you talk about some things, I think of the conversations I had with faculty that are kind of coming at this from a different direction and how everything intertwines here at E S F because our mission is so specific, you know? So, I'm sure there are other faculty that are interested in that. And when they have the opportunity to compare that to some of the research that they're doing in other trees, this is going to be fascinating. So, do you think that we're going to be able to take what you all have learned and apply it to other trees that we've lost? Are you going to be leaving a roadmap for people who want to restore a tree in the future?

Bill Powell: Absolutely. And that's actually one of the things that I want to do before I retire, is actually establish a tree restoration center here at E S F so we can take all the things we've learned with chestnut and apply it to other threatened trees. We already are doing that with some of the ones that are more closely related. We actually got some of our first samples from ash trees just a week or so ago, and we're trying to get those in tissue culture. I don't know, Linda, do you want to say anything about that?

Linda McGuigan: Hannah Pilkey and I went out to Dave Amberg's house about two weeks ago and we collected some shoots from his tree. He has two or three ash trees on his property, and most of them have been devastated by the Emerald Ash Borer. But we, he has one that's growing, that's not affected and it looks great. So, we took some samples and we're going to try to put them in tissue culture.

Joanie Mahoney: What is tissue culture?

Linda McGuigan: Plant tissue culture is taking plants from the outside world and putting it into a container with a growth medium and sterilizing it so there aren't any microbes and it has everything it needs to grow. It has nutrients, it has humidity, water. So, they grow really quickly and they don't have to worry about competition.

Joanie Mahoney: And what will you be looking for in those samples you took from Dave Amberg's property?

Linda McGuigan: We're going to start by growing it in tissue culture and seeing how they grow. We want to develop a system, and eventually, if we need to, develop a transformation system for it, we'll have the samples.

Bill Powell: So, I just want to say, for the tissue culture, I mean, when we say we grow them in there, we're actually multiplying shoots. So ,you can start with one little shoot that you've taken off the tree and you can make a whole forest in a jar so you can, you know, go from one shoot to thousands of shoots and each one of those could be rooted and make a separate plant. And those are the ones that we use for our experiments.

Joanie Mahoney: And that's what's planted at the Lafayette Experimental station that you go to, is that right, Kyra?

Kyra LoPiccolo: Yes. So, we have a lot of clones straight out of tissue culture. But then, as we get these subsequent generations from outcrossing, we also have all of those planted, the clonal trees we call our t-zero trees. And then each subsequent generation is t-one, t-two, t-three, and so on. And, like Dr. Powell said, we're trying to get to that t-five generation and we have almost a living history of all of the different genetic events and transformations that have led us to the Darling 58 out at that Lafayette Road Field Experiment Station. And in addition to that living history, we also have experiments where we are looking at growth in a forest setting versus an open field setting, and we have common garden experiments that are replicated at other universities in Virginia and Pennsylvania and Maine. So, sort of throughout that natural range of the American chestnut we look at not just those clonal trees that came from tissue culture, but also all of the offspring to ensure they're behaving the way we expect them to with the blight resistance.

Joanie Mahoney: It sounds like there's an unlimited amount of research that can be done on the various aspects of this whole project. So, you are headed to grad school and are you going to continue to study the American chestnut?

Kyra LoPiccolo: I am not necessarily planning to continue studying the American chestnut, but I am going to Penn State University and my hope is to work with researchers at the Schatz Center for Tree Molecular Genetics and learn more about how we can incorporate genetic diversity and preserving genetic diversity into these larger restoration plans.

Joanie Mahoney: There can't be a student that's going to start with you that will be coming with as much experience and knowledge as you're going to be starting with. So, I wish you well with that. So, Bill, tell us about where you are in the process of approvals from the federal government. You said there's three agencies or four that you need approval for.

Bill Powell: Yeah. So there's three in the United States and then we have actually two in Canada, because we'll probably be going up to Canada also since that the range

of chestnut goes into Canada. So, the first one we submitted to over two years ago was the U S D A APHIS B R S, all their initials there. And they've been reviewing our trees looking at what they call plant pest risk. And they actually have that evaluation done, but they also have to do an environmental impact statement. And so that's still going on, and that's the one that we hope to have finished by August of 2023, And, all these things also have open comment periods. So, the public can always chime in and mostly it's been very positive, which is great. So, we've had that with U S D A, the E P A, we've submitted for getting close to a year now and they look at the environmental aspects of the chestnut restoration and we're doing very well with them so far and they've sent us two letters, ten-day letter, then a 75-day letter where they ask questions and you have to respond in that amount of time. The F D A is has a much narrower view, they're just interested in food and feed, and that's the shortest one actually, because I like to show is that, you know, this is not an allergen, it's not a toxin. you know, there's nothing, nothing harmful about it because it's found all over the place anyway. But we hope to have them all wrapped up at the same time in fall of 2023.

Joanie Mahoney: And we'll have a big celebration here.

Bill Powell: That's what I hope. Yes. OK.

Joanie Mahoney: I'm in. So, just recently your work was the subject of an article in National Geographic.

Bill Powell: Yes. We've been on their website a couple of times before, but this is actually the first time in the actual magazine, which was great. So, in the May issue of National Geographic, they have a section on four remedies to save trees, and we're one of those four. So as that has wonderful. We recently got a short mention also on Good Morning America.

Joanie Mahoney: That's really great for the college because we get talked about a lot as a hidden gem and we don't really want to be hidden. We want to tell the world about what's happening here. I know in the scientific community we're not hidden because there's a lot of interaction between researchers at this college and other colleges. So, what's next for you, Linda? When we get to the approvals and we're starting then to put these plants out in the public in the fall of 2023?

Linda McGuigan: Oh, there's always going to be something to do. There's other tree species that are battling some kind of issue. So, there's always going to be a tree that needs help. And we're trying to become a tree restoration center. So, we have American elm, we have the ash we're starting with.

Joanie Mahoney: I look at the pictures from the house I grew up in and right along the park, I grew up on one of the city parks in Syracuse, there were the whole row of absolutely beautiful elm trees. And when I look now they're all gone. And that was what we referred to as Dutch Elm Disease. There's probably a more scientific term for it, but we lost all those elm trees and it's great to think that we can have a tree restoration center here that can then continue its work. And unfortunately, I think

there'll be an unlimited amount of work. But what's most important is that you've really put a blueprint together that gives a giant head start to researchers in the future. How about for you, Bill? What's going to happen when this day comes and you have all of these approvals and you're moving toward a hundred thousand trees and you're making them available to people in the public?

Bill Powell: We do want to broaden this out. It took us a long time to build up the infrastructure as well as the skills and knowledge base and all our team. And we have typically around 30 people working on this project every year, everything from high school students up to postdocs. And we have colleagues at a lot of different universities that work on this. So, we want to make sure we don't lose this knowledge. So, there's a publication recently that stated we can lose up to 40% of our forest biomass just to about a dozen pests and pathogens that have been introduced into this country. And so, there's going to be lots of opportunities to try to save our forests, especially when we want to use these forests to sequester carbon. We can't be planting trees at the same time losing trees to these pests. So, we want to make sure that we have trees that are resilient and resistant to these challenges.

Joanie Mahoney: And the first one is always the most difficult. And you're doing that. And I hope then as these pathogens come and our species of trees start to have new threats, that we will as a public be more able to more quickly respond and maybe not have to decimate the entire population of trees the way we pretty much have with the American chestnut before we enter with a solution. So, I'm just going to end with this, and I kind of want all three of you to answer the same question. So, Linda and Bill, you have a minute to think. Kyra, you have no minute to think. What's the thing that you would like the public to know about this project?

Kyra LoPiccolo: Well, first you mentioned the enthusiasm, and that goes so far beyond just the researchers involved at E S F and other colleges. Everybody has a chestnut story. And one of my favorite things is when we give tours to the public of our field stations, people cry seeing all of these American chestnut trees in one place. And as you mentioned, you grew up with chestnut trees and you grew up with elm trees lining your street. Everybody has a story like that. So, the enthusiasm extends to every corner of the country to some extent. And the one thing that I would like people to know, I would say that it's not something to be scared of. And the best thing you can do is ask questions and learn more about it because you're only scared of things that you don't know anything about.

Joanie Mahoney: Well said. How about you, Linda? What's something that you would like the public to know about the work that you're doing?

Linda McGuigan: I just want them to know that we spent a lot of time on this. It's not something that we just came up with and are putting out there. We've researched this we've done a lot of work on it. We've tested this. It's 39 years of research, so it's not something that they should be scared of.

Joanie Mahoney: I think that's a really important point. It's been 39 years that we've been working on this and we've yet to get the final approvals and yet to make the tree available

to the public. So, they should take some reassurance from that fact. And how about you, Bill? We'll give you the last word.

Bill Powell: Well, first I want to say that this has been such a great honor to be on this project. I have colleagues who say you are so lucky you're working with such a charismatic tree and that's true because no other tree probably could have gone through this process. You know, it's because of the love of the public for this tree. I mean, how many trees have a song written about it? Chestnuts roasting on the open fire. Right. I'm so grateful that we could start with the chestnut. But I do want to emphasize that this is just the beginning, the chestnut is the ice breaker. We're building a path forward and we want to try to apply this to save other trees. We're interested in the environment, and there's a lot of challenges out there, and we want to be able to meet those challenges.

Joanie Mahoney: And E S F is the place where the solutions are being created. And I hope that you know how much appreciation we have at the college for the work that you're doing. We're really lucky that you're doing that work here. And I just hope that you have a lot of satisfaction when you imagine the impact that you're going to have on the landscape and our country. So, thank you so much for taking time to sit and talk to me and to talk to us and to teach us a little bit more about the American Chestnut Project.

Bill Powell: Thank you.

Linda McGuigan: Thank you.

Joanie Mahoney: That will wrap season two of the campus conversation, the podcast hearing about some of the great research that's done here at E S F. There's lots more to talk about, and I'm looking forward to season three. I want to thank Tyler and Jason for the work you've done producing and editing this podcast. We will be back in the fall and hope to have more conversations then. Thanks.