Heather Field:

Hello everyone who's joining. We're just bringing our presenter in shortly. So just give us a couple of minutes.

Hi everyone. We're just waiting just a couple of minutes for our presenter to pop in and we'll get started.

Graeme Anderson:

Welcome everyone to the webinar. Just getting a few things hooked up behind the scenes, but we've got a great session today with a great farmer's perspective on some terrific work. And also they've measured lot of things and over time done a lot of land care works, high production farm, and sharing their journey on making sense of carbon and emissions. We'll also be sharing some of the resources we've got available with Agriculture Victoria on making sense of carbon and emissions. We've got booklets, we've got some fact sheets and other resources there for people. So I think all's going well behind the scenes. Hope you're enjoying your day and it's not too wet wherever you are, having just enough rain. Ready to hand over to Heather.

Heather Field:

Thanks, Graham. And I think we do have Cam and Fiona online, so I'll just stop sharing my screen so we can bring up their slides. How you going, Cam and Fiona?

Cam Nicholson:

Yeah, good thanks, Heather. Yeah, good thanks. Sorry for the technology. The video's not working, but that's... I don't know.

Heather Field:

That's okay.

Cam Nicholson:

Anyway, as long as you can hear us, I suppose is the main thing and we can share the slides as...

Heather Field:

Yeah. If you want to pop up your slides and I'll do a little bit of a introduction while you do that.

Cam Nicholson:

Yeah. You'll just have to enable me to share.

Heather Field:

Oh, okay.

Cam Nicholson:

I'm disabled at the moment, so to speak.

Heather Field:

Okay. Should be able to now.

Cam Nicholson:

Yep.

Heather Field:

Excellent. All right. Well, I'll do a little bit of an intro while you yourselves all set up. So today we have a webinar on a farmer's perspective, which is making sense of carbon and emissions. And my name is Heather Field and I'm a climate change service development officer with Agriculture Victoria, and will be facilitating today's webinar.

So before our presenters begin just a few housekeeping items, this webinar is being recorded and we'll be made available after today. And we've got you all muted at the moment to stop background noise. But if you do have a question, please use the chat function and we'll be able to read out those questions to our presenters today. And we will have a quick survey following the webinar, which will only take a minute or two to complete and we greatly appreciate you completing that.

So before we commence, I'd like to acknowledge the traditional owners of the lands and water on which we are all meeting and pay my respects to elders past, present and emerging. And I'm tuning in from Ballarat, which is the lands of the Wadawurrung people. And I would like to acknowledge all the lands on which everyone is tuning in from today.

So I'm pleased to welcome our presenters, Fiona Conroy and Cam Nicholson, who have a interest in understanding the opportunities and future market challenges around carbon accounting and reporting, and will describe their progress so far and their future thinking around carbon emissions and to seek restoration.

Fiona and Cam run a 400 hectare beef sheep farm on the Bellarine Peninsula. And Fiona is the day to day manager of their farm, which runs a self replacing commercial performance recorded Angus herd, and a super fine Marino flock with a focus on productivity, animal welfare and environmental management. Fiona is also a farmer representative on the Western Victorian Southern Australian Livestock Research Council. A member of the MLA working group, developing environmental credentials for the Australian beef industry. A member of the Victorian Agriculture and Climate Change Council and secretary of the Victorian Farmers Federation Bellarine branch.

And Cam is a partner in Nicon Rural Services, a consulting business near Geelong, working with the grazing and cropping industries. And Cam has been involved in many farmer programs for the DRDC, MLA, Landcare and the current Future Drought Fund initiative. And he provides consultancy advice to farmers and lecturers on animal and pasture systems at Malcolm Oldham College and his work most recently has focused on understanding and discussing risks in farming businesses and how to enhance decision making.

So as you can imagine, we are very excited to have both of them here to present on their experiences in making sense of carbon and emissions. We've had overwhelming interest in today's webinar with quite a large number of you online today. So with that introduction complete, I will hand over to Fiona and Cam and hopefully you're right to go.

Cam Nicholson:

Yep. Thank you, Heather. And thank you for the introduction. We thought we'd do this presentation in two parts. We'll talk a little bit about the carbon side of things for our business, and then talk about the emissions side of it because we sort of see them as two separate things to think about.

So first of all, if we move on the carbon bit of it, we've had an interest in trees and improving soil health and things like that for a long time. Well before, I suppose, the interest in carbon arose and people are talking a lot about carbon now, but we had an interest in this back in the 90s and early 2000s, because we just saw having trees on farm and having healthy soils is just part of good farm management. So we haven't just started in the last 10 years, this has been many decades that we've worked on it. And we've also had some skills in that space as well, family and I had a tree planting business. We used to plant trees for other farmers and property owners on the Bellarine Peninsula before we were married. So we knew how to plant trees, and with my background as an agronomist, had a pretty good understanding of soil and soil interpretation and stuff like that.

The first trees that were planted on the place, Fiona's dad planted in 1980, he put his first plantation in, otherwise they were bare blocks, essentially. And we've had 33 planting so far since 1980. We also monitor our soils in a very intensive way. So every paddock on the farm gets soil tested every three years and has since the mid 1990s, so that's just a rolling average of phosphorus across the whole farm. So there's 40 odd paddocks in each of those data sets as it moves through now. So it allows us to manipulate our inputs as far as nutrients and lime and things like that go from a phosphorus point of view. That's across the whole farm and we can do that for individual paddocks. So we tailor our soil management based on individual paddock results that we get from our soil testing.

We got a bit excited in the early two 2000s about carbon and possibility of selling carbon and making money out of it. Mainly through Graham actually, who's a locally now part of the world, and he was talking about some of the early pilot schemes that the state government were looking into about carbon and being able to sell carbon. And we saw our trees there and thought, "Oh gee, there might be an opportunity to make a dollar out of it." But in the back of our mind, we had this nagging suspicion that maybe someday we could actually need that carbon ourselves. And if we sell this carbon to someone else, we essentially have to manage it and keep it there, but it's someone else's property and not ours. So we never went down that path, but our interest was really peaked in the early 2000s.

And then I was very lucky, personally, to be involved in a project with a select group of agricultural consultants in 2013 through a federal government initiative called Carbon Outreach Program, to really understand some of the methods that were available to potentially record carbon sequestration and then potentially make money out of them. And part of that project was you had to work with a number of your local clients and apply the thinking and the opportunities that were behind here to see if there were any opportunities within individual farm businesses. So I've had a very strong sort of background in trying to make these methods work from a farm perspective and a farm management point of view, and what's good for the farm business is sort of part of that.

And then, so that's been a great foundation for us and therefore more recently when this [inaudible 00:14:49] 30 and the climate change discussions have started to ramp up more, we've been in a pretty good position to actually understand the background to it. So that's the little bit of, I suppose, carbon contexting, but I might just hand over to Fiona to talk a little bit about the farm itself.

Fiona Conroy:

Okay. So just to give you a bit of a rundown, we've got 395 hectares, I think that Heather said 400, it's probably six in one and half dozen of the other. And of that, we lease 111 hectares on neighboring properties and effectively have 10% of the farm land that we own or have direct influence over under trees. Those trees have gone in over a period of time on a number of locations, depending on salt type and stuff. We might want to flick to the next slide.

So we've used tree plantations on boundaries initially, which was a bit of a bio-security stuff, because good neighbors are pretty dependent on having good fencing. And then as we've gone through, we fenced off a water course that went through the middle of the farm so we could put in some major dams, that's the water course through there, and then reticulate water through to troughs. And then we started fencing off all the boundary fences on our paddocks. And we land-classed fenced, so all our fencing which went in was based on soil type and soil conditions. And then we've planted different pasture species on those soil types. So we've got everything from phalaris in some paddocks to rye grass-dominant pastures in others. We've got lucerne in some paddocks and we've got fescue-based pastures in others and that's allowing us a spread in pasture production. And we use that in rotational grazing, it's extending our growing season. So we spring lamb and spring calve and we rotate and manipulate those paddocks in rotational grazing, so we graze and spell.

The other thing that's been really important with the tree plantations is that we've got shade and shelter for stock, and that's fairly crucial now in optimizing lamb survival. We've also got increases in biodiversity. We've measured a lot of changes in bird populations and we now have about 130 different bird species on the farm. In the tree types that we've planted, originally, we went with what we could get, then we've gone into tube stock and at various stages we've gone into direct seeding. And in that middle part of the photo with the ute in the paddock, that is actually a spotted gum woodlot for timber production. So we've got a couple of woodlots as well, with the idea that potentially we could harvest timber down the track.

So what all this has done, by increasing soil conditions, land class fencing, getting the pastures right, because in a lot of cases those pastures were originally dominated by onion grass and fog grass, is we've effectively doubled our stocking rate, which has increased our productivity. So what we've done, is if we look at our beef production, we've seen our beef production steadily increase over time, and that's coincided with having more lease blocks and stuff increase over time as well. One thing we do is we do a hell of a lot of monitoring. We weigh animals regularly, we monitor stock weight gains, we condition score sheep, we monitor pastures, and we've got a soil moisture probe as well. So we can monitor where our pastures are going, where our stock are going and make decisions early. If stock aren't gaining at the rate that they should and aren't going to meet target markets, we can look at alternatives or we can upload stock.

So if I take a step back, we run a self replacing Angus herd that's performance recorded, and we produce feeder steers for Rangers Valley and Stockyard Beef. If we don't think those steers are going to make the market targets, we can look at back grounding those steers somewhere else. With our self replacing Marino flock, we also run a mob of Marino wethers. So if things are getting tight, we can offload those wethers as a bit of a risk management tool. But what we've effectively done with the pasture improvement and the trees and the subdivision and the rotational grazing, is we've doubled our stocking rate from originally about 10 DSCs per hectare to 20 DSEs per hectare.

Cam Nicholson:

Okay. Just to finish off the bit of the carbon side of it, I want to concentrate a little bit on the soils. It's my bent anyway, but there's been a lot of talk about soil carbon and the opportunities of storing carbon in soils. All the way from the politicians saying there was going to be rivers of gold and you're going to make a huge amount of money out of them. Just want to show you what the data that we've collected over time on the farm actually shows. And I've put in brackets there, "It fits the science." So if you look at the good, credible science, what's happening on our farm mirrors that, so I'll just touch on a few of those things briefly.

The common [inaudible 00:20:17], "We can improve our soil, but..." And there's a few buts associated with that. So I do agree that there is opportunity in some soils and some soil types based on where they're currently sitting, that they can accumulate more carbon in the soil, but there are a few caveats to that. Just want to show you some data I've pulled together. Now these are nine paddocks. And so in total they average 116 hectares that have been monitored every three years since 1995. And I've just been following through the organic carbon, so there's 153 soil tests that make up this data set that I'm going to show you.

Those paddocks have got good soil fertility. This was the most recent soil tests we had. So part of building soil carbon, you do need good soil conditions and soil fertility as well. That's where they sit at the moment, our Olsen Ps when we started were sixes and eights in the 1990s, and they sit around about that 15 to 20 mark now, potassium pretty high and sulfur-rite. And we've gone a little bit higher now on the pH that we're trying to get for our soils. Typically, our soils can have a pH in calcium chloride of 4.2 to 4.6. So it's set a fair bit of lime associated with getting those changes as well.

If I put up the graph, so this is the graph of our soil carbon. Now, each of those dots represents a number of paddocks and adjusted for the hectares, so that's a per hectare soil carbon. And typically where we start, and we found this on the lease blocks that we picked up from cropping, we typically are starting around at that 2 to 2.5% range. And what we saw over time is that it started to accumulate to that 3, towards a 3.5% relatively quickly and then it tends to plateau off. And the science will tell you, this is what tends to happen. If you change your production system from what we had down here and grow a lot more plant material, then you soil carbon will rise relatively rapidly to start with, and then it moves towards hitting an equilibrium.

Another thing that you can see on the graph here is that despite having nine pads involved in this sort of stuff, and lots of tests involved, the dots still bounce all over the place. And it's just inherent that I've learnt from soil testing and soil carbon. Just look at it from a trend point of view, don't read too many absolute values into it. And to give you an example, you'd see there's a bit of a gap between those two dots there. We did have one series of soil tests and they came back and the average soil carbon was 4.8, which would actually put it off the screen.

Now, if I had only had the odd sample here and there, I may have believed that 4.8 had actually happened and we'd increased our carbon from 3 to 4.8 into two years. But because we have this longer term trend, the next time we re-sample those paddocks, they we're back around three and they've sat around that three mark. So the 4.8 was an aberration. It's the samples that were just duds, which I probably should have got retested, but I wasn't as focused on carbon at the time. But message to take out of that is just look at it as a broad trend rather than anything in particular.

Something that I do think though is coming out is when we look at where those dots are going up and down, you start to first of all think about, where's the ceiling for us? Now, the computer models will tell you that it would be around about 3.5% For our climatic conditions in our soil types, so we're probably pushing towards the top end of that 3.5%. But if you look at the way that it's got a bit of a sawtooth effect, I think it's related to growing season, which would make sense.

So I've got growing season here. So over those four years, we've had a decile three growing season, two nines and a six. So basically we've had a reasonably good run over that period of time, grown more biomass, we've had good production years, really good production years over the last two or three years, and it appears that your organic carbon starts to go up, which would make sense, because you're putting more material into the ground. Same sort of thing over here when we had a period of favorable seasons.

If we contrast it when it went down here and I look at, we had a decile two and a decile one, so basically we went through a droughty period there on the farm, picked up towards the end, but we didn't get the same growth response that we got once we've had a few good years. So message to take out of this is I think the seasons have got a lot to do with it and trying to read too much into an individual soil test, unless you start to look at those longer term trends of seasons, I think can be a bit misleading and a bit dangerous.

It's a pretty tough soil that we're working on. This was a soil pit dug by the ag department in the 1990s on the farm. You could see we've got about 30 centimeters of top soil then and the rest of it is a pretty nasty sodic clay sub soil. Having said that, and this is a sort of soil type that we started on, we've been able to improve our soils. And in particular, what I've noticed is what I'd call the soil biology, or the soil activity, has improved as part of growing more pasture species in it. This is typical of what we get across paddocks. As soon as we get a bit of rain that's earthworm activity, so they're worm castings that pop up, every paddock pops up like this.

This, for example, is a paddock. It was sewn in 1983, so that's a 40 year old paddock in front of you. We started rotationally grazing in 93 when Fiona and I got involved in the farm. It's had what you might call traditional fertilizer for 21 of those 30 years, combination of the single, super [inaudible 00:26:09], potash, super potash. We've used chook manure a few times when they were chook sheds on the Bellarine Peninsula and that was easy to get. It's become much harder and more expensive. So I don't mind using chook manure if it's the right product for the right time and it's been limed three times.

And if you look at the soil health of it, it's gone from the soil pit to look like that. If you break it up, and this was a test we did a few years ago called visual soil assessment, we did them on all of our paddocks, that's what it looked like. And if you zoom into that, high levels of activity with organic material, lots of earthworms through it, lots of variation in crumb size or structure from that. In this case, here's only 20 centimeters down before we hit that sub soil clay layer. But even when you dig into the sub soil, you see that, the earthworms drilling through it, and you could see holes through the soil as well and organic material in there. So we're getting organic carbon down to depth as well, simply by good grazing management and good soil nutrition and soil management from that point of view. Legumes are really good, which is an important part of it because they pump the nitrogen in, see the clovers are well nodulated there, which provides a lot of nitrogen.

I did play around for a couple of years with some of the biological soil testing. And I know that's been a fad and some people use that and they look at ratios of bacteria to fungi and this type of bacteria to that type of bacteria. I did a test one time on the same paddock where I took two sets of cores 15 centimeters apart. So I took multiple cores one spot put them in a bag, another 14 cores in bags, 15 centimeters apart. And when I got the results back, it said, this one on this side was really good, but this one needed a whole lot of different potions and stuff to go on it, to balance up the biological activity. And I looked at that and I thought, "There is no way I can read into that, anything that I think is of value."

And I might sound skeptical, but over the years, and I've done a lot of these things with various trial work that I've been doing, you could read anything into some of the biological tests. So I don't use that as anything that I think gives me any credible information around what the soil condition is like. The only one that I do think may have a little bit of value, and I've just started playing around with this now, is what's called the Solvita CO2-Burst. You can get this requested on a soil test now off most laboratories.

What that does is take that soil core, incubates it, so warms it up to ideal levels for the bugs, puts the amount of moisture in it, which is ideal for the bugs, and then it measures the amount of carbon dioxide that comes off it. With the ideal being that if you've got good food source for the bugs, which is the carbon that we're putting into the soil, and those bugs are the right balance and they're actively growing, they'll produce carbon dioxide as they break down that organic material and cycle it through the soil. And the test results that we got back from ours, they stacked up really well. So it seems to be telling me with whatever we are doing on the farm in the grazing and the fertilizer and the liming and all of those sort of things, and the species management, is producing a healthy soil at the end of it. And I think, Heather, we might just pause there for a minute in case [inaudible 00:29:30] questions related to that bit before we go onto the emissions side of it.

Heather Field:

Yes, sure. Yeah. Great insights there so far, Fiona and Cam. We do have three questions, a couple of quick ones and one a little bit more in depth, but Susie's keen to know what your soil type and rainfall averages are?

Fiona Conroy:

Oh, rainfall is about 600 millimeters. It's pretty variable. We work on a autumn break about the 1st of May, but we can get 90 millimeters in January, which is great if you've got perennial pastures, because they do respond, but it isn't really part of your growing season. We've got sandy clay loams, and as Cam said, they're on that sodic clay sub soil, which isn't really fabulous. We're very flat, so we're prone to water logging a fair bit as well. This year's been a shocker for water logging because that clay swells up and then that sandy loam on top is saturated and it doesn't drain through the profile. So yeah, the sodic sub soil's pretty nasty. It's highly dispersive, so we're also prone to getting sinkholes and things like that where fence posts and trees used to be. So it's not ideal soil and it is very flat, but 600 mills is the rainfall.

Heather Field:

Excellent. And Colin's to know... Let me just find that question. Colin's came to know what your views are on building carbon in cropping country.

Fiona Conroy:

Ah, look, I'm not a cropping expert so I can hand that to Cam, but the lease blocks that we've taken over, and as I said, we've got pretty nasty sub soils and top soils that are sandy clay loams and clay loams, all those lease blocks we've taken over had been continuously cropped. And the reason we got them was that they'd literally got to the stage where the soil structure had collapsed, but they had been cultivated regularly. And that's why we've been able to come in and pick those blocks up and put them into perennial pastures. But in terms of overall cropping, I'm going to handle that one at Cam.

Cam Nicholson:

I reckon it's pretty simple, Heather. It's about the amount of biomass you stick in the ground in a year. And if you do your subs in cropping compared to what we can do in a perennial pasture, we can put many more tons per year into a soil with our perennial pastures, particularly if we graze them well and rotationally graze them to encourage the root growth and things like that, then you can in a annual crop. And so you see this everywhere, you come out of a pasture phase, put in a cropping phase, you're producing less biomass in a year on that same bit of dirt. And therefore you will burn some of your soil carbon until it hits a new equilibrium.

So I personally think that the cropping game has got some real challenges. And I think for most croppers where you'll need to start looking at a pasture phase. And I think what we need to do is a pasture phase that just maximizes the biomass production in the year. And it will be like a sawtooth effect. And I know a retired CSRO scientist, Jeff Baldock, who I have quite a bit to do with, he said to us, "It'll be a sawtooth and that's the way we're going to have to manage it in the future. You'll need a high biomass growing crops for a few years. And then you'll go back into your cropping phase and then go back into the biomass accumulation phase again," is what we'll need to be sustainable.

Heather Field:

Thanks, Cam. I've got a question from Brad around the colvita carbon test. And just wondering if that reflects soil carbon levels in your trials?

Cam Nicholson:

Yes it does. So what is picking up is a fraction of the soil, which is called the labile carbon, or the particular carbon. So that's the carbon source that goes in directly from things like manure, roots as they break down, plant material that gets trodden into the ground or rots into the ground. And that's the quick and immediately available and broken down stuff, which from a farm management point of view, is what we want. Because as that organic material breaks down, it releases nitrogen, it releases phosphorus, it releases sulfur and so on. So it becomes a really important ongoing fertilizer source. In fact, more important than the fertilizer we put out of a bag early on in the season to keep our pastures growing for the year.

So the Solivta test actually picks up that labile carbon bit. And so if you've got high labile carbon, which it will measure, and then the carbon dioxide that's coming off that is high, it means, from what I understand, it means that you've got a good food source going in there. And secondly, you've got very good biological activity, which as a byproduct, is creating a whole lot of carbon dioxide, which might be a bad thing in one sense, but it's a great thing to tell you that organic material is turning over.

Heather Field:

Thanks for that. Now, we've got a number of questions. Probably take what three more, Cam, before we move to the next section?

Cam Nicholson:

Yep.

Heather Field:

We've got one about, you mentioned for your location, the soil carbon modeled maximum would be around 3.5%. So what model or models did you use for that?

Cam Nicholson:

Yeah, I'll touch on it a little bit later on, Heather. I might [inaudible 00:35:29] pass on that one.

Heather Field:

All right. Let me choose another one. We've got many questions. "Are there any differences between the rye grass paddocks to the phalaris pastures in terms of the carbon levels?"

Cam Nicholson:

Difficult to determine because there's so much noise within a paddock to try and compare between paddocks, and most of ours are phalaris-dominant, or more phalaris and they do have some rye grass in them. So yeah, I wouldn't say definitively it is, but we certainly know that our phalaris paddocks or even some of our tall fescue paddocks, if we try and put a tree plantation in them, there's a lot more organic material to try and break down before we can plant the trees in them than there are in the rye grass paddock. So I suspect there probably would, but I don't think the soil testing is good enough to pick that up.

Heather Field:

Excellent. And probably before we move on, I've got a tree question. "Have you had any better success with direct seeding or tube stock planting?"

Fiona Conroy:

Look, direct seeding is fantastic for getting a lot of trees in really quickly, but I think the big challenge with direct seeding is you don't have a lot of control on what's coming up. If I look at our direct seeding plantations, we've got a predominance of golden wattle, which isn't that good for carbon sequestration and it's not that long lived. And a lot of that may well have been seed that was already in the soil and the fact that we fenced it off, it's come up. In the more recent plannings we've done, we've gone back to tube stock. So we've got far more control on what species we have in that tree plantation. And we've gone predominantly for eucalypts that will produce more biomass. Interestingly enough, we did not put one golden wattle into those two tree plantations and they've still come up. So the tube stock gives you better control on germination or on species, whereas if you go direct seeding, you're at the mercy of what germinates, really.

Heather Field:

Great. Thanks, Fiona. So we might continue on, and I've got a few other questions, but we'll leave those, carry those over to the end.

Cam Nicholson:

Okay. All right. So the second bit we just wanted to touch on was around well I've called the emissions bit of it. So the first one was really about the carbon story and where we see carbon being stored and how we're trying to go about building that up. This second bit is the other side of the ledger, which is the emissions side of it. And I think what was important, one of the first things that we learned is just how important it was to actually understand the greenhouse bit of it, or the emissions bit of it, and where they're coming from.

And as people would probably know, but it's worth just touching on, livestock operation like we are our big emissions come from methane and nitrous oxide, so those two that are in the boxes. And if people have ever done any calculations, they'll realize that everything's converted back to what's called a CO2 equivalent and it's almost like a DSE type rating. So we know a DSE is a 50 kilogram weather maintenance, that sort of thing. And then a ewe and cow and everything else, there's so many DSEs, so in relation to that. So the methane, the CH4 and the nitrous oxide, the N2O are just relative multipliers of that. And so it's 28 times for methane global warming potential compared the carbon oxide and 265 for nitrous oxide.

Now, when we started looking into this, couple of things jumped out to us. Something like a cow calf unit like that, when you break down where are the emissions coming from out of an animal like that? It's 90% methane, it's 10% nitrous oxide and carbon dioxide doesn't really come into the equation. So you're running a lot of these, and you got a business that doesn't use much fuel as ours doesn't and we put out just a tiny bit of fertilizer, the big emissions by far, 95% of all of our farm emissions, come from what comes out of the cow or what comes out of the cow or the ewe and the sheep and cattle.

And just to put that in perspective, the cow calf unit that I've got there on the left, emits the same CO2 in a year as if you drove 13,250Ks in that Hilux. So when you start to think about how much an emission is out of those animals, that's what we decided to focus on. "How could we be as efficient as possible given they're producing that much?" And to put it in perspective, three cow calf units and I could drive around the world for the same level of emissions. So you start to think about, "Gee, what is it that we should focus on?" So our focus then turned to, "How can we make those animals as efficient? Or how can we produce the most amount of production as we can for the least amount of emissions?" Is where we started to focus our attention.

These are emissions over the last... And I went back to 2002 because we've got very good livestock records, so I knew exactly what animals we had on what month of the year and was able to do those calculations back. So we produce just under 1000 tons of CO2 equivalence per year. Fluctuates a bit, obviously with numbers going up and down and things like that, but that's roughly where we sit. If we look at the sequestration side, which is the other side of it, what are the trees actually doing for us? A couple of messages that come out of this.

First one is that the only way we could calculate it is, and the accepted method of calculating, is using a program called FullCAM. So we ran FullCAM based on the year the trees were planted and the types of trees that were in there for all 33 plantations. And obviously they were staggered at different times of the year when they were planted, but that's basically our tree profile on the farm. But when we started, Fiona's dad planted the first ones in 1980, and over the years, we'd planted trees all through this period here. We hit our peak a couple of years ago. And from now on, each year, while those trees are still accumulating carbon, they're accumulating them at a reduced rate over time. So we've passed our peak carbon sequestration emissions from the trees.

If I look at it for the soils, the soils was a real tough one to try and do. So I went back to farm data that we had, and there's a few calculations in here around bulk density and things like that to get your calculations of tons of carbon that you need to do. But the calculation that came out of using these equations, which is real data that we had on the farm, even though they're not ideal soil test to use, because it's only zero to 10 and it's Walkley-Black and not LECO and all those bits and pieces, it did give us a measure of where our soil carbon was traveling. And when you use some of the computer models, and I've just put this one up here, this is what's called Black Magic, this came from Tasmania, and I just converted it to our farm and our rainfall file and a few other bits and pieces.

It's a hard one to find this one, TIA put it together, but all of the models that I've used to model soil carbon on our farm, come out with exactly the same trend and basically exactly the same point as far as the ceiling goes of what our soils are capable of storing, in this case, top 30 centimeters is what this one calculates, and how rapidly that fluctuates going up and down. So basically you pick your pasture type, pick your growing season, what you do with that residual, so if it's crop will be burnt or whatever else, and what the yields are, and then it will do a calculation over a 10 year period for you.

So there's a number of those sort of tools out there. They do take a little bit of effort to make them work. Most important one in them is you've got to know your starting organic carbon. And that, if you've seen the figures that I showed you before, can fluctuate quite a bit, so that starting number is really important. And if we don't have a good handle on that, it makes it very hard to use these models and get anything meaningful from them.

But if you use those models, this is the way our soils look over a similar period, not as far back as the tree planting, but this is far as we've got our soil data back to. And you could see when we started off at very low carbon numbers, when we first started, we accumulated carbon quickly, but over time, we started to hit that ceiling. And it's just a few things here, we picked up a little bit more cropping country there. And this is when one of the lease blocks has kicked in that had a very low soil carbon and we've sewed that down to perennial pasture and it started picking up the estimated carbon accumulation in that soil over time. And then it will decrease again, it'll follow the same pattern as that one, as we bring new ground in.

If you stick those three bits of information together, so that's the trees in green, that's the soil sequestration in the browny or tany color, and the emissions that I showed you on that first one is that red line there. So there's a period of time there when our emissions are exceeding what we're sequestering. And then there's been this short period here where we've, we've probably done a bit better because of the amount that we're accumulating in our soils, but that dissipates pretty quickly as those soils, if you like, start to fill up and start the head towards that equilibrium. So this was a really useful exercise for us to look at that over a long period of time and just understand where we're traveling and where the emissions bit goes against the sequestration bit and how close we are to that idea around being carbon neutral.

There's just a couple of other things I'll touch on before I hand over to Fiona to finish off, and this is really from a business perspective. What's annoyed me, is probably a polite way of putting it, over the period of time is that the global warming potential, which is called the GPW100, is that relative estimate that they put on methane and nitrous oxide compared to carbon dioxide as a warming potential in the atmosphere. And when we first did our calculations in 2014, 2015, methane was multiplied at 21 times or 21 times the warming potential of carbon dioxide and nitrous oxide at 310. And this was set by what's called the IPCC, the international panel for climate change, which is an international body that sets it for the world, these numbers. And then they met again in 1920 and changed the number and methane went up and they met again a couple of years late and it went up again for methane and nitrous oxide.

So from an agricultural point of view, if you got livestock, this was a killer. In from 2014 to now, our calculated emissions have gone up 30%, even though we haven't changed anything materially on the farm. So if, when I first calculated it in 2014, 15, you could see for a long period there, we would've called ourselves carbon neutral. With the new calculations that you've got to do, if I superimposed them back or backdate them, that's what it looks like. Now, from a business point of view, when the rules like this change in how you need to calculate it, your emissions, and potentially then the sequestration changing, that puts a lot of risk in your business if you are going to sign up to anything. So you've just got to be aware that there's a lot of volatility in this space, as far as how we calculate things and that what you think your carbon neutral one day may not be carbon neutral the next, depending on what a group somewhere else have decided.

The other thing that becomes important in this is that there is an argument going on now about methane, because at the moment we're getting pinged at 28 times when it goes in the atmosphere, it takes 12 to 14 years for that methane to break down into one carbon dioxide equivalent. So it basically dissipates to one after 12 to 14 years, but from an agricultural point of view, we're held accountable for that at 28 times for 100 years. So I think there's some real issues with the accounting measures, particularly for livestock emissions that need to be sorted through. And there's quite a bit of work being done in the US at the moment at UC Davis on this number. So just watch this space, because I think over time, this number again will be adjusted up and our calculations will be adjusted up.

Fiona Conroy:

Okay. So I'm going to just wrap up in terms of what it means through our farm business. There's been a lot of discussion about people selling carbon. And I suppose, as Cam said, we've 950 tons of carbon equivalent sequestered a year. And at the spot market at $30 a ton, when you calculate it, that would probably give us about $27,000 a year in additional income. But really in the big picture of where farm income is, it's not a significant contribution. And I think selling carbon actually poses a significant risk on our business. If we want to be in a position where we can allocate carbon sequestration to stock in marketing, we really need that carbon in the business. And we face enough risk as farmers, without entering carbon markets where groups of people overseas can move methane potential and change everything.

I think the other risk we've got with carbon sequestration in soils is you commit for the long-term if you're selling carbon. And with that graph that Cam put up about growing season rainfall, you can have soil carbon bouncing all over the place. And with the forecast with climate change, we're going to have reduced rainfall. So I think we've got to look at a reduced capacity to store soil carbon in the first place. So we've made the decision not to engage in soil carbon markets at all. What we are doing is looking at emissions intensity, I think there's a slide on that. And we're focusing on trying to be as efficient as possible in producing as much beef as possible for the emissions that we've got. And that really focuses on trying to optimize turnoff. We're hovering around 10 kilograms of CO2 per kilogram of beef, or CO2 equivalence, per kilogram of beef we produce, which is at the lower range of what's being documented in industry, and I think that puts us in a good position. But we've got to focus on farm practices to be as efficient as possible.

So what we've got to do is make decisions early and make sure we don't have animals that are in the system that aren't being productive. So we've put a lot of effort emphasis on monitoring, and as I said, measuring. Fertility is a real game changer for us in terms of optimizing production. You can't have animals that you're growing out a heifer until she's two, if she doesn't actually effectively produce a live calf and then get back in calf, you carried that animal for two years worth of emissions and she hasn't actually added value to the business apart from being a cull cow. Similarly, with sheep, optimizing wool production, but also optimizing lamb survival in terms of getting as much production out of every adult animal that's on the place because they're contributing to that methane issue, which is not going to go away. So we're going to look at continually pushing emissions intensity.

We supply feed lots, and the two feed lots we supply both doing Asparagopsis trials. They see this is an important issue and they're going to be in a fantastic position where they can feed additives that modify room and reduce methane production by 80 to 90%, which is what some of these things are claiming to do, because they've got an ability to control what animals are eating. And they've got buyers that are actually looking for low methane production beef. We've got an EU buyer coming out to the farm on Tuesday with one of the feed lots that we supply to look at what we do. But especially in Europe, and as I said, EU, there's enormous potential for the EU to use this as a trade barrier and have border adjustment tariffs if you are not seen to be proactive in this area.

So we've really got to keep a pace of what the industry trends are in terms of beef sustainability. And we've got the beef sustainability framework, which is a fantastic foot in the door, but we've really got to keep on top of this emissions issue. And I think emissions intensity is probably the thing to focus on. I don't know if carbon neutral is going to be something that we can really grapple with easily methane warming potentials potentially keep changing in the future. So what I think we're probably going to do as a business is we are going to develop our own models, and Cam might want to add stuff about this a bit later, but we've been doing a lot of soil testing in the top 10 centimeters and that's not what the industry has. The industry uses a 30 centimeter depth and they use a different test. But I think we're looking at some sort of system where we have our own internal accounting system using soil carbon, because we've got the data there.

With the trees, I think there's technology that we can adopt. At the moment, a lot of the models just say how many hectares and what type of tree plantation, and there's really only three options that you can tick a box in. And I don't know if that really reflects what we've got on our farm, but I think there's technology that's used in the forestry industry where they use drones and the drones fly over a tree plantation. They have a radar and they can actually estimate the individual biomass of the trees, I think that would give us a more accurate accounting system. And then we can look at how much carbon we're sequestering.

And I think the challenge will be also if we're going to have it going through the supply chain, we've got to have some ledger system where we can follow carbon and allocate it to a particular product. And that might be through something with blockchain or whatever. I certainly know that there's going to be buyers out there that will want to buy products that they can say have been offset with the carbon. And it may well be that in our business we say, if we are no longer covering the entire farm business, we can allocate our carbon sequestration to feeder steers or wool, but we don't allocate it to the sales of cull sheep and mutton or breeding females.

I think the other thing, really important to keep in mind that if you sell your soil carbon, you can't count it twice. You can't use it. If you commit selling your soil carbon, you can't then turn around and use it to offset it in your business. And I think the other thing that's really important with if you soil carbon... And we've got three kids and they're all sort of interested in the farm and I don't know whether they'll ever come back and be interested in taking over part of the farm business. But if we sign a deal for soil carbon, we are committing to something that's about 25 years and we're at the wrong side of 55 and I don't know if that's something you really want to leave your kids with, is a commitment to selling soil carbon that may or may not be an option.

But I think for us in terms of our business, we'll keep focusing on emissions intensity. And I have a real faith that there will be potential where we can use things like feed additives in the future. There's a lot of research going on in this space in terms of things like Asparagopsis and 3-NOP. And it may well be a vaccine that we can treat our cow calf heard and reduce emissions. Because as was in that graph, that pie graph, our big challenge is methane and we've really got to get on top of methane. So if we could have a cost effective, easy way of dispensing rumen modifiers to count our calves, whether it was through, I don't know, a rumen bullet or a cell feeder with a few pellets or a vaccine, then that would be an absolute game changer. And we'd find that even though our tree sequestration is tapering off, it would cover all our emissions if we could get on top of methane.

Cam Nicholson:

I think we might pull up there, Heather, given the time.

Heather Field:

Yes, absolutely. And you've answered quite a number of questions just in that last little section, which has been terrific and really great overview. And we've got lots of questions coming in, which we won't get to them all, but we'll pull them all together and provide some responses to those where we can. There was a couple I'll raise, "When you say you've passed your sequestration rate, does that mean that the trees have stopped putting carbon back into the soil?"

Cam Nicholson:

You mean the trees' sequestration?

Heather Field:

Yes. The trees' sequestration.

Cam Nicholson:

No, they're still accumulating carbon above and below the ground, but at a slower rate as they mature. So I can flip back to it, I suppose, that one there. So what that's basically saying, so this is the annual, so it's a tons of CO2 equivalent per year. So we peaked it about 600 tons where everything was reasonable size and growing really fast. And the models are telling us that that will slow down. They'll still keep growing, but they grow at a slower rate over time. So we've passed the maximum we can accumulate in a year unless we start planning a lot more new trees and kick it back up again.

Graeme Anderson:

And that's a really good point, a really important one Cam, too, because while you're absorbing heaps of carbon in the trees, you've planted, sequestration doesn't keep going on forever. So what this is the graph of the annual sequestration, which shows it's a peak and it's all follows lot of the growth in the first 15 years and when most of your active planting was, which was that. But it's not an enduring source of income. If you're relying on it for carbon credits, it buys us time, but I think... And it's similar for soils. We can, both with trees and soils, we can increase carbon, increase it to a higher level that's on the farm and then it'll be stable. So any carbon credit market is relevant while we're increasing, but it doesn't keep going forever, which I think is a point of confusion for some. So it's well done of putting the whole story there together, because often that's missed out.

Heather Field:

Thanks, Graham. We've probably only got time for one more question. And then we just want to share some resources in the chat box with you all. We've got a question probably around, there's couple of them around, "What measurement protocols are you following to come up with your carbon numbers?"

Cam Nicholson:

Yeah, really good question. I really like the method used through the clean energy regulator, the emissions reduction fund to get ACCUs. I think that method is very sound. And in fact around the world, it's considered gold standard. Our problem with that, is we can't register a project because you have to change practice. And we've already ticked all the practices that they say would allow you to be eligible. But I think the method that they use, so that would be minimum zero to 30 centimeters, a certain number of samples with bulk density taken and gravel taken. And the carbon measured through LECO rather than Walkley-Black, which is a standard one that you get on your soil test.

Now, Walkley-Black, fabulous for a agronomic point of view, that's exactly the measure you want, but for this soil carbon we'll have to go to a different method. I think the National Soil Monitoring Program's got great opportunity for us because I'm just working that through now, both myself and with a couple of clients, of how we can use that, which will offset the cost to give us our first base lining, because the National Soil Monitoring Program does bulk density measurements. And you can pay an extra 10 bucks and get gravel done and they will do LECO carbon for you down 0 to 10, 10 to 20, 20 to 30. So we'll actually get that measurement done with part of that cost offset through this national program, if it all works out and it's eligible. And so I'm just working out how I can substitute what I've done in the past and paid for myself, still pay if you like the same amount of money to get some agronomic stuff from it, but also get this carbon base lining, and then I might repeat that every five years or so.

Graeme Anderson:

Yeah, that's right. It's a good method, Cam, isn't it? And the bulk density is a really important bit. So while you've got a great story of what you've measured with soil carbon percentages, bulk density is basically a matter of how dense or loose the soil is packed in. And so if you didn't have bulk density, if you just had some soil that had a certain percentage of carbon, if you ran over it with a wheel and squashed 11 centimeters of soil into 10, it would show it had a higher percentage of carbon, when in fact what we've done is just squashed the carbon together. So that's why the bulk density plus the percentage is the key thing and so that's really good.

Heather, we've got a bit of information on that with a resource of the soil carbon science snapshot, which has been put together, and it's a booklet, it's a electronic booklet that's got live links to about 70 recent bits of work and research that's been done on soil carbon, so that's available there in the chatline. So there's soil carbon science snapshot, there's also the making sense of carbon and emissions, which is pretty much just the summary overview for those that are trying to make sense of where does energy, livestock, trees, soils, fertilizer, all fit into it. We've also got the... There's a on-farm emissions action plan pilot, which is happening at the minute.

We've got questions to ask before farmers sell their carbon, because some of those questions that Fiona and Cam have raised are really relevant just in terms of, yes, we have got carbon accumulating, but what are some of the things you need to think about before a sign on the dotted line? And there's been a lot of deep thought over this over the last 20 years with various pilots and programs, so that questions to ask before you sell carbon is basically just a bit of a kitchen table guide for those that have already gone through there and the questions they've run through.

And the other bit, Heather was just a plug for those that are involved in giving advice on carbon or emissions on farms. We're looking at setting up a community of practitioners to help us compare notes about how this is done and explained from a whole of farm context for farmers. So if you're interested, there's an email address there, action plan pilot at agriculture.

But if I can, Heather, I'd just like to thank Cam and Fiona for a fantastic presentation. I remember meeting them when the Bellarine Tree Planting Group, so that was before there were land care groups. And you've done a tremendous amount of land care work down there and what you've done on your own property, and then doubled production. You've got a beautiful farm that's well-sheltered, 130 species of birds that are calling it home. It's actually a nice place for actually you to drive around and work in, which is really important, but what's not that common is having such good records and data over that journey. So really congratulate you on the discipline you've applied to do that over time. So we just really appreciate you sharing that story to a wider audience.

Heather Field:

Thanks, Graham. No, what a fantastic webinar. We've had such great questions come in and even though we haven't been able to get to them all today, they're really good for us to see what those questions are, because we need to know what the questions are that are coming in from you all. So we will try and attempt to get some responses out to some of those over the coming weeks, but also just want to thank Fiona and Cam for their time today and great presentation. It's always good to see and hear what farmers are doing on the ground and some really great insights that you've shared today.

Just a reminder to everyone, there is a little survey that will pop up on your screen when you do close out. And we have had really good interests, we've had about 150 people on online today, so appreciate your time in tuning in and providing your feedback and your questions. And we have recorded today's webinar, so if you do need to catch up and have another listen, we will be circulating that out to you all in the coming days. So thank you, Fiona and Cam, if you're still there.

Cam Nicholson:

Yep.

Fiona Conroy:

Yep.

Heather Field:

Excellent. Thank you for your presentation today. Great feedback coming in on the chat box and lots of people thanking you for your time today.

Cam Nicholson:

Pleasure, Heather.

Fiona Conroy:

No, thank you everyone.

Heather Field:

Thanks, everyone. And have a good afternoon.