Transcript of Episode 013 of the Plants Dig Soil podcast – "Caution on Carbon Payments"

Hello! This is Scott Gillespie and welcome to the second season of Plants Dig Soil. In this podcast, you will learn ways to transition from conventional to regenerative practices in agricultural, horticultural, and home gardening systems.

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The idea of paying farmers to store carbon in their soils has been around for decades. Companies that cannot bring their carbon dioxide emissions down to agreed-on levels can pay farmers to sequester the equivalent amount. Changing from conventional tillage to no-tillage was the first big way that farmers were seen to be able to sequester carbon. The next frontier is now looked upon to be regenerative agriculture. In this episode, I'd like to work through a series of questions you should be able to answer before you sign up for a carbon payment plan.

Before we get deep into carbon trading, I want to make it clear that, in this episode, I'm not going to talk about climate change and the science that argues causes, rates of change, solutions, or even if climate change is really happening. That is something to tackle next season. For the purposes of carbon trading, it really doesn't matter if you believe in climate change or whether we need to reduce carbon dioxide levels. I am simply looking at the business case for whether you should sign up for carbon payments or not.

Take for example Trey Hill, who is profiled in an article on The FERN (The Food and Agriculture Reporting Network)[1]. He didn't implement cover cropping on his farm to fight climate change. He did it because it made sense for the farm, and if he made a little money on the side from selling the carbon credits, he figured it would be a nice bonus.

So, there is the first question you need to answer: Can the practices I need to do to get paid for sequestering carbon fit into my farm? In Maryland, where Trey farms, there is a long, mild, and rainy winter period where cover crops can grow. In the article, they were looking at turnip growing in February. In my area, Southern Alberta, Canada, just north of the Montana border, we get killing temperatures as early as October and don't thaw out until March. There is definitely less potential here.

We also do not have the luxury of extra water. In Trey's case, excess water is likely more of an issue than too little. Without something growing through the winter, nutrients are at risk of leaching through the soil profile or washing off the fields through erosion. Even if you ignore all the soil health benefits and ignore getting paid to sequester carbon, just holding onto nutrients and holding onto your soil is enough to justify cover crops.

In my area we typically receive 300-350mm (12-14") of precipitation (snow + rain) over the entire year. This past growing season, we received approximately 200mm (8") of rain from mid May to the end of June, and that was it for the growing season. There were only passing showers during seeding and only after harvest had begun did it start to rain again.

An article on Cover Crop Strategies[2] mentioned dryland farming in Kansas as being an area where they receive 500mm (20") of moisture in a year. There's a reason why the area I live in is called semi-arid and nearly a desert. It's also why an early explorer called this area unsuitable for settlement. It is now known as Palliser's Triangle – the area that he sketched on the map – and why irrigation was developed by the railroads, so that they could sell the land they were given to lay the tracks.

The point of the article was to argue that cover crops of any kind are better than just letting the ground stay bare. Fallow only holds a quarter of the water received, so the case was being made that something that improves the soil while using the water that would be otherwise be lost was worth the effort. I fully agree with this. Why let water evaporate and potentially bring up salts? Or why let water run off your land (even if you have a cover of residue from the previous crop) when something living can be there to soak it up?

So, if you are going to use that water effectively, how should you go about it? New research posted by the Crop Science Society of America[3] on dryland cover cropping found that legumes are a good choice for dryland. They have shallow root systems that don't draw down soil moisture like grasses can.

They also may leave a nitrogen credit for the following crop. First, they will use the available nitrogen in the soil. After this is depleted, they will draw the nitrogen from the air by allowing a certain kind of bacteria to infect their roots and change the nitrogen in the air to plant available nitrogen.

Grasses and any other non-legumes will sequester nitrogen from the soil and protect it from loss as well, but they can't do the second part: add more nitrogen to the soil than was already there. They also tend to hold onto it more tightly in their residues. It will eventually go back into your cropping system, but it may not be available in time for your cash crop. Legumes will decompose quicker and can give a timelier release of their nutrients back into to the soil system.

Seems like a simple choice, right? But choices aren't always so simple.

Back in the early 2010's there was a show called "Once Upon a Time". Instead of seeing fairy tales happening in isolation the show portrayed all the fairy tale characters living in a magical land together. Rumpelstiltskin was one of the more powerful ones. When someone needed magic that only he could provide, he demanded a high price for it. As he would say, "All magic comes with a price!"

In our example the "magic" of taking nitrogen from the air costs the plant carbon. Bacteria will create this nitrogen for the plants, but they need energy, and that energy is mostly in the form of sugars produced directly by photosynthesis.

If you are carbon farming – that is, getting paid to sequester carbon in your soils – legumes may not be the best choice. In the study they found that the legumes weren't good at sequestering carbon. In one year, they appeared to give off more carbon than they accumulated, though they weren't able to discern why this was the case.

If you are getting paid every year and the money can go directly to paying for nutrients that are not created by using a legume and can make up for the potential loss in yield due to lower soil moisture, carbon farming may be for you. But if your payment comes at some point in the future, possibly years from now – will you have the cash flow to farm carbon? Or will you need to do what's best for your farm in this growing season?

[Transition Music]

The next question flows directly from the first one – looking ahead to future opportunities for your farm, what happens if you need the carbon that you've built up?

There might come a year when you can make more money by using some of that carbon for a cash crop instead of taking the payment for sequestering. Will the company that you work with allow this? Will you be required to pay back the money? Or will you need to buy your own carbon offset credits? Depending on the time scale you may be able to take a year out of cash crop production to re-build the carbon you used.

As an example, take an opportunity to grow potatoes on your land or to have a potato grower rent your land. Your field may make an ideal potato growing field. Potatoes and any other high disturbance crops like carrots, onions, or sugar beets take a lot of tillage. Some of the deep tillage is from having to break up compaction layers but if you've made a mellow soil through the use of cover crops the tillage may be confined to just the top 15cm (6") as the hills are made.

If you have built a healthy and disease suppressive soil, the potatoes should be of a higher quality and should produce more tons per acre. This means more money to you if you are growing them or make your field more desirable to potato growers and give you the ability to charge a higher rent.

It may not even be a potato year you are looking at. What if there is shortage of fertilizer some year and you decide to tap into the reserve in your soil? Healthy soils could be mined in years of scarcity and then rebuilt in years of excess.

Related to this question is: How will you get paid? How often will you get paid? What will it be based on? For Trey Hill in Maryland the payments were based entirely on data that he logs on his farm. No site visits, no soil sample, no lab tests. It is all based on current scientific understanding of carbon sequestration and computer modelling.

What happens if the models get updated with new information and they find practices did not actually sequester carbon? Or in the case of Trey Hill, what happens if, in 10 years when he does the audit, they find that the carbon was not actually stored? The companies that paid for the credits would rightfully want to get a refund. Most importantly, it means that in that time when people thought they were doing the right thing for the environment they were actually still contributing to the excess carbon problem.

This is where I get concerned. The model is based on 100 sample points across the United States looking at the top 30cm (1') of soil. Think of the amount of variation in climate, soil type, and farming practices in your county. How many counties are in your state or province? Keith Paustian, who leads the model development says, and I quote directly from FERN article: "We've got a pretty solid empirical base from decades of soil science and field measurements, I definitely think that we know enough to move forward." "Pretty solid", "definitely think", and "we know enough" are not scientific words that should be used when millions of dollars are changing hands and farmers are changing practices based on payouts from these models.

[Transition Music]

For the final segment of this episode I want to go deeper into the science. I'm going to highlight three articles along with some of the related articles that were cited or created in response to them. Each has many links that you can use to follow up on what interests you.

The first article is from MIT Technology Review[4] and dives deep into the controversy behind carbon payment plans. They have an overly negative view of the science behind carbon sequestration and have many articles cited to prove their point. They also bring up the case of trying to setup a carbon payment program in California and how it appears that some of the big players in the trading of these credits are influencing the process that seeks to verify them.

They are concerned, rightly in my opinion, that only 1% of the fields will ever be physically visited by a third party to verify that they are indeed sequestering carbon. This means that the company that is brokering the trades also verifies that the trades are legitimate.

Another article that seems overly negative on the impact of soils in holding onto carbon is one from the World Resources Institute[5]. They again cite many resources that you can investigate if you like on the scientific debate. One of their main arguments is that there can be faulty accounting if the entire system is not monitored.

The only time when carbon is actually taken from the atmosphere is when the plant is alive and actively making sugars. Essentially, plants dig soil. Nothing else does.

In fact, as we saw with legumes, there may be a period where they are emitting more carbon than they produce to make the nitrogen that they need. Once a plant dies or is fed to livestock, it's a slow decline from complexity to carbon dioxide. A fraction of the stable organic matter may sit in the soil for centuries, but this is only a small portion of the original material.

Faulty accounting comes into play when a farm may look regenerative but is only just transferring carbon around. Manure gives a very clear example of this. The animals that produce it are in a barn and their feed is brought to them. No one collects manure behind the cow out on pasture. If the manure goes back to where the feed was produced, then the cycle is complete. To be truly complete the animal remains would have to go there too. And if it was eaten by human then then the urine and poop from the human would have to go back there as well.

Back to the example – if the manure is brought to another farm (even if someone went to the trouble to collect it from the pasture) the original piece of land that produced the feed has lost nutrients and carbon return in favour of the field that received it. If you want to dive deeper into this go the first episode of this season: 007 Plants as Soil Amendments[6]

This article prompted two counter arguments that are worth looking at. Keith Paustian, the same person that developed the "pretty solid" model mentioned earlier, along with other concerned scientists argued that the science was clear and that WRI was wrong to question the models and confuse the idea[7]. If you are looking for articles that support the role that soils have in sequestering carbon, this article is full of them.

Another article from the University of California Berkeley outlines the work they have been doing to mitigate climate change in California[8]. In it they claim that compost can have a net benefit to greenhouse gas emissions. I found this hard to believe so I checked out the link to the report[9]. It turns out that under certain circumstances you can have less emissions with compost application to rangeland, but it's not a net sequestration of carbon. It simply means this is better than putting them in liquid manure storage systems or sending to a landfill, where they are prone to emit more dangerous greenhouse gases.

The final article comes from Civil Eats[10] and uses the work on compost to make the bold claim that a single 12mm (1/2") application of compost could increase soil carbon sequestration by additional 1t/ha (0.4t/ac) for 30 years. Using compost density calculators[11] this means we need 84t/ha (33t/ac) of compost to sequester 30t/ha (12t/ac) of carbon.

I was unclear on how the effect could last for so long so I dug into the report[12] and found that the researchers reported that the greatest effect was in the first three years and that the effect declined after that. This is consistent with how I calculate manure or compost nutrient release rates for farms that I work on. They say that the effect could last for decades, and I agree with this. I've seen portions of fields grow better where historical manure was applied than areas that didn't have manure applied in the past. But I don't think this means that it will sequester at a steady rate for 3 decades.

At an estimated cost of $50/ton[13] this means an investment of over $4000/ha ($1600/ac) just to purchase it. Transportation and application are an additional cost and will depend on local availability. As a reference, Trey Hill received $15/t/yr to sequester carbon and he expects this to be the best-case scenario for the immediate future. So, if you need to invest $4000 today for the potential of a $450 payout over the next 30 years, there better be a lot more benefits coming to you than just the carbon payment.

[Transition Music]

I recognize that this episode has gone on longer than my normal episodes and I thank you for sticking along with me. Believe me, it took me a long time to put this all together in (what I hope is) and cohesive story.

I am taking a cautious approach when it comes to capitalizing on carbon sequestration. If you are able to answer the questions that I put forward early on in the episode then by all means, go ahead and sign up for a program.

To review, it must work into your current and future farming practices and you must be clear on how you will get paid. As models update and new testing methods are developed you need to be sure of your risk. If there is more sequestered than expected, will you be paid for the difference? If nothing was sequestered, are you on the hook for the offsets? If you decide to use your carbon for other cash crop opportunities, or it's shown that, in fact, you are mining the soil of carbon, will you need to pay back what you were given, or even more?

I want to leave you with one final study[14]. This is not a new study and in fact the original news release pre-dates most of the articles I talked about in this podcast. A California study showed that there was no difference between conventional growing practices and those that used cover crops over a 19-year period. The only way they could sequester more carbon was by adding compost, but of course this is an example of faulty accounting – where the field appears to be sequestering but it actually just transferred carbon from one field to another.

So how is it that fields with cover crops don't sequester more carbon than fields without them? The answer lies in the depth of sampling. In the top layers of the soils the cover crops do indeed sequester more carbon, but they do it at a cost to the layer below.

When the researchers studied soil cores 2m (6.7') deep they found that cover crops depleted carbon stocks in the lower zones while increasing them in the upper levels. This is likely beneficial for the farming system, as having the carbon and biological activity close to the surface and most of the roots should be beneficial, but it does mean that cover crops alone may not be sequestering carbon.

This is one study in one agro-climatic area, but if the trend shows across other areas, many of these carbon sequestering programs may need to rework their models.

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Remember to get local advice before acting upon this information. If you don't know who to talk to, get a hold of me and I'll help you find someone. If you're in my local area and are in need of help, contact me. It's always free to chat. If we get to the point that the scope broadens to consulting work, we can work out a plan that fits your budget.

Would you like to keep up with me through a free monthly newsletter? Go to www.plantsdigsoil.com/contact and select the newsletter option. If you haven't subscribed to the podcast yet please make sure you do that in your favourite app. If you're a long-time listener – will you consider leaving me a review? This helps others discover the podcast. If you know of someone that would enjoy this, please be sure to share it with them directly or through your social networks.

If you're still listening, you're probably like me and like to know what the catch is. Why am I putting out this information for free? The reason is that I love to learn, and I love to share the information. My knowledge has been built up from experiences in my own garden, advising farmers and agronomists in my consulting business, and from reading the latest books and articles on agronomy and regenerative agriculture.

I have a B.Sc. (Agr.) with an agronomy focus and a M.Sc. with a focus on Plant Science. Beyond my formal education, I have attained, and maintained, my Certified Crop Advisor designation and am a member in good standing with the Alberta Institute of Agrologists.

Nearly everything I talk about is from free resources posted to university and research organization websites. Books that used to be hard to track down are available to buy or borrow for nearly anyone with an ereader. The information is out there – sifting through it all is what takes the time.

I make my living entirely from consulting. I don't sell any products, software, or systems. I strive to be as independent and as unbiased as possible so I can provide the best advice to my clients and help as many people as possible move from conventional to regenerative agriculture.

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[1] Gabriel Popkin. 2020. Is carbon farming a climate boon, or boondoggle? https://thefern.org/2020/03/is-carbon-farming-a-climate-boon-or-boondoggle/

[2] Dodge City Daily Globe. 2020. Dryland Cropping Systems & Cover Crops. https://www.covercropstrategies.com/articles/1406

[3] Crop Science Society of America. 2020. Hot, Dry Soils Benefit From Cover Crops. https://www.covercropstrategies.com/articles/1125

[4] James Temple. 2020. Why we can't count on carbon-sucking farms to slow climate change. https://www.technologyreview.com/2020/06/03/1002484/why-we-cant-count-on-carbon-sucking-farms-to-slow-climate-change/

[5] Janet Ranganathan et al. 2020. Regenerative Agriculture: Good for Soil Health, but Limited Potential to Mitigate Climate Change. https://www.wri.org/blog/2020/05/regenerative-agriculture-climate-change

[6] Scott Gillespie. 2020. 007 Plants as Soil Amendments. https://www.plantsdigsoil.com/podcast/007-plants-as-soil-amendments

[7] Keith Paustian et al. 2020. Climate Mitigation Potential of Regenerative Agriculture is Significant! https://regenerationcanada.us15.list-manage.com/track/click?u=74b7d6f3ceea71c604e0ae73b&id=304065dac4&e=e24c146dc3

[8] California Climate & Agriculture Network. 2020. Regenerative Agriculture's Climate Mitigation Potential: A California Perspective. https://calclimateag.org/regenerative-agricultures-climate-mitigation-potential-a-california-perspective/

[9] DeLonge, Ryals, & Silver. 2013. A Lifecycle Model to Evaluate Carbon Sequestration Potential and Greenhouse Gas Dynamics of Managed Grasslands. https://link.springer.com/article/10.1007/s10021-013-9660-5

[10] 2018. Civil Eats. Carbon Farming Works. Can It Scale up in Time to Make a Difference? https://civileats.com/2018/06/12/carbon-farming-works-can-it-scale-up-in-time/

[11] El-Sayed G. Khater. 2015. Some Physical and Chemical Properties of Compost. https://www.longdom.org/open-access/some-physical-and-chemical-properties-of-compost-2252-5211-1000172.pdf

[12] Nicholas Institute Report. 2014. Greenhouse Gas Mitigation Opportunities in California Agriculture. https://nicholasinstitute.duke.edu/sites/default/files/ni_ggmoca_r_4.pdf

[13]John Biernbaum. Compost for Small and Mid-Sized Farms. https://www.canr.msu.edu/uploads/236/79117/Compost_for_Midsize_FarmsQuickCourse8pgs.pdf

[14] Kat Kerlin. 2019. Compost Key to Sequestering Carbon in the Soil. https://www.ucdavis.edu/climate-science/news/compost-key-sequestering-carbon-soil