Transcript – Forest Carbon Webinar 2023

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Peter Cochrane
Good afternoon.
Welcome to this Natural Resource Commission webinar on the carbon balance of NSW forests. I think we have enough people online, we will follow our usual format of a presentation, the panel and the Q&A session.
Before we commence I'd like to acknowledge the traditional owners of the lands on which we are each joining this meeting and pay our respects to their elders, past and present, I acknowledge and respect the deep connection of First Nations people to country and the knowledge from this connection that they hold and share. I particularly welcome First Nations people joining this webinar
Before I introduce our presenter, if you have any questions during or following the presentation, you can ask them through the Q&A function that's accessed by the Q&A button on the top of your screen. Note you must be joining through the teams app to access this function. We will only be answering questions about this project. We will not be addressing broader policy issues or any specific compliance or regulatory matters.
This webinar is being recorded and a copy will become available on the NRC website where you'll also find more information on the monitoring program design, it's implementation and progress to date. Now to introduce our presenter today, Mr Geoff Roberts, Geoff is a forester with a focus on national and project level accounting, carbon accounting as well as project level method development. Geoff's worked on developing practical forest carbon accounting methods for Australia's Emission Reduction Fund, as well as supporting international projects in Kenya, Sudan, the Philippines, Papua New Guinea and Tanzania. For the past eight years, Geoff has been working with the Mullion Group and Flint Pro to provide innovative solutions to complex problems in land sector carbon accounting.
Geoff will speak for about 30 minutes and then he'll be joined by one of our expert advisors for the Forest Monitoring and Improvement Program for a Q&A panel session.
Over to you, Geoff.

0:2:8.100
Geoff Roberts
Thank you, Peter, and I'm taking control.
Alrighty, nice to be on here with everybody and to see so many of you so close to Christmas, jumping into the webinar. So today I'm going to be running through the results of an update assessment that we've done for NSW Forests.
Some of you may have seen the work that we did a couple of years ago and this is an extension of that which I'll be running through today. And I'll change slides, that will probably help.

So to start off with one of the main purposes of this project was to do an update to the forest carbon stock assessment. So looking at the carbon balance of all NSW forests, that's regardless of tenure and of type, and to do a comprehensive assessment and we'll be looking at from 1990 through to the latest year of the update, for this one that's 2021.
That this work was supported by the NRC, the NSW Natural Resources Commission, and was largely done by our team inside Flint Pro but we did have a lot of collaboration, especially

from Forest Corporation of NSW, the DPE and the Commonwealth and sharing data with us so we can get the simulations completed.
What I'm going to be running through with you today is I'm going to be going through some of the methods and probably a lot of the focus is on how we developed the solution or what the solution looked like.
And then at end of the presentation I'll start talking about the outcomes that we found and then also short wrap up and hopefully leading to some interesting questions at the end.

So before we start, I thought we should go back to, I suppose day dot and talk about what is a forest. The objective, as I said is to say, what is the carbon balance of the forested landscapes across NSW? So in theory, I'm a forest is an area that he's dominated by trees with a mature stand height of more than two metres, crown cover that's equal to or greater than 20% and should have an area greater than .2 of a hectare. And that would mean Australia's definition of what a forest is.
So you can see on the right hand side of the slide where we start to see you have areas that have got a couple of trees, sort of sparse somewhere between the seven and 20% canopy cover, which would be classified under the sparse woody component. This is generally not forest, if it's mature, state is in that condition. And then greater than 20% is forest.

So in theory, if a piece land is moving from sparse into 20% canopy cover, then it's going to be classified as forest by that definition because it's got that potential there. However, in practice we end up with something a little bit more binary. So even though forest are natural systems, is this a gradient, so from sparse wooded to forested, with the remote sensing data that we're using it is a really binary application of what is or is not forest.

The data here that you can see on the right is the National Forest cover dataset. There's two classes, so the sparse woody and the forest cover. Forest being the green sparse woody being the brownie colour. Hopefully that comes up on the screen and you can see on the left hand images how that translates to what we might indicatively think is forested landscapes, so it works quite well along the denser areas, and then where there's less dense trees, we can see that it's classified as that sparse woody vegetation type.

I'll touch on this binary nature a little bit more as we go through, but what we're looking at is when a forest, a pixel or an area is marked as forest, we try and estimate the carbon stocked inside there. For us to do that, what we're really looking at is carbon pools. So the carbon pools that we're focusing on here, above ground biomass, below ground biomass, dead organic matter, harvest wood products and that gives us our stock levels. So how much is in those each of those pools? And then we also want to look at the movements between those pools. So how much carbon is moving from above ground biomass into the dead organic matter pool? How much is moving into harvest wood products and we're trying to quantify that as well.

And to do that, we really need to account for what we talk about is processes or events.
So as a tree grows, there's natural processes such as turnover, and that's where you have biomass moving from the living pool into the dead organic matter. The simplest way of thinking about that is leaves will fall off a tree and then be replaced, that's turnover rates.
There's also processes like decomposition. So when there's dead matter on the ground, you

end up with a decomposition of the dead organic matter, some will go to the atmosphere, some would move into the soil profile. So you have these sort of processes naturally cycling through, in addition to those we have events and an event is where a specific episodic thing happens that causes a movement from carbon from one location to another. A fire event, for example, will mean that we burn some of the biomass so it will move from the living pool into straight into the atmosphere, or it might move straight from the dead organic matter to the atmosphere through combustion. That event may also kill things, so again, with the fire event by a mass will move from the living carbon pools into the dead organic matter carbon pools, where there are those processes kick in and it starts to decay.

So that little diagram on the right we have a simple process, carbon will move from the atmosphere into the tree biomass via photosynthesis. It will move into the dead organic matter via that turnover process I was talking about as well as the events that are occurring and then we'll have decomposition and that's going to push carbon into the atmosphere again or down into the soil carbon pull. One that's not on that little list there is what happens when a tree gets harvested. In that case, the carbon will move from a living biomass, some will move into the dead organic matter pool and then other parts will move off into the harvest products pools, where they'll also start to go on a decay cycle.

For us to answer the question of what is the carbon balance of NSW forests, we needed to try and account for all of the processes and events that are occurring in all of the forests of NSW through time. To do that, we had to pull in an awful lot of different data from different regions. So as I was mentioning, there's the Commonwealth Department of Climate Change, Energy, the Environment and Water, but also data from ABARES, Forest Corporation of NSW and NSW DPE in terms of some of the other components for the soil datasets. All of that data was integrated through Flint Pro, which is a spatial modelling system that allows us to integrate remote sensing based products or other spatial data products, which you'll go into in a minute with models and for those models to model the processes and the events that we want to quantify for tracking the changes in carbon stock through time.

I appreciate I'm saying that quite quickly and because I can't see anybody, I can't see if anyone's nodding or shaking their heads in confusion about what I'm saying, but hopefully it will make more sense as we as we go through the next component and if not, I do encourage you to use that Q&A button at the top to ask some questions.

I mentioned about the integration of the remote sensing data products or spatial products with models. So just to touch on those spatial products, here are three different product types that we used in the assessment. So the first one is forest cover data, we took that the three class data where it goes from sparse to forest, sparse woody and forest cover. We dropped that to a binary product, it’s either forest or it's not, and that's what's displayed on the left hand side. Every pixel that's purple is forest, if that pixel goes from being purple to white, that means it went from forest to non forest and if it goes from white to purple it's gone from non forest to forest.

So then what would happen in this circumstance the model would say, well if it went from white to purple it would plant a forest based on the vegetation type or the native vegetation type and it will start to grow based on the growing predictions on that particular pixel. If it does the opposite, it goes from forest to non forest, so purple to white, then there will be a clearing event that gets occurred.

If we jump into the middle slide, there's a little bit hard to see, so my apologies for that, but hopefully you can see there's some blues and purples and other colours and greens scattered around this corner. So we're looking at the south-eastern NSW. That's the cumulative impact of 15 years of harvest data across that site and what the system will do in this circumstance, each colour represents a unique year. When a pixel hits that harvest event, it will know what year it is, and there's a silver cultural treatment attached to each harvest event as well. So you know, if it's about alternate coupe selection, single tree selection, light heavy or unknown, and it will apply a harvest event inside every pixel in the year that that harvest event occurs.

So in that situation, will have different harvest events firing off when there's the spatial data that tells us there was a harvesting event and then a proportion of biomass is affected, some will move into the dead organic matter pool and then some will move into those harvested wood products as well. Jumping to the far right of the image, we have four years of fire data, this banned the 2019-2020 fire season, which is why it's so horrific and you can also start to see through here the different fire intensity data as well that was coming through. So this fire data is the FESM data that was developed by the NSW DPE. The fire intensity data, where it's going from low intensity through to high intensity fire types and similar to with the harvesting when a pixel is affected by a fire, so we'll say in 2019 or 2021 one of these pixels in the green, it was impacted that was a low intensity fire and then there's a proportion of biomass that gets consumed by a fire event when that fire is detected on that pixel.

So the system starts going through and stitching all of this data together to start to model the impacts of those events. For us to do all of NSW, given the size of the area, essentially there was, I think it was 1.2 billion pixels that had to be assessed and model over 100 years. So you end up with quite a large amount of data that sits behind this process. I mentioned there about forest growing, so when we see a forest grow a forest just wanted to touch quickly on that is we replicated the tree yield formula that underpins FullCAM, I'm sure many on the call will be familiar with that, but FullCams the modelling construct that sits behind this national greenhouse gas inventory system and sitting behind FullCAM for the forest growth component is the tree yield formula. It's shown on your screen here. Essentially, what that does is it is tells you what the maximum biomass potential of a site is, so that's the M value.

That's a spatial data set that is based on the productivity of that particular pixel on that site. There's, I think 20 something variables that go into calculating the productivity on that site and then there's a relationship between that productivity and the maximum biomass potential of an undisturbed native forest. The M values are really important one because it changes the spatial distribution of biomass across NSW, if I jump up here, you can have this little outset of the M layer. Those blue colours are high productivity sites, according to the M layer means there's more biomass accumulation. So if there's a Forest there, it's going to grow faster than in these lighter areas in the state. The M layer is at a resolution of about 250 metres with an overlay of a 1 kilometre grid, which means each pixel there is about, yeah, 250 meters, so you'll start to see pixelation in the outputs and the forest cover data, which we're running at, is about 25 metres.

So we what the system is doing is slicing that 25 metre data with the 250 metre data and bringing also the vector datasets from the harvest information, intersecting all of that and inserting events through time. The growth curve of the bottom right, you can see there's a simple growth curve and the forest grows. When all these outputs come together, we spatialize it and it starts to look like what these series of slides that I'm going to run you through now. So I was mentioning about the M layer, this patterning that we're seeing through here is really being driven by the M layer. We haven't had events put over the top of this, this is early on in the simulation and we're starting to see that you can see that large pixelation, which is really being driven by that M class.

As we start to slice through some of the event data, so this is using slicing through the harvest data for this part of the state, you can start to see different shapes forming up over the top of that. And what you'll also notice here is that the shapes that are coming through in the early years, especially in this 1988 side, are really kind of blocky. There's not a high degree of mapping accuracy in the harvest history that the, older harvest history data sets, which is not too surprising because it was being really pre-GIS and this is from digitized records that were developed. As we move forward, we can jump from 88 to 2018. You can start to see a couple of things coming through. One is you're starting to see a lot more spatial variation coming through because you've got multiple events now that are occurring on a particular pixel, and we're seeing improvements in the mapping data for the harvest data types as well. So you're starting to see streamside reserves coming through or road reserves around the harvesting coupes. We're having much finer detail in that, where the harvesting activities occurring.

When we jump forward again, sorry I thought there was one more slide there, but I must have removed that one. So much finer detail, what the slide I was going to show you was there's a harvest event for a large scale fire event that goes through obviously in the 1920 and then you'll start to see that fire intensity comes through the data as well. All of this will be detailed in the in the report a bit more detail.

So what we're trying to do is work out what's the impact of all of those events, all of those processes that are going on. So where's their forest cover loss? Where's their forest cover gain? Where's their timber harvesting? Where is there a fire? What type of fire is occurring? Or forest type is occurring.

We're doing that for the natural forest systems as well as for the timber plantations, and in order for us to do that, we need to start the model somewhere. So we start the model in 1935 and we started age 15. Sorry, I just realized that there was a extra 5 in in my slide apologies, but it's 1935 at age 15, which essentially gives us a planning agent zero at 1920 to reflect some of the assumptions under the national inventory and the model starts to grow. So we call this the spin up period, between 1935 and 2020, we have a spin up period and our goal there is to try and get the model to be reasonable based on all of information we've got by 1990. When we get to the year we actually start to care about, so we're running harvest events and we're running fire events from 1935 onwards. So when they're occurring, we're bringing those in and then we're hitting the events from the forest cover gain and loss from 1989 onwards, as well as the harvest data sets coming through. So as mentioned, we're modelling the tree growth based on the tree yield formula as it sits behind FullCAM.

The plantations one, plantations represent small area relatively, you know, compared to the State and all of the natural forest areas, but certainly the more complicated things to try and get right. And this is where a lot of the focus was in the update from the last report to this one, was around the plantation side. We started from anything that was plantation at the start of the simulation, essentially pre 1988, we had standard management regimes that were applied through those in terms of especially on the harvest type. And then after 1988, we were relying on the remote sensing data that forest cover gain or loss to trigger a harvest event. So we're assuming that plantations are being clear felled when they're harvesting, and that's going to be detected by the remote sensing data set.

One of the most important points, I suppose, more about the system and the way that this did when we went through this is that because we're using a system for doing this rather than a manual process, a lot of the data and the data are the assumptions are all calibrated, are adjustable. This did mean that the project was a lot faster than the first iteration.

The key updates that we would apply to from the last run or the first run are the fire and forest extent data sets which updated. We changed some of the rules around the forest loss events that occurred with fires so that the fire event occurs, but the loss won't, assuming that's going to come back through the harvesting data was expanded, which was important.

We also adjusted some of the five parameters to impact the below ground biomass. It doesn't burn it, but it does kill it. And then the biggest change is really, again in the plantation side, was updating the plantation growth rates to reflect the national inventories. The National inventory report 2021 and also to change the initial age of the plantations and that gave us a much more normalized view of the Plantation age classes rather than what we had previously was a very big spike, kind of more like a cohort moving through the model.

In terms of functionality changes, we also popped in additional filters and flux types. So that means that we can start to say, well, what caused those movements and we separating, say wildfire from controlled fire, timber harvesting from forest clearing, which wasn't in the first report. I realize I've been prattling too long, and I'm going to have to jump into what you're probably all here for which is look at the results.

I have to point out these couple of slides are screenshots from Power BI, all of the results are available from Power BI and the NRC put that up on their website. So you can jump in and have a play around and start to create your own graphs and outputs.

So the results broadly consistent with what we did found in the last update for the first assessment in that there's been a decline in the forest carbon stock through the 90s through the 2000s, after which they're started to be an increase in the forest carbon stock through time up until the 2019/2020 fire season where we had that catastrophic loss event that's going to be a dominant feature in all of these assessments rolling forward because of the size of that disturbance event.

The breakdown of where the carbon is, the majority of the carbon, so 47%, is sitting outside of land marked as state forest or national parks. Here we're colloquially calling it private, could be crown land or other purposes, but just not inside the public state forests or the National Reserve system. And there was interestingly different trends, which for me was probably is consistent with the first assessment, but with highlighting again both the state forests. So you can make out on the bottom graph and the national parks in that middle line. Both were generally increasing carbon stocks through time up until 2020 fires where it was the forested land outside of those systems, which is in decline and was driving that loss that we're observing in that the state-wide assessment. From 2010 onwards, there was a plateauing in the losses and then it slowly started to increase in the private until we also had that impact of the 2020 fires.

If we start to unpick that a little bit more, we can start to look at the net annual change in the forest carbon stock. So you can see that a lot of the losses, a lot of the negative side, the losses are coming in that private, as I was mentioning the state forest and reserve systems were generally positive through time. There's occasional years where there were losses such as around the 2003 to 2006, coinciding with fire events that occurred in there, where the national parks and state forests were quite impacted, and we had those losses, but then it kind of corrects itself after that, it goes back into a sequestration. So it's really kind of a different patterns based on tenure.

The big thing here is the fluxes, or the change that occurred, because of the 2020 fire events, so in in here it's an order of 120 megatons of stock change and that's compared to a maximum of about 25 megatons prior. So that event catastrophic as I'm sure we all are aware, but the emissions associated with that were also significant.

The right hand side you can see that as well. We can see the impacts, so we've got clearing. So this is where we see land that goes from forest to non forest. Being that kind of teal colour being a major and constant contributor to those emission sources, the smaller change that you can make out through there is the orange, which is the timber harvesting that's in the native forest systems as well as plantations.

And you can see how it's relatively constant through time, but somewhat dwarfed by those clearing fluxes. And then you have the wildfire and control fire activities and you have these periodic large scale fires which dwarf sort of everything in terms of the fluxes.

One thing just to note, while you're looking at this graph and talking about fluxes. These are carbon movements, so these are movements that were triggered by those event types, these are not necessarily emissions, so each of these events will move carbon from living pools over dead organic matter, where it's going to sit and decay. So it will realize the full emissions associated with those clearing events, there is a temporal element which isn't being accounted for in this graph.

When we started looking at the spatial outputs and how that starting to vary, I'm really hoping that this graph comes up slightly better on your image images than the small screen that I'm looking at the moment, but you can start to say basically the East Coast is almost all red and that's because we're looking at the change from 1990 through to 2021.

And again that impact of those fire events that's occurring by and large, it's the fires that needs driving that change on the coast and we can see that we're more central New South Wales is, you might be able to make out a faint blue, and that's where there's some gains that have been driven in that part of the state which haven't been where there's been recruitment and increases in forest cover, which is resulting in increases in forest carbon.

The types of event that we'll see, we've got harvesting activities on the left. So you can start to see some of the patterns in that. So it looks this like plantations as well as potentially a native forest systems, but you can see where they're sort of losses that are associated with the harvesting activity based on the compared to a 1990 base, we have forest clearing which is these sort of big chunky bits. And then we also have these gain loss components, so a gain loss is where a pixel goes from forest to non forest. And we think that might be from canopy expansion or it could be part of the signal noise from the remote sensing product. We get these edge effects coming through where you get some losses and you also get some gains.

With the assessment, we overlaid the we overlaid a filter type to try and understand when there's a clearing event or a forest loss event, where the forest is going and that's what these bottom graph is. And so what we're looking at here is the total fluxes split out by. whether the resulting product basically we've ended up being non forest at some stage. So essentially, we went from greater than 20% canopy to less than 7% canopy, and how much of it went into what we call sparse woody, so it went for more than 20% canopy to less than 20% canopy, so it's still forest loss, but it's not what we would consider, you know, uh, like what you might consider as a full clearing event. The interesting thing here, one, it varied spatially, but there's the other side is that year on year, almost half of what was being marked as a forest cover loss event was transitioning from forest vegetation into the sparse and not actually going to that not woody component.

So essentially it means that there's some more dynamics at play here that are probably not as well represented as it could be. So final slide. The outputs they represent the most current and comprehensive update of the first carbon balance that we've got to date, but there are limitations and there's always going to be limitations on the outputs that are being driven by the inputs as well. With all systems you what you put forwards is what we get out and what we think would be greatly improved is reducing the gaps in the forest cover datasets. There are there's two year gaps in the early 90s and that might create some noise, extending that forest cover data to pre 1988, pushing it back into the early 80s on both of those, I note that CSIRO is working on a product that should do both of these at the moment, we're really looking forward to that coming out in the next year or so.

I'm it would be terrific to replace some of the assumed management under plantations with actual harvest informed management information and that would again smooth out some of the noise. We haven't included harvest server products in the landfill, which means that in there is potential gap in that overall carbon balance story that we're talking about, if we're talking about harvested products.

With the data we started off with 32 harvest events and then we distilled that down to 12 generalised ones. So there's an opportunity to push it back out to that full silvicultural sweet and to better represent some of the temporal changes in in harvest types. And then the other big one though, want to point out is to improve the data on the impacts of wildfire. So again, I think there's a real opportunity to try and better understand when there's a severe fire type. What was the actual impact of that and to have better data to feed some of those modelled inputs?

In terms of functionality that I think would be useful to change, this would be to really focus on that sparse woody and forest transitions, because that's where we're seeing an awful lot. So 50% of those losses were going was just between forest and sparse. It wasn't ever going into the non wooded by mass component and I think that's looking at that would change some of those balance equations and give us a better holistic view. Expanding into the soil carbon component, so that involves looking at the non forest land use as well, so it's a little bit more complex than just what's happening under the forest component. Then expanding out into the non carbon matrix.

So this might be habitat quality or other elements that are relevant for forest monitoring, cause obviously forests are much more than just sticks of carbon and it would be good just to have all of those components feed into that output. Which I think the forest monitoring program also touched on so. With that, I'm about 3 minutes over, so I think that's probably pretty good for now and I saw Michael jump on, but for now I might wrap up and we can jump into some Q&A and see what questions there.

0:32:45.960
Peter Cochrane
Beautiful. Thanks very much Geoff.

That's a very comprehensive summary of what you've been doing for us for the last year or so. The questions are open, opportunities for questions from any participant. I think we are going to be joined by Patrick Baker, who is one of our experts from the Forest Monitoring and Improvement Program.

Patrick's a professor at Silver Culture and Forest ecology in the School of Ecosystem and Forest Sciences at the University of Melbourne, has got a Master in Forestry from Yale University and a PhD from Forest Ecology and Management from the University of Washington, and he's been working with us for many years. Patrick, I think is in the field potentially and also having some connection problems. So we might just go straight to Q&A's if we can't get Patrick on online.

Geoff while we're waiting for any questions to come in, let me just see if we've got any so far, feel free to ask questions, please. I can see one coming in from Jocelyn, and Geoff, I'm not sure whether you can actually see the Q&A, but I'll read them out.

0:34:15.210
Geoff Roberts
Uh, not yet, but I can probably bring it up.

0:34:16.30
Peter Cochrane
And okay we have got a couple coming in already, excellent and Patrick's online, I think. Let's go to the questions that are coming in and I'll come to Patrick when he manages to connect. So Liam Costello has asked how accurate is the model in detecting species outside the public forest estate, that's different plantations and farm forestry types.

0:34:44.510
Geoff Roberts
Yeah, very good question, variable, because it depends on the size of the plantation types that's been driven off. We used a hybrid of data for doing this. We used the Forest Corporation data for inside the public estate about what plantation species were where, and then there's the ABARES plantation extent data that was used for plantation areas outside of the public estate.

In general, we find that that works quite well for large plantations, and they're being picked up, detected, but the smaller lots, not necessarily. And anything that's not mapped in as those plantation types, we've made no attempt to essentially differentiate.

So if you went planted a, I'm not sure what I could give as an example, and oak or horticultural crops and things like that, they'll end up in those results. But because the proportion of those areas relative to the rest of the forest area, it's probably not going to materially change the output. But if you're going to downscale it to a file level, for example, then you're likely to find inaccuracies at that at that point.

0:35:49.570
Peter Cochrane
Okay, Melanie Zeppels asked what caused the massive 2020 change in stock, I think you did answer that, Black Saturday.

0:36:1.860
Geoff Roberts
Yep, yeah or black summer, as it was. So the intensity and the extent of those fires really were unprecedented in all of the data we ran it through.
So even though I didn't show you the pre 1990 stuff, we had large fire events in the 80s that came through as well. But those obviously were completely dwarfed again by those 2019-2020 fire season.

0:36:32.930
Peter Cochrane
You know Steven Dobbyns has asked does Flint Pro allow you to model smaller regular losses of carbon from hazard reduction burning versus large losses from major wildfires.

0:36:43.710
Geoff Roberts
Yeah, really good question.
Where the data exists that this is always where the challenge comes through.
So the system itself is completely flexible, but what we need to feed it into it is some activity data.
So what that would look like is spatial data sent to say this is where a controlled fire goes and we do have some of that from the RFS data set and from Forest Corp where the wild controlled booming were going through and then the impact of those events is much milder compared to those large scale fire events.

So for the later years, from 2017 onwards, where we're using the FESM data, so that's the fire extent severity dataset for a NSW we separated out the controlled fires, which basically consumes the dead organic matter, but has almost no impact on the living biomass.
But then we have these extreme high severity fires where they had a large amount of the dead organic matter is consumed, and there's also tree deaths and crown consumption as well for the trees that don't die.
So I think the most extreme one, it's 100% crown combustion of the leaves for example. And then in the outputs those results are split out as well, so you can say show me wildfire versus controlled fire.

0:37:58.260
Peter Cochrane
Thanks, Geoff.
I'm going to wait until Patrick's on screen.
You may be able to hear us, but David Leslie's asked, what are the policy and management impacts of this research?

0:38:13.270
Geoff Roberts
That that one sort of sits beyond me in in sort of an answer that I can I can answer directly, but I suppose what I found most interesting about that. Sorry.

0:38:25.960
Peter Cochrane
That's Patrick trying to come in.

0:38:29.40
Geoff Roberts
Yeah, the troubles of field work. So I was going to say one of the biggest things for me is that focus on what's happening outside of the public forest areas in terms of climate mitigation opportunities and things like that, sort of, just from my interest site, it's sort of said there's a big part of the story that that I think is important to be, you know, to have holistically looked at. But as I said, looking at the policy implications directly, not within scope of my remit.

0:39:3.930
Peter Cochrane

But you could use these modelling tools to forecast what might be possible in terms of carbon sequestration from plans and forest.

0:39:12.410
Geoff Roberts
Ah, yeah, yeah, definitely. And that goes into the into the farmlands. So a lot of the work that we do beyond this project, organisations looking to understand what their Carbon, their mitigation activities might be and that can be at the state level. So if we reforested, this area we, if we put a plantations down instead of environmental plantings, what does that look like for our carbon balance? And there's that focus on insetting versus offsetting for organization. So there's kind of increasing focus on that component with the system as a whole.

0:39:44.160
Peter Cochrane
And does your data set go to biodiversity as well?
So in terms of species or a really, is it just trees and carbon?

0:39:53.840
Geoff Roberts
Good question. Not yet. I think that's where you again, with the natural extension of this sort of work goes down into it'll separate by forest type, so really broad forest type.
What we're looking at there is like the major vegetation classes and things like that, so tall eucalypt forest or open eucalypt woodlands, and that's to reflect to the calibrations of the models that are doing the carbon growth component.

With the biodiversity side where it starts to get interesting is where we start to look at condition, score and other indices types. If we can, you can scale essentially your Carbon number from time since disturbance, and you can start to get an indication about where's the least disturbed and where's the most disturbed component of the landscape.

I suspect that there's a correlation there with other environmental indices, but we all know that generally you probably want to matrix of disturbance across there for good biodiversity outcomes. So there's some elements that can come into it with the outputs, but yeah, not there quite yet in terms of the service specific species.

0:41:9.120
Peter Cochrane
And just actually following along before I go to the next question. Geoff, can you match your data on, that is suggesting forest clearing, at least where it's going from forest to non forest with data sets on land clearing and the actual sources of or the causes of land clearing.

0:41:29.760
Geoff Roberts
Yeah, we do it for this one, I can’t remember, I’ll have to go back.
Yes, so one of the one of the benefits of the data system in general is you can start to throw other layers or other pieces of information in there.

So one of them would be to feed in say the SLATS data set, and I think we did do that under to this model, where you can feed the SLATS data in where you say, well, we've got anthropogenic forest cover loss is occurring within this polygon, which means that if we have a forest cover loss based on the National Forest cover data and it falls inside a SLATS data, that's where anthropogenic clearing occurs. Then you can just pull those numbers out those hectare numbers out as well, there's two things that are challenging about that.

One is that there's a risk of temporal misalignment between the SLATS data and the NCAS data set, so they're different products developed at different times using slightly different methods where you'd hope that they will line up temporally. So if there was a loss in 2020 and porting to SLATS, there was a loss in 2020 according to the National Forest cover data set. Nut if the National Forest covered dataset doesn't seem till 2021, then you might miss that that window. What we do for that is we kind of we flatten out the SLATS data. So it's essentially a single layer that says, well, there was anthropogenic clearing that occurred within this Polygon at some point over the period. And then we're saying, well, if at some stage there was anthropogenic clearing in that Polygon, we're going to assume that all clearing in that Polygon is anthropogenic from, you know, from that point forward.

0:43:12.300
Peter Cochrane
So that actually leads nicely into the questions from Melanie Zeppel, could Flint pro be used by CER academics, journalists or others to determine if projects are actually gaining all or losing genuine Carbon in certified carbon units.

0:43:32.950
Geoff Roberts
Yes and no. It depends where it is, so one of the what it works really well is where you're getting these clear signals and you're getting a clear change in the impact of. So you're seeing land transition from one type to another.

So in the circumstance where you go from cleared land through to sparse woody through to forest, and it is HR, IR projects that go through that transition, then you can start you say, well, OK, I'm seeing it a gaining woody vegetation, so I'm going to fire that off and it's going to model that increase in carbon that's reflected on what the National Inventory approach will do for that. The no component of that is if there's no change in state inside these Carbon project areas, so if you've got a Carbon project area and it stays within that sparse woody component, so it's somewhere between 7 and 20% canopy cover, because of that data sets binary, we're not going to see subtle changes in those increases or decreases, at least with the National Forest cover product.

If we replace the national product with a different product, then you may be able to say, OK, we're seeing some transitions from you know 7% to 10% or something to that effect and then you could start to model those implications. It could be used by other organisations to look at what is the contribution or expected contribution of all of these project activities to Australia's national accounts because then essentially you're aligning the model with the national accounts output.

So you can then do well, there's many accuses have been handed out or how much abatements been handed out, how much has been realised inside our national accounts and is there a discrepancy there or not.

0:45:21.340
Peter Cochrane
Yeah, great. So can we just see if Patrick's, audible?

0:45:27.480
Patrick
I'm back. Can you hear me? Yeah. So I apologize, I'm up here on the North Coast of NSW and uh, we had some connectivity issues and a big lawn mower but I'm back.
So just I'll make a quick comment, I've heard some of the questions and answers and I've missed a few of the others, so I apologize if I repeat anything that might have already been asked or addressed.

I guess the first comment I would make about this in terms of a broad piece of work is really I think the scope of it and the scale of information that was brought together to address a pretty fundamental question is pretty remarkable.

And Geoff made the point about 1.2 billion pixels, and I guess in this day and age, lots of pixels may not seem like a lot, but managing them across a range of different data types across a range of data, qualities over time, and then synthesizing that into a product that provides a time series of now nearly three decades of information on carbon stocks, I think, is a pretty remarkable feat. And I think they deserve a lot of credit for having pulled that off.

I think the other thing that it also highlights is the real value of just monitoring in general, I think you know this notion that we can now look back nearly 30 years at the trends in the carbon stocks in the forested lands of NSW, is a pretty is a pretty impressive thing, and we can pick where there have been real impact. So the fires in early 2000s and obviously the big 2019-2020 fire a season have had a pretty profound consequences. It also gives a good indication of the sort of general accumulation of carbon on NSW public lands in general. The sort of bigger decreases were off of the public lands and I think that's something worth noting when we when we think about the management of the public lands.

But I guess the question that I would have for Geoff, which again if it's already been asked and answered then just say so, is the opportunities, well, let me preface this by saying I think this reflects a real revolution in our ability to collect data at big scales and find resolutions and that in particular enforce monitoring is been happening very fast and there's always, these remarkable sort of steps forward in, in our technical abilities.

So the obvious question is the ability or the opportunities to update these results as new information comes in, new data types come in new sources of data come in, whether from different remote sensing products, national greenhouse gas inventory data. So how easy is it to do, and what's the scope for making this a sort of readily updatable program of monitoring?

0:48:33.130
Geoff Roberts
Yeah, I love that question. Largely cause it's a focus of everything that we try and answer as well. So it's really about having a system to solve this question.
So and that means that, I'm going to say plug and play, but essentially, you go well, there's a new data set here, so that that forest cover dataset we don't we're going to remove the National Forest data set and replace it with this data set.

The ability to plug in and out data is straightforward in that sense, whereas meeting the current framework or the current model setup, it’s literally just selecting a different data set inside the simulation area. So those components means that we're trying to build in the whole purpose of FlintPro is to have a future proof system because we know that there's more data is coming on stream isn't like an exponential increase in data coming in at the moment. That looks backwards as well, so you're seeing a lot more remote sensing based products for biomass, for example, can we use that to get out better initial biomass numbers? And I would say yes, I think that would be a really important part to go into is to try and use up, you know, these new data streams as they come in to improve the understanding of where we are today.

The nice thing about having the system, and I think that's probably done, might be represented in the update to the harvest history information where we had a more complete harvest history that was brought in under this assessment, we update, we replace it and so use this data not that data but it updates the entire time series. So we updated the whole time series from 1935 through to today, which means that the change that we're seeing in the result isn't being driven because we used one data set last year in a different data set this year. It means that we have consistency in those methods as well. So the trends that we're seeing, that there should be a rational reason for seeing what we're seeing, not that we change methods or data types halfway through that assessment type.

Obviously, data quality is going to be really important in there. I think that there is a real value at this continual monitoring program. And I might even just go back to say when this whole project started, I think it was 2019, around 2019, that this whole project, the Forest Monitoring program actually kicked off and if we turned off the system then, we would have missed the biggest event to impact NSW forests in the last 100 years. But because it's been done, we actually have done 3 updates now so there was a draft update and a complete update which was released last year. I think it was and then this update as well. And then the rationale here is that I think the first one just from some data issues, it took about nearly 18 months to go from start to finish and this one was about four months from start to finish in the update.

So you find that as new data comes in or more expediently picked up and updated, and then those updates flow through. So it was a really nice project to be part of in that, that sense. And also just having all of the state agencies providing their data sets in was also terrific and to be able to use all of those different data streams to develop the output.

0:51:55.380
Peter Cochrane
Thanks Geoff.
We've got three more questions.
One is just a clarification quickly of explaining the term harvested wood in use.
And then two more questions.

0:52:6.600
Geoff Roberts
Yep, yeah. So essentially it's when there's a harvest event, the carbon's going to move from the a living tree. It will be in use or in service, so essentially that means it's still in carbon pool that's somewhere out in the economy somewhere, but it is a straight decay curve. So basically it will if you harvest a log, we assume it goes out into product and then a bit of that will be leaked off through time. Where it will actually go is from in use, it goes either decomposes and goes to the atmosphere or what is also likely to happen, it will go into landfill component. At the moment we don't do landfill, so in use should be seen as basically a carbon stored in wood products based on the harvest activities within NSW that's still in wood products.

0:52:59.80
Peter Cochrane
Surely, surely the bulk of that's timber, though, isn't it? With a pretty reasonable lifetime.

0:53:2.140
Geoff Roberts
Yeah, it varies. So there's short lived products, so there's pulp and paper, which has got a pretty short half life. And then there's construction material, there's panel material, bioenergy and mill waste, so it's different harvestable wood components and they have different decomposition rates. It's a simplified modelling of the hardest wood products. So where I think the opportunity also sits is to go to something like Fabiano Jimenez has step change model where it kind of sits in use for a long period. You build a house as kind of be there for 20-30, fifty years, then it disappears, it doesn't. You know the house isn't decaying from the day it's built over 50 years, which is what this simplified approach does.

0:53:49.490
Peter Cochrane
Right, okay, thanks.
In the time remaining, Steven Dobbyns has asked a lot of private property forests have been high graded in the past, can you model the carbon sequestration costs and benefits for resetting those sites to more productive, vigorous forests., i.e. Biomass markets?

0:54:10.150
Patrick
Can I just jump in on that one? So I was going to ask a similar question to that and so just to sort of answer both of the questions, with the increasing move towards more retention based forest harvesting, this coming from a forestry perspective, what's the ability to sort of pick up on that finer scale of forest structure that's left behind?

So I think to Stevens question where you're leaving bits and pieces of the forest and looking at the recovery with the resolution that your tools, your remote sensing tools have. Is that something you can pick up on is? If not, is it something you can sort of adapt to going forward, and if so, what would you need to do that?

0:54:51.400
Geoff Roberts
We won't have time to answer what we need to do to do it, but I'll start with how you do it. So the biggest problem we have with the native forest and the private native forest areas is knowing what happened where and trying to find an authority of data set for that.

So in principle it's straightforward, if you can tell us where harvesting and high gradings occurred, you can put those event all that activity type into the into the model. The real challenge is identifying where and when it's occurred, and finding a data set to allow us to do that. I know that there are programs that work that are looking at, you know, at how different remote sensing products can be used for detecting fine scale disturbances like timber harvesting or selective harvesting.

But yeah, it it's a very difficult thing to do at scale, but in theory, if you could say, well, this is the area if we knew where it was, then there will be mechanisms for saying if we you know took out more biomass and essentially did a reset on that area, they would go from being a static state and then to a recovered state if it's in this oppressed condition, then there's mechanisms available from reflecting that inside the model.

But not to say it's necessarily straightforward, but because of those challenges in identifying where these things have actually occurred. It's sort more kind of about how we can, if I want to look forward on where there's opportunity, it might be around whether the organisations that are managing that private native forest harvesting activities and start keeping records of the spatial extent of those harvest activities and the silver cultural treatments that are being applied, ideally biomass being removed.

You'd have that opportunity to bring in the private forest activities into this modelling, at the moment we have no harvest data at all on the private sector in the private forests that's been incorporated in here outside of plantation forests, where there's a clear fell and you can see it with the remote sensing.

0:56:54.490
Peter Cochrane
And I think you've in effect answered the next question, which is about the capacity to update the model with new data. For example, local verification from owners of smaller private plantings. Or, as you've said, the contractors or even LLS, that must hold some of that data.

0:57:11.660
Geoff Roberts
Yeah, it depends where you're trying to get accurate. I think that's probably the most

important question. So you wouldn't build the system to try and be accurate for, like to take farm level information from every farm in NSW and feed it into there, that might be inefficient. So then you look at our remote sensing approach to try and pick up areas that have previously been missed, but then there is that opportunity to downscale it.

So some of the other organizations using the system as a whole, separate to this project is where they go, well, here's my environmental planting, the remote sensing can't see it, but I can and this is where that is, and I planted it in this year and then it will start to grow from that component.

So you end up with this hybrid approach where some of the remote times it's remote sensing that tells us where the forest is or isn't, and then you override that with a different data set and now I know there's trees there just because the remote sensing data doesn't see it doesn't mean it's not real.

0:58:6.10
Peter Cochrane
Fantastic. I don't think we've got anymore questions. There was a comment here from Steven saying I understand that there's some landfill work done by DPI that shows that paper in landfill isn't as short lived as currently believed.

0:58:19.180
Geoff Roberts
I yeah, I think it's about 1 ½ % maximum loss, something like that. So more than 98% of it stays in landfill when it goes there. So there's that opportunity to put that in and that's assuming it doesn't get diverted out. There would be a reasonable carbon stock that sits inside landfill that's not reflected in these outputs.

0:58:43.10
Peter Cochrane
It seems like the sort of information and models that you've been developing and the these datasets would be critical national datasets if they were applied across the whole country. Surely NSW isn't the only state that's doing this sort of exercise?

0:59:1.880
Geoff Roberts
There's two parts of that. One is a lot of what we're doing here is built on the back of the national system. It's just being applied in a more holistic way and have been able to be applied to the state level. The other side is Queensland, Tasmania are also looking at doing similar sort pieces of work. Haven't heard from WA, so if you're on the call, ask. But I think that there's a role here about having a national scale program or at least for comprehensive modelling.

The main thing here is about having that iteration, so the value improves the more you do it, the more data comes in, then the more value we get out of it. The unfortunate thing would be if it was a one off program and then you know, two years later we try and reinvent the wheel with completely different methods. It's a big lift to do the first one.

0:59:51.80
Peter Cochrane
Well, I think we've proven that coming back to you to get updates periodically as a in incredibly valuable exercise.

Thanks Geoff. I don't think we have any more questions. Patrick do you want to make any closing comments before I close off altogether?

1:0:15.820
Patrick
Sure, thanks Peter. I guess I would reiterate my admiration for the scale and quality of the work that's been done and I think I'd also just reiterate a point that Geoff made earlier about this is not something that is easily done and it is really on the back of a lot of different agencies with a lot of different data, everybody sort of pulling their orders in the same direction in order to come out with a product that is beneficial to everybody. And then I think that's sort of collaboration across organizations, government agencies and the private sector has been, I think the output speak for themselves. I think it's really been a fantastic undertaking.

1:1:2.580
Peter Cochrane
Thanks Patrick and thanks Geoff and all the participants for your interest in the and the questions.

Can I encourage you to go to the NRC website for more information on the forest Carbon project, where you can create your own insights into this data through interactive charts via Power BI, which Geoff mentioned earlier, where you can explore this data further.

The data is also available on TERN. This webinar recording and any unanswered questions and I don't think there are any, will be published online shortly.

We have a short survey where you can provide some feedback about the webinar and we'll email it to you after the webinar or you can scan the QR code which should appear on your screen.

Thank you for joining us today. Very best wishes for the end of the year and the beginning of next year and I hope you have a safe and peaceful Christmas thank you.

1:1:51.640
Geoff Roberts
Thanks everyone. Bye.