



Dr. Jill

Your Functional Medicine Expert®
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[#94: Dr. Jill Interviews Levon Durr on Mushroom Mycoremediation After the Wildfires](#)

Dr. Jill 00:13

Hello everybody! Welcome again to another episode of Dr. Jill Live. Today I have a special guest who I just met a week or two ago. If you haven't caught my episode—I think it's around number 91—it's called "Breathe: What to Do After the Wildfires." I got on with Dr. Lyn Patrick and Dr. Louise Tolzmann, who have both been instrumental in environmental medicine, talking about what we can do about the air quality after wildfires and what we can do for our bodies to detoxify. If you missed that episode, check it out. But thanks to Dr. Louise Tolzmann, she introduced me to Levon Durr. He's the owner of Fungaia. How do you say your farm?

Levon Durr 00:59

Fungaia.

Dr. Jill 01:00

Fungaia, okay. Fungaia Farm—a mushroom company. In 2011, it was founded in Humboldt County, California. I will formally introduce him in just a moment. I'm super, super excited to have him here because, as Louise was sharing after her conversation with him, we can use mushrooms—we'll hear all about that today—to remediate our soils after the fires. I am certain that this is going to be really valuable information.

Dr. Jill 01:27

Many who've been listening, or if you've been watching the news at all, know, but just in case you don't, on December 30th—just a little over a month ago—we had one of the most massive wildfires in [terms of] destruction in the history of Colorado, our state. It destroyed nearly 1,000 homes and businesses. They were all in my neighborhood of Louisville and Superior. All around my office in Superior, Colorado, [there] is destruction and devastation in neighborhoods that are completely gone.

Dr. Jill 01:56

The great thing about today's content is that I'm going to learn right along with you from Levon. I feel like this will be really practical in the next months and years going forward because we know that there's all this devastation. Especially in those areas of grassland that were burned, the soil is bare. So as it gets dry and the snow melts, we're going to have a lot of dust and debris and things. And as we talked about in the previous presentation, within these charred remains of homes and things are so many toxic chemicals. We're going to dive in today about maybe one of the solutions that you hadn't heard about before in mushrooms.

Dr. Jill 02:31

And I am so excited to introduce my guest, Levon Durr! Like I said, it's Fungaia Farm, a mushroom company [founded] in 2011 in California. He's a passionate ecologist and has spent most of his adult life farming and learning from nature. Levon holds certifications in Permaculture Design, Permaculture Teacher Training, Mushroom Cultivation, and Mycoremediation, which is the topic of today. Through his journey with permaculture and mycology, he became more and more fascinated with the ways that we as humans could not only find balance with our surroundings but also help heal some of the wounds that have been inflicted on our earth. Fungaia Farm focuses on low-impact mushroom production and mycoremediation and provides classes and supplies for people to grow their own mushrooms.

Welcome, Levon! I am super excited to learn with you and our listeners today about mushrooms.

Levon Durr 03:26

Thank you.

Dr. Jill 03:28

I love starting with [one's] story. I would love to know—we heard a little bit about how you got into this—how did you get into mushroom farming, ecology, and all this passionate business? I love it.

Levon Durr 03:38

Yes. I was an avid wild mushroom crafter in my late teens and early 20s. That got

me more interested in learning about ID'ing lots of the beautiful fungal flushes that we have all throughout California. I spent some time up in Oregon and the Pacific Northwest. It's well known for the beautiful forests and old growth that we have, as well as the tremendous amount of rain we have, which the mushrooms love. The mild climate gives us a long mushroom-fruiting season, so it's a spectacular place to wildcraft mushrooms. That led me into [having an] interest in cultivating mushrooms, looking at cottage businesses that had a good niche for our area.

Levon Durr 04:27

Our mild climate is also a great place to grow mushrooms, so [we're] promoting that in our area for folks. And then there is the need to provide and be able to give people the tools and supplies that they need to grow their own food. We set up our business in 2011, Fungaia Farm. We initially started supplying folks with spawn and things to grow their own mushrooms. Then we transitioned and added fresh mushroom and medicinal mushroom production to our business as well.

Dr. Jill 05:02

Wow, so you basically help people who want to grow their own. Do you have a farm and do you sell the produce from it?

Levon Durr 05:09

Yes.

Dr. Jill 05:10

So multiple different ways.

Levon Durr 05:11

Not very many vegetables. We grow a lot of food for ourselves. We do a little bit of excess sales at the local market. But yes, fresh mushrooms. We do oysters, lion's mane, and shiitake. Mostly fresh mushrooms. Then we also grow reishi and dry lion's mane for our tinctures. We wildcraft turkey tails and grow cordyceps mushrooms for our tincture line too.

Dr. Jill 05:38

Oh, I love this. As a physician who's in functional medicine, we use mushrooms all the time for brain health and recovery from brain injury. Lion's mane is particularly good post-concussion. I'm sure you know. You might have as much or better

knowledge of the medicinal purposes of these. Do you want to briefly talk about reishi, cordyceps, and lion's mane and some of the ways that you see people using them?

Levon Durr 05:59

Sure. Medicinal mushrooms have a lot of overlap with the health benefits that they have. But they also have very specific things that they can address for folks. Reishi has been known for a long time as a really good builder for your immune system. It supplies lots of nutrients, minerals, vitamins, β -glucans, and polysaccharides that are building blocks for a lot of our body systems. Not that we don't find these things in other places in nature—in plants and other things that we eat—but in mushrooms, they're extremely concentrated. They do have some unique things, for instance, lion's mane or cordyceps. Cordycepsins are [inaudible] compounds that are very specific and aren't found in nature or other things that we eat. They can address specific ailments and concerns that people have.

Levon Durr 06:54

You touched upon lion's mane, which is an incredible regenerative [mushroom] for the cellular structure of nerves, brain tissue, and connective tissue. A lot of people suffering from a wide variety of ailments or ailments that cause damage to those systems can benefit from regular use.

Levon Durr 07:17

Eating mushrooms is great. They lower your cholesterol, they give you protein, and they're full of vitamins and nutrients. But getting the medicinal dose is important for folks who are trying to address health concerns. Tinctures and supplements are a great way to get that regular usage where you can take them a couple of times a day and see if that's something that helps you.

Dr. Jill 07:39

Wow, I love it. I use all those in clinical practice and make recommendations. For full disclosure, I'm allergic to mushrooms. I have to say that. And I have a lot of patients who have mold illness. And I want to just say the obvious here. First of all, often in the very beginning, when people are sensitive to mold or fungally colonized, they don't do great on a lot of mushrooms. But I get this question all the time, so I'm just warding it off. Unless you're completely allergic to them—often

after mold treatment, remediation, and stuff for your own physical body—you can tolerate them again. This is one of those things that's best to talk to your doctor about. I get some people [who are like]: "What about mushrooms? I thought I shouldn't eat those." I don't think that's true for everyone at all, even if you had a fungal issue or mold exposure. But if you truly have an allergy...

Dr. Jill 08:24

Interestingly, you mentioned β -glucan. That's one of those components that's in these mushrooms. It's so powerful for immune support. We use the supplement—the derivative, the β -glucans—for immune support in these mushrooms. And as you mentioned, do cordyceps and reishi contain that? Or maybe all of them a little bit?

Levon Durr 08:39

Yes. A little bit—all of them. Yes, exactly. Because you are eating spores. So if you're toxified with spores... Mold is a fungus.

Dr. Jill 08:54

I was talking to my colleague. We both treat mold-related environmental toxicity and illness. We were both saying that it's a love-hate relationship. We do use mushrooms clinically. We love them. I'm a huge advocate. So don't get me wrong here. But because I know I'm going to get those questions, if someone's in the midst of a severe colonization of fungal issues or mold toxicity, sometimes it's best to temporarily take them out and then add them back in at a later date. And it's all balanced. But they're powerful.

Dr. Jill 09:21

My background is mold in the environment and how it affects the human body. It's fungus. What it does is remediate material, which is what we're going to talk about. It chews, eats up, and causes it to go back to the form that it should be. But if it's in our house, maybe it's not so good compared to the garden.

Levon Durr 09:38

Even when we're farming, we have to wear respirators and stuff because of the amount of spores, specifically in oysters, reishi, or something. Certain spores germinate faster and are more irritant to our lungs than other spores, [depending on] their size, shape, and variety. Being someone who works around it all the time,

does a lot of shoveling wood chips around, and lives in a wet environment, we have to be careful. Even in the fruiting room, it's not a big problem for somebody who just grows a couple of oysters in their house or something, unless they have a mold allergy. But for somebody who works around it daily, you have to be careful.

Dr. Jill 10:22

I'm so glad you said that because I'm such a big fan of what we're going to talk about. I think it could be for almost anyone, even someone like myself, to have in my home. But I love the caveats because, in my population, a lot of the listeners are like: "We have mold illness. What do we do?" Precautions and things. But it doesn't mean you can't necessarily eat them, take them, or do that. Again, it depends.

Dr. Jill 10:44

So let's talk about, first of all, remediation in general. We know that mold, spores, and fungi— in general, their job is to turn over the earth. Tell us a little about this background and why it's important to someone after the fires.

Levon Durr 11:01

Yes. We know, like you pointed out, that fungi are remediators and digesters. If we didn't have them, we would be standing in 100 feet of organic waste on the planet. They dissolve everything around us and break things down through this enzymatic activity. The mushroom that we referred to, just to give a little context, is the generic name for the fruiting body of the organism. The larger mass of the organism that we're talking about, the fungi, is the mycelium. And this is the root-like structure that grows through the substrate, be it the leaf mulch in the forest floor or a log in your backyard. This is where the big organism is existing.

Levon Durr 11:52

People have equated it to [the following], for instance: What you're seeing is the apple on the tree. The apple pops up out of the ground, but the tree is underground. And that's the mycelium. The way the mycelium eats its food is by secreting these powerful enzymes, somewhat similar to the pancreatic enzymes that we use to break proteins and carbohydrates down. It's secreting these through these little hypha threads. They look like cobwebs. These cobwebs can grow extremely fast and break down a wide variety of materials. [They have] very dense bonds. Obviously, its favorite food is carbonaceous materials. It's looking to eat

lignins and cellulose out of the materials and, out of that, get the sugar. Of course, they use minerals and other things to build their structure and that's why they're so medicinal. But when we're just talking about remediation, we're looking at using that same enzymatic process to break down other bonds, be they chemical bonds, high hydrocarbon bonds, and things like that.

Levon Durr 13:03

There's been a lot of great research looking at: What fungi, molds, and yeasts can break down what different chemicals? We have that knowledge now. There's been some great books written and people have researched all that. A lot of it's been in a laboratory setting. Bringing that out into the field is where the movement is right now—understanding how to take a biological organism and give it these very specific parameters of humidity and temperature where it's comfortable to live. And then, if there was a contaminant that we're looking at breaking down, like hydrocarbons, for instance, how can we create an environment where that mycelium will thrive, come in contact with the hydrocarbon, and also molecularly disassemble the hydrocarbon so it can get at that carbohydrate bond? That's all it's doing with a piece of wood, too.

Dr. Jill 14:00

Yes. Wow. I love this. Basically, what you're starting to teach and give the opportunity for people in your state of California to do, and we'd love to do that here too, is [determine]: How could we grow or use the mushrooms?

Dr. Jill 14:15

We have these subdivisions that are gone. And of course, the debris there is concrete. It's just nasty. There are still yards and stuff, but then there are also these areas of grassland or open space. It completely obliterated the grass cover. Say the city of Louisville wants to use mushrooms. How would you advise a city on rebuilding after a wildfire and the use of mushrooms?

Levon Durr 14:38

Great. Because I give these talks frequently and I get a lot of questions from folks, I like to clarify. There's the process of pulling toxins out of the ground and embedding them into something, which is commonly used for phytoremediation. You plant grasses, sunflowers, or alfalfa. Say, for instance, lead, cadmium, or some

toxic heavy metal. You pull that up into the plant. Mushrooms are capable of doing that, which also makes them a candidate for being toxic because they can be full of lead.

Dr. Jill 15:20

That was my next question. Can you eat these? I'm assuming no.

Levon Durr 15:25

No. But when it comes to organic compounds, like hydrocarbons, or manmade chemicals like pesticides or flame retardants, we can use the mycelium to break down and molecularly disassemble those bonds and let the mycelium get at that carbohydrate that it wants to eat. Then we end up with base salts, some gases, and this non-toxic substrate if we've broken it down sufficiently. Mushrooms are capable, like we just mentioned, of bioaccumulating heavy metals. In two of the three hydrocarbon remediations we did using oyster mycelium, we never fruited the mushrooms. We never grew actual fruiting bodies like mushrooms. So we're just using the mycelium.

Dr. Jill 16:24

It's like the underground network, right?

Levon Durr 16:26

Yes, the underground network. Right. Creating the fruiting conditions to bioaccumulate the heavy metals into the fruiting bodies and then harvesting those fruiting bodies, just as you would [with] plants, and then removing that and throwing that into a landfill or incinerating it and reclaiming the metals or whatever is possible. But it's a lot more complicated than growing alfalfa or sunflowers on the site. That's where phytoremediation really excels.

Levon Durr 16:55

Where mycoremediation really excels using fungi is when you're just dealing with organic compounds, like hydrocarbons. Metals don't break down. Maybe in a supernova or something; I'm not sure what happens. But to use a classic example of lead, you can bioaccumulate that into plant matter and then remove that plant matter. That would be something I would recommend for folks who are looking at heavy metal toxicity. But if there are flame retardants, chemical spills,

hydrocarbons, and things like that, that's where the mycelium really excels—in breaking those contaminants down.

Dr. Jill 17:41

They're biodegradable. As a layperson, this is all new to me, so I'm going to try to reframe what you said and see if I'm getting it right for the listener. It sounds like the mycelia—which is that network that's underground—is not really fruiting, so we wouldn't even see any mushrooms. Are they spores that you plant?

Levon Durr 18:02

Just the mycelium itself.

Dr. Jill 18:05

Say I was a homeowner and my house burned. I want to rebuild and my yard is covered with hydrocarbons and stuff. Is this an example where you could put the mycelium in my yard? Obviously, if it's burned, there's no grass, just dirt. Do you need a dirt ground cover? What if there's grass there? Does it compete?

Levon Durr 18:22

Good question. There are major challenges with the right time of year and the temperatures. Is it too cold? Is it too hot? Is it too dry? You have this living organism you have to take care of.

Levon Durr 18:36

Just to back up, the first thing we always want to do is gather knowledge. And you know this is a doctor. Somebody comes to you and says, "I think I have Lyme disease." You'll be like, "Well, let's test." "I think I have lupus or something." It's like, "No, we have tests for that." And it's the same with remediation—test, test, test.

Levon Durr 18:55

We want to do hydrocarbon tests. We want to do a chemical analysis. We want to do a metal analysis. That's your starting point. What is actually the problem and what do I need to remediate? There are metals everywhere. Which are the toxic ones and which are the toxic levels? It's okay if we eat a little bit of zinc and copper, but if we eat too much, it's poisonous. So that's where I always encourage people to start. Find your local soil testing and water testing company and contact them.

They usually have little containers you can pick up and go and take tests throughout your property or field.

Dr. Jill 19:34

Okay. So you start with testing. I love this because this is just what I do. You test your soil. And by finding out, you can either have hydrocarbons, flame retardants, chemicals, benzene, toluene, or whatever—those are more in the air—or you're going to have metals. Two different solutions; two different problems.

Levon Durr 19:51

Two different solutions. People are looking at mycoremediation for metals. There was a report just published where they were doing dried mycelial mats. They were burying them in the soil to absorb lead. They didn't tell you how they were doing it. They just said they got a grant and it was through this university. But it was a pretty cool project. I could put links later—after this talk or what have you. It just popped up in my feed and I was like, "That's really interesting!"

Levon Durr 20:18

There have also been mushrooms that have been found to bioaccumulate huge background levels of radioactive isotopes, acting like a metal that the mushrooms were bioaccumulating into the fruiting bodies. But it's super challenging to create those conditions to fruit the mushrooms, whereas plants excel in absorbing heavy metals. This might be multiple years of planting alfalfa or grasses. There are also a couple of mustards in the mustard family. They're very hardy. Mustards grow like weeds everywhere. They're all over the planet. But you might be growing it, planting two or three crops a year, collecting that biomass, drying it, disposing of it, and then retesting the soil and seeing if your lead levels have gotten lower and lower.

Dr. Jill 21:08

This is so cool because it's so parallel to humans. Say they have lead or mercury. We're using clay, charcoal, and binders in the body. And, of course, other things like alpha-lipoic acid and glutathione. We're pushing the toxins out. We're usually collecting them in the bowel through the stool. Then we retest the human body and say, "Is the level lower?" It parallels [inaudible].

Levon Durr 21:28

Exactly. We are of the earth for sure. And these [regarding] systems, I like to point out to people that on the family tree, plants and fungi branched off. Millions of years later, animals and fungi branched off. Genetically, we have a lot more similar processes to fungi than we do... That's why they're not a plant; they're not an animal. But they're definitely not vegetarian. They eat insects. They attack larvae.

Dr. Jill 21:57

Wow, I didn't know! We need to have a whole other talk about: What else do mushrooms do? That's fascinating.

Levon Durr 22:01

Yes. They're very, very advanced beings. And they've been here a lot longer than us. So, surprise, surprise, they come across a hydrocarbon molecule... [Someone may be] like, "What's a hydrocarbon?" It's just a bunch of organic matter that piled up before there were fungi on the planet and turned into hydrocarbons. So it's not like oyster mycelium—*pleurotus oestreatus*—is going to run down into an oil field and eat the oil. We need to have that oil or chemical in a state that's going to be hospitable to that mycelium for it to grow.

Levon Durr 22:36

And that leads me to describe the mycoremediation process. For instance, [with] the two projects we've done, hydrocarbons [are a] huge problem. [There are] oil spills everywhere. People spill gasoline. People have spills. The companies have spills. It washes up on the beaches. We don't know what to do with it. The landfills are filling up. Nobody wants these hazardous wastes. So along come the fungi. It's an amazing remediator.

Levon Durr 23:02

In two of the three projects we did up here, we grew the mycelium out on burlap and straw. We brought these rolls inoculated and fully colonized with the oyster mycelium. Rolls of burlap. Then we layered this in a lasagna-type layer of contaminated soil with some straw, with the mycelium, with a little more straw, and with some contaminated soil. You can read this whole report on our website if people are interested in implementing this in their own area.

Levon Durr 23:36

We created small piles because we don't want to create a thermophilic-like compost pile where it gets too hot for the mycelium. The mycelium wants to live at 60 to 70 degrees, not 140 or 120 degrees. Then we tarped everything. We contained the soil because it was contaminated. It's a hazardous waste. We kept the rain off of it. And we treated the soil. In the case of the diesel fuel spill, we treated the soil twice. In the case of the motor oil spill, we treated the soil three times. These projects took over a year to two years, partly because we were dealing with the cold winter and the too-hot summer. So we have these little spring and fall windows where we could get this mycelial growth to happen and the remediation to take place.

Dr. Jill 24:26

Wow, that's so fascinating. Yes, we want links. I'll be sure to share them if you're listening. Wherever you're listening, we'll have links to this and your website for sure. This is fascinating to me. I think what we're talking [about] is some of the future of environmental remediation, climate change, and all the things that we are dealing with. We need new solutions. This is an old solution because mushrooms are so... But to me, at least, I'm fascinated. I love this.

Dr. Jill 24:51

You mentioned climate. If we were going to use this in some area with the wildfires around our community—we're in Colorado and it's super dry—is Colorado too dry for mushroom growth? Or could it be [used] at certain times of the year?

Levon Durr 25:03

Pretty much everyone has a time when it's below 70 degrees in their community. It's [about] finding those specific windows.

Dr. Jill 25:15

What's too cold, then? If 70 is the upper limit, what's the...

Levon Durr 25:18

Below 40. You're trying to find the mid-60s or low-60s. That's pretty much what most things are going to thrive at. This takes monitoring. And like you mentioned, this is a very old technology. We're just using this biomimicry of this process, where if we all vanished today, fungi would come in.

Dr. Jill 25:45

They'd just do it automatically, right?

Levon Durr 25:46

They'd eat this computer. They'd eat my whole house. They'd eat this computer. It would all be gone in a few thousand years. We're just trying to use these processes to speed things up. As people have begun to realize, as populations on the planet have gotten bigger and bigger, our landfills have filled up, and we've created more Superfund sites and toxic hazardous waste everywhere. There is no away. When you decide to throw this contaminated soil, we're just moving it to someone else's watershed. And sure, maybe the landfill is lined, but that liner is a ticking time bomb too. That's going to degrade. Some fungi are going to eat that, and then it's leaching into the river. It takes a long time for these natural cycles to process all this material. We can speed this up by creating the perfect environment for the fungi to live and break these chemicals down.

Dr. Jill 26:41

I love that thought. Like you said, this is what's already happening. This is part of why mushrooms exist—the circle of life. But it makes so much sense to think about it the way your company is teaching people to use it, [which] is accelerating the process and giving you a specific space, a home, or a place for this to happen. From what you said, of course, the... What do you call them?

Levon Durr 27:08

Mycelia.

Dr. Jill 27:08

Mycelia. These guys go under. These are the hydrocarbons. They like to chew that up or whatever. And that would be, like you said, with oil spills or any hydrocarbon toxicity anywhere. Then we talked about the metals and the fruiting body. That's going to take more because you're growing it and you have to have good conditions to get it to fruit. Also, you're going to burn it or whatever because it would not be consumable due to toxicity, right?

Levon Durr 27:32

Exactly. There's a great book. Leila Darwish wrote a book called *Earth Repair*. She combined these three systems, looking at phytoremediation, mycoremediation, and bioremediation. It's really interesting. When I read the book—

Dr. Jill 27:49

Can you define, for those listeners and someone like me, phyto, bio, and myco? Tell me what these things are.

Levon Durr 27:54

Yes, thank you. Phyto is using plants to remediate. Myco is using fungi to remediate. And bio is using bacteria.

Dr. Jill 28:03

Okay. It's fascinating. Really quickly, you mentioned a few plants. I know you're not the expert in phytoremediation, but what are some of the other common phytoremediators in this realm?

Levon Durr 28:15

We know that plants pull up minerals out of the ground and metals are just like another mineral to the plant. Some seem to bind with them faster and pull them up out of the soil quicker. Of course, like with the mycoremediation, how deep are those roots going and how deep is that lead? What was exciting about our conversation is that if the ash is just right on top of the soil, that's great. It's not as if there was a copper mine or something where these chemicals leached into some sandy soil five feet down, which might need to be tilled and planted and tilled and planted until the metals reduce. This is a huge problem in urban settings, too—people converting parking lots and old empty lots to community gardens where they can't use the soil that's there and stuff like that.

Levon Durr 29:13

Alfalfa has been found to pull up metals quite well. It is pretty resilient. It grows in a lot of different environments. Sunflowers are a super-hardy, drought-tolerant plant. It has a big root system. Plant them really close together. Do a thick crop of them. And certain mustards have been found to be good remediators. It's another aggressive, prolific, vegetative, drought-tolerant plant that you can work with.

Dr. Jill 29:43

I want to talk about the species of mycoremediators. But before I move on to that, one thought is that we have natural shrubbery and grasses and stuff. Some competing things get introduced, and then all of a sudden... I can't remember the name of the tree that's now endemic here in Colorado that was brought in. Would any of these plants or these mushrooms take over the natural habitation? Or would they just do their thing?

Levon Durr 30:06

Great question. We don't want to bring in another problem. You go to Hawaii and they're like: "Then they released ferrets. Now there's ferrets everywhere." We've seen a lot of those all over. "Oh, we're going to put this beech grass in to control the sand drift in Humboldt County." And now we have this invasive beach grass. Yes, that is a good thought. We can clone and replicate local wild mushrooms. That is an option that's totally viable.

Levon Durr 30:38

That being said, oyster mushrooms are growing on every continent on the planet. Bringing in a more domesticated commercial oyster mushroom that we know is really aggressive and grows in a more broad temperature range—[based on] the fact that we're not producing fruiting bodies that would produce spores, this is a very short life thing. The mycelium will be dead in a couple of months. *Pleurotus ostreatus*, the oyster mushroom that we used for our remediation, does not live in soil. We were asking it to eat all this straw and come into contact with some soil that was soaked in diesel fuel. And as soon as it ran out of food, it died.

Dr. Jill 31:29

Got it. It's like it's giving it its little food source, [inaudible].

Levon Durr 31:33

It's like that. There's not a huge risk of it sporulating. And even if we went there, if a mushroom fruited and it spored, if it wanted to cross genes with the wild oyster mushrooms, it could. For that matter, everyone's growing this mushroom that I'm shipping all over the country constantly anyway. There are very little restrictions on these things, like shipping to other countries or even Hawaii. It's listed [as] allowable. You know that Hawaii's very restrictive.

Dr. Jill 32:05

Yes, so you know it's probably pretty safe. Okay.

Levon Durr 32:09

It's very unlikely that it would go feral or cross. Even if it did, it has been for millions of years already. [laughs] These are wind-borne spores all over the planet.

Dr. Jill 32:21

Okay, that makes so much sense. And something else you just mentioned—we first started talking about it because of listeners with mold and allergies—when we're doing mycelized mycoremediation, we're not even growing the fruiting body to spore. So if there is an allergy, it's less likely to cause an issue as well. Would you say that's true?

Levon Durr 32:37

Exactly, yes. And it's not that it wouldn't happen if you created fruiting conditions. I assisted with a project in town here. They just happened to do it in the spring. It happened to be foggy, drizzly, warm, and rainy. She took the tarps off and grew these giant, plate-sized oyster mushrooms in her backyard. Of course, we advise people not to eat those because there may be heavy metals in the hydrocarbons that you just picked up. When you have engines grinding metal against each other, they can have heavy metals and waste hydrocarbon products.

Dr. Jill 33:13

Wow, this is fascinating. Obviously, with these big oil spills, it makes so much sense. And that's so exciting—what you've already been involved in and the future of that—because we continue to have these accidents and ruin our environment. It's nice to have some solutions. But how would you see it for an average community? Say for Louisville and Superior, what would you see as possibilities to use mushrooms in the community where there are no wildfires? Would it be in the open space? I'm still trying to figure out, if people wanted to use them, where would you recommend they do that or how? With the first test. They need to know what's going on, right?

Levon Durr 33:51

Right. Testing. When we had a diesel tank spill, it soaked seven feet down into sandy loam soil. Let's say there weren't heavy metals there before, which there

might be. But let's say a home burned down, and now there are chemicals from the ash, all the appliances, couches, and everything. It's very likely that the first two or three inches of soil is all that would need to be removed. I would take that and I would scrape that up. I would get it tested to know what I'm dealing with. If it was heavy metals, I would do the phytoremediation using plants. I would plant plants in the soil. I would harvest that biomass. I would dry it and then dispose of it. If it was hydrocarbons or some other organic compound, I would then address the right fungi for the right chemical. There are some great books out there. I'm always happy to consult with people on—

Dr. Jill 35:03

What you're saying is even deeper than that. There's enough data. Say they have these three chemicals. There are probably some types of mushrooms that are better than others at remediating those.

Levon Durr 35:14

Yes. There's a reason why turkey tail (mushrooms) are on the front of this book. Turkey tail is a huge remediator. And surprise, surprise, turkey tails are growing on everything in my yard. They're growing on dog fur. They're growing on oak. They're growing on tan oak. They're growing on some apple cuttings. They'll grow on anything, [which] is basically the answer to that. And oyster mushrooms are another big remediator because they are super willing to eat a lot of different things. They'll grow on newspaper. They'll grow on straw. They'll grow on a wide variety of woods. So when you see that diversity in saprophytic fungi, a wood digester, its adaptation has allowed it to eat a wide variety of different woods and break those bonds. If it can eat a conifer loaded with all these resins and, at the same time, eat an oak like a hardwood, you can see the diversity of its digestion.

Dr. Jill 36:20

You know that's probably going to be a good mycoremediator.

Levon Durr 36:23

Yes. Whereas some things are very, very specific. They only grow on these woods. These folks in these books have researched all these different yeasts and molds. And it's not always 100%. Sometimes it degraded it [by] 70%. Sometimes it degraded it [by] 90%. Sometimes it degraded it [by] 50% and you had to do it three times to get it fully broken down.

Dr. Jill 36:49

This is so fascinating. Again, I treat mold-related illness. I use different binders in the human body, and each of them has different affinities for different types of molds. I might have *Aspergillus* or *Penicillium* and use certain types of binders. Then, if I have *Stachybotrys* or *Chaetomium*, I'll use clay and charcoal. So, in a different way, it's very similar to our bodies. I see lots of parallels.

Dr. Jill 37:13

This is fascinating. Is there anything we haven't talked about that your company does? Obviously, the mycoremediation, the oil spills. You've done two separate specific endeavors that were written up on the oil spills, right?

Levon Durr 37:27

Yes. The report on our website was our first big project. It was a huge learning experience. In a lot of the report, I wrote about what we did wrong because I really wanted to learn.

Dr. Jill 37:38

You learn, right? I love that.

Levon Durr 37:39

Yes. Don't repeat these wrong mistakes. This is what went right, and the project was successful and it worked. But I want people to skip over the failures and get right to the success. The motor oil spill was great. And I knew a lot more when we addressed that. I made it into a short YouTube video you can see because I wanted people to get the tactile experience of seeing the process in the field.

Levon Durr 38:09

And some of the challenges: It was snowing where they were and then it was 100 degrees. We had to do three different treatments and the oil was very viscous. It was this sloppy sludge of soil. So I noticed that the mycelium was having trouble penetrating in there. The straw was decomposing fast. So we switched to some wood shavings and started mixing inoculated wood shavings into the second and third treatments. That was more successful. We only got a 30% reduction the first time. Then we got a 70% reduction. Then we got a 90% reduction. And we were

like: "Okay, this is good enough to use as her driveway." This was used motor oil. We never did a heavy metal test. This isn't like, "Oh, plant my veggies right here now."

Dr. Jill 39:00

This is so fascinating. I love it because it's a new topic that I did not know much about. And it's so parallel to what I do. It fits in and it's so important. I think we'll end with: Are there any future things that you see that maybe haven't been done based on what you've seen and know that you would love to see happening in your world of mycology and mold?

Levon Durr 39:25

The lovely thing about these technologies is that they're very achievable by the average person. There are plenty of remediation companies out there that have solvents that will dissolve chemicals and [there are] dispersants that will get the oil off the top of the ocean and send it to the bottom. Some of them are great. Some of them clean it up completely; some of them don't. This technology is not a silver bullet. It's another tool in our tool belt to have at our disposal.

Levon Durr 39:56

What's wonderful about it is that anybody can grow some oyster mycelium. Oysters are so forgiving. They're the easiest mushrooms to cultivate. You can take an oyster mushroom, cut the stem off, roll it up in some cardboard, and start oyster spawn in your backyard. No spores, no mold, just mycelium growing. Put it in some straw. Mix some contaminated soil in that straw. Test it before and test it after. See if it was successful. It's a very achievable thing, like growing mustards or alfalfa. You can test the soil. It usually costs about 60 to 70 bucks to do a heavy metals test on your soil, and then you can test it afterward [to find out things like]: Did I draw enough of the lead out of my soil?

Levon Durr 40:46

We are totally open for Zoom consultations. We do sell supplies for people and grow things. Obviously, shipping is not practical. Mycoremediation needs to happen in your local community and grow. We can supply cultures, things like that, and things to get started. But this is something that people have to grow on-site most of the time. I did ship a roll of inoculated burlap to a student in New York who was doing a mycoremediation project. The shipping was very expensive.

Dr. Jill 41:24

Yes, I bet. It's heavy. Wow!

So, where can people find you? Where is your website? I'll include whatever you share with me, but tell us where to find you.

Levon Durr 41:35

We're in Northern California—Northern, Northern California. People think of San Francisco—that's Central California. It's a long state. We're an hour from the border, right around the bay in Humboldt County. Our website is FungaiaFarm.com. We do classes and consultations and sell spawn and lots of supplies for people to grow edible medicinal mushrooms or do remediation. We're on Instagram, Facebook, and stuff like that. We love hearing from people. We love hearing about projects that people are doing and love promoting this community action to clean up the earth.

Dr. Jill 42:27

Awesome. Thank you for letting me be a part of what you're doing and interviewing you. It's so fun to learn new things. I love what you're doing! And thanks for letting me know how I can support you.

Levon Durr 42:36

Great. Thanks for having me!