# Episode 19 - Nurturing the Soil Food Web with Dr. Elaine Ingham


## FULL EPISODE TRANSCRIPT

With your host

**Hayley Weatherburn**

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Welcome to Thriving with Nature, a podcast that gives you the tools you need to live a modern lifestyle that helps regenerate our planet. And now your host, Hayley Weatherburn.

**Hayley:** Welcome Thrivers to **Thriving with Nature** podcast. We have an extremely special guest today. I just want to welcome you, Dr. Elaine Ingham. Thank you so much for your time.

**Dr. Elaine:** Glad to be here.

**Hayley:** For those of you who don't know Dr. Elaine Ingham, she's a world-renowned microbiologist and soil biology researcher, and founder of the soil food web, which is an amazing website. You have to go and check out. She's made everything so easy to understand. She's known as a leader in soil microbiology and author of the USDA soil biology primer. So, we have someone who's been, how long have you been doing the research in this?

**Dr. Elaine:** For about 45 years.

**Hayley:** If there's anyone you want to talk to about soil biology, we have the number one person here. I'm just extremely honored. I guess the first thing I want to ask you is what led you to a life and passionate about life in the soil?

**Dr. Elaine:** I guess it really disturbed me that people pour on toxic chemicals and then think that that's going to be edible food. When we know that when you kill the biology in the soil, we now know that when you kill the biology in the soil, you reduce the ability of the plant to access the nutrients that are in the soil. There is no soil on this planet that lacks the nutrients to grow plants. So, why are we putting on inorganic fertilizers? This is nuts. If people really understood, they would never ever take those toxic inorganic salts. Every single fertilizer is an inorganic salt, and you're killing the organisms in the soil. You're killing your plants. You're making it hard for them to be healthy. They can't get the nutrients that they need. Does this not sound like a story of woe and dim, dismal? What are we doing to ourselves? [Yes.] So, we have to get this news out to everybody that there's no reason to be doing this to ourselves. It's why we're sick. It's why we're

not healthy. Because food doesn't have the nutrients that you require. It means your immune system is going to be suppressed. You're not going to be healthy. You're going to be tired. All those sad woeful things. And there's an easy solution. Start [yeah] cycling your own nutrients. Take the waste plant material. Turn it into really good compost. Apply those sets of organisms that do all these benefits to your plant. And take the nutrients that are in your soils. As I said, there is no soil on this planet that lacks the nutrients to grow plants. You just have to convert it from a plant unavailable form into a plant available form.

**Hayley:** Right. Right. Really interesting. We're going to get right into that. I did Soil Advocacy Training with Kiss the Ground recently, and that's where I was introduced to your amazing video series on your website. Go to soilfoodweb.com and then, click how it works. And you've just made these beautiful cartoon illustrated diagrams and videos explaining exactly this. So, you had a hypothesis. You could feel your heart breaking when you saw people putting toxic soils in the chemicals and then, see how you're heart, you're like something's going on here and I need to find out what it is. Is that sort of the journey that took you to find the answers?

**Dr. Elaine:** Well, it was a little more convoluted than that. When I started my PhD at Colorado State University, which is when I shifted into soil mode, before that I had been interested in Marine microbiology, but it became very apparent that there was no money in Marine microbiology. And I've gotten used to this idea of being able to eat.

**Hayley:** That is important.

**Dr. Elaine:** So, yeah. You have to have a job where you can actually make some money. And so, when I arrived at Colorado State University, my major professor asked me to take on a project where we would look at how do you assess active living organisms in soil. [Wow.] What's the total biomass? What's the active biomass? And one of the things my major professor asked me to do was to go around to all of the other professors in soil-related agricultural plant growth related subjects. And he asked me to ask them, what do all these organisms in the soil do? We know that there's lots of bacteria and fungi and there's some protozoa and there's some nematodes and what do they do in the soil? Would it be a wise idea? Would it be a good idea to get my PhD work, my dissertation? I'm looking at these organisms in the soil and starting to figure out what it is they actually do. And absolutely, every single person I talked to their reaction was, Oh, no, you don't want to do that because those organisms are just there.

They don't do anything. [Interesting.] Yeah. This is how recently people had this attitude about dirt and soil are the same thing and they're anything, but the same dirt doesn't have biology in it. And so, if you're trying to grow a plant in dirt, you are stuck having to use the toxic chemicals. You're going to be using pesticides and herbicides and all those inorganic fertilizers. You're going to have to tell you're going to (do it), because there's nobody home to do the work. [Right.] Okay. If there's no one home to do the work, then you're going to have to do the work. And we are really abysmally back. Talking to our plants and saying, so what do you need hon? A little nitrogen today? Or do you need fosters or maybe magnesium? How about some boron? What do you need? Come on, grow faster. Or I'd just look at these yellowing leaves. Look at these purple veins. Look at the dry crinkly edges. Look at the bubbly surface of the leaf. Well, we didn't know those things. We didn't know how to interpret those things. Nature talks to us all the time. We just don't listen. We don't know how to interpret that information. And so, I spend a lot of my life trying to look at some of those visual cues as well as the biological cues. And we've only begun to speak with mother nature really. [Wow.] We have a lot to learn. And it's a little depressing every once in a while when you realize just how arrogant we've been. As species, we have to learn to live with nature and not fight with nature. Because if you have a battle going with mother nature, okay, human beings may win one or two, but when you're having a war, who's going to win? Ultimately, who's going to win? [Yeah.] Nature. Exactly. So, we need nature. Mother nature doesn't need us. So, we have to alter our ways. We've got to get back to working with nature instead of against her. So, starting my PhD at Colorado State University, it was really kind of eye-opening to realize just what we didn't know. Those organisms have to be there for a reason. Mother nature doesn't let organisms that aren't doing anything. They're just lying around kind of, you know, taking up energy or something. She's not going to let them hang out and just exist. They're there for a purpose. And it was up to us to figure out why they were there? What are they doing? How are they important? [Exactly.] When we started investigating that, it was one discovery after another. Where the light bulb just came on and it was like, well of course, that's how it has to work. Nutrients have to be converted from not plant available into plant available. Nature's only been doing it for the last, we have billions of years. Yeah. Just because we didn't realize it, we paid no attention. It doesn't mean they weren't in there doing all the things that they're supposed to be doing. So, we've got to catch on and we better catch on quick. Because if we can get these organisms back into the soil, we can take all that elevated CO2 in the atmosphere. And very rapidly, sequester it back into the soil in no time flat within, we do different calculations and we come up with kind of different answers, but it's usually somewhere around five years, maybe 10 years, if we're really slow and stupid, 10 years in order to put all that elevated CO2 and methane and nitrous oxide, and ammonia back into the soil from once it  came.

**Hayley:** Yes, it is. It's such an important (idea). That's something that we learnt with Soil Advocacy Training is if we just step back, I like to talk about if you align with the force of nature, that's why she's always going to win. You might conquer those first two, like you said, but her force is unforgiving. It will always keep going. You walk away from a garden. The force is just very obvious. And so, but what we found was rather than trying to dominate and replace and understand everything, if we just nurture, nourish those soil microbes. Not only is it going to improve our soil health, it's going to improve our vegetable nutrition. And like you said, sequester the carbon back in. It's simple yet a powerful solution to u moving forward.

**Dr. Elaine:** And it's an interesting process to understand how we got separated from taking care of nature. What were the steps along the way that resulted in modern agriculture? There's nothing modern about it. There it's a new cum approach to life, really, when you think about it, which is sad. We were feeding the world. Human beings were feeding all these humans on this planet ever since there have been humans on this planet. What happened is that we, the Monsanto's of this world, the buyers, the DuPont, the chemical companies, Oh, no. If we don't have these inorganic fertilizers and pesticides, we can't feed everybody. We have no but, and we actually, we are growing more than enough food to feed everybody on this planet. [Yeah.] That's a total lie. And that they're using to try to make us feel like, Oh, I've got to use these toxic chemicals. It's a total lie that we are not making enough food to feed everybody on the planet. The problem is our distribution of that food. We don't give that food to the people who are starving to death. Yeah. Yeah. Truly Christian. [Yeah.] They're starving to death. They need this food, but don't give it to them. [No.] So things have to change. [Yeah, definitely.] So, let's stop destroying the soil because ultimately we will reach that point where we aren't growing enough food to feed people. And that's where it's going to get really nasty. Please let us never go down that pathway. Let's get this biology back into the soil where these organisms do all of the work for us.

**Hayley:** Yeah, exactly. Speaking all of these organisms and for those who've never heard of what a soil food web is, can you give an example? I do have a screenshot of the soil food web that I can share. But I'd love for you to explain to people what the soil food web is.

**Dr. Elaine:** Pretty simple picture here. If you start on with plants, let's see, looking at the far left, your general average plant, pretend that that's a great big banana or it's a grass

or whatever you want to think of. How do those plants obtain the nutrients that they require? How does that plant let the rest of the system know what it needs? And so, the plant photosynthesizes, making sugars and those sugars are then pumped down into the root system. That plant is going to release the specific structures of sugars and carbohydrates and proteins. (It's) exudates is what we call those generally. Things that are being produced by the plant, released out into the soil to tell the bacteria and the fungi. So, you can find there (that) there's the fungi. There is the bacteria. Those exudates tell the bacteria and fungi what the plant needs. And so the bacteria and fungi are saying, thank you very much for the cakes and cookies. This is wonderful, but I know if I want any more cakes and cookies, I have to do the job that this plant is requiring of me. So, these bacteria and fungi make the enzymes to pull the nutrients out of the crystalline structure of the sands, the silts, the clays out of rocks, out of pebbles, out of gravel, out of the big boulders, out of the parent material on which our continents are based. And those bacteria and fungi pull those nutrients. Now, they're going to tie those nutrients up in their biomass, in their bodies. And so, it's a bit of storage. It's a pantry for your plant. And of course, the growth of those and fungi mean it's going to attract the protozoa, the nematodes, and some micro arthropods. So, you can see that kind of the next trophic level over towards the right are protozoa, nematodes, micro arthropods and they eat the bacteria and fungi. But because the nutrients in the bacteria and fungi are so much higher in concentration, there's so much higher in phosphorus, in sulfur, in magnesium, in calcium and sodium potassium, boron, zinc, selenium, all the things that the plant needs to be able to grow. They're much higher in bacteria and fungi than they are in the protozoa, the nematodes and the micro arthropods. And so when the predators eat the prey, that's going to result in the release of all of these soluble nutrients, which is the form now that the plant has to take up. It's going to release all those nutrients in the proper balances because remember, it was the plant putting now the exudates, telling the bacteria and fungi what to pull into their bodies. And so, those soluble nutrients are released. The plant takes up what it needs. Everything is delivered right to the doorstep of that root system. I kind of think of it as being like the pizza delivery guy. And here you are the plant and you decide that you need some cheese pizza or pepperoni or whatever it is you need. You get on the phone and you call up the pizza parlor and they make your pizza. And it's kind of like the bacteria and fungi. They're going to make and take their enzymes. Pull the nutrients into their bodies. And so here we are, we've got the prepared pizza, but now we got to have somebody to deliver it to our doorstep. And that's the protozoa, the nematodes micro arthropods. They release those nutrients right around the roots. Plant takes up what it needs. If excess is being released, then the bacteria and fungi that weren't eaten by the protozoan, nematodes, and micro arthropods are going to take up those soluble nutrients and keep it right around the root system. So, the next set of predators that

come in will eat those bacteria and fungi release the nutrients and your plant gets a second try at them. But it's like two, a day later, 24 hours, 10 hours later, whatever, how rapidly is that plant growing? Well, it's going to be pumping out exudates faster, the faster the plant grows, the faster this nutrient cycling occurs. So, that's how we don't have to be putting on inorganic fertilizers anymore. It's absolutely not necessary. If you put in organic fertilizers on, you're going to be killing these very organisms that would do your work for you. Instead, you've opted to have to do the work with spreading all this inorganic fertilizer out. And we don't do a good job of putting out the right fertilizer. Your plant doesn't grow on nitrogen alone. It's got to have all those other nutrients. And I don't know if any of you have looked at how many essential nutrients plants require from soil. But back in the 1940s, people said we're only three nutrients that were necessary. NPK. Your plant can't stay alive on NPK. And that's it. It's got to have all these other things. Five years later, now they were saying, no, no, no, there's five essential nutrients. And 10 years later, it's 18 essential nutrients. By the time I got into high school, it was 24. When I got out of graduate school, it was 32. Which one's the real number? Will you please stand up? The plant needs all of them. And when we put out these inorganic fertilizers, we're stressing our plants because they're not getting the full balance of all the nutrients that they need. If your plant can't get the nutrient it requires, it's going to be subject to pests and the diseases attacking. And I've often had people say, why would mother nature have made all these pests and problem and disease-causing organisms? Why? Are these things in existence because it makes life so hard? Well, mother nature has those creatures to do specific jobs, just like the bacteria and the fungi, the protozoa, the nematodes, micro arthropods. Those disease-causing pest and problem organisms are there to take out the garbage. So, if your plant is being attacked by pests or diseases or problem organisms, mother nature's really sending you a message and saying, these are unhealthy. You shouldn't eat these plants. [Right.] Because they don't have the protection. They don't have the nutrition in them to be able to guard themselves against the diseases and the pests and the problem organisms. We've got to learn to understand what that message, what that signal, what does it really mean? [Yeah.] We need to get the biology back into the soil to set up this food web that will deliver the nutrients. So, your plant is never stressed, never incapable of protecting itself against all these diseases and pests and problem organisms.

**Hayley:** Yeah, exactly. I've said like, if there's an excess of one particular insect or what, you're calling a pest, it's a communication. It's like, why is that there? What is out of balance in this soil food web? Yeah. There's a great documentary called the Biggest

Little Farm which really illustrates the importance of that cycle. From there, they talked about the microbes. But they also go beyond that like the birds and the coyotes.

**Dr. Elaine:** And if you want to fix your problem with your grasses out in the field, really what you have to do is go find some foxes and you fix the whole food web all the way along that who eats who chain. [Yeah.] So sometimes, we may have to wait a little bit for all of, we add the Fox and the consequences, feedback to the bacteria and fungi growing around the root system of that plant. [Yeah.] So, we have to understand that. Right now, we're really delving into trying to understand what all of the jobs that micro arthropods are actually doing in the soil. And we've always thought of them as just being predators. They eat the things that eat the bacteria and fungi. So, they are kind of keeping things in control. But it's far beyond that. Many of these micro arthropods have really critical roles in maintaining the immune system of the plant, helping to weed out some of the undesirable microorganisms. And so, there's so much more we have yet to learn. It is just frightening.

**Hayley:** Yeah. It keeps it exciting. It keeps it very interesting with those new revelations. On your journey, I'm curious to see what's like one of the most fascinating maybe bacteria or microbes that you discovered that does something really interesting or unusual? Is there one you might not have a favorite, you know, like a mother with children?

**Dr. Elaine:** No. Yeah. There's a whole bunch of really interesting creatures, but like one of my favorites are nematode trapping fungi. [Oh, wow.] Most people don't think of fungi as being a predator of nematodes. We think about them the other way around, bacterial feeding nematodes, guess, what do they eat? Bacteria. Fungal-feeding nematodes, what do they eat? Fungi. Predatory nematodes eat other nematodes. But some of the fungi have developed the ability to produce rings. The heifers as it's growing along, branches and it puts out three separate cells that form a ring. And then, the inside of those rings start pushing out exudates that are exactly like the exudates that your root system puts out. [Sneaky.] So, it's attracting those root-feeding nematodes that attack and damage the root system of the plants. [Right.] So, now here comes the nematodes and I can sense that root. It's here. It's here somewhere. Come on. Where is it? Where is it? And sooner or later, it's going to put a head or a tail into that ring. And wherever it touches the edge of that ring, it causes these cells to well up [oh, wow] and clamp down on that nematode. And there's some great pictures on the internet showing these ruffini nematodes just going crazy like, Oh man, he's got to get away. I got to get away. And of

course, they can't because they are really well stuck there. And then, the fungus will use its enzymes to eat through the cuticle of the nematode and get inside the nematode. And spoil it, produce thousands, millions of spores that go off into the soil spread by all kinds of other creatures, spread by water movement through. So now, you're going to have one nematode, trapping fungi growing in the near future. And it's a very rapid way to deal with root-feeding nematodes. There's no reason to be putting out on a mass side because nature has plenty of ways to deal with all those things. Those rings, they're beautiful structures. There is a lot of fun to watch. We even have taken and we'll grow them in an additional laboratory and then we'll drop a couple of nematodes into the dish. And it's like, which nematode is going to buy it first? Yep. So, I have my money's on number one. It's way better than a computer game.

**Hayley:** Here we go. We've just had an inside look at what research scientists are doing in these labs.

**Dr. Elaine:** What are we doing here?

**Hayley:** It's awesome.

**Dr. Elaine:** There are so many others, you know, there's like stellate amoeba that looked like stars that you go on the top of your Christmas tree. There are (lots of it) I could go on and on.

**Hayley:** I know, I know. Well, I want to bring this back to home for people. You've said, there's no soil on this planet that lacks the nutrients. That's great. Thank you for reiterating. For those people, this is the thing. So yes, if you're growing in the ground which allows this infinite access for these bacteria and fungi and all these microbes to reach, to get the nutrients. What if, well, for those people that are growing in pots or growing a raised bed. I have a raised bed here. I don't have a big enough garden. To have everything that's needed inside there, the actual, the sand, silt and clay for the soil part. What can people do in those situations to ensure that when they're growing their vegetables in a contained area where the fungi can't reach out to places to get? What do you suggest for those people to have how to grow the soil that way you?

**Dr. Elaine:** You want to get adequate organic matter [okay] into that pot mixed into the sand, silt and clay. And of course, if you're buying good compost, really bio complete

compost, that's one of our trademarks because we make compost, bio complete. It has all of this food web already in it. And so, you mix that into your soil and you get all these organisms doing all of these things. You've got the organic matter to help feed those microorganisms until your plant gets back up to speed, putting out the exudates. Your plant goes, Oh, look here, micro organisms. Put out some exudates. Tell these guys what we need them to do. So, it can take a little while for the populations to grow up and get to an adequate level, to allow enough nutrient cycling for your plant to then be very, very healthy. It does mean in a pot or in a small bed where you only have the inputs of the plants that are growing there. You may have to every year put in another layer of compost, really good compost. And one of the things we've found is that succession occurs. You go from bare soil, the weeds, to some herbs and small forbes and things. And now, you get grasses growing a more productive, meadows and highly productive row crop systems. And you go over the edge that all of the systems I've mentioned so far are bacterial dominated. But fungi start to creep higher and higher, more and more of the food web is going through. And the energy is going through fungi. And when you go over the edge into a fungal dominated system, now you start setting the stage to grow shrubs, vines and things like that. Keep improving the fungal biomass and you're now growing your orchard trees, your deciduous. Keep going even higher with fungi and extremely fungal dominated systems are all growth forests. [Right.] So, nature pushes that succession by ever-increasing the fungal biomass. And there's a couple of really good reasons and I can get really detailed. I put everyone to sleep here when I started digging deep into the science. But you want to push it along, you want to balance the fungi and the bacteria, which balances all the rest of the food web [right] to support the growth of the plant you want to grow. We know a lot of those specifics about you wanting to grow carrots. Well, then this is what you should have in the soil to promote your carrots and nothing else is going to be able to out compete your carrots. Well, maybe I want grapevines, or maybe I want mango trees, or I want orange, whatever. On a set the conditions in that soil up so that those plants are the ones that are selected for their root systems will go down as deep as they need. [Yeah.] In a lot of the places in Australia, for example, where we work with wine grape growers or table grape growers, they will say to us when we come in to start working with them, they'll say, we don't have enough water. We can't possibly grow the number of plants you're talking about here. We say, put them in because we know that we can build the structure in the soil and hold the water so that those plants will have water all year long. In many cases, we've reduced water use by up to 50 to 70%. They can double or triple the amount of grapes that they can grow without having to add any additional water into the system. It's just whatever comes in that spring time or rain. In Australia, the rainfall is usually not in the springtime. So, you have to store it in the soil. You better already have well-structured soil which means you've got to have the bacteria and the fungi,

protozoa, nematodes, micro arthropods. You've got to have the earthworms. You have to get that whole food web back into the system so that they will do that work for you.

**Hayley:** Yeah. I was just going to say, I have a worm like a bathtub of worms, my little red wigglers compost worms. And so in my head, I'm going from I'm learning as I go. And one of the things is that I should make sure I put some mushrooms in my, I've eaten mushrooms, put leftover mushrooms. So, this is my theory, right? If I put some local leftover mushrooms I've eaten, they're called gemorra which is a mushroom. It's like an oyster mushroom. And I'm like, if I put that in the worm farm, then therefore, I've created an opportunity for fungi in there. Have I completely made a guess of that or is there some truth to it?

**Dr. Elaine:** There's absolute truth to that. Yeah. You'll spread those spores, some of the hyphae perhaps, throughout the worm bin. Then, when you take that compost and mix it with your potting soil, now you're going to get those fungi growing. And especially, when you're dealing with shrubs or trees or even row crops, even your potatoes and your tomatoes or your carrots, they need a certain amount of fungi in that soil. And they'll help select for those species of fungi that will most benefit themselves at that plant.

**Hayley:** Do you recommend the biodiverse kind of like in a raised bed how there's the monocrop kind of thing? You just said, if you're just growing carrots, this is the kind of soil you need. We often hear that the best way to help grow microbes is to have biodiversity and even a biodiverse range of plant. So, I've sort of thrown a lot of different plants in thinking they should be beneficial microbes that go across a few and maybe it helps one will help the other. Is there a truth to that?

**Dr. Elaine:** And I think what most people don't understand is that every time conditions change. It gets a little bit wetter. It gets hotter. It gets colder. There's all the combinations of weather conditions as you go through a growing season. You have to have a different community of bacteria present at 15 degrees Celsius as compared to 16 degrees Celsius as compared to 20 or 25. So as it warms up during the year, this set of organisms is awake and functioning. Change the conditions a little bit, now it's this whole other set of organisms that are going to be up and functioning. Well, change a little bit more, there's a whole other set. So, you have to have all of that diversity present in your soil. So, your plant is getting nutrient cycling. It's getting all the benefits at each of these different temperatures and moistures, humidity, sunlight. All of those factors play a role. And of course, we haven't even identified more than 5,000 species of

bacteria. And yet, we know from DNA analysis that there's well over a couple million [wow] species of bacteria.

**Hayley:** We know the tip of the iceberg. There's still so much.

**Dr. Elaine:** Way to go. Call the rest of this to figure out. So, I'm sure someday, when I was think of that Star Trek episode where Dr. Rashaan is walking around with his tricorder and points it at the soil, the ground, and he goes, ah, yes, this is good agricultural soil because it's got this many bacteria and fungi and protozoa. And I'm sitting there going, I want one of those. [Totally.] In diversity, we don't have to know every name of those organisms. We don't have to know their genus species name. We just need to know that we've maximized diversity. [Right.] And the way you maximize diversity is in your compost pile. Put in lots of different kinds of organic matter. Lots of different organisms are going to be on those leaf surfaces. They're going to be on the surfaces of your apple cores or the skin of the apple or on the banana or on others. Yeah. But don't buy bananas that have been grown in toxic chemicals situations because there is no decent biology left on the surface of that banana. [Yeah.] It's just plain organic matter. You're not getting the improvement in diversity that you really need. And when you think about your own gut microbiome, where do those organisms in your digestive system come from? That's from what you eat. And if we sterilize the surfaces of all of that plant material that we're eating, we are not replenishing our own microbiome and we're not going to be healthy. We're not going to be capable of warding off diseases and passing on some problem organisms. We've got to have those organisms in our digestive system to change the food that you're eating into those soluble nutrients that you take up across your gut lining and into your bloodstream. We have to have those organisms. Where did those organisms come from? They come from the food that you eat. [Yes.] But if you've sterilized your food [exactly], no wonder we're not healthy. No wonder we have to take all these vitamins and minerals. That drives me crazy too because well, it's insane. You have to take vitamin pills. No.

**Hayley:** It's like, again, I was trying to work out what calculation of what elements inside of the soil, we step back and just nurture and nourish the microbes in our guts. It will do what we need to do in it. It'll maintain your health. Which brings me, this is a great little segue. I'm about to embark on a project because I have a hypothesis. My brother likes to remind me, it's not a theory, it's a hypothesis. I've heard of this method of where you plant a soil in a particular way. For example, you put the seeds in your mouth for 10 minutes and then, you plant the seeds and there's a few other things. And then, every

day you go, after you've woken up in the morning barefoot and you stand in that particular area of the garden and you just wash yourself down. And then, at nighttime, you're soaking your feet. So again, you're pulling the toxins from your water and then you water that plant. So, my hypothesis is and the project I'm about to embark on is called the **Living Supplement Garden** is that we can grow our own medicine cabinet. I'm curious to hear what you think or what comes to your mind when the toxic water that we're putting in on this plant. And I mean it's not going to be that toxic, depends how toxic you are of course, but it's not that much. But these particular plants that only has to be a few that you grow in this living supplement garden that if you start eating that daily, add to a bit of your salad or whatever, the plants are going to grow the exact nutrient composition and the microbes that your body is lacking. With the knowledge that you know, with that hypothesis, what comes to your mind with that?

**Dr. Elaine:** I sure would like to follow the sets of bacteria, fungi, protozoa, nematodes in the soil, in the water, on your surfaces. Because if you're healthy, you have to have a really good layer of all these beneficial organisms all over your body. People always get all worried about body odor. So, they put on another chemical deodorant. You just killed everybody there. And no one's left to protect you. So now, you get some really bad things grown under there that the next time you get a little sweaty or a little or perspire, you're going to start promoting those anaerobic organisms and you smell that. You develop a really bad case of body odor. Get that normal set of microorganisms on your surfaces and you don't have a problem with body odor. They're aerobic. They don't produce the stinks in the smells. So, it's kind of the same thing that you're talking about is you want to make certain that you're delivering your beneficial organisms to your plants and then, they're going to help return that to you. It's a feeding biofeedback is positive and so everything benefits from it. [Interesting.] You take city water that's got a lot of chlorine and chloramine in it. What are you doing to the organisms when you water with that chlorine and chloramine. Typically, what we do is make sure that we take some compost. We run that water through the compost. So, now you're getting all the really good beneficial organisms plus the humic acids. The humic acids will bind the chlorine and the chloramines so they're not going to kill anything. And that's what you water your plants with. So, it'd be interesting to have two treatments where you're just taking the city water straight and then, putting it on and how much damage is happening, how rapidly are you going to get a set of microorganisms that can deal with the chlorine and the chloramine. And then, we're going to have another treatment where you're putting on the compost treated water where they're not being challenged by the chlorine and the chloramines. [Yeah.] Which one is better for us? Then, you're going to have to do the left hand or right hand differently.

**Hayley:** Yeah, exactly. I mean that's where it's going to keep the experiment quite consistent. There's quite a lot of things I've got to think about here. But something that you said actually, because I was thinking it was the toxins and the negative stuff that there was going to be biofeedback on. But what you're saying is it could potentially be you're introducing the positive bacteria that knows how they look after and keep you healing that into the plant. So, it does the same thing with the plants to create that. So, that's interesting. That's something I hadn't even thought of. So, I appreciate that. Those people that are starting to get fascinated by this, I mean I personally can talk to you for another couple of hours. But for those people that do want to get more time with you, do want to learn more and the lifetime skill that you would have from being able to analyze your own soil and just go, okay, these things are missing. Knowing exactly what microbes and how to nurture that soil food web, how can people do that? I believe there's a foundation course, is that on your website?

**Dr. Elaine:** Yeah. So, the foundation courses, the first series of lectures is the theory where we go through the science behind. So, we delve a little bit deeper than I've been able to do today. And try to present it in a very simple, easy to understand language so that we don't go off on all of the academics where people just kind of glaze over and they go, what are they talking about? It's English that everybody can understand. And then the second of the foundation courses is how do you make really good bio complete compost? How do you make that? And it's really simple. We do some really small scale things, some intermediate size things, and then larger scale things. And we talk about how you would shift what you would do. You're going to end up with the same results. It's really pretty easy. You need a thermometer and a pitchfork basically. Then we, the next one is okay. It's not always that easy to put down solid compost. So, let's extract the organisms from the surface of the compost and grow them in that compost tea. And now, you have the materials that you can spray on foliage or inject into the ground around the root systems of your plants. And then, we teach people the fourth foundation course is learning how to use a microscope. And we've never had anybody who just couldn't learn that, couldn't get it figured out. So, this is not something, you're not likely to fail it. The biggest problem is where people will be looking through their microscopes and looking at what's in their soil and going, I don't see it. Oh my gosh, look at that thing. And now you've got to follow it. You're trying to keep up with it. And it's just running around inside your drop of water that's on the microscope slide. So yeah. We talked to our nematodes. We talked to protozoa.

**Hayley:** I'd probably name them if I could.

**Dr. Elaine:** Yeah. George, don't do that. Don't you eat that fungal Haifa?

**Hayley:** Exactly. Yeah. So, I will put a link below in the show notes. You will find them also on the website and of course soilfoodweb.com. I definitely recommend you to go and click how it works. It will just blow your mind. It's really quite simple. And we need to get that out there. The sooner more of us are nurturing the microbes on this planet, climate change can reverse. Our nutrition, our health as humans can reverse. It's a very easy thing that we can all be involved in. And if you cannot grow your own, start looking for people who are nurturing the microbes, right?

**Dr. Elaine:** Yep. It's like if you really don't want to learn how to use the microscope, try to get somebody else to do that work. You can be growing the plants and they can be doing the assessments and telling you which compost to put back on or which foods to put out there to select for the biology that's going to benefit your plants. So, you don't ever have a plant that dies on you.

**Hayley:** Can people contact soilfoodweb.com and say, Hey, this is where I am. Do you know of anyone that's got your knowledge so that they can come and consult for me? So that's definitely another way.

**Dr. Elaine:** In soil@soilfoodweb.com and we deal with two-300 email questions every day. [Yeah.] So, we have the staff, the people that really help you out. We have a training program. You take the foundation classes and you can do this yourself if you want to start consulting for other people. We teach you how to do that consultation if you want to start a lab. So you can be doing the microscope work for other people. We have those programs already in place.

**Hayley:** That's so amazing. And I just want to say thank you so much. The 40 years that you spent doing this and what you're sharing right now is imperative that needs to get out there and it's just thank you so much because it's such an opportunity for us to and done so simply, shared so simply. So really, really thank you, Dr. Elaine. I really, really appreciate it and thank you so much for your time today. I know you're busy. And so to take the time out to share this information, I'm really, really grateful. And I'm sure my

Thrivers out there have just been stoked as well as much as I have doing these things with you.

**Dr. Elaine:** That's great. And I really appreciate the opportunity to talk on your program here because we've got to get the word out. We have to change the way people manage dirt. We've got to turn it back into soil and get all these, these organisms, all these benefits and it's easy to understand. People always say, I knew that this is how soil had to work. I knew that this was how it was supposed to be done and I just couldn't get any confirmation from the chemical world because they're more interested in taking the money out of your pocket and putting it in theirs.

**Hayley:** Because there is no money in nurturing mother nature. She does the work for us.

**Dr. Elaine:** That's right, yeah. Unless of course, you're trying to eat really good food, then there's every reason.

**Hayley:** Exactly. Yeah. So, thank you so much. For those Thrivers that have listened to this on the podcast, this will be on YouTube as well, because we have shown obviously a soil food web if you want to see what that looks like. But yeah, thank you so much Thrivers. Have an amazing week. Thank you, Dr. Elaine, and I'm going to hit stop. So, have a nice day.

**Dr. Elaine:** Okay. Thank you very much.

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