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Resilient ranching workshop: field session 4, cheatgrass and soil pit

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BEGIN TRANSCRIPTION

00:00:01:10 - 00:00:35:00

Unknown

Yeah yeah yeah. Well, you. You you know, that smells like down. Yeah. So Steve's going to tell us about what's been happening here historically. Can you hear me there? Yes, I can, you know. I think you're good. Okay. So this, this particular field was probably the most heavily farmed historically when we showed up in 91.

00:00:35:02 - 00:01:11:08

Unknown

It had been plowed. You know, maybe 2 or 3 years previously. There are rocks everywhere. There was a huge old that makes it that had dug there to find water. Obviously, it didn't work. That's where we threw all the rocks. Lots of bare soil here. That second year we were here. I disc the thing and planted, oats and alfalfa in late March, and it came up.

00:01:11:08 - 00:01:38:24

Unknown

It was a beautiful crop. And June came along and. But by the time June was over, everything was dead. So it's been a struggle to get something going here. What were the historically, forms? I, I don't know, but I think alfalfa, alfalfa notes, I think, I don't know.

00:01:38:27 - 00:02:13:03

Unknown

Anyway, just a heavily cultivated field. Lots of cultivation going on here. So, recently we've been trying to cover crop here and have had little to no success. This is probably the best. That's air quotes. When I came here, was it last year? Last year? Yeah. Last year it was all purslane here. You know, it was red purslane and, it was about this tall.

00:02:13:05 - 00:02:35:07

Unknown

And there was a lot of bare soil for, you know, 20 acres of this. Whatever. So it was and it was blowing, you know. So I think it's actually a real improvement this year. But we've had rain, but with that

rate, which has been so amazing, huge four inches of rain made us. Yeah. Yeah. Which is why it's come up.

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Unknown

So I strip grazed this thing with my yearlings earlier. You can kind of see the line here on the left hand side. So I strip that side first. You know, three different pieces. Probably not as heavy as I should have. This one, the middle part was a little bit heavier, and I skipped over the next part. You can see where the line is here.

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Unknown

I skipped that, so I did three different plantings there three days in a row. So the first piece I planted, a cool season mix the next day was the warm season mix. And then the third day over on the other side of that line where we didn't graze. That was back to, I think that was the warm season mix over there.

00:03:25:07 - 00:03:57:14

Unknown

So this was sort of. Yeah. Yeah. Yeah. That line that were the pig weeds in here? Yeah. Yeah. Yeah. So that's, you know, so we've got some turnip in here. This guy here. That's critically. There's cow peas. The other thing that we did here, as we did, an application of high fungal compost extract that we applied as a spray.

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Unknown

Just, Rio did it actually did a lot of it, but to stop the truck. And then we did, what else we did? We coated seeds, so we coated seeds. We've put a lot of it here. Yep. And that was last year. And last year we had a real crop here, as you guys know, was very dry at, tough to really get anything going.

00:04:18:12 - 00:04:44:09

Unknown

And then we just applied it in small plots this year and we can actually see some real changes, from our application this year, we'll go out and look at those. So that's kind of the management component over there on that hillside up there is a solid monoculture of grass too. So we've applied extract to there. Also thinking, well, maybe we can make, I don't know, jump start.

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Unknown

But we we've a control. Yeah. We've got some real controls in here, one of which is right behind you. And it's just a big strip that goes all the way out, and I don't I wouldn't say that we've seen a huge difference from last year, but, this year we can see more of a difference because first of all, I just put out small squares.

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Unknown

I just wanted to see, you know, just small test plants, you know, to make it look very, very obvious. And we we've got some pretty obvious differences as we walk out that direction. So, and actually right here where all the cheatgrass is right on the other side. Yeah, it's right on the other side, right on the strip going all the way over.

00:05:27:01 - 00:05:57:00

Unknown

Yeah. All the way up to the hill, 50ft wide. Well, no, it's 20ft wide. Okay. And actually, Patrick O'Neill is here, which is really opportunistic. Patrick is an agronomist who lives in the San Luis Valley. He's also part of the master Hooper Conservation District. But Patrick was really the kind of galvanizing, galvanizing force behind the compost.

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Unknown

Do you want to explain that whole effort? Because it's pretty awesome. Sure. So in 2015, I met up with, doctor David Johnson from New Mexico State University. And for years he'd been traveling all around the southwest and all around the globe telling people about this, some research that he was doing based on making a really high fungal compost in a pretty unique way.

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Unknown

So static pile method. So the composting method here is doing was unusual. Most people who had compost for sale weren't using it, and the stuff that was available commercially for for farmers, ranchers to be able to use was massively bacterial. And and the limits of compost when you put it on ground, any kind of ground were were pretty, defined.

00:06:46:10 - 00:07:25:14

Unknown

We knew what to expect out of it and often it wasn't very much. So in 2015, I met up with Doctor Johnson and then began dialoging with him. And in 2018, through our our local soil and water conservation district, we were able to to, put together a project with a bunch of farmers and ranchers in our region, including George and Julie, who are here today to put money in a pot to get the interest of a commercial composter who would take on the method, that Doctor David Johnson had developed, modify it so he could upscale it and make it into a kind of a commercial venture and into a a large scale

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Unknown

static pile compost. And our intent and, all, all the while was, okay, we want to see if it can be made in a big way. That's that's scalable. And if if the quality can hold and it can actually become a fungal thing. And over the span of a year, we had this massive pile that did become a big pile of fungus and, highly fungal compost.

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Unknown

And so and he got word of this, Steve was interested. So the whole made compost and got that compost. These guys, they made extract. In year one, we had the drought in year two. I think you guys picked up extract, already made and then brought it out and applied it. So we actually made it.

00:08:12:00 - 00:08:35:20

Unknown

You made it? Okay. You picked up the compost and made extract here. Okay. So the the original effort was, effectively 14 farmers and ranchers getting together and and making something happen. And then it's kind of snowballed into we got dozens and dozens and dozens of farmers and ranchers trying it out across all the West. And it was quite an a financial investment from all the guys.

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Unknown

And, yeah, it was about five grand apiece that they put together to get this thing rolling. And it was, really people who were were committed to soil health and, and, and committed to see what could be, what could be done beyond what they've tried before. And I mentioned that just because, it took quite a bit of faith and, and persistence on the part of those who, who started the project out to funded the project out in order to say, okay, let's try it now.

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So as part of that project, the initial, farms and ranches got the compost, put it on their, their properties and some portion I got, anywhere from five, I think 15 acres to 220 acres got treated at a time, and it was all irrigated ground. They got it. So we were looking at hay and crop ground.

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And with that, we started monitoring and doing soil health testing and carbon testing and, and just seeing what were the relative impacts of having this type of a compost within these systems and generally in the forage based systems and, and surprisingly, in the potatoes, where we had this applied in the San Luis Valley, it really shown so that we had within the span of one year, one crop cycle for hay and potatoes.

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Unknown

It really stood out. So those were the, the, the things that were surprising because everybody went into the size open thinking this small amount of fungal based compost going on to a system of millions of pounds of soil. It sounds like pixie dust. It sounds like it's too good to be true. But everybody had in the back of their mind, well, what if it isn't?

00:10:18:26 - 00:10:46:22

Unknown

What if it could actually work? And that was the. That was the hook, I suppose. And probably the reason why Nicole gets invited places is what if what if this kind of thing could actually work? So we put it out and and it did work. And now we're in a cycle of repeating, monitoring and and seeing from a bulk compost application that we use the rate of 400 pounds per acre, which was the same rate that the guy that developed the system originally started out with in his research.

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So we tried that and we said, okay, is this going to be a lasting effect through time when we're using extract or we anticipate that, that it's probably not going to be a lasting effect through time? The same extract impact will probably every time you see it, you need to reintroduce it. But trying to figure out if you take 400 pounds of this finished compost, which is relatively expensive, you take a few pounds of finished compost and then put that in a water extract and multiply that over many, many hundreds of acres.

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Unknown

That may be a recurring expense that somebody could take on as compared to the one time big investment. So that's some of the context for the fungal compost that they used in these extract trials.

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Unknown

And we're doing trials on rangelands irrigated and non irrigated throughout the plains really in in my region. So recent years we've tried it at scale. Some of the, some of our spots. Logan let's see, we've got Kit Carson County of Livingston's Logan County just kind of sprinkled throughout. My family's in Las Animas, so, so we're trying it on some of the more alkali conditions in the valley is, it goes through a thermal milk face, so it goes through a heating phase, big bacterial boom initially.

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Unknown

So you're mixing all these things together in a really wet environment and then letting them sit and and that bacterial boom creates a lot of heat. And once the temperatures go from ambient temperature, you get them wet and you mix them up. It's spiking up to 100 4000 50°F. It does that for a while and then comes back down and once.

00:12:38:27 - 00:13:04:09

Unknown

So this is a this is a non turned after after day one process where it's a static pile and it's passively aerated. So you go on YouTube you can find David Johnson's process that he describes and from, from the setting of his backyard where he's making one of these piles. And this passive aeration is part of probably what allows the fungi to develop this, because it's not being turned around and it's not being disturbed.

00:13:04:09 - 00:13:29:06

Unknown

So the mycorrhizal or so mycorrhizal or obligate, you got to have a plant that's present in order to feed that. So these are initially saprotrophic and probably largely saprotrophic fungi and whatever else is floating around in the atmosphere. But what are the spores that that fall into this pile? But we're not intentionally pushing it one way or another with a particular inoculate.

00:13:29:09 - 00:13:54:27

Unknown

But, that so you go through this heating phase and then the pile temperature climbs down to 98 degrees. And that's where composting worms are introduced. And that introduction of composting worms is intentional to facilitate this from becoming just a, a big pile of rotting mulch into an actual worm compost. And so it's a long cycle it takes.

00:13:54:29 - 00:14:17:25

Unknown

In our instance, it took a year or a year and a bit, to come to completion and a high fungal load. And that well worked from a compost material. But in the end, that's what we let out into the world. And they did it in the San Luis Valley. Yeah, in the icebox in Colorado. Yeah, yeah, I was I was like, you're actually I mean, we, I first went out there in the winter.

00:14:17:27 - 00:14:37:25

Unknown

Yeah. So that, that we were thoughtful of because Doctor Johnson clue to send this is this is a long process. This is not a quick composting process. And we brainstormed back and forth, back and forth back and forth for several years about how could this be done. Eventually we put it under a hoop house. And that's how we kept it from freezing solid, because it's a it's a super wet material.

00:14:37:25 - 00:14:59:12

Unknown

We're ranging from 60 to 70% moisture of that material in the pile. Yeah, it's like a slimy it's like a slimy clay. It's what it feels like. Yeah. So we had we had a frost crust in the top few inches, sometimes during the dead of winter when it was -38 outside in the night. But it didn't freeze any deeper than that.

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Unknown

We had earthworms, not earthworms. We had composting worms coursing through the whole, depth of that pile through the year. So through a number of the different types of fungi was actually increased over time. Do. Right. Yeah. So the diversity of fungi increased over time. The the total biomass of fungi increased over time. And the ratio of fungi to bacteria increased greatly over time.

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Unknown

In this in this setting, the water that we're using is three years of water and.

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Unknown

Your bacterias and stuff. Yeah, there's a lot of fertilizer that sprays. Yeah. So this, this this was a non chlorinated water source. It was a well water. You get your you know your small dirty go to mix it at home to spray your if you're using chlorinated water you're killing what you're trying to look like. So that yeah figuring out do you have a water source that's not biocidal?

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Unknown

It's probably a good thing. Yeah.

00:16:07:16 - 00:16:32:29

Unknown

Thank you. Yeah. Sting your water because we find hard water can be a real limitation. Obviously, chlorine saline, those kind of things. So making sure we're not trying to grow biology in a system that's not functioning very well. And what I'm finding on most ranches, especially irrigated ground, is your main limiting factor is your water quality. And seeing hard water being applied again and again and again.

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Unknown

So you then create a soil system that's very compacted and becomes water repellent. And the water that you use to grow is now the problem. So making sure you are tasting water and doing something about it. Now we have microbial testing in here in your sheets for this field. So this field is what we call a very bacterial field.

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Unknown

So for every one fungus we have two bacteria. So a 2 to 1 ratio instead of a 1 to 4 ratio. The visual way that we can see that is we get slaking. So you get rainfall events or rain landing on this and you see that impact on that smoothing out. So if you get that on the ground, it's telling you that your bacterial dominated notice there's no real crumb structure in here right.

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Unknown

That it's fungi that build the crumbs. It's fungi that's hydrating the system. So even though this is his worst soil it shows the impact of soil type. All right. So we can still there's no obvious patterns. There is some compaction layers in here. But you guys can't see on that side. We have got some evidence of compaction, but not really like this is just a structural a soil.

00:17:42:22 - 00:18:09:22

Unknown

Right. And as a result of that, when it's dry, we're getting things like purslane growing. You're getting the very beginning. Building blocks of soil. It's like these are the organisms that are going to do well in here. Notice there's not a lot of rooting material in here at all. And this is where the benefit of getting your eye look at those little rust, the roots, the benefit of getting, our cover crops in here is this incorporation of organic material.

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Unknown

So you think of, these, what do you call them? Just tillage radishes in the, you can see how deep this is going. I've been on a lot of properties where that tillage credits just goes straight up out of the ground, and they'll only be this much in the ground because of compaction. We had a lot of last year here last year.

00:18:30:08 - 00:18:57:14

Unknown

A lot of those were sticking up, So it's really great to see it sticking down because this is all going to turn into food for the microbes, ambulance or dinner. Unfortunately, that is unfortunately what starts to happen. You can sell over here. So yeah, oats do make a really good rhizome. She's, we've I just dug up a vetch and some peas and we can see, the.

00:18:57:17 - 00:19:18:12

Unknown

They were nodules and they moved them. Right. So we're seeing nodules in here and, and soil sticking to those roots. So that's a good sign on these young plants. But really it's. Yeah. How do we get organic material in here? So you figured out here like you'll roll out bales in the past. Just fed, just fed, not bio grazing is such.

00:19:18:19 - 00:19:40:23

Unknown

All right. So really the game becomes, you know, how do we get organic material in here. We're very low in all of our nutrient cyclists. So there's pretty much. Yeah incredibly low fragile. It's amoeba ciliates. So those are all your protozoa and then your nematodes. So and if you have a look what's cool about this test is they'll tell you what kind of nematodes you have as well.

00:19:40:23 - 00:20:06:06

Unknown

So there's another sheet that'll say these, fungal feeding or bacterial feeding or root feeders. And what I find is often when we lo and nematodes, half of them are probably going to be root feeders. Right. So checking for stuff like that is a good idea. This field is in our soil. Testing is the top one. Cheatgrass pasture cheatgrass yet to grow.

00:20:06:08 - 00:20:20:25

Unknown

Can you what do you call this place? Cheatgrass. Okay. You might be maintaining a status quo. You want to check it out? But when we look at cheatgrass, what do you know about its root systems?

00:20:20:27 - 00:20:44:17

Unknown

What kind of root systems is cheatgrass? Got? This is fairly show grass numbers know it is the meanest plant. Like, he's really not contributing a lot to the success of your operation. That is the bare soil. Yes, indeed. Yes. So we should be happy about that. But into.

00:20:44:19 - 00:21:07:24

Unknown

But not contributing a lot. Right. And a lot of these annual a decent forage. Yes. Here. I didn't see cows not preferring it at all. Well, they didn't see it. Yeah. Other options, maybe. What's interesting, though, is as we start to increase biological activity, as we increase the nutrient density of what we growing. And so something you would have been like, the cows never eat this.

00:21:07:24 - 00:21:26:17

Unknown

They now start to eat or become a preferred forage. It's also part of the dynamic of like, I don't know if you've heard this before, but when you go to longer residual, longer recoveries, people will tell you that's rank or that's what we call it in New Zealand. Just you're going to lose and you're going to lose production, right?

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Unknown

You're going to lose performance per animal. Have you heard that? Okay. So that's true in a conventional system. But once we start to increase microbiology we increase the quality the quality of that. So I've got dairy farmers that are grazing on grasses, this tool that are outperforming those that are doing these rotations right on their 14 day rotations that they do in New Zealand, is we can maintain that quality.

00:21:49:05 - 00:22:08:08

Unknown

That's all about market biology. So cheatgrass likes a very bacterial soil and it wants to keep it that way. This is not a succession species. So thinking of Medusa head or Japanese brome or venta nada, which I think some of you, having experiences with.

00:22:08:10 - 00:22:26:14

Unknown

Not one other name for been to nada. I don't see it so much here. Okay. Be happy about that. Now. I did, because you want to. You want to know if it starts showing up when you're getting. It's really bad in Nevada. It's really bad in California and really bad in Oregon. It's getting worse. I'm seeing it start to move east.

00:22:26:14 - 00:22:53:25

Unknown

But yeah, it's it's kind of like, Oh, I call it kind of here grass. It's it's like cheatgrass, but the, the seed heads are much, much smaller. It's very, very, very. And it seems to be not preferred at any time. And. Yeah. Yeah. And that's what's that's the problem is that once we get cheatgrass into a system, it's kind of not about what's here now.

00:22:53:25 - 00:23:18:28

Unknown

It's about what's coming. Yeah. Because the days ahead will come in and Venta Nada and those species are not possible. So yeah, those are those are real problems. And they're all bacterial levels and they're all low phosphorus lovers. So as we break down our mycorrhizal relationships, do we have that on this test? Mycorrhizae wasn't on the test. No.

00:23:19:03 - 00:23:41:29

Unknown

You needed to add you need to ask for it when you do a test is once we shed that relationship, it's actually setting the scene for a lot of these plants that don't really care about fungal relationships. Right? They're very selfish and not giving a lot out and not giving a lot away. And what we find with annual annuals species is as they go to seed, they send their reserves up to here and then they're done.

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Unknown

Whereas a perennial is sending its reserves out to the soil environment and trying to, like it wants to see that environment improve. Whereas cheatgrass is like, this is good. I just I like this like that. Yeah. And not giving a lot back. Someone asked me about leafy spurge, who's got leafy spurge?

00:24:03:10 - 00:24:31:27

Unknown

It's a couple of. Couple of you. It's actually a fungal soil larva. So, and it's a bio accumulative or, dynamic accumulator of zinc. So we're, we're feeding fungi, and we're providing zinc in that process to help ships that leafy spurge away. But again, that's animal impact, because how if things become sleepy and have low biological activity, that's where we're going to see the.

00:24:32:00 - 00:24:51:21

Unknown

Pinyon tree. That's. Where are we going to see, what have you guys got? Like the what's the shrubby little things, Oak brush? Oak brush. Juniper, Cedar, juniper, cedar. But these kind of low, shrubby species come in when soils are not getting adequate disturbance. Right. You need to have animal impact in there, which might be your pasture size.

00:24:51:21 - 00:25:14:10

Unknown

Is it too large? Right. So just thinking about that. So notice there's very little root material in here. There's very little, change in color that there's not really even topsoil in here. Right, to look at color wise, it's all pretty much the same color. And if you smell it.

00:25:14:12 - 00:25:33:13

Unknown

There's not much of a smell going up, but you can smell it smells like dust, actually, that dusty smell. But what I like to do is go and look at where we've done this phrase, because I think that's really fascinating. I think we should spend less time out here rather than more. But let's look at what kind of species you see as we travel over to the test plots.

00:25:33:16 - 00:26:04:00

Unknown

Do you could we talk about the crested wheat area? Do you have experience with wheat, too? Okay, great. Oh, we sprayed that with compost. So you probably know this plant better than I do, but we're down there. Everything got the same, the same trail you pump extract right there. Yeah. And we find that extract, and it may.

00:26:04:03 - 00:26:30:25

Unknown

I know, but that's right. Does everyone want to get around and and it can tell me what happened here. This is a cow poop. That's I happen okay. So this was our extract that we sprayed this season. So we obviously had pretty good moisture paired with this. We sprayed it in May. And this area to Steve, you did not graze this prior to seeding, right?

00:26:30:28 - 00:26:55:04

Unknown

That's correct. Yeah, I did not. And you can really see the difference. We're just talking this square right here. Yeah. This square right here seeded all the way through. Right. And then you just fungal there and just fungal on top. Yeah. Yeah. Yep. And what is that. This is the high fungal compost. Yeah. What's point sorghum. It's supposed to grow a great big old version.

00:26:55:07 - 00:27:16:02

Unknown

That's the dark crest, is it not? It's a hybrid between the two. So interesting. Okay, well, Brian, it is Steve. Okay. But we passed over a few patches where you could see this test has happened, so it's kind of like a yard by yard ish, right? This one is there one there, two with yellow flags or anything.

00:27:16:02 - 00:27:40:06

Unknown

Yeah. So you can see where some of these yellow patches are. But I think some of these flags have been pulled out. Yeah I think so. Yeah. It happens with the animals. They make up like deer. They love flags. Yeah. It was just plant flags. But notice what species that seem to be more successful. As we were walking over that ground, what did you see?

00:27:40:06 - 00:27:45:08

Unknown

What are the species that seem to be really thriving?

00:27:45:11 - 00:28:15:04

Unknown

Purslane. Tumbleweed. Switchgrass. Yeah. Russian thistles. Russian. Russian. That's the tumbleweed, though, isn't it? Very nice. Brought that here. So think, the the turn, the the turn up. The a reddish the non mycorrhizal species. So there are species that don't have mycorrhizal relationships are doing the best out of these things that we can see. Except for there where you had some big ground and here you've got your patches.

00:28:15:04 - 00:28:37:21

Unknown

So it's kind of interesting just to see who's who's winning the game. Out here is the non mycorrhizal species and bacterial dominated. And then in here it seems to shift there's no brassica in this patch. There is buckwheat. So those of you haven't seen buckwheat before, see how pretty. It's got a lot of hot.

00:28:37:23 - 00:29:07:27

Unknown

These are also non mycorrhizal. But what, we like about them is they release these really powerful acids and they make phosphorus available for the following season. So people use this and lupine does the same thing. So lupine is the only non mycorrhizal legume. So lupine and this one like people might use them in their gardens or, you know, people put lupines in gardens with this buckwheat to really, set your soil up for success for the following season.

00:29:07:27 - 00:29:33:09

Unknown

So these are a good cover crop mix. I want to have more mycorrhizal species than not. So oats are, they're actually grown commercially to grow mycorrhizae. So they're a big mycorrhizal spore later. And so these, you sorghum Sudan, they're growing again. We capture the mycorrhizal spores around the roots to populate an area. So having diversity in your system is really helpful.

00:29:33:09 - 00:29:53:12

Unknown

But thinking what are these species doing for the underground biology to set this up for the following year. So you're going to see a benefit here next year with the crop that comes in, because it's going to be full of mycorrhizal spores in this zone, which is kind of cool. But I think this this definitely is a trial was really successful.

00:29:53:14 - 00:30:18:14

Unknown

And thinking about all right, lifting fungi here is having a return lifting fungi when you already had a pretty high fungal balance. And then other fields didn't really show anything. Although we didn't look at the measurements. But here, very bacterial soil. Awesome response. Yeah. So are you saying like, you mentioned oats that supports mycorrhizae? Yes. Yeah, yeah.

00:30:18:16 - 00:30:46:06

Unknown

We planted cover crops in probably the most predominant species that showed itself was oh yeah, along with some ripen collards. Yeah, I think that oh, it's on the whole, it's pretty darn hardy triticale. You said similar. Yep yep yep. Oh, it's just seems to have another notch up above rye or anything like that. Wheat and wheat.

00:30:46:09 - 00:31:06:21

Unknown

They've done something to the wheat. So wheat. Now, the many cultivars are non mycorrhizal. They don't even signal like these plants right now are talking to biology. They're actually communicating to the protozoa and saying things like hey I need zinc or I need this or I need that weight. Can't do it anymore. It's lost its ability to communicate with biology.

00:31:06:24 - 00:31:30:03

Unknown

So anything that's been really, really heavily manipulated has kind of lost some of its nature. Used to be this tall. Now it's this tall. Yes. And it's got lots of seed heads with no quality in them anymore. Yeah. Like it's sick. Yes. Bread. Yeah. That's right. And it's just a process of breeding. And there times when you'll introduce some mycorrhizae inoculate.

00:31:30:03 - 00:31:55:04

Unknown

Or do you just use what's, what's native there wherever there is. I mean it's here it looks like because I don't think you guys inoculated anything on the seed. You just bought the seed and mix it up and then put it out. So but whatever woke up was already here. I did go to see if you go to the seed with this, but cucumbers that are they extract so.

00:31:55:07 - 00:32:22:15

Unknown

But I wouldn't expect to connect the compost itself that it came from to be a huge source of mycorrhizae because there's nothing growing in the compost pile except for fungi. Mycorrhizae need plants in order to go to increase. But but now. Well, here's compost enhance the system for my mycorrhizal fungi. So, what do we know? I'll tell you the theory that we're working on the coattails.

00:32:22:15 - 00:32:50:00

Unknown

We're we're we're we're running on. And and David Johnson talks about it being not so much. You're, you're introducing, fungi that's going to colonize your system. It's more you're introducing a, signal for whomever is already there to wake up and support local craft that you're trying to grow. Perfect. Okay, so there's mycorrhizae in here. You're just not providing the conditions.

00:32:50:02 - 00:33:16:12

Unknown

And there's like, if you think of all the commercial ones. So they might be 4 to 6 commonly used commercial mycorrhizae. The reason that they're used is that they're easy to breed. But there's hundreds and hundreds of different types of mycorrhizae. It's kind of like, probiotics. There's now showing that if you take a probiotic after you've like, had an antibiotic, that your system takes longer to fully recover than it does if you did nothing.

00:33:16:19 - 00:33:38:12

Unknown

And I think you're interfering by trying to think I'm going to put 1 or 2 varieties out here when that system can set itself up itself. We did some work in Australia and showed that, product that was similar to the Johnson Sue, even though it had no mycorrhizae in it and increased mycorrhizal colonization by 230%, because it's setting that signal up.

00:33:38:14 - 00:33:58:00

Unknown

So the mycorrhizae are here. They're in the atmosphere. When birds land, birds bring them on their feet. You know, the deer will be bringing them when they I mean, they come through animal poo. So like the deer are bringing in mycorrhizae, your cows are bringing in mycorrhizae. So the spores last through manure. So I think I'm not so worried about inoculating.

00:33:58:00 - 00:34:26:18

Unknown

I think it's expensive. And in a lot of places we're not seeing any yield difference. We we've been doing it. So, I'm not doing it any more unless you have zero colonization. I like your answers. Anyway, good for somebody that's cheap. Cheap? Yeah, but I think seed dressings, seed dressings, if you're putting something out, is probably the most cost effective thing that we can do to jumpstart that system.

00:34:26:24 - 00:34:48:03

Unknown

And it doesn't have to be expensive. And you think how Father Johnson Zoo is going? It's very, even if you don't think this is a great response, which I think it is. You're crazy not to like. No. Fine. It's it's pretty impressive when there's nothing around it. Yeah, but. Yeah. Russia's thistle. Well, you can see the lines.

00:34:48:11 - 00:35:08:07

Unknown

What I've noticed, planting. Say pretty clear oats or anything. If you just go out and drill it, you're not going to get a very good stand out of it. Yeah. You come in here and chisel it and then planet. Yeah, make a seed bed. And because your roots are only going to grow as high as your credit goes to you about it.

00:35:08:09 - 00:35:29:04

Unknown

So if you make a seed bed to get your roots of what you're trying to grow in that right now, if you were to chisel this, it should be here as much

moisture as we've had this year. Yeah, but you're kind of robbing Peter to pay Paul when we chisel it, right? Because you're you're exposing carbon. That was never going to be exposed and it burns off.

00:35:29:04 - 00:35:45:27

Unknown

So you kind of go in the opposite of what we want to do with building, our carbon based. So my carbon price and you get this big flush of microbiology and they eat everything up and then they die off basically. So it it gives us a short term response. And I think that's what's exciting about doing things.

00:35:45:27 - 00:36:08:06

Unknown

And there's some places that I would come in and turn a soil over that in really poor shape. And maybe I would have said that for this, like, this would be the one time I would come in with mechanical intervention. And then get that system working. But if you've already got pasture, then, then I'd rather do an approach like this and just get that plant to build it rather than, degrading the resource.

00:36:08:09 - 00:36:30:11

Unknown

It can take like from a, from a big cultivation. It can take 80 years for that microbial population to come back. Like it can be a really long impact. But when things are so degraded, it doesn't really matter. I'm going to do it. Maybe one question that we had when we were applying the extract was the first year that we were here.

00:36:30:11 - 00:36:53:09

Unknown

I mean that there's pretty much nothing on the front. Yeah, there was like the person was just I mean, was really terrible. And we did not get a response. And I wondered if the reason why we didn't get a response is because we didn't have anything to feed it. Yeah. What would you recommend in that situation. So there's nothing growing that personally.

00:36:53:12 - 00:37:09:29

Unknown

And it's in the middle of a drought. Yeah. And like just not to waste your money. Right. I'd roll bales out and bale graze. Yeah. Like just find organic material if that's free. You know, I, you always see people with piles of rotten old bales. I'd be like, I'll take them off your hands and just roll them out.

00:37:09:29 - 00:37:30:03

Unknown

Yeah. Just get organic matter out here however you can. Because personally, I'm like, really low organic matter. Yeah. It's it's it's it's germination signal in that one area. Remember we had that hey we had that. It turned out I mean did you look under moisture and all kinds of stuff and there's grass there. So I don't know what's there.

00:37:30:03 - 00:37:55:01

Unknown

Now. I haven't kept up, so. Yeah. Well, Kayla came over you. No, no, no, I've been here right off. Are you affiliated with H.R. M or you're a university professor? No, I'm just the international woman of mystery. I know I'm totally. I'm an independent. I'm not associated with product or a university or a dogma. Like I'm anti dogma.

00:37:55:03 - 00:38:20:04

Unknown

I'm about like, what works well in context. Be a little less footstep on the soil and yeah, definitely eat a little. Yeah. Now I'm not saying to cultivate I'm saying and if you are at ground zero and the worst case scenario cultivation might fit. No. And that's what I'm saying. Like, so I work with the saying some of the best, H.R professionals in the world, and their only tool is grazing.

00:38:20:04 - 00:38:41:25

Unknown

And I'm like, there's a whole lot of other tools that we can have. If your grazing is not getting you over a hump. So people have had a response to grazing, and now they've hit a plateau and they're like, we still have big ground, we still have whatever. That's kind of one of the reasons why this particular group is here is because you guys all have good grazing management already.

00:38:41:27 - 00:39:03:29

Unknown

But but I, you know, I was thinking we can we can build on grazing management, right? We I mean, I'm tired of just saying just rotate. Right. The thing is everything. And what's the reason for 30 or 40 on years that a few percent of us farther with self manage grazing. What's the reason, right. Why do you know.

00:39:03:29 - 00:39:29:03

Unknown

For 40 years we've heard this in North America. Yeah. Others that do it at rest want nothing to do. Yeah. Cowboys, cowboys boots. So we're seeing some interesting phenomenons where I'm at in big Timber, as we calculated on a ten mile radius, that 50% of that land area is now using adaptive grazing management. And it's now using some of these tools that we're talking about.

00:39:29:05 - 00:39:57:25

Unknown

I think the initial stuff is people were concerned like it was weird or like, see, in New Zealand all we do is rotational grazing. Like that's just the norm. We set up electric fence. It's just the norm. But we're on 14 day rotational overgrazing. We are the masters at rotational overgrazing. And it's normal. But you come out here and the normal way is you turn them out at the beginning of the season and you bring them back in full.

00:39:57:27 - 00:40:15:03

Unknown

And so it's shifting that mindset. People think that it takes too much time. So we've got I don't see any shifting in the last 40 years. Right. Yeah. Yeah. It definitely seemed like it was those innovative people to start with. And then it kind of stalled out. I don't exactly agree though. I think I think it's growing.

00:40:15:08 - 00:40:40:29

Unknown

Yeah. Because, you know, we were some of the very first ones and we fought with our BLM personnel and with the government agencies just like you. But now they never accept it. Alan Savory because of his is damned. Is he pissed at me? Pissed off everybody. But if you listen to them talk like on your shoes from a range, hoping her language is going to be infused with all these ideas, those ideas.

00:40:41:01 - 00:41:12:29

Unknown

But they had to go through the universe a professor, and he had to make them his idea. And those concepts. But it's it's come around these these kids know ten times more about this than they all range cousins that I worked with back in the 80s. So it's it has changed. It's just it hasn't been a straight line for him to suddenly become like I've tried to reference Allan Savory in several academic papers just on the concept of adaptive management, which is what the academic community has decided to call it.

00:41:12:29 - 00:41:34:13

Unknown

And the reviewers went ballistic like that was not. Yeah, that this paper isn't getting published. If that reference stays. Yeah. How do you like the color of that soil? See, like, this is quite exciting. So, what we're seeing is that beginning building block, that's the color we're looking for, as well as your dark brown chocolate. And this is happening here.

00:41:34:16 - 00:41:55:08

Unknown

All right, so you can see soil building actually happening right in front of you. Right. Well that compared to the over there. Yeah there's a little bit of smell. It's not kind of knocking me over with it. And it's got a lot more. Yeah. Aroma a lot more aroma. So yeah. Account for some of that mixing moisture in the color.

00:41:55:10 - 00:42:13:05

Unknown

So if, if we hadn't had the rain that's your dark brown with the rain, would that be a medium brown. Yeah we probably so if we were going to look at it we want to moistened it. So you use some water on it. But one of the things I want you to get about thinking about fungi is fungi build their bodies with chitin, which is carbon.

00:42:13:08 - 00:42:34:20

Unknown

So they're adding carbon all into this in their bodies. But what they're doing to is they take that carbon, hydrogen, oxygen, they use the carbon

to build their bodies, and then they release 20% of that is H<sub>2</sub>O. So 20% of what's happening is fungi are aspiring is the release of water from not water. Just plant material magic. Okay.

00:42:34:20 - 00:42:55:26

Unknown

So free lunch, free lunch. So part of this rehydration of landscapes is getting fungi back into the system. Sometimes I feel like they're finding me. I go out and talk about us. All right, let's talk about the funky. Let's get the fungi going. But these two are white seed clouds, right? So thinking about fungi and these spores coming off that actually get up in the atmosphere and they see clouds.

00:42:55:26 - 00:43:14:08

Unknown

They see rainfall. Right. So it's that whole cycle of through our grazing management and through the deterioration. But they say 90% of semi-arid lands in America is significantly degraded. That's 90% of all that fungi and all that stuff. That would be seeding clouds that we've lost all right. So how do we bring that back? These soils are cooler.

00:43:14:15 - 00:43:45:00

Unknown

And I've got a temperature gauge somewhere. So fungi make soils cooler as they build that structure. And if we look at, you know, starting to see that I feel terrible digging these up, I'll go. Yeah. I know. Oh, wow. Look at that. Look at that. That is crazy. That is amazing. All right. So these wow. So these guys here's some of our Rastafarian roots and the beginnings of these crumb structures that we're missing in the soil right.

00:43:45:05 - 00:44:13:25

Unknown

So I'm so magic fairy dust. Anyway so for me this is a tool that we apart from the cost of application is really, really cost effective. So we're talking about maybe \$0.50 an acre for the cost of what we're using on rangeland. So we're doing this in Montana. We're putting it down with the seed. We might put 30 pounds of the boom a cast or a high fungal compost down with seed.

00:44:13:28 - 00:44:36:02

Unknown

To get this process kick started or we're doing, the same sort of. Right you guys are doing. So it's \$0.50 an acre for a foliar spray to get these kind of effects. And what we're seeing is the native seed bank germinating. So seeing latent seed bank respond, which we actually did see in one of these plots, one of the flag plots here, it's all perennial grass.

00:44:36:05 - 00:44:58:10

Unknown

Yeah. It's like a square root for any old grass of. Oh. So what can we look at that? Yeah, I just need to find it now. You didn't. Do you always seed when you when your phone in, put in the. What you were just saying

about \$0.50 an acre spray that always involves seed. Or can you just spray native rangeland without.

00:44:58:10 - 00:45:15:18

Unknown

You could just spray native range in without. But I'm I'm have an addiction to chicory and plantain. I'm just going to say it right now on native range. And I'm putting it on native rangeland in my sprayers. So the sprayers have a fifth of an inch nozzle size, and we can put all sorts of seed in with it.

00:45:15:21 - 00:45:41:06

Unknown

Chicory and plantain, just really big mineralized. They're going to take the role of, say, your kosher or, you know, your tap rooted weedy species, high production crops and, they really show up really nicely plant. And they both broadcast off the surface. So when you're not drilling it and you're not just spraying it and then, bring animals in afterwards, just give it a little bit of a press down.

00:45:41:10 - 00:45:58:11

Unknown

Sometimes we see the chicory doesn't come up. And then 3 or 4 years later, it appears we're like, oh, okay. And so would you do that in the spring and the fall? I'm only going to be doing these applications when the plants are actively growing. So you could do it in full. You do a full seeding or we do it in spring.

00:45:58:14 - 00:46:17:04

Unknown

Yeah. He's coming in perennial too. It, it it farms I work with. They've been running it for ten years. So if you don't maintain it for ten years, it's generally because the deer are overgrazing it because they love it. And I'm like, it's a deal of it. I'm all over it. So the the deer will actually graze.

00:46:17:04 - 00:46:34:19

Unknown

You find these little holes, these circles where the with the chicory was, which is a bit annoying, but we're doing rehabilitation and we're putting about a pound an acre in the mineral and chicory and planting can really nicely throw a cow. So you get a cow pie with chicory, with alfalfa and sweet clover. Yes. If they come through real nice.

00:46:34:19 - 00:46:59:18

Unknown

What about chicory? Chicory. So good. And the seed that you buy here comes from New Zealand, which is hilarious. But we market it as, as calf weight gains as milk production and lamb finishes like it's the. Except in New Zealand, they grow 100% of it and see the diversity. But it's an awesome crop and it it will do okay in the semi-arid ten inch annual rainfall.

00:46:59:22 - 00:47:17:02

Unknown

So it doesn't come in a monsoon. It comes year round. I call it my dog disease plant because it will grow in the rain and in the dry and in the heat and in, in the cold. So we're growing it top of Alberta. We grow it in Western Australia. We grow it in six inch rainfall to 40 inch rainfall.

00:47:17:02 - 00:47:37:05

Unknown

So I'm yet to find a place that. But you got to get that fungal content with it. Or if we just go out and broadcast planting and because having I don't live 30 miles apart. Yeah. And like to try and get stuff surface striking when it's like this you might struggle. This is why we put it out with the slurry.

00:47:37:05 - 00:47:57:24

Unknown

So we're spraying it with a slurry. It's like I dunno if you read the book The One Straw Revolution. So fucking. Okay, so what he was doing was coating seed with clay. We're coating seed with worm cast in the beneficial organisms. So it's going out with that. And that's we're getting a good strike. I can show you some cool pictures where we've done it to rehab land that was like this.

00:47:57:27 - 00:48:21:07

Unknown

It's. Yeah, but where are the spraying it? Or with cows using the cows? I'm kind of like they're out there anyway. Make them work. So. Yeah. So you're having the cows do the seeding of the tickers? Yes. Yeah. And so you're doing this. Oh. So if it's broadcasting, what kind of start do you need to get enough hoof impact to make a difference.

00:48:21:10 - 00:48:41:26

Unknown

Right. And then it's \$1 million question. It's pretty hard to get 1 million pounds. You stop. If you were here. Yeah. I don't I don't think you need to get 100,000. I don't think you want to like. Yeah, I'll be making up numbers, but yeah, we're you're seeing pretty good spread of manure like.

00:48:41:28 - 00:49:04:03

Unknown

So how well does that work when you roll it in your book, you talk about putting the seed in with your mineral. Yeah. This is a pretty effective thing obviously, since you mentioned in your book, but, it is very effective. I just find some grasses won't go through. Well, so the general rule of thumb, old heirloom hardcoded seed, they're all going to go through really well.

00:49:04:05 - 00:49:24:10

Unknown

So just experiment for yourself. We're having some great success with pubescent wheat, which is not meant to go through an animal. And we're seeing really good strike. And I'm saying the other night I, I said that

to a rancher and he put \$350 worth of seed into one mineral tub, which wasn't what I said. And the cow PiS struck a we call it striking.

00:49:24:10 - 00:49:45:25

Unknown

You guys didn't have that word germinated. So this is take the word strike. It's a it. All right. The grass is struck and it look like one of those trolls that you can buy here. Oh just grass. So I'm like, grass is coming through, you know, and we all complain if you ever make a, a garden bed with horse manure, you know, grass seed sprouts.

00:49:45:27 - 00:50:02:11

Unknown

So look to what your varieties might be. You can try it nearer to the house so you can have a look at what's in those cow pies. And the amount of times I've been, you know, hands and knees with branches. And we're looking through manure and looking at all the different species that are germinating. It's it's mind blowing when you start seeing it.

00:50:02:11 - 00:50:23:16

Unknown

So but I know alfalfa, sweet clovers, a lot of the clovers and going to be a good one to I'm not having such good success with saying that milk, which we, and chicory and planting and the good thing of putting chicory into it because it's such a yellow leaf, it really shows up. So if you're up on the range, it'll get you off your horse.

00:50:23:16 - 00:50:43:14

Unknown

Go, whoa, look at that. Because it really stands out. And we've seen stuff on bony ridges where nothing's growing. And here's a cow pie with alfalfa growing in it. You know, I'm going to be, make a spray that. It'd be, would make a spray that or anything like that out on the range. Yeah, they wouldn't, because they wouldn't let you know it's not a native species.

00:50:43:14 - 00:51:11:07

Unknown

Yeah. No. And I think, I think I think, just the proviso. I think in Colorado chicory is illegal. So you didn't hear me say that. And you can get it over the border. A lot of it. I think it's illegal there. Really? Yeah. Only because native, non-native just growing around the borders open. But, you know, people brought it here are a great smooth brome isn't native.

00:51:11:13 - 00:51:29:21

Unknown

Yeah. So many of these things aren't. But, you know, your great ancestors brought them through on the wagon trains so they could roast it to make coffee. So this chicory all over the US, I could just see it in ditches and stuff all the time. So I'm not worried about it. Five minutes. I want to see the perennial.

00:51:29:21 - 00:51:53:05

Unknown

Yeah, the perennial grasses are over here. These slides over here. This is the perennial grasses. Yeah. I think it has to be here and there. And then there's another flag over there. Look what I've noticed though is that that the, the cheatgrass really doesn't like it. The cheatgrass. So we're actually seeing big around in some of these spray patches rather than cheatgrass, which is kind of fascinating.

00:51:53:07 - 00:52:17:15

Unknown

So this seed wasn't planted. This is a native response I'm sorry the seed wasn't planted. It's a native. No, it's not planted. It's cool. Although there we planted in here I planted in here. Yeah. But this is not. But isn't this just, Western wheat? Oh, it's not wasting. I don't know my grasses, but I don't need green.

00:52:17:17 - 00:52:42:16

Unknown

I don't know, this is, either. This is, Slender wheat grass, slender wheat, but it's rhizome just as well as. Right. And so this one little plant. And pretty soon you've got a big like this. Yeah. Yeah, it's very similar to Western wheat. So you think it's a coincidence that it's in the middle of the spray? Could be.

00:52:42:18 - 00:53:28:23

Unknown

Oh, cheatgrass didn't come. Yeah, yeah, yeah. And you can see it on every patch. Even more obvious. You know, it's like a really pretty obvious one. Yep. There's another. What's the plant? The last place we were at which the cover crop that was grown. So we're going to sit in with sorghum shoot in 2230. Yeah, yeah, yeah. Yeah.

00:53:28:25 - 00:53:56:27

Unknown

Pretty amazing. Yeah. Just like the other flat. Yes. Yeah. Go to Crown like it. And then when you go in with the. So you, you put the patches out before you go through. We did, we did it. Yeah. It was okay. I had a that's the first you sprayed first. And then we spray these plants for. Look at that soil.

00:53:56:27 - 00:54:09:27

Unknown

It's like black soil again I said like oh man, these other new plants or them. It was it was actually it's a new plant. It it it.

00:54:09:29 - 00:54:23:04

Unknown

So some of these are new plants. New. Well it hasn't got any connect. There's no rhizome to connect it to the neighbors. That's cool. That is cool.

00:54:23:06 - 00:54:50:12

Unknown

This one is part of horizon. The. New little friend okay. Pretty cool. So in the presence of a rhizome implies more than two years old or. Yeah, more than a couple years when? The couple of years. But it this is a growth form that this could be just this could have been a coincidence. But what does the soil look like?

00:54:50:12 - 00:54:58:18

Unknown  
This.

00:54:58:20 - 00:55:19:10

Unknown  
We have some mixing. What you see two is this is the trick when we do these squares is biology moves. So when we, when we do our trials, you always want to have a good buffer for your control. So moisture in there.

00:55:19:12 - 00:55:48:25

Unknown  
We have plate structures. Right. So there's evidence of compaction that we don't see in there. There's no that's the flat surface. Yeah. There's flat those those plates. So because this is such a light sandy soil, it's harder to make plates that we can So yeah, that's pretty evident. Yeah. Yeah. I mean, there's definitely little layers that it's even like a sandwich, but it's it's falling apart.

00:55:48:28 - 00:56:10:04

Unknown  
Oh. But there's a good layer of mulch and stuff that's been put down on this ground. I may not be happy. You know, as a transition we're hitting, I feel like we're hitting in the right direction. It's just. Are we getting this stuff incorporated? And what you notice is we don't see that same little here on the spray strip because it's been converted.

00:56:10:04 - 00:56:31:19

Unknown  
It's been broken down. So we're seeing that darkening of the soil as opposed to oxidized lettuce sitting on top, you know. No, no. What do you guys get pretty excited about? Litter. We can't build litter in New Zealand. It's not possible. So if we get these experts come in and say build litter. If you have litter, your soil's broken.

00:56:31:22 - 00:56:55:26

Unknown  
All right. So it's a sign that microbial activity is not happening. Yes. We want litter more than big. Absolutely. But this black, oxidized, pale white is is a sign of a lack of nutrition. And it's not been converted into humans. So, yes, I want stuff like down in these climates that I want to converting to humus. And I want to see grass is growing in there instead, you know, in an ideal world.

00:56:56:00 - 00:57:18:10

Unknown  
But you think that's just one of the brittle on the scale of the whether it's microbial. Well, oxidation is the only way you break it down without

microbes. That's right. So working in brittle and super brittle environments in Western Australia, what we're seeing is the color changes as we get new nutrition and biology in there. It's a yellow color and it breaks down really fast.

00:57:18:12 - 00:57:37:17

Unknown

So it becomes we need plant density not litter. We want both right. But that litter breaks down. So then it becomes a challenge because you got to be careful not to leave animals in there too long because they take everything. So in cropping areas where we are building nutrition, so we can only have sheep in there for very short amount of time, or they take everything.

00:57:37:20 - 00:58:03:17

Unknown

Whereas now in most cropping areas they're having to burn stubble because after four years they still can't get the stubble to break down. Well, it's a biological issue, right. So the gray stuff that's sitting around and now we've got decomposition happening okay. We got structure starting to happen. We've got carbon starting to build. So yeah I for me it would seem really good visual signs and all of these patches.

00:58:03:19 - 00:58:05:29

Unknown

Great. It's hot. Let's let's go.

END TRANSCRIPTION