Transcript

December 4, 2023

Todd Maher 0:45

Good afternoon, everyone.
Welcome to this Natural Resources Commission webinar on design and early rollout of an ambitious for Fauna Monitoring program across NSW Coastal State Forest under the Coastal Integrated Forestry Operations Approval Monitoring program.

This work builds on a cross tenure baseline established for fauna occupancy that has been recognised as the largest and most significant project of its type in the history of NSW Forest Management.

The presentation will be followed by a Q&A session.
Before we commence, I'd like to acknowledge the traditional owners of the lands from which we are joining this meeting and pay our respects to the 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.
Particularly welcome First Nations people joining this webinar today.

Before I introduce our presenters, if anyone has questions during or following the presentation, you can ask them through the Q&A function that is accessed via the Q&A button on the top of your screen.

We will be only answering questions about the webinar projects today.
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 will also find more information on the monitoring program, design, implementation and progress to date.

Now I'll introduce our presenters for today, Mr Chris Slade and Dr Brad Law.
Chris Slade is a senior ecologist for hardwood forests at the Forestry Corporation of NSW, with a lead role in the implementation of the Coastal IFOA Fauna Occupancy Monitoring program.
Brad Law is a principal research scientist at the Forest Science Unit in the NSW Department of Primary Industries, focusing on ecologically sustainable forest management practices.

Both Brad and Chris will speak around 30 minutes, followed by a Q&A session where Professor Phil Gibbons will also join the chat.
So over to you Brad and Chris.

CS **Chris Slade** 3:20
Thank you, Todd.

I'd just like to also acknowledge that I'm presenting from Biripi lands and respect and acknowledge the people, culture and connection to the lands on which I work and live.

So the fauna monitoring program is a collaboratively developed program under the guidance of the NSW Forest Steering Committee, which includes a range of agencies listed and independent experts.
The committee is chaired independently by the Natural Resources Commission, in addition to Technical Working Group of cross agency representatives, including independent experts, has also been established, which has helped, developed and continues to oversee and review the program.

So the program is an inquiry driven approach across multiple scales.
Looking at how long term occupancy trends and a range of a range of species are being monitored across the broad landscape using remote sensors and this was not going to cover every species, so this is supplemented by occupancy trends for specific species, but also recognising that monitoring was not going to provide data for other knowledge gaps and that the program is further supplemented by species specific issue or question research.

The program has been guided by the development of the series of questions:
To what extent does the Coastal IFOA conditions maintain species occupancy?
To what extent do the conditions maintain population status of focal species?
To what extent do the costs of Coastal IFOA conditions maintain fauna species viability in the landscape?

To what extent are the species specific management plans effective in maintaining the viability of that species?

How are koalas responding to conditions including changes in tree retention rates, species distribution and size?
And finally, can technology improve the probability of detection for a range of species and forestry operations?
So the development of the program has followed extensive workshops to determine the targeted species and suitability of those for monitoring, along with the most appropriate methods to provide data on long term occupancy trends.
A pilot trial was undertaken to assist the feasibility of the methods, suitability of sites, provide learnings on plot establishment, number of plots required, detectability, equipment recommendations during survey, the survey duration requirements and other unforeseen factors such as the noise of creek water flow rifles drowning out the noise of fauna calls, for example.
The design that has been implemented establishes 100 plots across each of the three regions, these being southern, so from Sydney to the Victorian Border, lower north east NSW and the upper north east NSW.
A plot consists of two subplots at which three devices are deployed for 14 nights.
So in total over five years, 300 plots, which equates to 600 subplots will be sampled.
The selection of plots has incorporated existing long term programs, including a North Coast koala songwriter program, large Forest owl program in the Eden area, and a remote camera program targeting Southern brown bandicoots also in the Eden area.

A range of other factors have been incorporated into the design and plot selection, which includes disturbance history to ensure a range of these has been included, the landscape position to ensure the heterogeneity of the forest is sampled and lastly

access and remoteness has also been considered just to enable the program to run efficiently.
So the maps here show location of the plots across each of the three regions and just noting that the middle map there shows central which refers to the lower North East region, which I've already mentioned before.
You can see there's a really good distribution of sites across the landscape within the State Forest estate.
At the finer scale of the subplot establishment, the sites are established at an on track and an off track location.
This enables the sampling of a suite of species that utilise the differing parts of the landscape.
For example, some predators utilise the trails, while other species avoid them.
This is also the case for many echolocating bats species. A remote camera, ultrasonic sound recorder and an audio sound record are deployed at each of the subplot locations for 14 nights.

As I mentioned, the program is established over a 5 year period to sample all the subplots.
The regime has fifty annual plots per region, with an additional 10 plots that are sampled once every five years, equating to 60 plots per year for each region.

There is a seasonal split to give coverage to species that may not call or not be as active at the spring, for example, the powerful owl, and this split allocates 45 plots for spring and 15 autumn for each region every year.
So what this sees is 180 plots or 360 subplots sampled over each year, and the 600 subplots sampled over the five year period.
The program follows a similar program that's been underway in the forests of the Pilliga for the last 10 years. Just recognizing the value of the former colleague in that part of the world, Dr Pat Tap.
So this table demonstrates the sampling regime, showing the seasonal sampling amongst the annual plots. I recognise it's a lot of data to look into there, but all it's ideally showing you is that across each of the annual plots they all get a sampling mostly through spring, but also get a snapshot of autumn occasions and amongst the once every five year plots, you can see how the schedule works there.
So again, a bit of a split amongst the seasons to ensure we're getting coverage of

those seasons for those species that call less frequently in spring.
So some finer details about the equipment we're using, we're deploying remote cameras and these are Reconyx Hyperfire cameras which are baited with a mix of peanut butter, rolled oats, truffle oil and tuna oil.
These are recording all species but are targeting Rufus bettong, Long-nosed bandicoot, Southern brown bandicoot and the Long-nosed potoroo and the details under the photo are really just to indicate the standardization of the settings across the program to make sure we're standardizing all those aspects.
We're also deploying ultrasonic call recorders for echolocating bats, and specifically, we're using wildlife acoustic song meter mini bat detectors for sampling the echolocating bat species.
Again, these are recording everything but the target species are Eastern false pipistrel, Eastern freetail bat, Greater broad-nosed bat, Southern myotis, and the Yellow-bellied Sheath-tailed bat.
And again, I'm just showing you the details there to show the standardization of the devices across the program.
Similar to the ultrasonic recorder, for the audio call recordings we're deploying wildlife acoustic songwriter minis.
Again, these are recording everything but the target species are Barking owl, Masked owl, Powerful owl, Sooty owl, Booboo owl, Glossy Black-cockatoo, Brown treecreeper Rufus scrub-bird buried, Varied sittella, Grey-headed flying fox, Koala, Squirrel glider, Sugar glider, and the Yellow belly glider.
Again, the details there just provide that standardization and the metrics that we're putting in place for all the devices everywhere we deploy them.

To ensure that all the sampling is done consistently, we've developed a range of standard operating procedures which include, as I mentioned before, all the device setups, the subflow establishment and managing the data.
So as mentioned before, we have a range of species specific programs underway for which the broader monitoring program may or may not pick up and these, just as the list shows, Southern brown bandicoot based in the Eden area, Yellow bellied glider on the Bago Plateau near Tumbarumba, Smokey mouse in Eden, Giant burrowing frog, also in Eden, Large forest owls, in Eden, Hastings river mouse on the Northern Tablelands, the Koala in the northern forests, Greater glider in the Southern and Northern Tablelands, and just noting there that the program is looking to be

expanded using some thermal imaging drones in the future and also multiple flora species are underway as well.
So just to show you a bit of data that comes out of some of these programs, this is naive occupancy for the Southern brown bandicoot camera monitoring program in Eden and it's showing the trends for Southern brown bandicoot in the darker line, the blue Line, and Long-nosed bandicoot in the green line, along with the rainfall and the wildfires in the 2019-2020 season there indicated by the vertical dotted line.

And while it's fantastic to see the amazing recovery post fire, it's also just really used to highlight the value of these long term monitoring programs.
So yeah, the fire point was there and just also shows the decline in the drought leading up to the wildfires as well.
So again, just to highlight the, the value of the long term programs provide some amazing data.
Also like to take the opportunity to acknowledge the very exciting news this year, one of our cameras detected the first ever Long footed poteroo detected in NSW and led by our Dr Ryan Billing in Eden, so that's very exciting news.

As you can imagine, this program is generating an enormous amount of data in the order of around 30 terabytes per year. There are lots of challenges in getting consistent management of this, especially through the slow regional Internet connections.
So we're currently using Amazon snowballs with hard drive copies to get that uploaded into the cloud where the analysis is also occurring in the cloud.
So quite a challenging space, but lots of great people working on that.
And just sort of getting close to the end for me, just wanted to share some of the great images we're capturing on the cameras.
So Spotted-tailed quote, of course, some great images of all sorts of species occurring, and the supermum we call her, with bandicoots in tow, babies.
And lastly, I guess just a nice little anecdote, I deployed some equipment at this particular site disturbed the White throated nightjar off an egg and came back two weeks later to pick up the gear which I did move to avoid disturbing them.
And this was born and hatched only a few days beforehand, so very exciting to see some of the things we're witnessing in the forest and happy to answer some

questions shortly.
Thank you.

Todd Maher 15:36
Many thanks, Chris. Over to you, Brad.

Brad Law 15:41
Thanks Todd. I'm just going to share my screen and does that coming through OK?

Todd Maher 16:02
Yeah. Looks good Brad.

Brad Law 16:03
Yeah. Great. Thanks for that. OK.
I'm going to be talking about the data side of the fauna occupancy monitoring program.
But just to begin with, I wanted to acknowledge that I'm coming to you from Garigal in Northern Sydney and also to acknowledge our team of great ecologists that have been working on this data set. Everything from developing recognisers using AI to data processing and data management.
What I wanted to do was to provide an introduction to fauna, occupancy monitoring and how we're processing all of this data that's being collected especially for acoustics because it's relatively new in Australia.
So to begin with occupancy monitoring, it's a fairly standard method in ecology to look at changes over time, trends.
So here's an example of a recent paper that was able to detect small changes in populations at landscape scales using a bioacoustic approach and on the right hand side you can see an example for Spotted owls in north-west America.
So when this monitoring program began back in 1989, you can see that occupancy for this hour was very high. About 8:00 or above, but it's been declining over time and you can also see in 2014 there was a large wildfire that burnt a number of these sites.
The ones that are marked there in red had high severity fire that covered more than 50% of the surrounding area of their sites and those sites had a population crash after the fire and basically the population hasn't recovered in those sites since then.

This is the sort of data that we really want for our forests here in NSW.
We want to know whether species are increasing, decreasing or remaining stable.
One of the fundamental things about occupancy monitoring or modelling is to account for imperfect detection using detection history and a range of different covariates.
So for example, we can look at the effect of season on detection probability.
Some species are going to be more detectable in spring than autumn. We can also look at things like weather during the survey. Rain can decrease detection probability for some but may increase it for others. Acoustic recogniser version, so as a AI improves over time, detectability will probably improve. The same goes for sensor model, that's the hardware of what we're using and putting out in the bush, that will change over time, but we can account for that by modelling as part of detection probability, and we can also do that if the survey method itself changes from one method to another over time, as long as there are repeat visits and the last of these methods are repeat visitors are different nights of survey.
So that detection probability once that's modelled that carries forward to modelling of the probability of occupancy. In year one, which is where we are at the moment with this program, and that's modelled using a range of spatial covariates or environmental attributes.
Then, as monitoring proceeds forward over time, we're able to look at a trend in occupancy and that's done by looking at temporal covariates and how that relates to extinction and colonization of species at different sites.
One of the powerful things behind this monitoring program is the co-location of multiple sensors to record a diversity of fauna, noting that passive acoustics is an emerging method and we've had to develop recognisers for individual species as part of this program and as Chris mentioned, the multiple methods include trail cameras and song meter minis for bats and general acoustics.
For passive acoustics, here's a recent paper that that came out earlier this year, and it stated that acoustics has emerged as a transformative tool for applied to ecology conservation and biodiversity monitoring.
So it's really important that we've been able to include this method as part of the program. It's really able to capture data on a lot of those iconic forest species that were difficult to do otherwise, especially in a repeatable or repeated fashion.
Here's a schematic of an acoustics workflow for monitoring, so if I just take you through this, starting on the left hand side, the start at a) we've got sensor

technology - there are a range of different sensor devices that can be used out in the bush. That's where you begin with you select your devices, and then they're deployed via a survey design b).
So in this case we've got a multi sensor network and that is also going to be repeated over the years so that we capture monitoring data to look for trends.
Once that audio was recorded, it's also associated with metadata from the site at which it's deployed, and then that audio is processed using signal classification, and in our case, that's AI algorithms to recognize individual species.
Once that's done, it's transferred into species records per site, so every site will have a list of species that are recorded on a nightly basis, and then that can then be used in statistical analysis to look at changes or trends in occupancy over time and from place to place.
When we're talking about acoustics, this all hinges on the fact that we had these spectrograms for different species, and they mostly have their own signature, although it's not, they're not always necessarily easy to pick out one from another. But here are just some examples from different species.
So in a) up there at the top left you've got Pied currawong, over here on c) we've got a male koala bellowing, other different species down here and we've got noise generated by wind, and then on the bottom right hand side we've got noise generated by rain.
We develop algorithms to detect or recognise these different species using AviaNZ software. So the software is able to both develop recognizes and can also be used to validate the results of scanning all of this data. It's an open source software, so it's free to use and it uses AI to develop the recognizers in particular, that's convolutional neural networks. We found it to be also quite a user friendly software to use, so as an Ecologist, not an AI specialist, that's a good thing.
Over the last three years, our team have been heavily involved in developing acoustic recognisers using AI. This is a program that the NRC have been supporting, so we now have recognisers for a range of different species, including koalas, different species of gliders, different species of forest owls, Grey headed flying fox and nectivorous species, and two threatened cockatoos.
So I can't give one of these presentations without playing sounds, hopefully you'll be able to hear this.
This is a yellow bellied glider and this is the spectrogram that we get from one of our recordings and yellow bellies are a very vocal species out in our forest, so they're

readily detectable with these devices.
Here's another example, this is your test for the afternoon, I'd like to see if you can have a guess at what this species is based on its spectrogram. So that I've just included for a bit of fun, that is, of course, a dingo. We don't have a recognizer for that species, but as part of one of our other programs with DPE, we'll probably be trying do it to work on that later this year. Sorry, next year.
For bats, we use software called Anascheme to automate the process of backhaul identification, and this is software that's been around for about 15 years so it's getting a little bit dated now. It is an automated process, but we have a current project with DPE, it's an SOS project that's scanned to use AI to develop new models for identifying bat species across different regions of NSW. So we're expecting this will lead to you know more efficiency, greater accuracy at doing our identification. Hopefully in a couple of years time that will be ready for use.
Then we've got our camera data, so unlike the other methods, this is much less automated in identification of animals, and we do use a mega detector that removes images with no animals from the set of images, so that at least means we don't have to go through thousands of images of grass or branches blowing in the background. But once that's done, image tagging is done manually and we do that in Exit-pro software. It's likely that in the next few years there will be increasing use of AI to automate the process of image recognition, but at the moment it's not quite there.
So just a little comment on pilot studies that we use to inform power and survey effort, in particular the number of sites for this monitoring program that's been based on a number of different studies. So to begin with, there was pilot Chris mentioned, the Pilliga grid based monitoring program that was started in 2013 and is ongoing. There was a DPI monitoring feasibility study in 2017 and the CIFOA also had a pilot program in 2021.
So these graphs on the screen are just some examples for yellow belly glider and the large one on the right hand side. If you look at the green dashed line, that's data from spring using one song meter mini and we're able to see how many nights of sampling you need to do to be 90% confident of detecting the species.
So in this case, for the yellow bellied glider, it's about six or seven nights of sampling to be 90% confident.
We can then take that data and use that in the other plot to work out how many sites need to be surveyed given that level of detection probability across the program and it turns out looking at a range of different species that about 300 sites is

recommended.
So that's what the program has adopted, Chris has already gone through this, so I'll just go through this quickly. 300 sites across the three regions. each has two subplots, so that's 600 in total, and for year one where we're at the moment, that's 180 sites in their spread between spring and autumn.
So here's the data that has been collected and that we've been able to process so far. These are the results for acoustics and we have over 120,000 detections so far just from the spring sampling and that's from 11 species.
So I've presented the data, I've got number of call detections, the number of sub plots at which are call was detected and also average naive occupancy. Naive occupancy is just a percentage or proportion of sites at which the species was detected.
So looking at the first region, first, central or lower north-east, you can see that the koala was the most widespread species detected amongst those species, so it was recorded on 64% of sites equal to the sugar glider. I think that also provides us with some food for thought and perspective when thinking about koala occurrence in relation to other species. Looking at northern region the koala was the second most commonly detected species, but it had a even wider rate of detection of naive occupancy at .8, so detected on 80% of sites and it was just pipped at the post by the Boobook that was recorded on almost 100% of sites.
Scrolling down to the bottom to look at the southern region, you can see that those values for naive occupancy are quite different to what occur in the other regions. They're much lower for all species, and although we don't exactly know what the reason is for that at the moment because we haven't done our modelling, more than likely it's got something to do with those extensive and severe wildfires that occurred in 2019-2020 that were particularly bad in the Southern region. So that's an answer that we hope to get at once we do our modelling.
Here's the data for bats, we have over 400,000 bat detections or passes that have been recorded so far, and that's from 19 different species or species groupings, and you can see at the top of the table there on the right hand side a lot of the bat species occur at almost 100% of sites, so they're very widespread.
These are all hollow dependent species, so that's really good to see. The ones that I've highlighted in yellow are threatened species and on the whole they have a much lower level of naive occupancy than the other species and generally that's what you would expect for a threatened species.

And these are our results for camera trapping, we have over 14,000 detections and that's with a one minute separation between trigger events and over 21 species have been recorded.
Again, looking at the table on the right there, the most commonly recorded group or detected group or rodents that actually comprises a mix of different species that we've just grouped together as rodent and then looking down the table you've got all those usual suspects that are pretty common and widespread in forests. So we've got Long-nosed bandicoots, Swamp wallaby, small dasyurids like antechinus, Northern brown bandicoot, Common brushtail possums and then we've also have the Southern brown bandicoot here, so relatively high occupancy, but that is actually an average of all three regions and they only occur in the southern regions.
So it's occupancy down south is much much higher than that. A couple of other things to note in this table are cats, are somewhat widespread in the forests, they have an naive occupancy of .17 and then looking further down, we've got red foxes are perhaps much less common than we than we might have expected in forests or naive occupancy of only .07. So there's going to be some interesting results there to do our occupancy modelling on.
When we come to do that, what we do is we relate a whole range of covariates to those detection records for different species. So this is a list of the covariates that we intend to use, and different covariates are used for different parts of the modelling. So we have some covariates that are just used to look at detection probability.
We have other covariates that we use to look at initial occupancy and initial occupancy is referring to the first one or two years of the monitoring program, and then we have other covariates that are that are really designed to look at change over time, and colonization and extinction.
So the actual covariates themselves, some of them are climate based, so for example, we look at annual rainfall preceding the survey and annual maximum temperature. So that's obviously really important with droughts and extreme rainfall years and as we go into climate change, that's going to be a very important covariant.
And there are also a range of environmental covariates like DEM, that's just the elevation of the site soil fertility. There's a range of topographic covariates, the extent of old growth forest and rainforest and also NDVI, so this is a remote sensing variable that is like a surrogate for site productivity, and essentially it's measuring the canopy greenness. Then we have a series of disturbance variables, so we want to be able to look at timber harvesting and whether it's been heavy or selective and also

the time since harvesting has taken place, so we've got different time categories there, less than five years, 5 to 15 years since harvesting 16 to 30 and greater than 30 years since harvesting. That also goes with the extent of old growth forest mentioned above and at the very bottom of that table we have the extent of wildfire. Obviously that's a becoming a more and more important variable in our forests, and we're able to separate that by the extent of high severity fire or low severity fire.
So we haven't done that modelling yet for the IFOA data that's at the next step in our process to do that.
But we do have some data that I'd like to share as an example of what sort of results we get out of doing this modelling.
So one example is the DPI acoustic monitoring program between 2015 and 2021 in North East hinterland forests, and that takes place across 224 sites and so far this has been focusing on koala occupancy.
This is the trend in koala occupancy across that time period and you can see that occupancy is relatively high sitting at about 0.75 probability of occupancy. That's quite consistent with what the IFOA is recorded in its first year and you can see that Koalas have had a stable trend in occupancy or relatively stable, despite drought and unprecedented wildfire in 2019, because we've got that sequence over years, we've been able to look at local extinction probability, and we found that it was a correlated positively with the extent of high severity fire. So no surprises there, the more high severity fire have, the greater the chance of koalas being locally extinct at a site, but with some opportunity of recolonizing in the future, which is what a monitoring program can also capture.
Here's another example from that dataset, Yellow bellied gliders in those northeast public forests, so this is state forests and national parks from our data.
And you can see that occupancy over this time period has varied from about .45 to .6, so lower than koalas and also that there was a 34% decline in 2019.
When we look at extinction probability, which is what's driving that decline, we found a relationship with the mean NDVI surrounding a site and that relationship, the extinction probability was high when NDVI was low. So that really means low NDVI is less green, more brown, so it's probably a combination of drought, affected canopy at those times and also burnt forest from the fires that's affecting Yellow bellied gliders.
We can also go further back in time and look at a 1990s baseline study that was done as part of the FMIP program that the NRC posted.

Again, this is a Yellow bellied glider example for the northern region and the 1990s are really characterized by extensive surveys throughout many forests and also the 1990s predate a lot of the effects that would have been apparent from climate change.
So they provide a really good time period for developing a baseline from which we can make comparisons now back in time.
So for the case of Yellow bellied gliders, there were 292 detection sites from all these surveys that we compiled and over 1,800 non detection sites, so more than 2000 survey sites, it's a lot of data.
We found that detection varied with season and then when that was used, median occupancy was .39 for this northern region.
So just going back with our contemporary data or recent data, that occupancy back in the 1990s was slightly less than what we're finding now for Yellow bellied glider occupancy, so that's interesting.
And also the other thing that this occupancy modelling gives you is a spatial representation or a spatial model of the distribution of a species.
So you can see over here there's the spatial map of occupancy for Yellow bellied gliders in the 1990s.
We can produce the same sort of map from contemporary data and not only see what the change in occupancy has been, but where those changes have taken place.
We can compare the two maps from the two different time periods.
So just to finish, my quick summary is that what we have is a massive multi species dataset from acoustics, ultrasonics and cameras.
We've got seasonal sampling and regionalised data capture, so we're able to look at both of those aspects in our data analysis and the program really is going to provide a strong foundation for future monitoring of species trends. But not only that, the data can be compared to the past, so we've got the DPI acoustics monitoring from 2015 to 2022 and a lot of that analysis is still in progress for different species.
We've got the FMIP baseline study from the 1990s. We have species occupancy estimates for a range of species, certainly not all species, but a good range.
And there's also wild count data for camera trapping from the national parks estate, so that could be relevant for comparisons with the camera trapping data from the IFOA program.
And my final point is just that I think this program has the potential to be one of Australia's largest terrestrial fauna monitoring programs.

I really can't think of a bigger program at the moment that covers as wide a geographic extent and such a big range of species as well, so I'll leave it there. Thank you.

Todd Maher 39:17
Great thanks, Brad and many thanks to Chris too.
So we're in our Q&A session now, I encourage you in the middle of your screen there on teams there's a Q&A button.
So I encourage you to pop questions in there now and we can throw to our panel like Phil, Professor Phil Gibbons is just joined us. So Phil's from the Fenner School of Environment and Society at the Australian National University and Phil is also an independent advisor on the NSW Forest Monitoring Steering Committee, which overseas this program.
I'm probably going to throw to you, Phil and put you in the first hot seat here, look, I guess I'll probably just ask for your general observation and comments at this stage given you know you've got over 20 years experience in forest management, monitoring and research, I think going back to the comprehensive regional assessments we've done, as Brad mentioned, the significant baseline work there where we mine data for over 30 years. I'll throw to you just to start with any general observations or comments.

Philip Gibbons 40:27
Thanks, Todd and thanks Chris and Brad that was fantastic.
I guess what jumps out for me is that you know the sample sizes now we're dealing with, with the changes in technologies is just fantastic. So that's really great that you're really talking big numbers and we can be much more confident in the data that's being produced, you know, compared with the traditional sort of field based activities.
There's a few things we've found with monitoring, in our research on what monitoring programs are successful and one is, you know, transparency and a culture of publication and it's great Brad and Chris that you have had a culture of publication in the past and I hope that, I trust that's going to continue. I guess we're going to see, there's a list of species that you showed Brad for which you've developed call recognisers and I only assume that's going to improve pretty quickly through time and I noticed you mentioned you don't use AI for the cameras.

You know, whereas there's things like wildlife insights, which is a Google collaboration, you're probably aware of it that we've used, it's great but it does cost a lot for organisations to use it.
As a university, we get it for free, so I can understand you're not jumping on that bandwagon yet, the other thing that we found with monitoring was that it works best when researchers work closely with managers and I think that there's great capacity, I mean, it's great that you're this is a collaboration between DPI state forests and Forest corporate NSW, so I think that's fantastic and with NPWS in the fold as well, that would be great to keep that close collaboration going.
So finishing off there's just a couple of questions that I've got that might come up as well from the audience, and that is, obviously the Greater glider is a species of concern and as a species that has become federally listed and uplisted in recent times, relatively recent times, it doesn't call. So I know you mentioned, Chris, that you've got a program for Greater gliders, so I'd like to hear a bit more about that and of course the final thing is that monitoring works best when it happens over a long period of time so I'm just wondering where the funding is going forward and maybe Todd, you could help us out there, but thanks again.

TM **Todd Maher** 43:16
Brad, Chris, would you like to respond to Phil's first question?
I can come back to the funding.

CS **Chris Slade** 43:23
Sure, thanks, Todd. Thanks for all the great question there. We have been monitoring Greater gliders to date and that's been via spotlighting transects and the emerging technology that we're pretty excited to jump on board with is the thermal imaging drones and looking to expand that program across the table lands and other areas as well.
So we've been looking at multiple repeat measures, the technologies now improved. So you can use the spotlight from the drones, I'm very excited about the use of this technology and the opportunities it can provide from a relatively efficient way compared to spotlighting from the ground and I think the detectability has the opportunity to be greatly improved as well.
So look, very excited to see where that can go and I think, yeah, we've definitely got a lot of plans in place to expand that drastically across the landscape.

Todd Maher 44:16

Great thanks, Chris, and to go back to your comment and question too, Phil, on funding, happy to announce that the program has secured up to $1,000,000 per annum over 20 years.

It's a fantastic result, so that was provided under the last NSW budget in 2023.

Also, a shout out to the EPA have also contributed up to $275,000 this financial year for the program and that builds on their $2,000,000 that they provided in seed funding in 2019 so we really welcome that as the Steer Co.

We've got a range of questions flooding in now, I'm going to start with the first one from Jocelyn.

Hi, Jocelyn, good to see you again from down south. So Jocelyn's question is and either to you, Chris or Brad, how did your screen out photos of trees and leaves blowing again?

Technical question, over to you, Brad.

Brad Law 45:17

Yeah, my simple version of that technical question is we use this thing called a mega detector, which is an AI process that's able to recognize animals, but it doesn't do a particularly good job of recognizing what the species is, but it can pick if there's an animal in the image.

If it is, it gets kept, if there's it doesn't recognize there's an animal there, it gets ditched into another folder.

So it's a great way of wedding out all those grasses and branches blowing in the background, that's pretty standardly available, but you can feel free to contact me if you're not sure where to look.

Todd Maher 45:55

OK, great, thanks Brad.

Next question, Graham. Hey, Graeme Gillespie, have you attempted to optimise occupancy modelling for a selection of species but how have you optimized design effort and site selection for temporal trends?

And Graham follows up with a statement, you could have robust spatial modelling but lack power to detect temporal trends.

Chris or Brad.

Brad Law 46:22
Yeah, I guess we have done power analysis to look at what's required to look at temporal trends for koalas. So we've done that and that's inside the very massive baselines report.
There's a section on power for monitoring and also there are general power curves that can be used for once you know what the detection probability is for any species, and it's likely occupancy, you can use those power curves to estimate how many sites are required. So have a look at that section of the baselines report.

Todd Maher 47:00
Okay, thank you.
Another question coming in from Jocelyn and it's back to Greater gliders and I think some of this has been answered, but maybe we can unpack it a bit further.
How are observations for Greater gliders followed up as they are not vocal and Chris, maybe I can throw to you some of the work on the South Coast I know that Rowan's been leading down there. Before you do, I will note that under the Coastal IFOA Monitoring Program going into this year, we're establishing an ongoing species specific monitoring program.
This will be long term for Greater gliders and it will be building on the existing data, and that's one of the first steps is mining a lot of the data at the moment and do some covariant modelling too. Over to you, Chris.

Chris Slade 47:47
Thanks, Todd. Look, I guess the just trying to get a handle on the question, how do we follow up the sightings?
I guess from a monitoring perspective, they're all recorded via our what we call a map app, which is a field based data capture system now and they are captured in perpetuity and make their way into BioNet in a corporate data exchange program we have going. So all those records are captured and available for anyone to see via BioNet. We follow those up the old spotlight transects that used to be done, and currently we record the perpendicular distance and as best we can estimate that from the transect centre point and estimate density along that length of the transect.
So we definitely follow up and all those records go into the mix for future management on the forest as well.

I'd also just like to support too, thanks to the NRC and the EPA for their funding and also to add that there's a strong definite commitment within Forestry Corporation to continue in this monitoring program indefinitely as well.

Todd Maher 48:53
Great, thanks, Chris. Got a question here from Chris Brack.
Hey, Chris, do you collect any stand structural information at monitoring locations such as course, fine woody debris, standing dead trees, number of big trees, etc, might be better than simple harvested, not harvested.

Chris Slade 49:15
Yeah Todd, I can jump in there quickly and yes, we do definitely.
There's a plot sheet that occurs at each of those subplot sites where we're recording number of hollows detected, tree stand characteristics, including of course woody debris, disturbance history from a fire, and harvesting history as well.
So a range of those that then go to support the covariate data that we get remotely.
Thank you, if you want to add anymore Brad.

Brad Law 49:43
I guess the thing with fauna modelling is that fauna, you know, move over a landscape so you can have these plot based measurements around your recording device, but that doesn't really tell you a lot about what's truly available to a species that's moving over a bigger area.
So that's where we really do need these GIS variables so that we can put like a 500 metre buffer or A1 kilometre buffer around our site and say you know what is the state of the forest in this area.
You know, harvesting is one way of doing it. Until we have LIDAR that's available for forest structure measures, you know sort of wall to wall almost, then I think we're going to struggle to model. But still that data that's collected at the plot scale, is still useful to inform what's going on.

Philip Gibbons 50:33
Can I just jump in there? I think it's a great question from Chris and it's that intermediate scale, isn't it, that really is probably the hole at the moment and I know Forestry Corporation and others and NRC is supporting for work on this.

You know, on trying to improve the habitat variables from LIDAR at at large scales, Chris, Chris Brack, that is. So I think that's definitely an area that we need to improve upon.

Todd Maher 51:04
Yeah, great.

Brad Law 51:04
It's a good question.

Todd Maher 51:06
Yeah, I'll just note, thanks for mentioning that Phil, that the program over the last two years has collected up nearly 300,000 hectares of new LIDAR data, so we're going to be doing some retrospective analysis through past data sets, but I know, Brad, you can probably weigh in now, I know there has been some discussion here is about potentially using that data to explore some of that covariant modelling.

Brad Law 51:31
Yeah, look, the discussion has started and there's been a report on some of the LIDAR metrics that have been produced so far, so we're really on the cusp of being able to use that.

Todd Maher 51:43
And Phil, you mentioned the word hollows there are very important habitat feature. Did you want to just a quick comment on some of the work that's been happening to date on the hollows?

Philip Gibbons 51:54
Yeah so I guess on the lighter stuff, one thing that hasn't worked very well in forest to date and I and it's still work in progress, is being able to map individual hollow bearing trees.
So I think I think until that can come that sort of high result, some type of high resolution remotely sensed product to that picks out individual hollow bearing trees across the landscape. I've been working with Forestry Corporation to get hollows into their Frames model.

So frames is their yield scheduling model or models forests through time and I've been working with them to put tree hollows into that modelling framework and so we're pretty much finished our pilot study and that will be coming out shortly, I believe.
So that might be a good interim product which provides some type of spatial mapping of hollow bearing trees that have better information than what we've got and probably a good interim product until we can improve what LiDAR and other emerging remotely sensed products can produce.

Todd Maher 53:13
And Phil I'll keep with you there on the hollows, some of the interesting insights I know from the data that you and the team and at ANU were working on with Forest Corp, that you explore some of that data on the North Coast and some of those concepts around functional hollows.

Philip Gibbons 53:27
Yeah so one thing that's difficult is that all of our data is based on what you see from the ground, Todd and of course, when you look into the research, research like people who I've done, we've looked at trees once they've fallen or people who have climbed trees. Only around about half of the trees you see with hollows from the ground actually have hollows suitable for occupancy by vertebrate fauna.
So one thing we've done in that project is also use some data that was used in the Pacific Highway upgrade where they looked at trees before they felled them and then felled them, we used those data to sort of improve the models of what trees are suitable for occupancy by fauna.
So you know, we're part way there, I'm still not entirely happy with it because you know, once you take out the data that's not suitable and our sample sizes aren't great, but we are trying to get closer to, actually looking at trees that are actually suitable for vertebrate fauna. So it's certainly improving upon what we've had.

Todd Maher 54:44
Great thanks Phil..
Just noting a quick comment here from Justin Williams.
There is wall to wall layers from satellite imagery, which is useful for this plus LiDAR data which can help with modelling disturbance, fire and harvesting.

Thanks, Justin.
A question from Natasha.
Can you explain what is the old growth layer that was mentioned as a modelling covariant and how is it defined?
Brad, is that best to throw to you on that one?

Brad Law 55:14
Yeah, off the top of my head, it's a bit confusing because there are multiple layers. I think the layer we use is the layer that gets used in the IFOA, which is the high conservation value, old growth forest layer.
I'm pretty sure that's what we use and there are faults in that layer, everyone knows that, but it's the best that's available and at the very least it's mapping old forest, whether it's old growth or not, it's at least long time since it's been disturbed, so that's what we use.

Todd Maher 55:57
Great thanks, Brad.
Look, we're coming up near to the close of the webinar, but I've got a couple of questions here for Brad and Chris.
You've been in a large design phase for it, and you're really in the first year of implementation.
What are some of the key challenges to date and what do you see some of those going forward?

Brad Law 56:21
Chris, do you want to go first?

Chris Slade 56:24
Sure thanks Brad.
Yeah Todd it's a great question.
I think the managing of the data is a really big challenge.
As I mentioned in the presentation, we're dealing with around 30 terabytes.
There's multiple players playing in the field, so some of the data, I guess the deployment consistency are some of the learnings who have had.
I also feel like there's probably some good use of the technology that can come to

improve the time frames of delivery of data for example.
So currently it's a bit of hard drive copies getting onto another big hard drive that gets imported up to the clouds and there's potential, as we're hearing, there's lots of technology coming on board, so being able to cash in on those opportunities, I think is going to really value add to the program and improve the efficiency of analysis and data management.
I think field wise were seeing some fantastic images coming through the forest and look really excited about where it's going and we're extremely excited to be part of the program and seeing what's happening on the forest. Some of the learnings are probably the data handling and the data management is probably the biggest one that I see we've got some work to do in that space.

Todd Maher 57:44
Great thanks, Chris. Brad.

Brad Law 57:45
Just quickly for me, I mean without a doubt data processing is also a challenge.
It's a lot of data to process, every algorithm that we apply gets validated by people, so it's not purely AI there's a big human involvement, and that does take time, but this field is all advancing so quickly that it's only going to get better.
It will get more efficient and quicker, and Phil's comment about there are some AI methods for cameras, that's where we're going to head I guess that's the way we'll go. Same for diurnal birds we've generally steered clear of that because they're a lot harder, they're more variable in their calls than daytimes noisier.
We've only really done the Glossy black cockatoo and the Gang gang cockatoo, but you know there's other groups who are working on diurnal birds. Cornell University, for instance, of doing some great work in that space.
So yeah, that's the future.

Todd Maher 58:48
Great, thanks Brad.
Noticed Chris Brack has thrown in a comment about how great LiDAR and resolution is available these days.
I agree.
It's amazing what you can do with LiDAR. We're right on 4:00 o'clock, which is an

hour, but I will throw in one last question because that was the last one I saw from Chris.
Just quickly, probably to yourself, Brad, as I said, we've been in a design phase piloting really and now a year of data collection and moving into analysing that data, how many years really do we need to establish say robust trends for a lot of these species?

Brad Law 59:21
Yeah that's a good question.
I guess our data that we've collected over that seven year period with our, previous acoustic monitoring 2015 to 2022, that's I7 years.
We we've been able to establish clear trends with that data, we've seen the Yellow bellied glider drop in occupancy during that fire year and start to recover.
We're going to build on that analysis for other species, so I think three years is probably not long enough, but five years is probably, giving you an initial idea of what's happening, but really, that longer term picture is great that we now have that 1990s baseline to go back to, to put it in to some perspective, without that, I think even five years it's sort of be a little bit grappling with you know, you might have a recent trend, but you're not able to put it into a longer term picture.
So I think that is really important.

Todd Maher 1:00:26
Great thanks Brad, and finally, we're going to throw to Phil.
Phil, Brad made the claim at the end there that this may be one of Australia's largest terrestrial fauna monitoring programs, from your perspective?

Philip Gibbons 1:00:38
All look, it's huge.
You know, I think like I said, I think it's just the amount of data being produced through the new technologies is amazing.
I mean, so look, there's been long ones, I reckon if you've got someone like David Lindenmayer, they would argue that they've been going longer of course.
But no, it's a massive scale and it's got institutional support as well.
Can I just jump back to, I know we had a meeting a while back when we were watching the Southern Brown Bandicoot numbers decline very precipitously in the SE

NSW forests and I was pushing for some really heavy intervention.
And then of course, it rained and things turned around very quickly for that species and.
And so the need for long term monitoring as Brad said is really important.
So yes, it's definitely up there with one of the biggest monitoring programs in Australia for fauna and it sounds like it's also funded and is looking good for the future too.

BL **Brad Law** 1:01:50
Only year one of course, but it's on the right track.

TM **Todd Maher** 1:01:56
Great thank you.
OK, we've gone a little over time.
So in closing, I thank Brad, Chris and Phil and to you, the participants for your interest and questions.

TM **Todd Maher** 1:02:06
I really encourage you to go to the Commission's website for more information on this monitoring program.

TM **Todd Maher** 1:02:12
The answer to today's questions and many other publications on the extent and state of forested landscapes in NSW are available on our website.
We have one final Webinar upcoming next week, that's on forest carbon balance and I hope you will join us for these.
We have a short survey where you can provide feedback about this webinar.
There's a QR code if you could participate in that would be very grateful.
So thank you for joining us today and enjoy the rest of it.
Thank you.
Bye bye.