A guide to carbon farming for ecological planting on the Atherton Tablelands.

Final report from the Freeman's Forest pilot project, May 2019

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1. Project Summary

This project investigates opportunities for ecological tree planting works in the Atherton Tablelands region of far north Queensland (the Tablelands) to deliver income via registration as carbon farming projects. This work specifically looks at plantings that are done primarily to rapidly increase biodiversity values (ecological plantings) and which typically contain a high diversity of plant species and are established using particular methods intended to achieve canopy closure within 2-4 years and to promote natural seed dispersal and forest regeneration processes (Goosem and Tucker 1995, 2013; Moran *et al*. 2017). On the Tablelands, the biodiversity values of ecological plantings are higher than for plantings that are undertaken to maximise specific ecosystem services such as timber production, at least in the first few decades after planting (Kanowski *et al*., 2003; Catterall *et al*., 2004). This rapid provision of biodiversity habitat is important considering the immediate need for more habitat by many taxa that struggle to maintain populations in the current landscape, as a result of habitat loss and degradation, as well as climate change. However, the costs of ecological plantings are also substantially higher than for other plantings because of the methods used to establish cover rapidly (e.g. dense stem spacing) and to promote ongoing ecological processes (high diversity of plant species). In the Tablelands region, costs of ecological plantings are usually at least partly covered by grants obtained by individual landholders, community groups (e.g. TREAT, Landcare and catchment care groups), private contractors, the Tablelands Regional Council, or Queensland Parks and Wildlife Service. Funding is always limited and variable from year-to-year and the ongoing availability of public funding for tree planting is uncertain.

In addition to the direct benefits of increasing biodiversity value, ecological tree plantings sequester carbon, stabilise soil, shade waterways, and can function as windbreaks and promote native pollinator populations. This project examines how registering the co-benefit of carbon sequestration by ecological plantings could yield economic returns and, more specifically, whether or not these returns could be sufficient to offset some of the costs of ecological planting on the Tablelands. While this project was being implemented, work by Terrain and others progressed the development of market mechanisms to deliver economic returns for water quality benefits (e.g. https://www.reefcredit.org/) and biodiversity benefits; these should be included in future consideration of economic opportunities arising from tree planting in the region.

The Australian government has established a system of crediting the carbon that is sequestered by planted trees. In order to receive carbon credits to sell for money, planting works need to be formally registered as carbon farming projects. For ecological planting, this would not change what is done on the ground, but does requires a range of compliance and administrative tasks. Assuming that public grants and volunteer support (e.g., labour, land for tree planting) will continue to cover the costs associated with ecological planting, the payments received for carbon credits would only need to exceed the costs of carbon farming program compliance and administration to yield surplus income. This income could be used to maintain plantings, undertake ecological planting where funding isn't available, or provide economic return to landholders. The current report evaluates the feasibility of accessing this potential but largely untapped source of income for ecological planting on the Tablelands.

With funding support from Terrain NRM, TREAT implemented an on-ground trial to document the logistics, processes and costs involved in carbon farming. This work delivered understanding of the:

- accounting systems used to calculate carbon credits and their application to ecological planting on the Tablelands
- steps needed to register and participate in the carbon farming program
- economic outcomes for ecological tree planting works in the Atherton Tablelands under different scenarios.

Three proposed actions have arisen from this work:

Action 1. That Terrain NRM take the lead on discussions with the LRF about representation to the Australian government in relation to reducing audit costs and approving a carbon accounting methodology for ecological plantings in the Tablelands.

Action 2. That Terrain NRM take the lead on discussions with the LRF about developing practical understanding of a market for biodiverse carbon from ecological plantings.

Action 3. That TREAT take the lead on discussing carbon farming with landholders of candidate planting properties. This could begin with a field day and workshop, in conjunction with a launch of this report.

THE BOTTOM LINE

Using a pilot project, we assessed whether or not there is reasonable scope for carbon farming to deliver income from ecological planting on the Tablelands. The project developed a calculator to account for the range of factors that affect the economic outcomes of a carbon farming project and which vary widely between different situations. We can draw the following general conclusions about the situations that will deliver income from carbon farming:

- the costs of site preparation, planting and maintenance of ecological plantings will still need to be mostly covered (e.g. by grants) ;
- at current carbon prices, projects need to be several hectares in size to earn enough carbon credits to balance the costs of compliance;
- smaller project areas could be profitable if higher prices for carbon credits were obtained, for example if the high biodiversity values of ecological plantings augmented the price paid for their carbon;
- using a carbon accounting method that accounted for the higher carbon stocks in ecological planting could mean that projects become economically viable even if they are small and/or if current carbon prices are maintained.

Using the approved FullCAM accounting method, one hectare of ecological planting on the Tablelands is expected to sequester 790 tonnes of carbon dioxide equivalent (tCO2-e) per hectare (ha) over 25 years (the current period over which carbon credits can be earned for a given planting). This would deliver 790 carbon credits (ACCUs) per ha of ecological replanting on the Tablelands[1]. At $18/ACCU, one ha of ecological replanting on the Tablelands will yield $14,220 over 25 years. The cost of establishing 1 ha of ecological planting is substantially higher than this (ca. $33,000/ha), but since grant or other funding typically covers most of these costs, carbon farming may offer opportunities to derive income from ecological planting.

The main compliance cost associated with carbon farming is auditing (between $30, 000 and $50, 000 over the lifetime of the project).This means that, if establishment costs were covered, a project would need to be 2.1-3.5 ha to earn enough (at $18/ACCU) to cover the audit costs. Larger areas would be needed to deliver surplus income, and to cover any other costs such as project management and administration.

Higher prices for the ACCUs earned by ecological plantings would mean that compliance costs could be covered from a smaller project area, creating more opportunity to earn surplus income from ecological planting. It can be reasonably expected that substantially higher price for ACCUs will be able to be attained where projects can be marketed as having high co-benefits. Ecological planting on the Tablelands delivers substantial biodiversity value at local scales (e.g. Catterall *et al.*, 2012), and habitat restoration on the Tablelands has high potential biodiversity value from regional , Queensland and national perspectives (e.g. WTMA, 2004; Reside *et al*., 2014; 2017). A 'biodiverse carbon' price of $25/ACCU, for example, would mean that a project areas of 1.6 ha or 2.6 ha would cover audit expenses of $30,000 or $50,000, respectively.

Finally, using an accounting method to accurately calculate carbon stocks in ecological plantings would be likely to show that substantially more carbon is stored than is estimated using the standard equations in the FullCAM model.

[1]A project that earned 790 ACCUs/ha would need to be over 60 ha in size to earn at least 50, 000 ACCUs – the minimum required to be eligible to sell ACCUs to the government. This isn't realistic for small ecological plantings, so ACCUs earned from these projects would need to be sold on the secondary market, where the price is currently around $18/ACCU (compared with the Australian Federal government price of $12/ACCU).

PART I. Carbon farming and replanting: Background and pilot project

2. Background to carbon farming and replanting

2. 1 What is carbon farming?

The Emissions Reduction Fund (ERF)[1] is a scheme of the Australian Federal Government to enable "*…farmers and land managers to earn carbon credits by storing carbon or reducing greenhouse gas emissions on the land. These credits can then be sold to people and businesses wishing to offset their emissions*" http://www.environment.gov.au/climate-change/emissions-reduction-fund/cfi/about

Carbon Farming (Carbon Farming Initiative) Act 2011 (hereafter "the Act") is the legislation that governs the ERF and is administered by the Clean Energy Regulator http://www.cleanenergyregulator.gov.au/, the Federal government body with responsibility for administering any legislation aimed at reducing carbon emissions and increasing the use of clean energy.

A range of activities are covered under the Act. These include activities that avoid or reduce emissions of greenhouse gases from such things as digestion in livestock or introduced animals, fire in savannas or grasslands and landfill. The Act also covers activities that remove carbon dioxide from the atmosphere (i.e. sequestration). This includes tree planting (called *sequestration offsets projects*) because carbon is stored in the trees. Eligible tree planting projects must establish and maintain trees that have the potential to attain a height of at least 2 metres, and a crown cover of at least 20%, on land that has previously been used for agricultural purposes. This project considered opportunities for revegetation work on the Tablelands to participate within the sequestration offsets part of the programme.

2.2 How do carbon credits earn money?

A carbon credit is a tradeable certificate or permit that represents a specified amount of carbon (usually one tonne). Carbon credits can be earned by sequestering the specified amount of carbon (e.g. by tree planting) or by avoiding the emission of that amount of carbon (e.g. by changing fire management practices). Carbon credits can then be sold for money to someone who wants to emit the equivalent amount of carbon, or could be sold to someone who wishes to pay for the environmental or social benefits obtained by the removal of carbon from the atmosphere or the reduction of carbon emissions.

Under the ERF, carbon credits are called Australian Carbon Credit Units (ACCUs). One ACCU is earned for each tonne of carbon dioxide equivalent (tCO2-e) that is stored or which is avoided. ACCUs can be sold either through a carbon abatement contract with the government[2] (currently the price for one ACCU is approximately $12 tCO2-e), or on the voluntary (also called "secondary") market[3]. There is no fixed price for an ACCU on the Voluntary market because

[1] The ERF replaced the former Carbon Farming Initiative (CFI) in 2014. The ERF expanded the scope of the CFI to include additional activities and streamline processes.

[2] Projects that will deliver less than 2000 ACCUs/year on average over the term of the contract cannot register to participate in an ERF auction. Under the 'Reforestation by environmental or mallee plantings methodology', a project could not estimate more than 900 -1000 tCO2-e per hectare over 100 years (i.e., 9-10 tCO2-e per year, on average). Using this methodology (the most appropriate for plantings in the Tablelands region; see *Approved methodologies* Section 9, below), a project would need to include at least 200 hectares of planting to be able to register to participate in an ERF auction.

[3] The Voluntary (or secondary) carbon market is named because carbon credits traded on this market are bought by businesses or individuals to voluntarily offset emissions, rather than because they are trying to meet their carbon obligations under the

the price paid depends on the value the buyer places on the carbon credit. The current price for a basic carbon credit on the voluntary market is around $18 tCO2-e, although higher prices can be secured for projects with additional or co-benefits associated with the carbon sequestering or emissions mitigation activity. For example, preliminary discussions relating to Queensland's recently-established Land Restoration Fund propose that carbon credits with biodiversity benefits may be valued above $20 tCO2-e.

The amount of carbon stored in a tree planting project (the *carbon stock*) is calculated using a standard model (Full Carbon Accounting Model (FullCAM)), or by cutting and measuring the carbon stocks in a sample of the planted trees (known as destructive sampling). Rules about how carbon stocks can be calculated for projects registered with the CER are contained in the Approved Methodologies (See Section 9).

2.3 Potential relevance of carbon farming for ecological tree planting on the Tablelands

Many hectares of ex-agricultural land are planted with ecological tree plantings every year on the Tablelands by community groups, private contractors, Local and State governments and private landholders. These plantings easily meet the criteria for land sector sequestration offsets projects in the Act.

The primary purpose of these plantings is to increase the amount of habitat for wildlife, rather than for economic return. However, registration of these projects as carbon farming projects could earn carbon credits, which could then be used to generate economic returns. Furthermore, the biodiversity co-benefits associated with these plantings may mean they were able to be sold for a higher price/tonne of carbon, compared with the market price.

Commercial participants in the ERF would seek economic return on their tree planting investments and may therefore use methods that meet (but don't exceed) the eligibility criteria and choose planting sites based on affordability and practicality. Carbon sequestration is the primary objective of these projects and biodiversity values are co-benefits. By contrast, ecological planting in the Tablelands is primarily aimed at producing biodiversity benefits and carbon is the co-benefit. These plantings are typically on fairly high-value land and the methods used aim to rapidly achieve biodiversity values (Goosem and Tucker 1995; 2013; Moran *et al*. 2017) and far exceed the 2 metre height, 20% cover requirements. Thus, much more expensive. However, many of the costs of establishing tree-planting projects on the Tablelands are covered by grants or other public funding. In addition, community volunteer planters, and/ or landholder contributions (e.g. of slashing or spraying equipment or labour) reduce the cost that would need to be recouped from carbon credits in order to gain an economic return from the planting.

Currently no money is earned for the services these plantings provide. Funding for tree planting is in decline. Income from carbon credits is a possible source of supplementary funding for ecological planting on the Tablelands. In the context of ecological replanting, it is not intended that proceeds from the sale of ACCUs returns to the individual landholder on whose land the project is situated. Rather, it is intended that these funds either be used to pay for the ongoing maintenance required or that they be put into a public fund or similar, and used to replant additional areas.

3. A carbon farming pilot project

Carbon farming is a potential source of income from tree planting that has not to date been tapped in the Tablelands region, partly because of a lack of information on the feasibility and logistics in relation to ecological planting. An ecological planting on the Tablelands (at Cloudland) had previously been independently registered as a carbon farming project with the ERF, but the program had changed substantially since then, and there was a lack of clarity around the specific steps involved, or the factors that determine whether the costs of participating in carbon farming are offset by the income gained.

Kyoto protocol and have a carbon abatement contract with the Government. For example, (continued next page) corporations may seek to purchase carbon credits on the voluntary market do this to be able to claim 'carbon neutral' status. Projects can be registered on the Australian National Register of Emissions Units for trading on the voluntary market https://nationalregistry.cleanenergyregulator.gov.au/

Thus, the broad aims of the pilot project were to de-mystify the carbon farming process and assess the feasibility of using carbon farming to delivery income for ecological planting projects on the Tablelands. Specifically, the project aimed to use a real-life project to document:

- the process of project planning, securing project approval, implementing on-ground revegetation works, reporting and auditing and ultimately being issued ACCUs;
- the economic costs and benefits from registration of an ecological planting as a carbon farming project;
- any lessons and key issues for carbon farming in the context of ecological planting.

These are addressed in Part I of this document.

In addition, the pilot project has delivered three outputs:

i. a "How To…" guide for community groups, landholders or others potentially interested in registering ecological replanting as carbon farming;
ii. policy advice on climate change policy and carbon farming;
iii. a calculator that accounts for the range of variation in factors that determine the economic outcomes of carbon farming for different scenarios

The 'How to' guide forms Part II of this document. Policy advice was addressed via submission to the Review of Climate Change Policy by the Federal Department of Environment and Energy and to the Review of the Carbon Farming Initiative Legislation and the Emissions Reduction Fund by the Climate Change Authority (Appendix 1). The calculator currently takes the form of an excel file, held by TREAT.

Freeman's Forest is property located adjacent to Lake Eacham National Park on the Atherton Tablelands, and forming part of the Petersen Ck. Corridor (a large-scale, community-based riparian revegetation project). Since 2011, the property has been progressively revegetated using ecological planting methods.

Ian Freeman was the former owner of the property. Since Ian's passing, the property has been owned by South Endeavour Trust Pty. Ltd., an independent not-for-profit, charitable trust. For the pilot project, 1.6ha. was planted with 5000 seedlings of native trees.

4. An overview of the steps taken in the pilot project

The Freeman's Forest pilot project established a carbon farming project and completed the first major stage of the project (Figure 1). A summary of the work conducted during the pilot project is provided in Sections 4.1-4.6 and in Table 1. Work on the pilot project will be ongoing.

Figure 1. Major stages involved in running the Freeman's Forest ecological replanting as a carbon farming project.

4.1 Determining the project proponent

For the purposes of the pilot project, David Hudson - a TREAT and SATRA member with his own project (Cloudland) already registered with the CER - acted as the proponent for the project. This expedited the process so that it would fit within the time constraints of the pilot project.

4.2 Project Registration

It took approximately one day of work for the Project Proponent to complete the application for the pilot project, but this was spread over 4 weeks that included lead time to obtain supporting documentation, GIS mapping, FullCAM analysis (see below) and so on and doesn't include the time spent doing the mapping or FullCAM analysis. These tasks may take around two days each to complete, once the software and programs are familiar. The experience gained in the pilot project could reduce (probably by half) the time required to complete the project registration (i.e. by using this guide). Appendix 2a contains the completed project registration for the pilot project.

As part of the registration, it's necessary to decide which of the approved methodologies is going to be used for the project (See Section 9 in Part II of this document for more detail). For the pilot project, the following methodology was used: Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014. It is most likely that this methodology will best suit ecological plantings in the region (see discussion in Section 9; Appendix 6).

In the case of the pilot project, there were TREAT members who had the requisite skills and access to the required computer programs to complete the GIS and FullCAM analyses for the project registration. One of the lessons learned from this stage of the pilot project is that it is prudent to avoid a project area that extends right to the property boundary because inherent GPS error and variability between different mapping systems can result in the edge of the project area being mapped on adjoining property, causing trouble with neighbouring landholders.

It took the CER the maximum time of 3 months to assess and approve the project registration (under the CFI Act, the CER has 90 days to process project registrations, variations and crediting applications http://www.cleanenergyregulator.gov.au/ERF/Want-to-participate-in-the-Emissions-Reduction-Fund/Step-1-Apply/processing-times-for-project-registration-variation-and-crediting-applications). Appendix 2b contains the project registration approval.

4.3 Planting and Record keeping

Seedlings were sourced from the Tablelands Regional Council Revegetation Unit nursery and the Queensland Park and Wildlife Lake Eacham nursery. Planting was undertaken in 2 planting sessions by community volunteers, organised by TREAT. Methods used were typical of the methods used in most TREAT community plantings, i.e.:

- the site was sprayed twice with herbicide prior to planting to kill pasture grasses
- holes were drilled using an motorised auger approximately 1.8m apart
- fertiliser and water-saving crystals were added to holes before planting
- seedlings were planted carefully; dead pasture grass was pulled around the planted stems as mulch
- following planting, weeds were sprayed as needed on several occasions.

For subsequent auditing, it is necessary to document many aspects of the on-ground methods used in the project, including:

- Species selection (in order to show that the project used appropriate native species for the site)
- Number of seedlings (and source of seedlings e.g. nursery receipts)
- Planting method (in the case of the pilot project, this included augering holes, fertiliser use)
- Timing of planting
- Fuel use (in the case of the pilot, volunteers coming to the plantings (estimated from volunteer sign on sheet); augers; contractors doing spraying and other maintenance (recorded kilometres). Emissions from these are accounted for in calculating ACCUs.

The pilot project developed a template based on the requirements of the methodology ('Project Diary'; see Appendix 3 for the completed template for the pilot project) the (Part 5, Division 5.3 of the Methodology). The completed template satisfied the information needs of the initial audit in the pilot project and should be sufficient for other projects.

4.4 Project report and application for ACCUs

Project proponents are required to submit Project Reports to the CER to claim ACCUs. It would probably be sensible to wait until site capture (i.e. 3-4 years after planting) to submit the first Project Report. This would mean that most of the project maintenance would have been completed during the time covered by the first project report and that subsequent reports would be more straightforward (see Audit section, below). However, because it was intended that the process be trialled during the pilot project, a project report and application for ACCUs was submitted after ca. 18 months. The report only covered the first 12 months (i.e. 1/4/17 to 31/3/18), but a further 6 months was required to prepare for and undergo the initial audit. Appendix 4a shows the completed first project report for the pilot project. It took approximately one hour to complete the Project Report in the pilot project. Once again, using this guide should reduce the time it takes for similar projects to complete their Project Report.

On acceptance of the Report (and Audit, see below) by the CER, the Freeman's Forest pilot project was awarded 41 ACCUs (Appendix 4b).

Project reports and applications for ACCUs can be submitted at any time (after the first 6 months) throughout the 25 year crediting period. Three of these reports (including the first one) must be accompanied by an audit report. This is set out in the project registration for each project (see Appendix 2b).

4.5 Initial Audit

Periodic, compulsory project audits are the main way of ensuring project compliance with the CFI Act.

The CER will develop an audit schedule for each project. It typically will include 3 scheduled audits throughout the project. For the pilot project, audits were scheduled as follows (Appendix 2b):

- After September 2017 (i.e. 6 months from project start)
- After September 2025
- After September 2033

Additional audits may be required by the CER, for example if the /amount of carbon claimed by a project is outside the variance audit threshold for the project (in the case of the pilot project, this was any single report claiming 100,000t$CO_{2\text{-}e}$ or more).

Audits must be undertaken by a registered auditor; a list of auditors is available on the CER website http://www.cleanenergyregulator.gov.au/Infohub/Audits/register-of-auditors. The cost of the Initial Audit may be up to $20,000, but this depends on the nature of the project (size, complexity, the need for a site visit, etc.), the nature of the client (community or commercial project) and how much work is required to be done by the auditor. The auditor (CarbonIntel; http://www.carbonintel.com.au/index.php/site/aboutus/) undertook their Initial Audit of the pilot project for a favourable rate, because of the community-based nature of the project and because a considerable amount of the preparatory work for the audit was done by TREAT members.

The Initial Audit for the pilot project was submitted for the first 12 months of the project (Appendix 5a). It took 6 months to complete the Initial Audit of the pilot project.

Subsequent audits are generally less expensive than the Initial Audit, although a range of factors affect their cost. Over the lifetime of a project, audit costs may be between $30,000 and $50,000. As with the initial audit, this variation in costs may arise from the size and complexity of the project, as well as how much work is required to be done by the auditor. Waiting until after site capture to undergo the Initial Audit and submit the first Project Report and Claim for ACCUs should help minimise the costs of subsequent audits because the auditors would only need to examine maintenance records and associated issues (e.g., fuel use) in their Initial Audit.

In the case of the pilot project, it was decided that the auditors would visit the site as part of their Initial Audit, partly because the nature of this ecological replanting project was quite different to the commercial planting projects CarbonIntel had been involved with. The site visit was an opportunity to explain the rationale behind the methods used in the project and to demonstrate early stage outcomes, as well as to observe the outcomes attained in other planting projects using similar planting methods.

4.6 Offsets Report

The requirements of the Offsets Report are set out in the Methodology (Part 5, Division 5.4). The completed Offsets Report must be examined by the Auditor and uploaded as an attachment to the online Project Report. The pilot project developed a template for the Offsets Report which was accepted by both the auditor and CER (completed Offsets Report template for the pilot project is in Appendix 5b).

The paperwork for the Offsets report would take around one hour to complete, while the required FullCAM modelling and production of verified outputs may take at least a week of work, once familiar with the software (see Section 9). Appendix 6 sets out important information for consideration in the use of FullCAM and information about what was done for the pilot project. Appendix 7 shows the calculations used.

One of the experiences of throughout the pilot project was that the program is complex and the information available on the CER website is not always easy to find or understand and is sometimes conflicting, for example when superseded information remains available, or terms change or are used incorrectly.

Table 1. Summary of the work undertaken during the Freeman's Forest carbon farming pilot project[1]

Activities	Summary of lessons from pilot	Useful or required skills or materials
Determine Project Proponent	In the pilot project it was expedient to use a TREAT member with existing registration as the Project Proponent. It was therefore necessary to prove legal right of the Project Proponent because they weren't the landholder. A Project Proponent could be a landholder or community group. Legal advice received during the Pilot Project suggest that TREAT would qualify as a Project Proponent.	Access to legal advice if the Project Proponent is other than the legal owner of the property.
Project Registration	Need to select from the Approved Methodologies which of these will be used in the project. Need to accurately define the project area. Paperwork fairly straightforward.	GIS software and skills Ability to use FullCAM
Planting and record keeping	Planting using usual TREAT methods. Record all on-ground activities relating to site preparation, planting and maintenance, including kilometres travelled, fertiliser use etc.	Record-keeping template (Appendix 3)
Prepare Project Report and Claim for ACCUs	Paperwork fairly straightforward.	See Appendix 4
Audit and Offsets Report	FullCAM modelling Auditor	Confidence in the use of FullCAM, understanding of alternative FullCAM model settings Offsets Report template (Appendix 5)

[1]Most of the time that was taken to administer the pilot project, undertake Project Registration, prepare the Project and Offsets Reports, provide information to the auditors, co-ordinate the auditor site visit, and consult with legal advisors was undertaken on a voluntary basis (by David Hudson).

5. Factors that affect the economic outcomes of carbon farming

During the Freeman's Forest pilot project it became clear that there can be substantial variation in the economic costs and benefits of carbon farming. For example, the area of the project has a big influence on the economic outcomes, because the cost of auditing is fixed for a project, while both the costs of establishment and carbon credits (income) earned, increase with project size. Furthermore, the costs of auditing and the price received for carbon credits are not fixed. In order to get some idea of the economic outcomes under different scenarios, the pilot project developed a calculator to factor in variation in a range of variables that affect the costs and income associated with carbon farming (Table 2). The way that these factors are incorporated into the model is shown in Table 3.

Table 2. Factors in the calculator and their relationships to carbon farming costs and income

Factor	Units	Rationale
Project area	Hectare (ha)	• Varies depending on project • Positively related to the cost of establishing the planting • Positively related to the from number of carbon credits earned

Number of properties	#	• Relevant to aggregated (group) projects
		• Likely to be positively related to the time (costs) required to:
		  • determine the project proponent
		  • develop understanding of the requirements of registration
		  • negotiate agreements in relation to rights to carbon credits
		  • amend registration in response to any change in ownership or other relevant status etc.

Site preparation	$/ha	• No fixed price; estimates used in pilot project informed by TREAT experience: $2, 200 preparation; $17,800 planting; $13,000 3 years maintenance • Positively related to the cost of establishing the project • Increases with project area, but may not be linear (i.e. there may be some economies of scale with larger projects) • May interact with number of properties (i.e. if they are not adjoining) • Often covered by grant funding
Planting	$/ha	
Post-planting maintenance	$/ha	
Carbon price	$/ACCU	• No fixed price on secondary market; values between $18 and $30/ACCU were used • Positively related to the income derived from each ACCU earned • May be increased for biodiverse ecological plantings
Number of ACCUs earned	#/ha	• Fixed at 790 ACCUS/ha over 25 years for the pilot project (calculated from FullCAM) • Number may vary if different settings were used in FullCAM or an alternative method (e.g. direct measurement of stems) for estimating carbon stocks was used.
Audit costs	$ for project lifetime	• Varies depending on auditing company used, project complexity, amount of information able to be provided to the auditors • Different cost scenarios used in pilot project: $30,000, $40,000 and $50,000

Administrative costs		• May be undertaken by volunteers or costed to staff or contractors
		• Costs may include:
		  • costs of project management and administration
		  • legal costs (e.g. for aggregated projects; to assign right to ACCUs)
		  • costs to mortgage holders etc

The example scenarios in Table 3 show the economic outcomes when different factors vary under three basic scenarios:

1. **Best case scenario:** where planting costs are funded and the audit costs are low (i.e. $30,000 over the project lifetime

2. **High audit costs scenario:** where planting costs are fully funded but the audit costs are $50,000 over the project lifetime

3. **Partial funding scenario:** where the audit costs are low ($30,000) but the costs of maintenance ($13,000/ ha) are not covered

Under these scenarios, different values are used in particular cases, as follows:

Project area	Small 1ha	Large 3ha	
Number of properties	Individual (1)	Group (3)	
Planting costs	Full funding $0	Partial funding $13,000/ha	
Audit costs (lifetime)	Low $30,000	High $50,000	
Administration costs	None	Low $1000/property	High $5000/property
Carbon price	High $30/ACCU	Moderate $25/ACCU	Low $20/ACCU

Using these figures, a 1ha project will not deliver an economic return, even when the carbon price is high ($30/ACCU), audit costs are low and there are no administration costs. The carbon price would have to be $38/ACCU to deliver an economic return (of $20 over 25 years).

Under the best case scenario, a 3ha project will deliver economic returns under high ($30/ACCU) and moderate ($25/ACCU) carbon prices, even when administration costs are high ($5000/property), but not if administration costs are high and the carbon price is low ($20/ACCU).

Under the high audit cost scenario, 3 ha projects deliver returns when the carbon price is high; under a moderate carbon price scenario, economic returns would be gained only if administration costs were zero or low ($1000/property). When audit costs are high and the carbon price is low, a 3 ha project cannot deliver an economic return using the settings in these examples.

Under the limited funding scenario, a 3 ha project does not deliver a financial return even if the audit costs are low, administration is zero and the carbon price is high.

Table 3. Calculations used to derive overall economic outcomes for different project scenarios

The first row in the Table shows the factors and how they are used to calculate economic outcomes for different scenarios. Three example scenarios explored in the pilot project are shown after the first row**: 1. Best case scenario: Planting costs fully funded, low audit cost; 2. High audit cost scenario: Planting costs fully funded; high audit costs; 3. Limited funding scenario.** For each of the three scenarios, several cases are considered. For each scenario, the costs that are held fixed are shown in bold in the first row, while the rows below show the values for factors that vary with each of the cases (Project area, Number of properties (aggregation), Administration and Carbon price).

Example scenario	Project area (ha)	No. properties	Site prep ($)	Planting ($)	Maintenance ($)	Audit cost over 25 years ($)	Administration/property over 25 years ($)	**TOTAL COST over 25 years**	Carbon price ($/ACCU)	No. ACCUs/ha	Project Carbon credits over 25 years	**TOTAL INCOME over 25 years**	**ECONOMIC BALANCE**
	a	*b*	*c*	*d*	*e*	*f*	*g*	*(a*c)+(a*d) +(a*e) + (b*g) + f*	*A*	*B*	*(a * B)*	*(a*B)*A*	TOTAL INCOME – TOTAL COST
1. Best case scenario: Planting costs fully funded, low audit cost			**0**	**0**	**0**	**$30,000**				**790**			
i. High carbon price – 1 ha, no admin	1	1	0	0	0	$30,000	0	$ 30,000	30	790	790	$23,700	-$6300
ii. High carbon price – 3 ha, no admin	3	1	0	0	0	$30,000	0	$ 30,000	30	790	2370	$71,100	$41,100
iii. High carbon price- 3ha with aggregation, small admin costs	3	3	0	0	0	$30,000	1000	$33,000	30	790	2370	$71,100	$38,1000
iv. High carbon price – 3 ha with aggregation, high admin costs	3	3	0	0	0	$30,000	5000	$45,000	30	790	2370	$71,100	$26,100
v. Moderate carbon price – 1 ha, no admin	1	1	0	0	0	$30,000	0	$30,000	25	790	790	$19,750	-$10,250
vi. Moderate carbon price – 3 ha, no admin	3	1	0	0	0	$30,000	0	$ 30,000	25	790	2370	$59,250	$29,250
vii. Moderate carbon price – 3 ha with aggregation, small admin	3	3	0	0	0	$30,000	1000	$33,000	25	790	2370	$59,250	$26,250

Example scenario	Project area (ha)	No. properties	Site prep ($)	Planting ($)	Maintenance ($)	Audit cost over 25 years ($)	Administration/property over 25 years ($)	**TOTAL COST over 25 years**	Carbon price ($/ACCU)	No. ACCUs/ha	Project Carbon credits over 25 years	**TOTAL INCOME over 25 years**	**ECONOMIC BALANCE**
viii. Moderate carbon price – 3 ha with aggregation, high admin	3	3	0	0	0	$30,000	5000	$45,000	25	790	2370	$59,250	$14,250
ix. Low carbon price – 1ha, no admin	1	1	0	0	0	$30,000	0	$30,000	18	790	790	$14,220	-$15,780
x. Low carbon price – 3 ha, no admin	3	1	0	0	0	$30,000	0	$30,000	18	790	2370	$42,660	$12,660
xi. Low carbon price – 3 ha, aggregation, small admin	3	3	0	0	0	$30,000	1000	$33,000	18	790	2370	$42,660	$9,660
xii. Low carbon price – 3 ha, aggregation, high admin	3	3	0	0	0	$30,000	5000	$45,000	18	790	2370	$42,660	-$2340
2. High audit cost scenario: Planting costs fully funded; full audit costs			**0**	**0**	**0**	**$50,000**				**790**			
xii. High carbon price – 1 ha, no admin	1	1	0	0	0	$50,000	0	$50,000	30	790	790	$23,700	-$31,300
xiii. High carbon price – 3 ha, no admin	3	1	0	0	0	$50,000	0	$50,000	30	790	2370	$71,100	$21,100
xiv. High carbon price- 3ha with aggregation, small admin costs	3	3	0	0	0	$50,000	1000	$53,000	30	790	2370	$71,100	$18,100
xv. High carbon price – 3 ha with aggregation, high admin costs	3	3	0	0	0	$50,000	5000	$65,000	30	790	2370	$71,100	$6,100
xvi. Moderate carbon price – 1 ha, no admin	1	1	0	0	0	$50,000	0	$50,000	25	790	790	$19,750	-$30,250
xvii. Moderate carbon price – 3 ha, no admin	3	1	0	0	0	$50,000	0	$50,000	25	790	2370	$59,250	$9250
xviii. Moderate carbon price – 3 ha with aggregation, small admin	3	3	0	0	0	$50,000	1000	$53,000	25	790	2370	$59,250	$6250
xix. Moderate carbon price – 3 ha with aggregation, high admin	3	3	0	0	0	$50,000	5000	$65,000	25	790	2370	$59,250	-$5750

Example scenario	Project area (ha)	No. properties	Site prep ($)	Planting ($)	Maintenance ($)	Audit cost over 25 years ($)	Administration/property over 25 years ($)	**TOTAL COST over 25 years**	Carbon price ($/ACCU)	No. ACCUs/ha	Project Carbon credits over 25 years	**TOTAL INCOME over 25 years**	**ECONOMIC BALANCE**
xx. Low carbon price – 1ha, no admin	1	1	0	0	0	$50,000	0	$50,000	18	790		$14,220	-$35,780
xxi. Low carbon price – 3 ha, no admin	3	1	0	0	0	$50,000	0	$50,000	18	790		$42,660	-$7340
3. Partial funding scenario:			**0**	**0**	**$13,000**	**$30,000**				**790**			
xxii. High carbon price – 1 ha, no admin	1	1	0	0	$13,000	$30,000	**0**	$43,000	30	790	2370	$23700	-19,300
xxiii. High carbon price – 3 ha, no admin	3	1	0	0	$13,000	$30,000	**0**	$69,000	30	790	2370	$71,100	-2,100

6. Key issues and proposed actions identified in the Freeman's Forest pilot project

Carbon farming offers opportunities for economic return on ecological planting in the Tablelands. Given the current prices obtained for carbon credits and the standard FullCAM method for calculating carbon stocks, the high costs of compliance (project audits) mean that small (1ha) projects are not able to deliver financial return. If audit costs were waived or substantially reduced, &/or the return on carbon credits was substantially higher than can currently be expected, &/or substantially higher carbon stocks were credited to ecological planting, small plantings could be economically viable as carbon farming projects. Earlier work has shown that ecological planting stored significantly more carbon than monoculture conifer plantings or mixed species timber plantations after ca. 15 years (Kanowski and Catterall, 2010).

It is possible that audit costs could be reduced for ecological plantings, for example if it was agreed that ecological plantings undertaken using 'typical' methods could be subject to limited auditing. Higher prices for carbon credits earned by ecological plantings is realistic if a market for biodiverse carbon or similar were accessed. During the pilot project it was discussed with Terrain NRM and other parties interested in carbon farming that these considerations may be able to be progressed through representation to the Australian government by the Queensland *Land Restoration Fund* (LRF). The LRF has an explicit interest in promoting carbon farming with co-benefits (such as biodiversity). The possibility of the LRF also furthering options for carbon accounting methodology that accounts for the actual carbon stocks in ecological plantings was also proposed.

Action 1. That Terrain NRM take the lead on discussions with the LRF about representation to the Australian government in relation to reducing audit costs and approving a carbon accounting methodology for ecological plantings in the Tablelands.

Action 2. That Terrain NRM take the lead on discussions with the LRF about developing practical understanding of a market for biodiverse carbon from ecological plantings.

Economies of scale arise with larger projects (e.g. 3 ha) because the audit costs are per project and not necessarily related to project size. Larger projects would not necessarily need to be on the one property or even to be contiguous. In this case, aggregating plantings on multiple properties into a single project would be required. Tablelands organisations such as SATRA, TREAT and Terrain NRM may be in a good position to aggregate replanting projects as an established, effective forum for collaboration on replanting. There are also commercial aggregators that may be interested. To put this into practice it would be necessary to understand:

- the work required to negotiate aggregated projects, and associated costs (in relation to economic returns); and
- issues associated with change of ownership; change of heart or damaging events on one property requiring renegotiation of registration of all properties.

In terms of the potential for an organisation such as TREAT to accrue carbon credits in order to fund ongoing work on ecological planting, it would be necessary for property owners to assign the rights to carbon credits earned from projects on their property to the organisation. Considering that the planting work would be publicly funded, and that most landholders who support ecological planting on their properties do so on an altruistic basis, it is reasonable to expect that this would often be acceptable, but would likely require some amount of additional negotiation.

Action 3 TREAT take the lead on discussing carbon farming with landholders of candidate planting properties. This could begin with a field day and workshop, in conjunction with a launch of this report.

PART II. How to run an ecological planting as a carbon farming project

Part II of this report is intended to set out the steps required to operate a carbon farming project in relation to ecological planting on the Tablelands. The information provided here is based on implementation of the pilot project, review of available material on-line, discussions with lawyers and accredited auditors.

7. Relevant organisations

With carbon farming in Australia you are dealing with two Government organisations and you will require an independent (private) carbon auditor.

Carbon farming is *managed* nationally by the **Clean Energy Regulator** (**CER**, an Australian Government Independent Statutory Authority). This is the organisation that registers your project and to whom you report and request **Australian Carbon Credit Units** (**ACCU**s).

The *methodologies* used to carry out various carbon farming options are currently administered by the Australian **Department of Environment & Energy (DEE)**. This is the organisation that determines what you can and cannot do to earn ACCUs (including the use of FullCAM; see Section 9.1).

7.1 The Clean Energy Regulator

The Clean Energy Regulator (CER) comprises:

- The "Regulator" consisting of a Board with Chair (ie the decision making body); and
- The agency (the operating organisation), responsible for implementing:

1. The Emissions Reduction Fund (ERF), which provides incentives to reduce emissions under the *Carbon Credits (Carbon Farming Initiative) Act 2011* (the "Act");
2. The Renewable Energy Target (RET), which aims to reduce emissions in the electricity sector, under the *Renewable Energy (Electricity) Act 2000*;
3. The National Greenhouse and Energy Reporting Scheme (NGER), which provides for standardised reporting, under the *National Greenhouse and Energy Reporting Act 2007*; and
4. The Australian National Registry of Emissions Units, an electronic system to track Australian Carbon Credit Units (ACCUs) under the *Australian National Registry of Emissions Units Act 2011*.

Carbon farming is one of a number of options that can be carried out under the Emissions Reduction Fund (ERF; 1. above).

It is important for those interested in establishing an 'on-ground' emission reduction project that they are familiar with the Clean Energy Regulator agency's Emissions Reduction Fund web pages (somewhat confusing, partly because they also reference legislation and methods managed by the Department of Energy & Environment).

8. Sequence of steps required to run a carbon farming project

The main steps required to run a carbon farming project are explained in Sections 8.1 – 8.10, together with links to the online locations of relevant information or forms.

It is strongly advised that current information be sought via the CER website at the time of project planning; it was clear during the pilot project experience that rules, guidelines and methods change over time.

8.1 Determine project proponent

A project Proponent needs to be a "person' in legal terms. A 'person' can include an individual, body corporate, a trust, a corporation sole (e.g., a sole proprietor), a body politic (e.g., a government body) or a local governing body (e.g., a local council).

Before submitting a project application the proponent must pass a 'fit and proper person' check. The 'person' must also be prepared to accept a range of legal obligations for the life of the project. http://www.cleanenergyregulator.gov.au/ERF/Want-to-participate-in-the-Emissions-Reduction-Fund/Planning-a-project/participant-obligations

The process of obtaining 'Fit and Proper Person' status is more straightforward for an individual than the other entities listed above. However, Once established (e.g., for a community group) the regulator would only need to be notified of any subsequent change, such as if the group or one of its executive was convicted of a relevant offence.

8.2 Register the project

The registration of a proposed project should start as least 4-6 months before the planned commencement of site preparation to allow for up to 3 months processing time once the application is submitted. The time needed to prepare the application and gather together all the necessary information will vary depending on the complexity of the project (e.g. number of landholders involved etc.).

8.3 Eligibility

Eligibility of the proposed project can be checked using the interactive questionnaire: http://www.cleanenergyregulator.gov.au/ERF/About-the-Emissions-Reduction-Fund/eligibility-to-participate-in-the-emissions-reduction-fund Table 4. provides details about eligibility requirements.

8.4 Client Portal Login

Sign up to the CER Client Portal (free) https://portal.cleanenergyregulator.gov.au/signup

Client information form. This must be submitted either before or together with the project application form. http://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/CER-CI-001---Client-information-form.aspx

8.5 Project application

The project application form and relevant Annexes must be completed to apply to register a carbon farming project. http://www.cleanenergyregulator.gov.au/ERF/Forms-and-resources/apply-to-participate. Table 5 provides more information.

Table 4. Eligibility requirements

Requirements of eligible projects	Relevance and implications for ecological plantings on the Tablelands
to be carried out in Australia	All projects eligible
satisfies the newness criterion http://www.cleanenergyregulator.gov.au/ERF/Want-to-participate-in-the-Emissions-Reduction-Fund/Planning-a-project/Eligibility-and-newness	Activities for the project must not have already been undertaken. This includes: • preparing soil for seeding or planting that is for the purposes of the project • seeding, planting or fertilising plants that are for the purposes of the project • installing an irrigation or drainage system for the purposes of the project. It does not include growing plants in a nursery, conducting negotiations or developing project plans.
is not required by law to be carried out (with some exceptions) http://www.cleanenergyregulator.gov.au/ERF/Want-to-participate-in-the-Emissions-Reduction-Fund/Planning-a-project/regulatory-additionality-and-government-programs	Not usually relevant to ecological plantings. Relates to situations where planting is being undertaken to development offsets, court orders to to reinstate vegetation etc.
proposed by a person who has had their identity confirmed and assessed against the Fit and Proper Person requirements by completing and submitting the necessary AFP National Police Check form. The test includes assessment of capability and competency, integrity and good character. http://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/AFP-National-Police-Check---Clean-Energy-Regulator.aspx	Determination of the project proponent will need to consider the factors in the test to ensure compliance.
does not rely on income from ACCUs to finance the start of the project	The commencement of the planting cannot depend on funds from the sale of ACCUs that are expected to be earned by the project in the future. This means that there must be actual funds available currently to do site preparation and planting. These funds may come from the sale of ACCUs earned by previous carbon farming projects, or from grants (except for certain government programs, see below), or from private investment. Ongoing maintenance of the planting may be financed by the sale of ACCUs from the project.
proposed by a person with the legal right to conduct project activities and exclusive right to claim ACCUS achieved by the project. If the project has multiple participants, all must have legal right to carry out the project and meet compliance obligations. Includes consideration of how *The Native Title Act 1993* interacts with the ERF requirements.	Determination of the project proponent will need to consider the factors that affect legal right.

Requirements of eligible projects	Relevance and implications for ecological plantings on the Tablelands
http://www.cleanenergyregulator.gov.au/ERF/Want-to-participate-in-the-Emissions-Reduction-Fund/Planning-a-project/Legal-right	
does not receive funding, rebates or other financial incentives from other government programs, including the 20 Million Trees program. It is important to contact the CER to clarify whether any funding associated with the project makes it ineligible http://www.cleanenergyregulator.gov.au/About/Contact-us	If the planting is funded under the 20 Million Trees program, it **cannot** be registered as a carbon farming project. Examples of other government programs that are excluded from funding a carbon farming project are State and Federal programs that aim to improve energy efficiency or increase renewable energy which would not be relevant to ecological planting on the Tablelands. It is worth double-checking with the CER for their current list of excluded programmes.
is to be implemented using approved methods.	To be consistent with the usual methods used for ecological planting (Moran et al), the 2 most relevant approved methodologies (at the time of writing) are: 1. Reforestation by environmental and mallee plantings - FullCAM http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector/Vegetation-methods/Reforestation-by-Environmental-or-Mallee-Plantings-FullCAM 2. Reforestation and afforestation 2.0 http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector/Vegetation-methods/Reforestation-and-Afforestation Method 1 uses a standard set of equations (FullCAM) to estimate the amount of carbon sequestered by the planting; Method 2 requires that carbon stocks be estimated by removing and measuring some of the planted trees. The Freeman's Forest pilot used Method 1. A third approved methodology (Plantation Forestry) may be applicable to some replanting on the Tablelands 3: http://www.cleanenergyregulator.gov.au/ERF/Pages/Choosing a project type/Opportunities for the land sector/Vegetation and sequestration methods/Plantation-forestry-method More information on approved methodologies is provided in Section 9 and Appendix 6).

Table 5. Project application

Components of project application	Relevance and implications for ecological plantings
Participant details.	
Appointment of nominee (if multiple participants in a project). Where there are multiple participants in a project, one must be appointed as nominee and written consent to this effect provided by each participant. The nominee will be the primary contact for all participants and will be authorised to act on behalf of all participants in relation to the CER.	This would apply for example to an aggregated project or in situations where the proponent Is not the landholder (i.e., where the ACCUs are assigned to a party other than the landholder).
Project name. A unique project name is required.	
Applicable methodology. This has to be one of the approved methodologies	See Section 9.
Annex A Sequestration project. Additional information. For a sequestration project, Annex A is required to be completed and attached to the project application. This form requires the following information:	Ecological planting projects will need to complete Annex A
Description of project location and area(s)	The description must take the form of a text description. A single project may be undertaken in multiple areas; in this case, each of the areas must be described.
Land title information for all properties covered by the project	
Geospatial files that clearly show the project area. Guidelines: http://www.environment.gov.au/climate-change/government/emissions-reduction-fund/publications/cfi-mapping-guidelines	Preparation of these files requires GIS capabilities.
Description of project and activities	
Description of skills and expertise of person(s) intended to be used to carry out project work	
Permanence period. There is a requirement that registered carbon farming projects have “permanency”. Under the Act, permanent plantings are plantings that are not harvested[4]. The	Since ecological replantings are usually intended to be retained in perpetuity, so a 100 year permanence period would usually be chosen. However, this is binding on the

[4] Harvesting may be undertaken for:

- thinning for ecological purposes;
- to remove debris for fire management;
- to remove firewood, fruits, nuts, seeds, or material that is to be used for fencing or as craft materials, if those things are not removed for sale; or in accordance with traditional Indigenous practices or native title rights.

permanence period is fixed at either 25 or 100 years at the beginning of the project and cannot be changed afterwards. If a 25 year permanence period is chosen, a discount of 20% is applied to any ACCUs earned; that is, less ACCUs are earned for projects with 25 year permanence, compared with projects with a 100 year permanence.	current and future landholder(s), unless they withdraw from the program (and return any ACCUs earned up to that point).
Forestry managed investment scheme. Identify which scheme, if applicable.	Not usually relevant to ecological plantings
Natural Resource Management (NRM) Plan. Identify NRM Plan covering the area and how the project is consistent with the Plan.	In the Tablelands, Terrain NRM's *Wet Tropics Plan for People and Country* is the relevant NRM Plan. https://www.wettropicsplan.org.au/ It identifies the Tablelands as a priority area - both regionally and nationally - for carbon sequestration and many parts of the Tablelands as important for revegetation for biodiversity.
Eligible interest holder consent. It is necessary to obtain the consent of all persons or organisations holding an eligible interest in the land on which the propose project will run. This will generally include those persons or organisations listed on the land title as having an interest in the property, and may include financial institutions that hold a mortgage over the property, registered native title bodies, or (in the case of Crown land), the relevant Minister. The consent form is a legal document that confirms that the eligible interest-holder(s) understand the details of the proposed project and any risks or benefits to them.	Guidance: http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector/eligible-interest-holder-consent Form: http://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/Eligible-interest-holder-consent-form.aspx
Start date. The date on which the project crediting period will start. It is optional to nominate start date; if no date is nominated, the date the project is registered becomes the start date.	

Crediting period. The period for a sequestration project is usually 25 years and is the period of time for which carbon credits can be accrued. The crediting period may not necessarily be the same as the contract period	For ecological plantings that include slower-growing species, extension of the crediting period may be beneficial because the additional carbon accrued over subsequent decades would be accounted for. This is in discussion at the time of preparing this report.
Forward abatement estimate (FAE). The FAE is a best estimate of the number of ACCUs likely to be earned by the project for the total crediting period. The FAE is used to schedule reporting and auditing for the project. To make a reasonable FAE: • identify the types of activities planned • identify how many locations you are planning to undertake the various activities at, and • use the method calculations, other tools or expert advice to guide your estimates of abatement. For tree planting, the FullCAM model may be used to estimate carbon sequestration over time; if a new accounting method is approved that more fully accounts for the carbon sequestered in ecological tree plantings, this would provide a more accurate estimate (i.e. FullCAM will underestimate the actual amount of carbon sequestered by these plantings, but if the absence of other approved methods, this is the method that would have to be used). It is expected that there will be variation between the FAE and actual carbon sequestration (documented in subsequent project reports). In the event of underestimation, additional audits (trigger variance audits) may be required. Overestimation of FAE may result in a reduced number of schedule audits.	The ability to use FullCAM requires a fair level of technical background, skills and experience. A TREAT member with a professional background in forestry was able to undertake the FullCAM analysis for the pilot project. In other cases, it may be necessary to have this work completed on a fee-for-service basis. http://www.cleanenergyregulator.gov.au/ERF/Want-to-participate-in-the-Emissions-Reduction-Fund/Step-1-Apply/Forward-abatement-estimates
Peak abatement period. This information is generated by the FAE modelling.	
Regulatory approvals. The application requires that any regulatory approvals (Commonwealth, State, Local approvals, permits and	An explanation must be provided if no approvals are required. This is not likely to be relevant In the case of ecological replanting on the Tablelands, but should be checked.

licence requirements) have been obtained and that these are listed and described.	
Additional information about project participants. Any convicted offences (specified in rules 61 and 62 of the *CFI* Act) relating to any of the project participants must be recorded. They may have occurred since submission of Client Information. Information from the 3 year period before the making of the application is also required, as are details of remedial actions. The application also requires that participants disclose if they have ever been refused registration in a renewable energy or energy efficiency scheme, had their registration cancelled, or been suspended from such a scheme.	This should be clarified during project negotiations.

8.6 Open ANREU account

An ANREU account is required in order to receive any ACCUs generated by the project. An ANREU account is not needed at the time of registration but an application for an ANREU account must have been submitted by the time of the first project report.

Guidance: http://www.cleanenergyregulator.gov.au/DocumentAssets/Pages/Guidance-for-opening-an-ANREU-account-and-for-participating-in-the-ERF.aspx

Link to application: http://www.cleanenergyregulator.gov.au/ERF/Forms-and-resources/apply-to-participate#Open-an-ANREU-account

8.7 Project Report and Crediting Application

Project proponents are required to submit Project Reports to the CER to claim ACCUs. See Appendix 4. Project reports and applications for ACCUs can be submitted at any time (after the first 6 months) throughout the 25 year crediting period. Three of these reports (including the first one) must be accompanied by an audit report. This is set out in the project registration for each project (see Appendix 2b).

8.8 Audit and Offset report

Periodic, compulsory project audits are the main way of ensuring project compliance with the CFI Act (to prove that a valid carbon abatement project has been carried out) and must be carried out by a registered, external auditing organisation. A schedule of audits required for the project is provided by the CER in the contract at project registration and depends on the profile of each project, but typically includes 3 scheduled audits over 25 years (the usual abatement period). Additional audits may be required as notified by the CER. Completion of the audit may or may not require a site visit. The Audit Offsets report for the Freeman's Forest pilot project is in Appendix 5.

8.9 Notification of events

If there is a 'growth disturbance' because of cyclone, flood or fire, the area affected needs to be mapped within 6 months. If more than 5% of the area of the project has been affected, this must be mapped and accounted for in the offsets report that relates to the period of time when the growth disturbance occurred. If the whole area has been affected, then it needs to be revised and labelled accordingly, e.g., 'disturbance affected stratum'. There is no penalty (i.e., requirement to pay back carbon credits) if carbon sequestration potential is lost (i.e., trees are killed) due to bushfire, drought, disease or the need to establish fire breaks. However, landholders have to take "reasonable action to ensure that carbon stores are re-established following natural disturbances". Carbon stores may recover naturally with only modest intervention, but in some cases active re-establishment or management may be necessary. Project proponents will not receive credits while the carbon stores are recovering. In the case of ecological plantings on the Tablelands, the number of stems planted usually far exceeds the minimum requirement for carbon plantings, so damage would have to be very severe to reduce the carbon storage potential.

8.10 Additional important information

8.10.1 Cancelling projects

Landholders can choose to cancel their project at any time, for example because they wish to sell the land without the project or use the land for something else. If they do this, they must hand back to the Administrator any credits that have been earned on the project. Credits could be purchased at the prevailing market price or the proponent could use credits from another of their projects.

8.10.2 Insurance

A risk buffer of five per cent of the carbon sequestered by the project will be applied to all sequestration projects. This means that for every 100 tonnes of carbon stored by a project, only 95 credits will be issued. The remaining five per

cent will insure the entire scheme against some residual risks that can't be managed by the other permanence arrangements, including the:

- temporary losses associated with a disturbance event such as bushfire, and
- long-term losses that may result from a proponent failing to re-establish carbon stores and relinquish units.

The risk of reversal buffer does not insure project proponents against the potential loss of income following a disturbance or for the costs of re-establishing carbon stores. Other mechanisms such as private insurance, or carbon pooling and diversification, may be suitable options for proponents to manage these risks.

8.10.3 Monitoring, record-keeping and reporting

Projects have to be monitored to ensure that rules relating to restricted activities are met, that the CFI Mapping Guidelines are met, and to collect information about management and disturbance events within the project area.

A series of records have to be kept to show:

a. evidence that there was no forest cover in the project area before project commencement;
b. a description of how each carbon estimation area was identified;
c. evidence to justify stratification within the project area, including any of the following:
    i. planting or management records;
    ii. soil, vegetation or landform maps;
    iii. monitoring records;
d. evidence of all plant species established within each carbon estimation area, including the stocking density and tree proportion at establishment;
e. date stamped FullCAM output files (.plo file) for each carbon estimation area modelled using FullCAM;
f. information regarding fires occurring in a carbon estimation area, including:
    i. the date the fire occurred;
    ii. the location of the fire;
    iii. the proportion of the carbon estimation area affected by the fire; and
    iv. the percentage of trees that were killed by the fire;
g. information regarding each Equation in Division 4.3, including:
    i. all input data;
    ii. the result; and
h. records relating to fuel use on project activities.

In addition, records of management events (planting, weed control, fertiliser) and disturbance events need to be kept.

There are specific requirements for the different offsets reports; certain information is required in the first offsets report, with different information needed in subsequent reports.

9. Approved methodologies for accounting for carbon stocks in planting

Registered carbon farming sequestration projects have to meet the criteria set out by certain "approved methodologies" determined under the Act. These methodologies establish detailed rules about the minimum density and canopy cover a planting project needs to achieve and describes the way to estimate the amount of carbon sequestration achieved. The methodologies also set out the rules for monitoring, record-keeping and reporting.

There are three approved methodologies – i) *Reforestation by Environmental and Mallee Plantings*; ii) *Reforestation and Afforestation 2.0*; and iii) *Plantation Forestry* - that could apply to the types of ecological plantings undertaken on the Tablelands (Figure 3). Under all methodologies, planting must be done using trees species with the potential to grow to a height of at least 2m, and the planted stem density must develop a crown cover of at least 20% on the site.

Ecological plantings on the Tablelands will typically very easily meet these criteria[5]. Under all methodologies, information is needed about the mature crown diameter of species planted. For a tree species that develops a 4m diameter crown at maturity, this would mean that 159 stems need to be planted per hectare. Most ecological plantings on the Tablelands would establish 100% crown cover and use a stem density closer to 3000 stems/ha. Similarly, these plantings would attain well over 2m in height.

Under all of these methodologies, plantings are done on cleared land that was previously used for grazing or cropping or left fallow for at least 5 years before planting OR, in the case of Reforestation by Environmental and Mallee plantings, had been grazed, cropped or fallow for over 5 years or otherwise been cleared land under settlement, used for nature conservation or not at all.

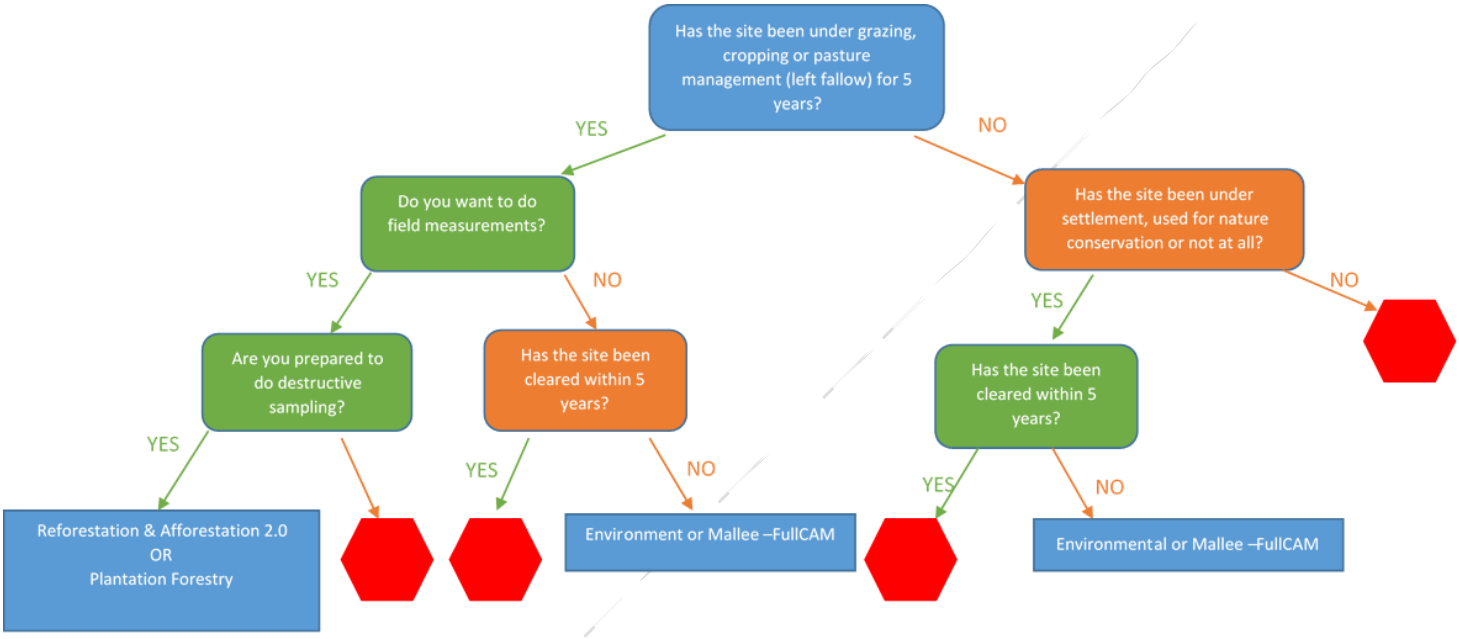

Figure 3. Decision tree for selecting the appropriate approved methodology for planting seedlings or seeds on cleared land to establish permanent forest cover. The red stop sign indicated that there is currently no approved method. Adapted from http://www.cleanenergyregulator.gov.au/ERF/Pages/Forms%20and%20resources/Planning%20a%20project/Part%202/index.html and http://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/Sequestration%20decision%20tree.pdf

However, currently only the Reforestation by Environmental or Mallee Plantings – FullCAM Verified carbon standard project is both suitable for small scale revegetation operations and does not require detailed measurement and monitoring (such as forest inventory and destructive sampling) to verify the carbon sequestered. This was the method used in the pilot project.

All methodologies have their own legislated **Methodology Determinations** and **Guidelines** (as separate documents) managed by the Department of Environment & Energy. The methodologies fall under one *Act* (*Carbon Credits (Carbon Farming Initiative) Act 2011*), its *Regulations* (*Carbon Credits (Carbon Farming Initiative) Regulations 2011*), and a *Rule* (*Carbon Credits (Carbon Farming Initiative) Rule 2015*).The methodologies fall under one *Act* (*Carbon Credits (Carbon*

[5] In fact, the actual amount of carbon sequestered from high density, high diversity ecological plantings is underestimated in all of the currently approved methodologies, since these types of plantings usually achieve 100% canopy cover and well over 2m in height. Development and approval of a new accounting method for these types of plantings would substantially improve the economic feasibility of ecological carbon farming plantings.

Farming Initiative) Act 2011), its *Regulations* (*Carbon Credits (Carbon Farming Initiative) Regulations 2011*), and a *Rule* (*Carbon Credits (Carbon Farming Initiative) Rule 2015*).

9.1 Reforestation by Environmental and Mallee Plantings – FullCAM verified carbon standard project

http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector/Vegetation-methods/Reforestation-by-Environmental-or-Mallee-Plantings-FullCAM

It is expected that the *Reforestation by Environmental and Mallee Plantings -FullCAM* methodology is usually going to be most suited to plantings done by SATRA member groups, because i) most planting sites will have not been actively grazed or cropped for longer than 5 years; ii) in general, these plantings are not intended to establish forestry plantations; and iii) the *Reforestation and Afforestation 2.0* method requires that some planted trees be pulled out of the ground so that their growth (carbon sequestration potential) can be measured. Mixed-species environmental plantings are eligible under this methodology. Mallee plantings in general are not relevant to the region in which SATRA member groups work, and anyway are restricted to areas that receive ≤ 600mm rainfall/year.

Rules and restrictions

This methodology is still strictly controlled and rules have to be followed, including a range of rules about stem spacing, depending on whether the planting is a narrow linear planting, wide linear planting, or a block planting. There are assumptions about rates of seeding survival (and different assumptions if direct seeding is used).

There are two options for estimating the stocking density for a carbon estimation area: A proponent can either:

- count every tree and shrub, and divide by the area of the carbon estimation area; or
- undertake systematic random sampling.

These counts can be done on-the-ground or using remotely-sensed imagery. Similarly, the proportion of trees to shrubs needs to be determined. On-ground measurements are to be done using a minimum of 10 plots per carbon estimation area, each of at least 0.01ha in size, and of varying shapes, depending on the shape of the carbon estimation area.

Grid overlays need to be established in accordance with requirements detailed in explanatory notes for this method.

There are also rules relating to competition from adjacent trees *"where competition has a material impact on sequestration in the planting".* Where there are trees adjoining a linear planting (narrow or wide), it is necessary to determine whether or not they are likely to cause a material difference in growth and sequestration achieved by that planting, because this will affect how accurately the model will estimate carbon sequestration from the planting.

There are a range of controls on the activities that can occur within the carbon estimation area, including the harvesting of fallen timber, other biomass, grazing and thinning. The use of lime and fertiliser is also controlled and affects the type of calibration that can be used.

CFI Mapping guidelines

The boundaries of the project area have to be delineated using the CFI Mapping Guidelines. If this area includes land that isn't planted under the program, this has to be mapped as an exclusion area.

A project can include more than one carbon estimation area; a given carbon estimation area must have uniform soil type, aspect, slope position, be planted with the same combination of plant species across the area, and managed under the same regime. Relevant management activities include:

- Site preparation

- Planting methods
- Thinning
- Weed control
- Fertiliser application

The project area can be stratified (divided) into different carbon estimation areas and exclusion zones, although if they are smaller than the 250m FullCAM grid size, there will be no improvement in the accuracy of the FullCAM modelling. The boundaries of the different carbon estimation areas and exclusion zones need to be defined in accordance with the CFI Mapping Guidelines, i.e., using field survey, aerial photographs, date-stamped, geo-referenced remotely-sensed imagery, or soil, vegetation or landform maps.

9.1.1 FullCAM

For the *Environmental and Mallee planting* methodology (and also *Plantation Forestry*), the amount of carbon that has potentially been sequestered for each carbon sequestration area at different points in time is estimated using the Full Carbon Accounting Model (FullCAM), which uses formulae to calculate the change in how much carbon is stored in a planting based on the biomass contained plants above and below ground, in the soil and as debris that is shed by plants (which gradually decomposes).

It is necessary to download and use FullCAM modelling software to estimate carbon sequestration. FullCAM Is a stand-alone computer modelling program that can be downloaded (free) from the Australian Government Department of Environment & Energy (DEE) website. Use of FullCAM requires a:

- continuing internet connection to the Australian Government FullCAM computer server (the FullCAM software searches for it automatically) to access data for creating new, and editing existing, plot files; and
- (decimal) latitude and longitude for the plot centre, otherwise you cannot move forward through the software to edit plot data.

FullCAM must be used in conjunction with the DEE Guidelines (which in fact are Rules because they state what can and cannot be done using the software), the CFI Mapping Guidelines, CFI rainfall map and a guide to the methodology (Note that the CFI has been superseded by the Emissions Reduction Fund (ERF), but the CFI name is still embedded in legislation titles and some of the methodologies referred to in documents. The ERF was under ongoing revision at the time of the pilot project).

Full CAM applies to most of Australia (where vegetation grows) and incorporates models for forest, agricultural and soils systems. It can be used at a number of levels, from the default level (which uses default data sets and is the most commonly used for carbon estimation) to the research and analysis level (where external data can be entered and tested). FullCAM provides for a broad number of forest and agricultural systems with only minimal additional information if using the default data provided by the Government FullCAM computer server.

For forests, FullCAM uses *Forest Productivity Indices* that change the shape of a normal ('S' shaped) plant growth curve, depending on the influences of soil class, climate, local environmental factors, tree species/ forest type and silvicultural (management) operations.

FullCAM must be used in conjunction with reading both the FullCAM Guidelines and FullCAM Methodology documents (see below). FullCAM is a generic carbon modelling tool so it can lead the user into misleading results. The computer interface also does not provide much explanatory information. Reading the FullCAM Guidelines is therefore essential in order to get started in FullCAM and to provide valid results. There are several documents that underpin the use of FullCAM:

- **Participating in the Emissions Reduction Fund; A guide to the reforestation by environmental or mallee plantings FullCAM method.** A relatively new document (undated, version 1)**,** produced by the *CER* which provides an overview of the *FullCAM method*:

<http://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/A%20guide%20to%20the%20reforestation%20by%20environmental%20or%20mallee%20plantings-FullCam%20method.pdf**.**

A rider in the document states:

'The Clean Energy Regulator is updating the information in this guide... general information about how to participate requires updating.'

However it is a good starting point.

Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014, Compilation No. 2; 17 February 2018 ("FullCAM Methodology"), the primary document for the methodology. This is a 'Legislative Instrument' and sets out the methodology in detail, but it does not provide a useful step-by-step process to follow. It also does not specify all the restrictions on using options that the FullCAM software may offer, which are given in the Guidelines, below.

This document replaces Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014, Compilation No. 1; 1 July 2015.

- **FullCAM Guidelines; Requirements for using the Full Carbon Accounting Model (FullCAM) in the Emissions Reduction Fund (ERF) methodology determination; Version 2; 16 Dec 2016** ("FullCAM Guidelines")**.** These guidelines provide step by step help. Although termed 'guidelines', as noted in the title, these are requirements for using the FullCAM software and they need to be followed.

  This document replaces Guidance for using the Full Carbon Accounting Model (FullCAM) in Carbon Farming Initiative (CFI) Methodologies; Version 1; 2014

- **Carbon Farming Initiative (CFI) Mapping Guidelines; version 5; 2018** ("CFI Mapping Guidelines").

  This document replaces Carbon Farming Initiative (CFI) Mapping Guidelines; Version 4; 2015.

The data that are required for input to FullCAM are:

- the model point location (latitude and longitude);
- the last planting date;
- the species;
- where applicable, the stocking density of the project trees and/or shrubs in the reporting period;
- where applicable, the tree proportion of the project plants in the reporting period;
- domain group information to support the use of a particular FullCAM calibration;
- management event data; and
- disturbance event data.

The required output from FullCAM is based on different equations for different characteristics, e.g., the carbon mass of trees, or the amount of methane emitted due to fire.

It can take some time to become familiar with the various operations in the model and allowed applications. For example, certain events (e.g. weed management) can alter the modelled rates of seedling growth and carbon accumulation. In most ecological plantings in the region, weeds are removed completely from planting sites prior to planting. However, there is no provision in the FullCAM model for site preparation events, even though rates of growth and carbon accumulation would likely be increased as a result of the pre-planting weeding. To account for this in the model, it may be possible, to include a weeding event immediately after planting, but this will depend on the advice provided by the CER.

Note that the methodology used in the pilot project had been superseded by the time of preparing the project report, but was current when the project application was approved. It's important to double-check the state of rules at the time of any new project.

FullCAM probably underestimates carbon stocks in ecological plantings. In combination with a low carbon price, this means that the costs of replanting primarily for biodiversity are not offset by the accrual of ACCUs. Approval of a new

model for biodiverse plantings may increase the carbon storage estimate (and hence ACCU accrual) in these projects, but would depend on monitoring of growth and carbon storage in ecological plantings.

9.2 Reforestation and Afforestation 2.0

The Reforestation and Afforestation 2.0 methodology explanatory document specifies the range of rules and restrictions that apply to this methodology, as well as monitoring and reporting requirements. There are some useful graphics towards the end of the explanatory document for grid overlays, different types of plantings and so on, that are not contained within the explanatory document for Environmental and Mallee plantings. The major difference between this methodology and the previous *Environmental and Mallee planting* method is that the biomass of planted trees needs to be actually measured on-ground, rather than using FullCAM to estimate it. This method may provide a more accurate measure of carbon sequestration by ecological plantings, but it does require destructive sampling (i.e., killing of some trees) and requires substantial field effort and access to specialised equipment. It is likely that this method would provide a higher estimate of carbon sequestration for ecological plantings than FullCAM does, but the additional work, skills, training and equipment required may offset these gains, especially when the price paid/ACCU remains relatively low.

9.3 Plantation Forestry

This method is generally not applicable to ecological planting on the Tablelands as it applies to plantings established for timber production. In terms of similarities to the two previous methodologies, the Plantation Forestry methodology uses FullCAM to quantify the change in carbon stocks over time. Following the amendment of the CFI Rule on 16 August 2017, any proposed Plantation Forestry project must first be assessed by the Minister for Agriculture for its potential to have an adverse impact on agricultural production in the region. This assessment is done through a plantations notification.

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Appendices

Appendix 1. Submissions to government reviews related to carbon farming

I) SUBMISSION TO REVIEW OF CLIMATE CHANGE POLICY

(Questions posed in the Review are shown in bold font)

This submission is made on behalf of the Southern Atherton Tablelands Revegetation Alliance (SATRA), whose member groups are actively involved in planning/implementing/supporting community landscape restoration on the Southern Atherton Tablelands of Far North Queensland.
SATRA acts as a forum for these community groups, agencies and revegetation contractors to share information & experience, collaborate on projects and discuss opportunities. The full list of members is at Appendix 1, although not all members were able to sign off on the submission.
Broadly, SATRA member groups represent community landcare/tree planting/wildlife groups, state and local government (including revegetation nurseries), regional NRM, and local revegetation contractors.
Depending on the level of grant funding available, the community groups combine to plant in the order of 30,000 seedlings per year to reforest approximately 10 hectares of disused pasture, marginal farmland etc. The majority of the revegetation undertaken is primarily for biodiversity purposes, although of course it delivers other outcomes such as connectivity, water quality and carbon sequestration.
The Wet Tropics Management Authority, in its "State of Wet Tropics Report 2015-2016. *Ancient, Endemic, Rare and Threatened Vertebrates of the Wet Tropics"* (SWTR) identifies climate change as "the most significant future threat to the region", viz:
Future threats
It seems almost certain that the most significant future threat to the region is climate change. This threat is exacerbated by reduced resilience caused by habitat fragmentation, emerging diseases, changing fire regimes, increasing human population pressures and invasive pests. There is a very real potential for significant biodiversity loss, especially of the high conservation value species that the region was originally protected to preserve.

The Southern Atherton Tablelands is identified as a priority area for restoration (see Appendix 2).
An important role for the Wet Tropics NRM Plan (Wet Tropics Plan for People and Country, Terrain NRM) is to help direct any investment for carbon storage and sequestration to the region and ensure it provides the greatest benefit to our environment and community. Significant research conducted by Reside et al underpins the Plan. One of the very useful conclusions from this research is that prioritising areas for habitat restoration based on their importance for biodiversity will also have substantial benefits for carbon sequestration, while the same does not hold for the reverse (Reside et al 2017: Trade-offs in carbon storage and biodiversity conservation under climate change reveal risk to endemic species)
Key Points of the Submission: Current Climate Change policy, particularly relating to the land/vegetation sector, is missing an opportunity for both the Commonwealth and local community groups by providing barriers to the establishment of small scale, but critically important restoration projects under the Emissions Reduction Fund. The main obstacles are
The level of complexity and compliance costs of participating in the ERF for small scale projects; and
The significant underestimation by FullCAM of carbon sequestration in biodiversity plantings in the Wet Tropics.
Trees for the Evelyn and Atherton Tablelands (TREAT Inc.), a SATRA member, is currently undertaking a pilot project assessing the cost-effectiveness of participating in the carbon market as a means to raise funds to support ongoing revegetation work. This submission is based on our learnings to date.

Submission endorsed by

Trees for the Evelyn and Atherton Tablelands Inc Yungaburra Landcare
Tree Kangaroo and Mammal Group Inc North Queensland Land Management Services
Malanda and Upper Johnstone Landcare Mark McCaffrey
Terrain NRM Barron Catchment Care

What are the opportunities and challenges of reducing emissions from the land and agriculture sectors?

This submission is primarily focussed on carbon sequestration, rather than reducing emissions.

To date there has been very little participation in the ERF on the Atherton Tablelands. There are currently 5 approved projects, of which 2 have been issued with ACCU's and just 1 which has successfully participated in an auction, and it is not a typical example of a community project.
Most of the land that has been revegetated by the community has been made available (with no expectation of a financial return) by conservation/community-minded landholders. Typical reasons include riparian restoration, wildlife corridors and remnant forest enhancement/enlargement. Other landholders could be motivated to take marginal land out of production if there was a financial return available such as via the carbon market.
The 2 most often quoted reasons for lack of participation are

- the complexity of the process, compliance costs, and policy uncertainty; and
- the perceived lack of return for the cost and effort required. TREAT's pilot project is exploring these issues.

The project has been nominally proposed by an existing CER client (Cloudland Connectivity and Carbon). All steps in the process are being documented (eg time to complete forms). The project site chosen is approx. 1.6 hectares and forms part of a larger long-term riparian corridor restoration process. The methodology *Reforestation by Environmental or Mallee Plantings – FullCAM* was selected for the project. Over this past wet season 5,000 seedlings were planted by community volunteers assisted by local contractors and agencies.
FullCAM modelling indicates carbon sequestration of 380 tonnes CO2 e over 5 years, which would EARN 380 ACCUs.
The direct costs to date have been $12,500 which includes site preparation by contractor, 2,000 seedlings (3,000 donated by TREAT/QPWS valued $10,000), and consumables eg water crystals, fertiliser. The best practice methods used (based on "Restoring the Rainforest" by Goosem and Tucker) require regular maintenance for approximately 3 years to control regrowth of pasture grasses, legumes and herbaceous weeds. This is estimated to cost up to
$20,000 per Ha. Estimates provided by registered auditors for the initial audit are in the range of $8,000 to $10,000. The Bottom Line

The cost of establishment of the pilot project including 3 years maintenance is $12,500 + $20k x 1.6ha = **$44,500**
(avge $27,5k/ha, but not including in-kind contributions such as volunteer labour for planting and donated seedlings)
The direct costs for the first reporting period including the initial audit and expert technical advice = **$10,000**
(not including in-kind contributions such as time to complete application forms etc)
Number of ACCUs earned is expected to be 380, @ the current average auction price of $11.83 this = **$4495.40 THE AMOUNT EARNED DOES NOT EVEN MEET THE COSTS OF AUDITING!**
Just to break even we would need to plant a minimum of 3.6 hectares. To make it worth all the effort we would need to plant at least 10 hectares. This would provide a net return of < $20,000.
The community is aware that it is possible to aggregate multiple plantings into a single project to reduce overall compliance costs, so this is feasible, given that the community plants around 10 ha already. However, the upfront costs of planting 10 hectares using best practice biodiversity techniques is in the order of $275,000 (depending on level of in-kind contributions), so $20,000 represent a very low rate of return.

Critical Issue:

The local community has a very strong perception, backed up by science, that the *Reforestation by Environmental or Mallee Plantings – FullCAM (REMP-F)* significantly underestimates the amount of carbon sequestered by our plantings. The legislation defines 'forest' as

- *land of a minimum area of 0.2 of a hectare on which trees:*
- *have attained, or have the potential to attain, a crown cover of at least 20% across the area of land; and*
- *have reached, or have the potential to reach, a height of at least 2 metres.*

The 'best practice' biodiversity planting method typically used by SATRA members involves planting at densities of up to 3,500 seedlings/ha, and these plantings achieve 80% crown cover and 2-3 metres height after just 3 years (see aerial/satellite images at Appendix 3 & 4).
We've been asked why we don't just reduce our planting density in line with the *Reforestation by Environmental or Mallee Plantings – FullCAM* methodology and hence reduce costs. The answer is that the community, with great support from agencies and professional researchers, has spent many years developing the best practice methods used. Reducing planting densities would only provide a marginal saving – seedling expenditure is reduced but preparation and maintenance costs are largely unaffected or even increase, and come at the cost of delaying site capture and habitat development.

The paper "Comparing above-ground biomass among forest types in the Wet Tropics: Small stems and plantation types matter in carbon accounting" (Preece et al. 2011), reports that FullCAM underestimates the amount of carbon sequestered by a considerable amount (approx. 40%) and that adjustments need to be made viz
"Our study demonstrates the inadequacy of current methods for estimating carbon stocks in rainforest and environmental plantings in north-eastern Queensland. Current estimates clearly deprive landholders of financial incentives and underestimate the national greenhouse gas benefits of tree planting in the wet tropics. A tailored biomass allometric and the re-parameterisation of FullCAM are needed. Until then, we recommend the Chave et al. (2005) allometric function, which provides intermediate values, is based on the widest range of tropical trees, and has been shown to be accurate away from the sites used for its development (Djomo et al. 2010; Liddell et al. 2007)."
As the pilot project proceeds we will compare the results delivered by this methodology to the Reforestation and Afforestation methodology, which we understand entails significantly higher compliance/auditing costs.
The pilot project will also assess the Human-Induced Regeneration of a Permanent Even-Aged Native Forest methodology. Natural regeneration is a very hit and miss affair in the Wet Tropics, and is generally regarded as a high risk strategy for habitat restoration, in particular for disused/marginal pastures. It can also take many years for quality habitat to emerge. However, given the very low bar set for the attainment of 'forest cover' it may provide an option for us to derive income from larger sites, depending of course on compliance costs. Researchers from Griffith and Queensland Universities have been conducting a long-term trial into the effectiveness of 'kickstarting' natural regeneration on the Southern Atherton Tablelands by addressing barriers to native seedling recruitment. This project will be making a final report later this year.

Are there any implications for policy?

Public funding available for landscape restoration has declined significantly in recent years. Hundreds of millions of dollars were stripped from the Landcare/NRM programs to fund the Green Army. When the program was cancelled only a portion of the savings were returned to Environment budget.
"*The Government will achieve savings of $224.7 million over four years from 2016-17 by terminating the Green Army program. The Government will redirect funding from this measure to repair the Budget and fund policy priorities, including $100.0 million over four years from 2016-17 to the National Landcare Programme (MYEFO Dec 2016)"*

The Newman Queensland Government initiated the Everyone's Environment grants program in 2012 (a first for Qld), with funding of up to $100,000 for 'large' projects over 3 years. The current Queensland Government scrapped that program and replaced it with the Community Sustainability Action Program with a $25,000/12 month limit, and a smaller funding pool.

Our community's enthusiasm and commitment is waning in the face of these policy decisions by governments. Our community has played a significant yet unrecognised role in sequestering carbon through landscape restoration activities. Since the introduction of the CFI in 2011 as much as 14,000 tonnes of CO2 equiv has been sequestered through revegetation projects conducted on the Southern Atherton Tablelands outside the CFI/ERF framework. One project alone, the award winning Rock Road Corridor, will contribute about 6,000 tonnes. This represents an unrealised source of income for community groups in the order of $150,000.
If the methodology was more reflective of the actual abatement delivered by biodiversity plantings in the Wet Tropics then the breakeven figures would be much more palatable for the community. Is the government prepared to review the methodology, taking into account the findings of Preece et al.
For smaller projects the compliance costs are a major obstacle. Assuming that there is less risk associated with smaller projects (in particular those delivering public rather than private benefit) is it not possible to have a less onerous audit process?
While the average auction price of $11.83 is extremely favourable for the Government's Direct Action targets, it is just the opposite for our community. It is extremely difficult to accept that a landholder in eg western NSW, can earn $11.83 per ACCU for essentially doing nothing ie avoided deforestation, while we put in an enormous amount of effort to actually sequester carbon, and deliver a whole suite of other benefits, for the same return. Would it be possible to create different classes of ACCU, one which delivers the bare minimum while the highest delivers multiple benefits? SATRA recognises that this may not be feasible under Direct Action (or international arrangements for that matter), but perhaps the voluntary market is a possibility. SATRA is aware of the Government's Carbon Neutral Program and the National Carbon Offset Standard but has been unable to ascertain if the voluntary market is delivering higher returns (per ACCU) than Direct Action.
How can a small rural/regional community engage with the major corporations participating in the Carbon Neutral Program? Can the government play a facilitation role?
An increase in price to (say) $30 per ACCU would dramatically alter the cost/benefit analysis outlined earlier.
Addressing the issues above would provide more motivation for community groups to participate in the ERF. The benefits would be multiple –
The community would be afforded access to a source of recurrent income for landscape restoration, income which could also be used to leverage additional funding;
A currently untapped resource could be added to the Commonwealth's Greenhouse Gas Accounts;
An additional driver could be introduced to critically important habitat restoration for species at extreme risk from climate change eg upland wet tropics endemics such as lemuroid & green ring-tail possums, golden bower-birds

What can be done to realise further benefits from emissions reduction activities beyond carbon abatement?

This question has been addressed above.

Are there particular concerns or opportunities with respect to jobs, investment, trade competitiveness, households and regional Australia associated with policies to reduce emissions in the land and agriculture sectors?

The decline in funding for community landscape restoration has had a direct impact on small business in rural/regional areas. There is a common perception that volunteers do all the work. This is certainly not the case in our area; the scale of the problem is too large. The membership of SATRA reflects the integrated delivery model adopted here – volunteers, private contractors and local/state government staff all contribute. As public funding declines so does income for our highly valued local contractors. The opportunity to diversify income streams in this area by way of carbon farming will go some way to countering the decline of traditional industries including dairying and native forest timber harvesting.

[Appendices not included; available from D. Hudson]

ii) SUBMISSION TO THE REVIEW OF THE CARBON FARMING INITIATIVE LEGISLATION

(Questions posed in the Review are shown in bold font)

This submission is made on behalf of the Southern Atherton Tablelands Revegetation Alliance (SATRA), whose members are actively involved in planning/implementing/supporting community-based landscape restoration on the Southern Atherton Tablelands of Far North Queensland.
SATRA acts as a forum for the revegetation community to share information & experience, collaborate on projects and discuss opportunities. The full list of members is at Appendix 1.
Broadly, SATRA membership comprises community landcare/tree planting/wildlife groups, state and local government (including revegetation nurseries), regional NRM, and local revegetation contractors.
Community groups and private landholders on the Southern Atherton Tablelands combine to plant in the order of 30,000 seedlings per year to reforest approximately 10 hectares of disused pasture, marginal farmland etc. The majority of the revegetation undertaken is primarily for biodiversity purposes, although it also delivers other outcomes such as water quality and of course carbon sequestration.
The Wet Tropics Management Authority, in its "State of Wet Tropics Report 2015-2016. *Ancient, Endemic, Rare and Threatened Vertebrates of the Wet Tropics"* (SWTR) identifies climate change as "the most significant future threat to the region", viz:
It seems almost certain that the most significant future threat to the region is climate change. This threat is exacerbated by reduced resilience caused by habitat fragmentation, emerging diseases, changing fire regimes, increasing human population pressures and invasive pests. There is a very real potential for significant biodiversity loss, especially of the high conservation value species that the region was originally protected to preserve.

The Southern Atherton Tablelands is identified in the report as a priority area for restoration (see Appendix 2).
An important role for the Regional Natural Resource Management Plan (Wet Tropics Plan for People and Country, Terrain NRM) is to help direct any investment for carbon storage and sequestration to the region and ensure it provides the greatest benefit to our environment and community. Significant research conducted by Reside et al underpins the Plan. One of the very useful conclusions from this research is that prioritising areas for habitat restoration based on their importance for biodiversity will also have substantial benefits for carbon sequestration, while the same does not hold for the reverse (Reside et al 2017: Trade-offs in carbon storage and biodiversity conservation under climate change reveal risk to endemic species). See Map at Appendix 3.
Key Points of this Submission: In its current form the Carbon Farming Initiative discourages the participation of proponents of small-scale projects. The main barriers are
The degree of complexity in the methodologies and related guidelines (eg CFI Mapping) and FullCAM; and
The high cost of project audits, which disproportionately affects small-scale projects.
Every year the local community plants trees and receives no financial benefit from the carbon sequestered. Similarly, the Commonwealth misses out on adding that sequestration to the nation's accounts.
Trees for the Evelyn and Atherton Tablelands (TREAT Inc.), a SATRA member, is currently undertaking a pilot project assessing the cost-effectiveness of community groups participating in the carbon market as a means to generate income to support ongoing revegetation work. Unfortunately this project has not been completed in time for the review; this submission is based largely on our learnings to date.
David Hudson
On behalf of SATRA 0428 742308
davidhudsonau@gmail.com

Is the coverage of methods sufficient or should other emissions reduction opportunities that are consistent with the offsets integrity standards be included? No comment

Are the existing methods fit for purpose, including with respect to the offsets integrity standards? Combining environmental and mallee plantings in a single methodology makes for a very cumbersome set of rules. We are currently attempting to edit it down to cover only the sections relevant to our activities.

Would emissions reductions from some ERF offset projects be delivered more efficiently through regulation or some other policy? No Comment

Is the process for method development and ERAC assessment efficient and transparent? No Comment

Why do some methods have low uptake? In the vegetation sector most projects fall under 'regrowth of vegetation by removing stock or fencing off land, or from preventing land clearing', which typically have low direct implementation costs.

To date there has been very little participation in the ERF on the Atherton Tablelands. There are currently 5 approved projects, of which 2 have been issued with ACCU's and just 1 which has successfully participated in an auction.
Planting projects might have a greater uptake if there were far better returns on investment than what is currently on offer from the auctions.

Should methods with very few or no registered projects be subject to less frequent reviews? No comment

Is the ERF delivering additional abatement? No comment

Could the additionality requirements be improved? No comment

Do any methods or projects raise particular additionality concerns? No comment

Are current emissions estimation approaches and tools fit for purpose? If not how can they be improved? Using FullCAM requires a high degree of technical competence, which is a deterrent to potential proponents of smaller projects. The CFI is almost biased towards the big operators who can afford to invest in that technical capacity, which of course they keep to themselves. As part of our feasibility study we currently have a highly experienced forestry professional looking at FullCAM, and he is having some difficulty coming to grips with its intricacies.
The local community has a very strong perception that the *Reforestation by Environmental or Mallee Plantings – FullCAM (REMP-F)* significantly underestimates the amount of carbon sequestered by our plantings. The legislation defines 'forest' as
land of a minimum area of 0.2 of a hectare on which trees:

> *have attained, or have the potential to attain, a crown cover of at least 20% across the area of land; and*
> *have reached, or have the potential to reach, a height of at least 2 metres.*

The methodology states in relation to default values that after 5 years from the planting date *"stocking density is taken to be less than 500 stems per hectare"*.

The 'best practice' biodiversity planting method typically used by SATRA members involves planting at densities of up to 3,500 seedlings/ha, and these plantings achieve 80% crown cover and 2-3 metres height after just 3 years.
We've been asked why we don't just reduce our planting density in line with the methodology and hence reduce costs. The answer is that the community, with great support from agencies and professional researchers, has spent many years developing the best practice methods used. Reducing planting densities would only provide a marginal saving – seedling expenditure is reduced but preparation and maintenance costs are largely unaffected or even increase, and come at the cost of delaying site capture and habitat development.
Our forestry professional is helping us to understand that our concerns may be somewhat misplaced, although we have not yet reached the stage that we can have confidence in the modelling.
However, the paper "Comparing above-ground biomass among forest types in the Wet Tropics: Small stems and plantation types matter in carbon accounting" (Preece et al. 2011), reports that FullCAM underestimates the amount of carbon sequestered by a considerable amount (approx. 40%) and that adjustments need to be made viz
"Our study demonstrates the inadequacy of current methods for estimating carbon stocks in rainforest and environmental plantings in north-eastern Queensland. Current estimates clearly deprive landholders of financial incentives and underestimate the national greenhouse gas benefits of tree planting in the wet tropics. A tailored biomass allometric and the re-parameterisation of FullCAM are needed. Until then, we recommend the Chave et al.

Are the ERF permanence arrangements fit for purpose? If not, how could they be improved? No comment

Do 25 year and 100 year permanence timeframes raise particular issues? No comment

Is the discount rate set appropriately for the 25 year permanence period and the risk of reversal buffer? No comment

Is there sufficient information available to inform land purchasers about permanence obligations? No comment

Is aggregation working effectively under the ERF? If not how can any issues be addressed? It might be for large projects, but the big carbon service providers who have looked at our projects have deemed them too small and costly. If they can't make a profit they're not interested. Our feasibility study is considering options for creating a local volunteer run not-for-profit company which could act as an aggregating entity.

Is concentration in the market an issue and how can it be managed? No comment

Should contracts between carbon service providers or aggregators and other participants be made available to the Clean Energy Regulator? No comment

Are there any barriers to entry for new carbon service providers? No comment

What are the barriers to Indigenous participation in the ERF and how can they be addressed? No comment

Are the eligible interest holder arrangements working effectively? If not, how could they be improved? No comment
Are the ERF arrangements to prevent adverse outcomes from ERF projects sufficient? If not, how could they be improved?
No comment

Is the guidance provided for participation in the ERF user friendly and easy to understand?
No! The CER website is very cumbersome to navigate. It's difficult to follow the process without having to constantly link out to other areas. The problem we have is that it is largely framed around participation in the auctions. We are only interested in registering projects and acquiring ACCUs which we can (hopefully) sell in the secondary market for a more realistic price. It would be so much easier to follow if there was separate guidance provided.

Are there administrative barriers that are preventing participation in the ERF?
As above, the complexity of the process; it's so hard to sort out just what's relevant. You think you're starting to get a handle on it, and then you discover something else buried somewhere else that affects your understanding.
Could the process for project registration and variation be improved?
A separate registration process for proponents who don't wish to participate in auctions.

Do scheme participants feel that enquiries about project registration or other administrative matters are dealt with efficiently?
There have been a couple of times when we've sort clarification and been simply directed back to the relevant section of the website/methodology which prompted our enquiry in the first place, which was no help.
During assessment of our project I received a request for further information as follows
Further information is required before an assessment of your application can be completed, a more detailed project description needs to be provided to align with the Reforestation by Environmental or Mallee Plantings methodology under which your project is to be assessed. The project description you have provided is not sufficient to assess the project application.
It took multiple phone calls speaking to various members of staff trying to find out what information was missing before receiving the response that
The CER has reassessed the information provided within the project description, and no further information is required. Please disregard this request, and apologies for any inconvenience caused.
Having said all that, we have now been able to establish a more constructive relationship with senior staff who are far more helpful and understanding.

Is CER decision making consistent, transparent and timely?
Timeliness has been an issue – 3 months to get our pilot project approved. Like most government departments they are probably under-resourced.

Are the ERF crediting arrangements fit for purpose? If not, how could they be improved? No comment

Are the ERF reporting and auditing arrangements and guidance fit for purpose? If not, how could they be improved?

Project auditing costs are the single greatest impediment to the participation of small-scale projects. While we have not yet been through the auditing process we have held preliminary discussions with a registered auditor and been quoted $8-10,000 for the initial audit of our pilot project. I personally have a tiny registered project on my own property and it cost me $8,000 to have it audited 2 years ago. My intention at the time was to use it as a learning exercise for my community but its value proved limited for a range of reasons (old methodology and model). When I was first registering my project I raised this cost with the CER and was told that their expectation was that the audit should cost around $500. The auditor's response was that the CER didn't know what they were talking about! After my audit I was told that the second would only be marginally less costly.

We have not yet been able to ascertain the likely costs for the 2nd and 3rd audits of our feasibility study, so we are unable to complete a whole of life costing for the project. Conceivably it could cost $25-30,000 over the 25 years just for audits. Our project is only 1.6ha and will deliver in the order of 700 ACCUs.

Fortunately the funding for our pilot project included a budget line for initial audit fees. We will still need to realise $25/ACCU just to cover the subsequent audit costs.

By comparison, one local group here is finalising a $100,000 grant from the Queensland Government to revegetate 6 hectares. To have that project audited by a local accountant will cost about $400; although granted it's not the same type of audit.

There does not appear to have been a risk-based approach taken in devising the auditing framework, rather a one size fits all. Irrespective of whether ACCUs are sold to the government or through the voluntary market it is imperative that integrity be maintained. However, where the risk is lower there could surely be a less onerous process.

Are there any opportunities for further streamlining reporting and auditing while maintaining the integrity of the scheme? See above

Are the purchasing principles fit for purpose? If not, how should they be changed? No comment

Is too much emphasis placed on the least cost principle? Definitely

Is the contracting and auction process fit for purpose? No comment

Are there improvements that could be made to the auction design or contracting process? No comment

Are the ERF contracting arrangements fit for purpose? If not, how could they be improved? No comment

How has the secondary market been operating? No comment

Is the secondary market sufficiently transparent and are any changes needed to increase its effectiveness?

For a very small player in a regional area it's very hard to get an understanding of how the voluntary market works, and how we might participate. This is clearly a critical issue for us to address in our pilot project if we are to derive any income from our plantings, we just haven't got to it yet.

Could the current governance structure of the ERF be improved? If so, how? No comment

In what ways could transaction costs be minimised for ERF participants while maintaining environmental integrity? See earlier comments on auditing

Is the current compliance regime effective including for relinquishment of ACCUs in cases of a lack of permanence? No comment

What would improve its effectiveness? No comment

Should the Government allow the export of ACCUs or imports of carbon credits to meet contractual obligations under the Emissions Reduction Fund? No comment

How can Australia ensure that ACCUs would be eligible in future international markets? No comment

What role should the ERF play in meeting Australia's future international targets? No comment

How would this affect its crediting and purchasing elements? No comment

To what extent (if at all) is uncertainty around the future of the ERF affecting investment decisions in offset projects and the secondary market?

It has been a significant disincentive, and continues to be. The community's willingness to participate further (after the completion of our feasibility study) could quite conceivably depend on the outcomes of this review. If the there is nothing done to address the high cost of auditing then the figures don't stack up at all well for small-scale projects, even if we do create our own NFP aggregating entity. This of course is complicated by uncertainty around just how much we might be able to realise ($/ACCU) through the secondary market.

On the other hand, the only vegetation-related government funding program specifically excluded from ERF projects is 20 Million Trees, so a revegetation project funded under eg the Threatened Species Recovery Fund would not be excluded. The premise underpinning our feasibility study is that we are seeking to derive a financial return from carbon being sequestered in revegetation projects planted on a year on year basis. Community groups typically rely on government funding (eg NLP) to implement these projects, and overall levels of funding have declined markedly over recent years. Income from carbon sequestration could help us deliver more vital restoration work in the future. If other government programs (eg TSRF) are excluded as a result of further policy changes then this opportunity could be lost.

Consider this scenario – without access to government funding a local group miraculously manages to borrow $75,000 (say from an impact investor) to revegetate 3 hectares. The project is registered and delivers 2100 ACCUs over 25 years. Auditing costs will add $25,000. The group would have to realise $50/ACCU on the secondary market to meet all the costs, and that's not factoring in any interest payments.

Appendix 2.a) Completed application to register pilot project; b) Approval of registration of pilot project; c) Audit schedule

(A) APPLICATION TO REGISTER A PROJECT

under the *Carbon Credits (Carbon Farming Initiative) Act 2011*

Freemans Forest Community Carbon Pilot

Appointed Nominee: David Alan Hudson

PURPOSE OF THIS FORM

This form is to be used to apply to the Clean Energy Regulator, under section 22 of the *Carbon Credits (Carbon Farming Initiative) Act 2011* (the CFI Act), for the registration of a project as an eligible offsets project.

This form is used to provide the Clean Energy Regulator with information about the person(s) responsible for carrying out a proposed project (the 'participant' or the 'multiple project participants') and the proposed activity (the 'project'), to enable the Clean Energy Regulator to decide whether or not to register the project as an eligible offsets project under the CFI Act.

INSTRUCTIONS FOR COMPLETING THIS FORM

Please read each part of the application carefully, fully answer all the questions, sign where indicated, and attach the required documentation.

You must complete and submit:

- Project participants
- Project details
- Eligibility details
- Project declaration

To participate in the Emissions Reduction Fund, interested parties must apply to the Clean Energy Regulator to get their projects registered. If you have not provided your information to the Clean Energy Regulator already, please submit the Client Information Form — available from the Clean Energy Regulator website, or by contacting 1300 553 542 — as part of the project registration.

PLEASE NOTE: Current Recognised Offset Entities under the CFI Act do not need to submit the client information again. However, if your details have changed, please inform the agency of the changes by contacting 1300 553 542.

To learn more about the steps involved in participating in the Emissions Reduction Fund, including your obligations under this initiative, please visit the Clean Energy Regulator website.

ADDITIONAL INFORMATION

Click here to view our Privacy statement

Click here to view information about Protection of Information

Click here to view information in relation to Disclosure of Information

NOMINATED NOMINEE

Multiple project participants of a project must appoint one of themselves as a nominee for the project.

If this option is selected, the participant completing this application will be appointed as the nominee and primary contact of the multiple project participants for the project, and will be authorised to act on behalf of all the multiple project participants in relation to the Clean Energy Regulator for the project.

All of the multiple project participants will need to provide their written consent to appointment of the nominee.

Name	David Hudson
Client ID	100125266
Role	Appointed Nominee

PROJECT PARTICIPANTS

Given Name	David
Family Name	Hudson

CONTACT PERSON (in relation to the Project)

Contact Details

Email Address	davidhudsonau@gmail.com
Contact Number	xxxxxxxx

PROJECT DETAILS

What is the name of the project?*

Freemans Forest Community Carbon Pilot

Describe your project in simple language*

The project will see 5,000 local rainforest seedlings planted on 1.65 hectares of disused pasture. The planting will link Lake Eacham National Park to the Peterson Ck Corridor, a long term, large-scale community-based riparian rehabilitation project. The project is being used by local landcare/conservation groups to determine the viability of participating in the carbon market as a potential source of ongoing funding for critical rainforest restoration.

Is the project proposed to be carried out, or being carried out, entirely within Australia?*

Yes

Method category*

Sequestration - Reforestation

Method*

Reforestation by Environmental or Mallee Plantings-FullCAM

Does the project meet the newness requirement?*

Yes

Are the project activities funded under any of the government programs, or do they include any activities listed in section 21 of the *Carbon Credits (Carbon Farming Initiative) Rule 2015* (rule)?*

No

Is the project, or any part of it, required to be carried out by or under a law of the Commonwealth, a State or a Territory (the regulatory additionality requirement)?*

No

Is the project, or any part of it, an excluded offsets project under Regulation 3.36 or Regulation 3.37 of the Carbon Credits (Carbon Farming Initiative) Regulations 2011?*

No

What start date do you wish to nominate for your project?

What is the forward abatement estimate for the project?*

50000

Total Crediting Period (years) of the project*

25

Average Annual FAE:

2,000

Period	Estimated C02
30/04/2020	184

What is the estimate of the peak period of the project or abatement period?

Attached Files

- Freemans Forest simulation.xlsx

Does the project require any regulatory approvals?*

No

Explain why the project does not require regulatory approvals.

Revegetation on private land in Queensland does not require any regulatory approval

Proposed Activities

Permanent mixed-species environmental planting

PROJECT ELIGIBILITY

Please indicate in which Australian states and territories you expect your project to be conducted*

- Queensland

The locations as reported in the bulk csv file downloaded from the client portal are part of this application.

Additional information on the project area*

The project will be undertaken on "Freeman's Forest" at 69 Cutler Rd, Lake Eacham on the Atherton Tablelands. The property adjoins Lake Eacham NP and the nearest town is Yungaburra. The local government is Tablelands Regional Council. A pdf of the project site is attached.

Attached Files

- Freeman Forest polygon 2.jpg

Attach details of geospatial information and files*

Attached Files

- Freemans polygon_compressed.zip

I confirm that all geospatial data is in a commonly used interchangeable digital GIS file format (e.g. Shapefile, MapInfo, KML, CFI Mapping Tool) and is not an image

Yes

I confirm the entire project area has been mapped within a SINGLE geospatial data file

Yes

I confirm that the datum of all geospatial data is the Geocentric Datum of Australia (GDA94)

Yes

I confirm that all geospatial data is either projected to Map Grid of Australia (MGA94) or uses a geographic coordinate system

Yes

I confirm that the digital geospatial mapping information is in accordance with the Carbon Farming Initiative Mapping Guidelines

Yes

Describe the project*

The project will be undertaken as a block planting on disused pasture which has been clear of forest for at least 5 years and contains no woody debris. We will use best practice local restoration techniques which will result in >20% canopy cover and >2metres height within 3 years. Seedlings will be sourced from the Queensland Parks and Wildlife Service (Restoration Services Unit- Lake Eacham Nursery) and the Tablelands

Regional Council's Community Revegetation Nursery where they are grown only from locally sourced seed of species which originally grew at the location.

Describe the skill and expertise of any person intended to be used in carrying out the project consistently with the chosen method*

The proponent has over 10 years experience in revegetation and has an existing approved/audited CFI project. The proponent will fill the role of Project Manager; on-ground works (site preparation, planting preparation and ongoing maintenance) will largely be undertaken by local contractor Mark McCaffrey. Mark is also a Nature Refuge landholder who has been responsible for revegetating >10 hectares of his own property. He is currently engaged by South Endeavour Trust Pty Ltd and the Tree Kangaroo and Mammal Group to undertake similar tasks on the large-scale Rock Rd Wildlife Corridor where he has responsibility for approx. 20 hectares of reveg. The seedlings will be planted by volunteers from local community group TREAT (Trees for the Evelyn and Atherton Tablelands) which has been operating for over 30 years.

Please select the permanence period for the project*

By selecting this option you are requesting that your project be treated as a 100-year permanence period project

Is the project, or any part of it, being carried out, by or under a forestry managed investment scheme?*

No

Provide details of the forestry managed investment scheme*

Is there a current regional Natural Resource Management (NRM) plan that covers the location of the project?*

List the current regional Natural Resource Management (NRM) plans that cover the locations of the project*

Name	Organisation	Publication Date
Wet Tropics Plan for People and Country	Terrain NRM	01/07/2016

Is the project consistent with the NRM plans?*

Yes

Does the participant, or do the multiple project participants, have the legal right to carry out this project?*

Yes

Describe the legal right of the participant/multiple project participants to undertake the project, including their contractual relationships with other parties; whether there has been notification of relevant interest holders and where relevant explain any contracts for aggregation that have been put in place for conducting the project and claiming the Australian carbon credit units generated by it.

The project will be undertaken on land owned by the South Endeavour Trust Pty Ltd (SET). SET was established in 2007 as an independent, not for profit, charitable trust with the sole purpose of contributing to nature conservation in Australia and currently owns 10 conservation properties. SET has provided written approval for the proponent to undertake the project.

Is/are the project area/s on exclusive possession native title land?*

No

Please provide the name and file number of the federal court determination.*

Is there an Indigenous Land Use Agreement on the project area(s)?*

No

Is your project a current or future aggregation project?*

Yes

Registered Landholder

registered landholder

holder of a registered carbon property or forestry right

The land is Crown land and the participant is the:

holder of a pastoral lease that includes the carbon sequestration right

government agency representing the Crown

holder of a registered carbon property or forestry right under the state or territory law

The land is exclusive possession Native Title and the participant is the:

registered Native Title body corporate

The land is covered by land rights legislation and the participant is the:

the registered native title body corporate for the land;

the native title holder holds the applicable carbon sequestration right in relation to the land.

For all other circumstance, please specify*

Have you obtained a complete Eligible Interest Holder Consent form from all persons who hold an eligible interest in the project area/s on which the project will occur?*

Yes

DECLARATION

This part must be signed by the participant/appointed nominee for the project making this application or, on their behalf, by a person duly authorised to bind them.

Applicant's Declaration*

Complete and sign the declaration

The signatory declares that they have the legal capacity and authority to bind the participant/appointed nominee for the project on whose behalf the signatory has signed this declaration, in respect of matters contained in this application and declares and acknowledges for and on behalf of that participant/appointed nominee, that:

- all information provided in, or in relation to, this application (including attachments and any other supporting information) is, having made all reasonable enquiries, complete, true and correct and not misleading by inclusion or omission and meets the requirements of Division 1 of Part 3 of the Carbon Credits (Carbon Farming Initiative) Rule 2015.
- the participant/appointed nominee understands and accepts the responsibilities of operating an eligible Emissions Reduction Fund project under the CFI Act (participants are strongly encouraged to read the CFI legislation and other guidance materials available at www.cleanenergyregulator.gov.au
- the participant/appointed nominee authorises the Clean Energy Regulator to copy, record, use or disclose any of the information provided in relation to this application for the purpose of assessing and making a decision on the application, auditing compliance, enforcement of laws, regulations and legislative rule, the performance of the Clean Energy Regulator's statutory functions and for related purposes subject to the requirements of relevant laws, in particular the *Privacy Act 1988* and Part 3 of the *Clean Energy Regulator Act 2011*.
- the personal information provided in this application may also be copied, recorded, used or disclosed by the Clean Energy Regulator for its administrative purposes, for example, to pre-populate other Clean Energy Regulator forms which the applicant wishes to fill out online in the future, and for improving the Clean Energy Regulator's service delivery to the participant/appointed nominee.
- the participant/appointed nominee consents to the Clean Energy Regulator sharing any information in relation to them or their projects with any Commonwealth, State or Territory government agencies for the purpose of assisting those agencies in the performance of their functions or powers relating to environmental protection and/or health and safety.
- the participant/appointed nominee has the legal right to carry out the project and, if required, has obtained the written consent of the relevant eligible interest holders to the making of this application or, as the case may be, will obtain the written consent of the relevant eligible interest holders to the existence of the declaration for the project, if the declaration is issued.
- the participant/appointed nominee authorises the Clean Energy Regulator to seek advice from the relevant authority(ies) on whether any regulatory approvals pertaining to the project or any element of it have been issued.
- the participant/appointed nominee understands and acknowledges that the Clean Energy Regulator does not have any powers or role in enforcing work health and safety, environmental protection, or planning laws. If you are unsure of your responsibilities under these laws you should contact the relevant local authorities.

Under the *Criminal Code* it is an offence for a person to give information or documentation to a Commonwealth entity if the person providing the information or documentation knows that the information or documentation is false or misleading.

Note that if after the project has been registered the Clean Energy Regulator finds that it was given false or misleading information by a person in connection with the project, the Clean Energy Regulator may revoke the registration of the project and where Australian carbon credit units have already been issued for the project, they may be required to be relinquished.

The participant understands that the permanence period of the project has the duration stated and that the permanence obligations under the Emissions Reduction Fund in relation to the project will last for that period, if not terminated earlier under the provisions of the Carbon Credits (Carbon Farming Initiative) Act 2011.

The participant understands that a carbon maintenance obligation may be placed over a project area or project areas during the term of the permanence period of the project.

Signed by or for and on behalf of

Participant Name

Name of Signatory	David Hudson
Date of Birth	

Signature

Signature Date

By Signatory Name

Uploaded participant's authority to sign form(s)

- Freemans Forest Location details.csv

Eligible Interest Consent Form

- Eligible Interest Holder Form_signed_SET .pdf

Signed Declaration Form

- signed application.jpg

Once you have signed this form, please scan and upload it before submitting the application.

(B) APPROVAL OF REGISTRATION OF PILOT PROJECT

ERF Project ID: ERF109689

Declaration of an Emissions Reduction Fund project

I, Sascha McCann, delegate of the Clean Energy Regulator, declare under subsection 27(2) of the *Carbon Credits (Carbon Farming Initiative) Act 2011* (the Act) that Freemans Forest Community Carbon Pilot (the project) is a registered project for the purposes of the Act.

The participant for the project is David Hudson with Client ID 100125266.

The project is located at 'Freeman's Forest' at 69 Cutler Road, Lake Eacham on the Atherton Tablelands 4885. The relevant land title is 87/RP743593.

The project is in the Tablelands local government area and in the Wet Tropics natural resource management region.

The applicable method for the project is the *Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings - FullCAM) Methodology Determination 2014.*

The crediting period for the project is 25 years, commencing on 1 March 2017.

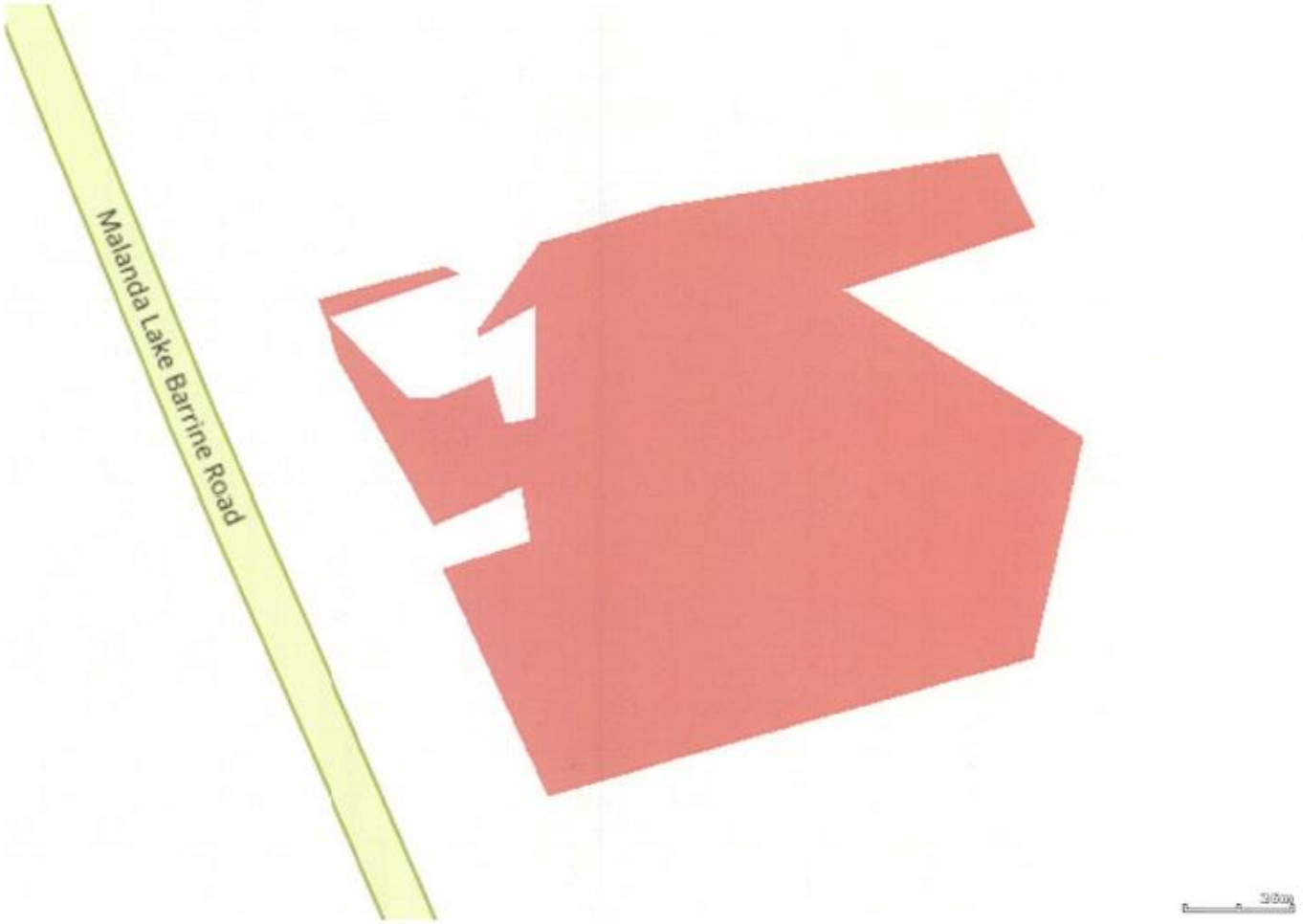
Attached is a scale map of the project area.

I also declare that the project is a 100-year permanence period project.

Sascha McCann
Manager, Land & Forest Section
Technical Assessment and Support Branch

1 March 2017

Scale map of Freemans Forest Community Carbon Pilot (Ref: ERF109689) as declared eligible



(C) AUDIT SCHEDULE

ERF ID: ERF109689

Audit Schedule Notification

Audit schedule – Freemans Forest Community Carbon Pilot – David Hudson

The audits required to be submitted with your project report are set out in the table below. The number of subsequent audits for your ERF project has been determined using the following calculation:

Annual average abatement amount = 50 000 tonnes CO_2-e / 25 year crediting period

= 2000 tonnes CO_2-e per annum

As the annual average abatement amount for your project is in the range of 50 000 tCO_2-e or less, the audit threshold for your project is Threshold A (small). As such, based on the *Carbon Credits (Carbon Farming Initiative) (Audit Thresholds) Instrument 2015*, your projects will require two subsequent audits. The project report that a scheduled audit report must accompany, is identified in the table below. The timing of audits for your project was determined based on the profile information provided with your application.

- The project start date is 1 March 2017. The initial audit must cover a period of 6 months, or the whole of the first reporting period, whichever is longer.
- A subsequent audit must cover a period of 12 months, or the whole of the reporting period of the project report that the report for the subsequent audit must accompany, whichever is longer. If the reporting period of a project report that must be accompanied by a report of a subsequent audit is less than 12 months, then the report of that subsequent audit must cover the whole of that reporting period plus any additional period(s) necessary to ensure that the report of that subsequent audit covers an uninterrupted period of 12 months.

Scheduled audit	Project reports that the scheduled audit must accompany
Initial audit	First project report submitted after 1 September 2017
Subsequent audit 1	First project report submitted after 1 March 2025
Subsequent audit 2	First project report submitted after 1 March 2033
Threshold audit	Any single project report claiming 100 000 tCO_2-e or more net abatement

In addition to the above, your project may be subject to additional audits as notified by the Clean Energy Regulator. These audits are:

- Variance audit – such an audit must be carried out if the carbon dioxide equivalent net abatement amount claimed by a project report is outside the variance audit threshold for the project and the Clean Energy Regulator requests the variance audit in writing.
- Qualified or other conclusion audit – where a previous audit has a qualified or other (non-clean) conclusion, and
- Regulator initiated audits – compliance and other audits conducted under sections 214 and 215 of the *Carbon Credits (Carbon Farming Initiative) Act 2011*.

For further information visit the Clean Energy Regulator website at www.cleanenergyregulator.gov.au.

Appendix 3. Completed project record-keeping template used in pilot project, with FullCAM calculations

	Operations completed & fuel estimates							Nat'l Greenhouse & Energy Reporting Determination					Equation 16			Equation 17
Date	**Activity**	**Details**	**No of units**	**Unit**	**Fuel litres per unit**	**Fuel used (L)**	**Fuel used (KL)**	**Schedule 1**	**GJ/KL**	**CO_2 (Kg CO_2/ GJ)**	**CH_4 (Kg CO_2-e/ GJ)**	**N_2O (Kg CO_2-e/ GJ)**	**Total CO_2 (t CO_2-e)**	**Total CH_4 (t CO_2-e)**	**Total N_2O (t CO_2-e)**	**Total CO_2-e (tonnes)**
2/03/2017	Pre-plant weeding-spraying	2 x 75km Toyota Hilux Diesel	150	km	0.1	15.0	0.0150	NGER item 54	38.6	69.2	0.2	0.5	0.0401	0.0001	0.0003	0.0405
2/03/2017	Pre-plant weeding-spraying	Equipment - spray unit - unleaded	2.5	hours	2	5.0	0.0050	NGER item 35	34.2	66.7	0.2	0.2	0.0114	0.0000	0.0000	0.0115
10/03/17-17/03/17	Planting-chipping & augering holes	7 x 75km Toyota Hilux Diesel	525	km	0.1	52.5	0.0525	NGER item 54	38.6	69.2	0.2	0.5	0.1402	0.0004	0.0010	0.1417
11/03/2017	Pre-plant weeding-slashing	Equipment - Tractor/slasher 6 hrs - Diesel	6	hours	3.33	20.0	0.0200	NGER item 54	38.6	69.2	0.2	0.5	0.0534	0.0002	0.0004	0.0539
16/03/2017	Planting-mix water crystals	75km Toyota Hilux Diesel	75	km	0.1	7.5	0.0075	NGER item 54	38.6	69.2	0.2	0.5	0.0200	0.0001	0.0001	0.0202
17/03/2017	Planting-chipping & augering holes	Equipment - Auger - unleaded	2.5	hours	2	5.0	0.0050	NGER item 35	34.2	66.7	0.2	0.2	0.0114	0.0000	0.0000	0.0115
17/03/2017	Planting-collect seedlings	2 x 15km Toyota Hilux Diesel	30	km	0.1	3.0	0.0030	NGER item 54	38.6	69.2	0.2	0.5	0.0080	0.0000	0.0001	0.0081
17/03/2017	Planting-put out seedlings, fertiliser, water crystals	Community travel, 10 vehicles, Avg kms 20	200	km	0.08	16.0	0.0160	NGER item 53	34.2	66.7	0.6	2.3	0.0365	0.0003	0.0013	0.0381
18/03/2017	Planting	Community travel to plantings, 35 vehicles, Avg kms 20	700	km	0.08	56.0	0.0560	NGER item 53	34.2	66.7	0.6	2.3	0.1277	0.0011	0.0044	0.1333
20/03/2017	Pre-plant weeding-spraying	2 x 75km Toyota Hilux Diesel	150	km	0.1	15.0	0.0150	NGER item 54	38.6	69.2	0.2	0.5	0.0401	0.0001	0.0003	0.0405
20/03/2017	Pre-plant weeding-spraying	Equipment - spray unit - unleaded	2.5	hours	2	5.0	0.0050	NGER item 35	34.2	66.7	0.2	0.2	0.0114	0.0000	0.0000	0.0115
21/03/2017	Planting(post)-return pots and trays	75km Toyota Hilux Diesel	75	km	0.1	7.5	0.0075	NGER item 54	38.6	69.2	0.2	0.5	0.0200	0.0001	0.0001	0.0202
24/03/17-31/03/17	Planting-chipping & augering holes	7 x 75km Toyota Hilux Diesel	525	km	0.1	52.5	0.0525	NGER item 54	38.6	69.2	0.2	0.5	0.1402	0.0004	0.0010	0.1417

	Operations completed & fuel estimates							Nat'l Greenhouse & Energy Reporting Determination					Equation 16			Equation 17
Date	**Activity**	**Details**	**No of units**	**Unit**	**Fuel litres per unit**	**Fuel used (L)**	**Fuel used (KL)**	**Schedule 1**	**GJ/KL**	**CO_2 (Kg CO_2/ GJ)**	**CH_4 (Kg CO_2-e/ GJ)**	**N_2O (Kg CO_2-e/ GJ)**	**Total CO_2 (t CO_2-e)**	**Total CH_4 (t CO_2-e)**	**Total N_2O (t CO_2-e)**	**Total CO_2-e (tonnes)**
25/03/2017	Pre-plant weeding-slashing	Equipment - Tractor/slasher 6 hrs - Diesel	6	hours	3.33	20.0	0.0200	NGER item 54	38.6	69.2	0.2	0.5	0.0534	0.0002	0.0004	0.0539
30/03/2017	Planting-mix water crystals	75km Toyota Hilux Diesel	75	km	0.1	7.5	0.0075	NGER item 54	38.6	69.2	0.2	0.5	0.0200	0.0001	0.0001	0.0202
31/03/2017	Planting-chipping & augering holes	Equipment - Auger - unleaded	2.5	hours	2	5.0	0.0050	NGER item 35	34.2	66.7	0.2	0.2	0.0114	0.0000	0.0000	0.0115
31/03/2017	Planting-collect seedlings	2 x 15km Toyota Hilux Diesel	30	km	0.1	3.0	0.0030	NGER item 54	38.6	69.2	0.2	0.5	0.0080	0.0000	0.0001	0.0081
31/03/2017	Planting-put out seedlings, fertiliser, water crystals	Community travel, 10 vehicles, Avg kms 20	200	km	0.08	16.0	0.0160	NGER item 53	34.2	66.7	0.6	2.3	0.0365	0.0003	0.0013	0.0381
1/04/2017	Planting	Community travel to plantings, 35 vehicles, Avg kms 20	700	km	0.08	56.0	0.0560	NGER item 53	34.2	66.7	0.6	2.3	0.1277	0.0011	0.0044	0.1333
4/04/2017	Planting(post) - return pots and trays	75km Toyota Hilux Diesel	75	km	0.1	7.5	0.0075	NGER item 54	38.6	69.2	0.2	0.5	0.0200	0.0001	0.0001	0.0202
12/5/17-4/7/17	Weeding-Maintenance-spraying round 1	14 x 75km Toyota Hilux Diesel	1050	km	0.1	105.0	0.1050	NGER item 54	38.6	69.2	0.2	0.5	0.2805	0.0008	0.0020	0.2833
5/9/17-15/9/17	Weeding-Maintenance-spraying round 2	6 x 75km Toyota Hilux Diesel	450	km	0.1	45.0	0.0450	NGER item 54	38.6	69.2	0.2	0.5	0.1202	0.0003	0.0009	0.1214
3/11/17-21/11/17	Weeding-Maintenance-spraying round 3	6 x 75km Toyota Hilux Diesel	450	km	0.1	45.0	0.0450	NGER item 54	38.6	69.2	0.2	0.5	0.1202	0.0003	0.0009	0.1214
6/12/17-30/1/18	Weeding-Maintenance-spraying round 4	4 x 75km Toyota Hilux Diesel	300	km	0.1	30.0	0.0300	NGER item 54	38.6	69.2	0.2	0.5	0.0801	0.0002	0.0006	0.0809
					Total	600.0	0.6000						1.5386	0.0065	0.0199	1.5649

(E_F)

	Operations completed & fuel estimates							Nat'l Greenhouse & Energy Reporting Determination					Equation 16			Equation 17
Date	Activity	Details	No of units	Unit	Fuel litres per unit	Fuel used (L)	Fuel used (KL)	Schedule 1	GJ/KL	CO_2 (Kg CO_2/ GJ)	CH_4 (Kg CO_2-e/ GJ)	N_2O (Kg CO_2-e/ GJ)	Total CO_2 (t CO_2-e)	Total CH_4 (t CO_2-e)	Total N_2O (t CO_2-e)	Total CO_2-e (tonnes)

Carbon dioxide-equivalent calculations	
Carbon Stock in Project *(C_P) (tCO_2-e)* from Equation 12	44.243
Burning Biomass Emissions *(E_B) (tCO_2-e)* from Equation 15	0.000
Fuel Emissions *(E_F)* (tCO_2-e) from Equation 17	1.565
Initial Carbon Stock *(C_N)*	0.000
Carbon Stock from Previous Report *(C_V)*	0.000

Project Net Abatement for Reporting Period *(A = C_P - E_B - E_F - C_N - C_V)* (tCO_2-e) (Equation 18)	42.678

Appendix 4. First project report and Application for ACCUs

PROJECT DETAILS

Project Name
Freemans Forest Community Carbon Pilot

Method
Reforestation by Environmental or Mallee Plantings-FullCAM c1

Method Category
Sequestration - Reforestation

Identifier
ERF109689

ANREUAccount
AU-1424

Checklist of conditions for application

The applicant was the project participant, or nominee of the multiple participants, identified in the project declaration immediately before t end of the reporting period relating to the abatement statement.
Yes

The applicant is the current project participant.
Yes

To the best of the applicant's knowledge the application for abatement statement for the reporting period passes the no double counting te as defined in section 15A of the CFI Act.
Yes

The project met the additionality requirements in lieu of the government program requirement, set out in section 21 of the CFI Rule, for the entire reporting period relating to the abatement statement being applied for.
Yes

Did the participant (or the multiple participants) identified in the project declaration immediately before the end of the reporting period relating to the abatement statement, have the legal right to conduct the project during the entirety of that reporting period?
Yes

Fit and Proper person events

For each participant who is an individual:

- *have any of the events specified in sections 61 and 62 of the CFI Rule occurred in relation to that individual, or*
- *has that individual at any time been an insolvent under administration?*

No

Has any project participant named in this form ever been refused registration in a renewable energy, or energy efficiency, scheme operating under a law mentioned in subsection 21(2) of the Legislative Rule; or had their registration in such a scheme cancelled; or been suspended from participating in such scheme?*
No

Changed project circumstances

Project participant has changed or died
No

A natural disturbance has occurred that has caused or is likely to cause a significant reversal of the carbon dioxide stored by the project.
No

Significant reversal of the carbon dioxide stored by the project has occurred or is likely to occur as a result of conduct engaged in by the proj proponent or another person.
No

Project has become inconsistent with regional natural resource management plan covering the project's project area or any part of it.
No

An error in previous project report provided in relation to the project — describe the error and provide the correct information.
No

The extent or manner of the project's compliance with the project eligibility requirements or monitoring requirements has changed during t reporting period since registration of the project (if this is the project report for the first reporting period) or since the end of the last reporti period (if this is not the project report for the first reporting period) — describe the change and explain how the project is continuing to com with the requirements.

No

The project's scope or location has changed significantly since the application for registration of the project was made (if this is the project report for the first reporting period) or since the end of the last reporting period (if this is not the project report for the first reporting perioc — describe the change and explain how the changed scope, or conduct or the project at any additional location, is consistent with the meth applying to the project.

No

Details of the sub-method if it has changed

No

Non-minor or non-trivial changes have occurred following which the project includes activities that were not previously notified to the Clear Energy Regulator.

No

The project area(s) for the project is, or has been, wholly or partly covered by a prescribed non-CFI offsets scheme and the project has been, is likely to be, issued credits or have the abatement otherwise accounted for under that scheme for any part of the reporting period to whicl the project report and/or abatement statement application relate.

No

REPORTING PERIOD

Start Date	March 01, 2017
End Date	March 31, 2018
Net Abatement Amount	43
Kyoto ACCUs	43
Non Kyoto ACCUs	0

You have provided the Clean Energy Regulator with written advice under section 77A of the CFI Act that you are dividing your project for the reporting period and are submitting a project report and application for abatement statement for each part of your project for that period – describe the part of the project this project report is about.

No

Is the applicant subject to a requirement under Part 7 of the CFI Act to relinquish a number of ACCUs, or to pay any penalty under sections 1 or 180 of the CFI Act related to the failure to comply with a relinquishment requirement?

No

LOCATIONS AND ACTIVITIES

The locations and activities as reported in the bulk csv file downloaded from the client portal are part of this application.

ADDITIONAL INFORMATION

Is this the project report for the first reporting period and the project's compliance with project eligibility and monitoring requirements have not changed during the reporting period since registration of the project? If yes describe that extent and manner by which the project has complied.

Yes

The project is a mixed species (tropical) environmental planting which has been implemented in accordance with the Reforestation by Environmental or Mallee (FullCAM) Methodology Determination 2014. Approx 5000 local native rainforest seedlings have been planted on a c1 hectare site.

Please attach the geospatial map file for the project that identifies the relevant carbon estimation areas and exclusion areas for the project.

Uploaded Filename: Geospatial file_Freeman8_CEA.shp

Please attach date stamped FullCAM plot files (.plo) and a copy of the associated output data in a spread sheet file (.xls) for each carbon estimation area in the project area.

Uploaded Filename: Att 12. Freeman-1stReport-MSEP.plo

Please include any additional information on the project to complete the offset report requirements.

Uploaded Filename: ERF109689_FreemansForest_First Offsets Report.pdf

AUDIT REPORT

Is an audit report required to be provided to the Clean Energy Regulator with this project report?

Yes

Has the audit report set out either a reasonable assurance conclusion or a qualified reasonable assurance conclusion for each of the matters audited?

Yes

Appendix 5. First offsets report for Freeman's Forest pilot project

Project # ERF109689 – Freeman's Forest Community Carbon Pilot: FIRST OFFSETS REPORT

In accordance with Part 5, Division 5.4 of the Carbon Credits (Carbon Farming Initiative) (Reforestation by Environmental or Mallee Plantings—FullCAM) Methodology Determination 2014 this is the first offsets report for this project.

5.8 Information in the first offsets report

(a) carbon dioxide equivalent net abatement amount for the project;	42.7
(b) carbon stock change for the first reporting period for the project;	44.2
(c) total emissions due to biomass burning for the project;	Zero (0)
(d) total fuel emissions due to project activities;	1.5 t CO_2 from diesel and petrol (using 2640g and 2392g CO_2/litre for diesel and carbon respectively)[1].
(e) initial carbon stock for the first reporting period;	Zero (0)
(f) if the planting date occurred before the declaration date—the initial carbon stock at the declaration date;	N/A (declaration date 1/03/2017)
(g) carbon stock for the project at the end of the reporting period;	Same as (b)
(h) forest management information set out in section 5.5;	(a) For the carbon estimation area: (i) evidence of forest potential, including: (A) estimated stocking density: **c3000 stems/ hectare, based on 5,000 seedlings planted on 1.65ha (Refer seedling supply lists Attchmnts 1 &2)** (B) anticipated crown cover at maturity: **100% The planting is designed to restore tropical rainforest described as 'complex mesophyll vine forest' (Refer Regional Ecosystem Description Attachment 3)** (ii) once forest cover is achieved: (A) an estimate of the year when forest cover was achieved: **N/A** (B) evidence that forest cover is maintained: **N/A** (iii) the modelling commencement date: **1/4/2017** (b) FullCAM inputs for each carbon estimation area, including the: (i) type and timing of management events, including: (A) planting: **1/04/2017 – seedlings planted manually into augered holes** (B) weed control: **Round 1: 2/04/2017 herbicide application (entire site)** **Round 2: 4/07/2017 herbicide application (entire site)** **Round 3: 15/09/2017 herbicide application (entire site)** **Round 4: 21/11/2017 herbicide application (entire site)** **Round 5: 30/1/2018 herbicide application (entire site)** (C) fertiliser application: 1/4/2017 **Fertilizer (Katek Organic Supergrowth) applied into the planting holes.** (ii) type, timing and extent of disturbance events: **No disturbance events occurred.**

	(c) a description of any management actions or disturbance events that affected a carbon estimation area during the reporting period, including if applicable, actions proposed and undertaken to ensure that carbon stocks are restored: **There have been no disturbance or management events that have affected the carbon estimation area.** (d) if applicable, evidence demonstrating that grazing has not prevented the requirements in section 3.47 being met. **N/A – no grazing on property**
(i) if relevant, specific calibration information set out in section 5.6;	**Not relevant, generic calibration was used**
(j) project area information set out in subsections 5.7(a) to (b);	5.7 Project area records A project proponent must create and maintain the following records relating to the project area: (a) geospatial maps that identify: (i) the project area: **Refer Attachment 4** (ii) carbon estimation areas: **There is a single carbon estimation area for the project.** (iii) exclusion areas: **There are no exclusion areas for the project** (iv) model points for each carbon estimation area: **Identified on map at Attachment 5** (b) if the areas specified in paragraph (a) are not clearly visible on the maps, a list of names or other identifiers that identify the project area and each carbon estimation area: **The areas are clearly visible.**
(k) date-stamped FullCAM plot files (.plo) and a copy of the associated output data in a spread sheet file for each carbon estimation area in the project area;	**Refer Attachments** **Att 5 Freeman-1stReport-MSEP.plo and** **Att 6 Freeman-1stReport-MSEP.xlsx**
(l) if forest cover is attained during the first reporting period—evidence that the cover has been attained.	**Forest cover has not been attained in the first reporting period**

[1] http://ecoscore.be/en/info/ecoscore/co2

Appendix 6. Important considerations involved in the use of FullCAM

FullCAM must be used in conjunction with reading both the *FullCAM Guidelines* and *FullCAM Methodology* documents. FullCAM is a generic carbon modelling tool so it can lead the user into misleading results. The computer interface also does not provide much explanatory information. Reading the *FullCAM Guidelines* is therefore essential in order to get started in FullCAM and to provide valid results (See especially Section 9 in the main body of this document).

A. Selecting the right "Tree Species"

After entering a latitude and longitude, FullCAM -for example -offers 32 'Tree Species' (or forest types or *Regimes*) for the Yungaburra-Malanda Statistical Area ("SA", Australian Bureau of Statistics Level SA2).

Of these, five may appear appropriate:

1. Mixed Species Environmental Planting;
2. Mixed Species Environmental Planting Tropical;
3. Rainforest & Vine Thickets;
4. Acacia Forests & Woodlands;
5. Other Forests and Woodlands.

Under the *FullCAM Methodology* only two may be used:

- Mixed Species Environmental Planting;
- Mixed Species Environmental Planting Tropical.

B. Understanding Generic & Specific Calibrations

The *FullCAM Guidelines* (para, 2.5) define:

- Mixed Species Environmental Planting as a generic *calibration*; and
- Mixed Species Environmental Planting, Tropical as a specific *calibration*.

Specific *calibrations* have quite defined areas within Australia where they may be used (*FullCAM Guidelines* Figures 1 to 5), whereas the generic *calibrations* do not.

Specific *calibrations* also restrict options that can be applied in FullCAM, sometimes to a single default option (or *Regime* with a fixed set of *Events*), that cannot be modified.

The *Mixed Species Environmental Planting, Tropical* (specific) *calibration* -for example -can only be used for *block* plantings, not *linear* plantings (*FullCAM Guidelines* Table 1, *FullCAM Methodology* Schedule 1, and see below).

FullCAM, because it is a research and analysis tool, often suggests and permits selection from a range of options or *Events*. But in most cases only the default option (*Regime*) as given in the *FullCAM Guidelines*, is allowable in a specific *calibration.*

The *FullCAM Guidelines* document (para. 2.10.2) states that except for "Planting trees" ("plant trees; seedlings, normal stocking"), "No other plantation establishment events such [as] fertiliser or herbicide may be added at the commencement of a project. The other permitted management activities and associated FullCAM events are listed in Table 2."

These permitted events (*FullCAM Guidelines* Table 2) consist only of *Wildfire -trees not killed*, *Wildfire -trees killed* and *Prescribed fire*.

The rationale is that specific *calibration*s already take into account all appropriate silvicultural (management) actions by default, so they are not adjustable.

An advantage of a specific *calibration* would be that it may be easier to use in modelling, requiring fewer inputs into the model.

But:

- The *FullCAM Guidelines* ("Notes on the availability of specific *Tree Species* calibrations, Note 2") state:
- "The specific calibrations can only be used for plantings up to 15 years of age, and where stocking density and tree proportion has been calculated as per the Determination"; and
- The *FullCAM Guidelines* Table 1 also shows that specific calibrations permit a "Maximum allowable age of planting for simulation" of only 15 years; while
- The *Act*, para 69(2); states that the crediting period for *an eligible offsets project* period is 25 years unless another period is specified in the applicable Methodology Determination. No such specifications are given in the *FullCAM Methodology* or *FullCAM Guidelines*;

It appears (therefore) that the FullCAM software is unable to provide a valid carbon sequestration estimate for specific *calibrations* under this methodology!?

[In addition to the above two *calibrations* there are four other *calibrations* possible under the *FullCAM Methodology* (Schedule 1; and also *FullCAM Guidelines*, Table 1). These are not relevant to tropical areas:

- Mixed Species Environmental Planting, Temperate;
- Mallee eucalypt kochii;
- Mallee eucalypt loxophleba lissophloia;
- Mallee eucalypt polybractea].

The generic Mixed Species Environmental Planting *calibration* by contrast (*FullCAM Guidelines* para. 2.10.3 & Table 3), has much greater flexibility, being able to include Fertilisation (as a 'starter' and 'mid-rotation'), Weed control and Thinning and provide simulations up to 100 years.

However, these operations are still restricted to their default values (*FullCAM Guidelines* Table 3). "Planting -High Stocking', for example, one of the *Event* options offered by the FullCAM software, is not permitted).

C. Sampling/ Not Sampling Stocking Density and Tree Proportion

Sampling only applies to specific *calibrations* in temperate regions.

However, in order to interpret *FullCAM Methology* Schedule 1 and *FullCAM Guidelines* Table 1 the following information is given:

- The generic *Mixed Species Environmental Planting* does not have any restriction applied to the planting geometry (shape) nor to stocking density and tree proportion.
- Sampling allows a change from one specific *calibration* to another specific *calibration* or to the generic *calibration* should the figures produced by sampling show that the CEA has a different stocking density or tree proportion to the criteria of the particular *calibration* being used.
- Sampling is required when it is specified by a *calibration*, or if:
- Stocking is higher than the default *No Sampling calibration* or minimum stocking density and/or tree proportion criteria of the *calibration* you are using, and there is an advantage to move to a more carbon productive *calibration*; or
- Stocking and/or tree proportion are now lower than the minimum stocking density and/or tree proportion criteria of the *calibration* you are using, and you are forced to use a lower carbon-productive *calibration* or a generic *calibration*.
- After 2 years from planting, you have a choice to sample stocking density and tree (vs shrub) proportion to ascertain measured values for relevant carbon estimation in meeting the criteria of a specific *calibration* (*FullCAM Methodology* Para 3.20).
- After 5 years, the stocking density and tree proportion must meet the criteria of the specific *calibration* being used and sampling is necessary if the *calibration* requires it (*FullCAM Guidelines* Table 1 heading "Minimum sampling data required to use a calibration after 5 years from the planting date").
- When required, sampling only has to be done once over the carbon crediting period, unless a disturbance requires *recalibration* (*FullCAM Methodology*, para 3.21(2)).

D. Project Site/Planting Requirements for Mixed Species Environmental Planting (mallee rules are different)

A project that has been registered under the *ERF* is equivalent to an *Eligible Offsets Project* under the *FullCAM methodology*. Its boundaries must be delineated in accordance with the *CFI Mapping Guidelines*.

An ***Eligible Offsets Project*** must be *stratified* into one or more *Carbon Estimation Areas* and *Exclusion Areas* (delineated areas within the project area where carbon is not being accounted for).

The basic land unit for FullCAM (software) carbon sequestration simulation (estimation) is the ***plot***.

A FullCAM (software) *plot* is equivalent to a *Carbon Estimation Area (CEA)* under the *FullCAM Methodology*.

FullCAM can aggregate data from a number of plots to provide an estimate for an ***estate***.

For land to be an *eligible project area*, it must (per *FullCAM Methodology* para 2.3):

- Be within Australia and in an area where FullCAM data exists;
- Not contain woody biomass or an invasive *native* scrub species that needs to be cleared before planting (other than known weed species that may legally be cleared);
- Have been clear of forest cover for at least 5 years before the date of application as an eligible carbon offsets project.
- Be capable of producing trees attaining 2m or more in height and a crown cover of 20% of the area [i.e it meets the definition of reaching *forest potential, forest cover* and *forest* (see *FullCAM Methodology* para 1.3. *Definitions*).

For an *eligible offsets project* or a *CEA* to meet the criteria of these definitions, it is required to have a minimum area of 0.2 ha.

*A **Carbon Estimation Area** (**CEA**, as defined in the *FullCAM Methodology*) is an area of land that:

i. Has uniform:

- Soil type;
- Aspect; and
- Slope.

ii. Has been planted with the same species combination;

iii. Has received the same land management regime for:

- Site preparation before planting;
- Planting;
- Thinning;
- Weed control treatment;
- Fertiliser application.

iv. Consists of one or a number of planted areas (polygons) within a radius of 1.5 km (the radius is 5 km for mallee).

Each *CEA* must be mapped in accordance with the *CFI Mapping Guidelines* (in addition to the *Eligible Offsets Project* area).

Care must be taken to ensure that the *CEA* boundary does not accidentally (through GPS instrument errors or GIS layer differences) extend outside the *Eligible Offsets Project* area or extend beyond the property boundary (e.g. onto road reserve), when plotted.

When surveying a CEA, the points of measurement are outside the stems of the outermost plants and, where the trees are planted in belts, is one metre beyond the outer row of stems on both the long and the short axes (*FullCAM Methodology* para 3.4. & Schedule 2, right-most column).

A *CEA* can be:

i. Linear:

- **Narrow**: Lines or randomly spaced trees (seedlings or directly seeded) in a strip 20m wide or less (tree stem to tree stem) with the edge more than 40m from the edge of any other planting in the project area. There are no spacing criteria.
- **Wide**: Lines or randomly spaced trees (seedlings or directly seeded) in a strip between 20 and 40 m wide (tree stem to tree stem) with the edge more than 40m from the edge of any other planting in the project area. There are no spacing criteria.

Linear plantings must not be subject to competition from adjacent trees. There are further *FullCAM Methodology* rules in assessing this.

ii. A block: Any planting that is not a single line of trees or a linear planting described above.

Planting stocking density

Revegetation projects in Australia's Wet Tropics should have no problem meeting the default stocking density criteria for the *FullCAM Methodology* (given that approx. 3,000 stems per hectare are planted) i.e.,

- First 5 years after planting, maintaining 85% of the average number of seedlings planted per hectare.
- After 5 years, less than 500 stems per hectare is permissible.
- (And bear in mind the basic requirement for the planting to reach *forest cover* is a height of more than 2 m and 20% or more crown cover of the land).

E. Restricted Activities (after planting)

Harvesting

Only up to 10% of fallen timber may be removed for personal (non-commercial) use.

Biomass Removal

Permitted to remove:

- Debris for fire management;
- Fruits, nuts, seeds and fencing/ craft materials for own (non-commercial) use;
- Materials for traditional indigenous use.

Grazing

- This must not affect achieving or maintaining forest cover;
- The *Regulator* may request evidence that this is so, or whether the stocking density or tree/ shrub proportion (in the case of a specific *calibration*) have been deleteriously affected.

Thinning & Fertiliser/ Lime use

- If these occur, a specific *calibration* can no longer be used and FullCAM would need to be recalculated under a generic *calibration*.

Other Reasons that may Require Re-stratification

Re-stratification with new boundaries identified and mapped as more than one *CEA* will be required in the next offsets report if any of the following occur:

- Site characteristics are no longer uniform;
- Land management regime is no longer uniform (ie changes to weed control or fertiliser application);
- Parts of the area fail to achieve forest potential;
- More than 5% of the trees are killed by a disturbance[6];

[6] There would probably be a good case to argue against this in the case of revegetated tropical rainforest given

- part of the area has to be *recalibrated.*

A *CEA* can have a change of calibration at any time a new offsets report is produced.

F. Our choice for the pilot project, after analysis

The Yungaburra-Malanda SA is within the Tropical specific *calibration* area therefore we had the choice of using, in FullCAM:

- Mixed Species Environmental Planting (generic *calibration*); or
- Mixed Species Environmental Planting, Tropical (specific *calibration*).

Given that the generic calibration is not specific to the tropics and could be applied anywhere in Australia (in higher rainfall areas at least), it was thought that it would not be our best model and the *Tropical* specific *calibration* would be more suitable for our requirement.

However, this was not the case. Apart from the carbon sequestration period 'confusion' (15 /25/100 years) noted above, the specific calibration is "fixed" and by **applying our management regime to the generic *calibration*, we were able to significantly improve our carbon sequestration estimate** over the specific *calibration*.

Our "standard" management regime is (and was, in our carbon pilot project):

Time (months)	**Operation**
-3 to 0	Site preparation (spraying herbicide to non-grazed pasture grass, completely killing it & creating good mulch)
0	Digging holes, Fertilising & Planting
3	Weed control (herbicide spraying)
6	Weed control (herbicide spraying)
9	Weed control (herbicide spraying)
12	Weed control (herbicide spraying)
15	Weed control (herbicide spraying)
18	Weed control (herbicide spraying)
21	Weed control (herbicide spraying)
24+	Fertiliser application

Although the FullCAM software does provide a "Site Prep'" *event* option, it is not an option in the *FullCAM Guidelines*. Further, the option only offers "Clear and Windrow" which -clearly - is not suitable for planting ex-pasture that does not have thick woody growth.

Other than "Site Prep" FullCAM does not permit any other operation prior to the start date (which, for the FullCAM software, is the planting date of the *CEA*; not to be confused with the registered carbon project or *eligible offsets project area* start date).

its high stocking density.

In correspondence with DEE, where it was explained that our herbicide site preparation/ mulch regime provided a weed-free advantage to planted trees for up to 3 months after planting, it was accepted that we could substitute "site prep" with an additional weeding *Event* (to those shown above), recorded 1 day after planting in the FullCAM *Regime*.

The FullCAM software [noted within the model *Event* descriptions] treats fertilising and weeding as accelerating events to the *Forest Production Index* (or growth curve).

That is, each weeding *event* included in the modelling adds 1 year's growth to the plot over a 1 year period. Each fertilising *event* adds 1 years growth to the plot over a 5 year period. Therefore our regime of 1 weeding (site prep) + 7 further quarterly weedings + 2 fertiliser applications (at planting and "mid"-rotation) add 10 years additional growth to the first 7 years of the FullCAM model's growth curve.

This is an advantage given that frequent, effective weeding is both necessary and expensive.

As tropical rainforest tree species generally develop "plate-like" root systems and are top soil feeders, generally relying on decomposing plant material for their nitrogen, carbon and mineral uptake, they are severely affected by competition from grasses, particularly fast-growing, exotic pasture grasses. Intensive weeding is essential in reducing tree mortality and (through enhanced growth), shortening the period to canopy-closure (when the reduced light then provides natural weed suppression).

Without recording this intensive weeding, the FullCAM model still accumulates carbon (at a lesser rate), but the plot (on the ground) would likely not reach its future estimates of carbon sequestration or the *FullCAM Methodology* stocking or height criteria (in the short term), requiring re-calculation of the carbon stock.

A. Running FullCAM

The *FullCAM Guidelines* provide the step-by-step process in setting up the modelling.

Notes for guidance if following the methodology of our pilot project

(All Section and 'step' numbers given below refer to the *FullCAM Guidelines*]

Sections 2.1 to 2.3

Do as suggested.

Section 2.4

As noted, the Start Date is the (last) Planting Date of the *CEA*.

When entering dates, full years need to be entered (ie '2014', not '14').

The minimum carbon accounting period under the *Act* is 25 years. However, a specific *calibration* cannot be used to produce a simulation beyond 15 years.

Section 2.5

Enter the decimal latitude and longitude of the approximate centre of the *CEA.*

"Download Spatial Data" will only occur if there is an internet connection.

Select "Mixed species environmental planting" (not "Mixed species environmental planting tropical") [steps 4 & 5].

This will automatically insert "Mixed species environmental planting (1970-present All Plantation high: Non-commercial planting; No prunes) 1" into the *Regimes (Initial Rotation)* box.

Do nothing with this. As our selection is a generic calibration, ignore the options provided in this drop down box and follow Step 6b.

Sections 2.6 to 2.9

Do as suggested.

Section 2.10

Take note only.

Section 2.11

This is where the generic *calibration Events* relating to our (or your own) management *Regime* are entered.

If you had selected a specific *calibration*, the *events* relating to this *regime* would be listed here.

In our case (of using the generic *calibration*) this will be blank, awaiting our data.

Section 2.11.1

Ignore this section if using the generic *calibration.*

Section 2.11.2

The Events tab in FullCAM may (probably will?) be different to the screenshot shown in the *FullCAM Guidelines*.

Instead of just an *Events List* you may get a tab that shows *Regime Editing* on the left and *Event Editing* on the right.

Ignore the *Regime Editing*.

To add a new *Event*, click the "New..." button in the *Event Editing* part of the tab.

Appendix 7. FullCAM Calculations for the pilot project

TREAT Project FullCAM Output & Carbon Sequestration Printed: 10/05/2019

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	**Month**	**Day**	**Dec. Year**	**CH_4 emitted due to fire (tCH_4/ha)**	**C mass of trees (tC/ha) [C_{ti}]**	**C mass of forest debris (tC/ha)**	**N_2O emitted due to fire (tN_2O/ha)**		***C_{di} [Equation A & B]***	**Total C mass (trees + debris) (tC/ha) [C_{di} + C_{ti}; Eq 12]**	**Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]**	**Total CO_2 equiv (tCO_2-e/ha) [Eq 11]**	**Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]**		**CEA Area (ha) [a_i]**
2017	3	31	2017.247		0.0000	0.0000			0.0000	0.0000	0.0000	0.0000	0.0000		**1.65**
2017	4	30	2017.329	0	0.2937	0.0038	0		0.0038	0.2975	0.4908	1.0907	1.7997		
2017	5	31	2017.414	0	0.2937	0.0074	0		0.0074	0.3011	0.4968	1.1041	1.8217		
2017	6	30	2017.496	0	0.2937	0.0109	0		0.0109	0.3046	0.5026	1.1169	1.8428		
2017	7	31	2017.581	0	0.2944	0.0144	0		0.0144	0.3088	0.5095	1.1322	1.8681		
2017	8	31	2017.666	0	0.3009	0.0179	0		0.0179	0.3188	0.5260	1.1688	1.9286		
2017	9	30	2017.748	0	0.3358	0.0215	0		0.0215	0.3573	0.5895	1.3101	2.1616		
2017	10	31	2017.833	0	0.4565	0.0262	0		0.0262	0.4827	0.7964	1.7698	2.9202		
2017	11	30	2017.915	0	0.7688	0.0335	0		0.0335	0.8023	1.3238	2.9417	4.8538		
2017	12	31	2018	0	1.4777	0.0483	0		0.0483	1.5260	2.5178	5.5952	9.2321		
2018	1	31	2018.085	0	2.6651	0.0755	0		0.0755	2.7406	4.5220	10.0489	16.5807		
2018	2	28	2018.162	0	4.4755	0.1177	0		0.1177	4.5932	7.5787	16.8416	27.7887		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2018	3	31	2018.247	0	7.1225	0.1903	0		0.1903	7.3128	12.0662	26.8138	44.2427		
2018	4	30	2018.329	0	9.5348	0.2862	0		0.2862	9.8210	16.2046	36.0102	59.4168		
2018	5	31	2018.414	0	12.8785	0.4183	0		0.4183	13.2968	21.9397	48.7550	80.4457		
2018	6	30	2018.496	0	16.4740	0.5785	0		0.5785	17.0525	28.1367	62.5259	103.1678		
2018	7	31	2018.581	0	19.9012	0.7756	0		0.7756	20.6768	34.1167	75.8149	125.0945		
2018	8	31	2018.666	0	24.0995	1.0079	0		1.0079	25.1073	41.4271	92.0602	151.8993		
2018	9	30	2018.748	0	27.9486	1.2666	0		1.2666	29.2152	48.2051	107.1224	176.7520		
2018	10	31	2018.833	0	31.7017	1.5547	0		1.5547	33.2564	54.8730	121.9400	201.2010		
2018	11	30	2018.915	0	35.8409	1.8548	0		1.8548	37.6957	62.1979	138.2175	228.0589		
2018	12	31	2019	0	39.6398	2.1882	0		2.1882	41.8279	69.0161	153.3690	253.0589		
2019	1	31	2019.085	0	43.4855	2.5432	0		2.5432	46.0286	75.9472	168.7716	278.4731		
2019	2	28	2019.162	0	46.3640	2.8789	0		2.8789	49.2429	81.2507	180.5572	297.9194		
2019	3	31	2019.247	0	49.5415	3.2641	0		3.2641	52.8057	87.1294	193.6208	319.4743		
2019	4	30	2019.329	0	52.5828	3.6494	0		3.6494	56.2322	92.7832	206.1848	340.2049		
2019	5	31	2019.414	0	54.9685	4.0584	0		4.0584	59.0269	97.3943	216.4319	357.1126		
2019	6	30	2019.496	0	57.2633	4.4700	0		4.4700	61.7334	101.8600	226.3556	373.4868		
2019	7	31	2019.581	0	59.5820	4.9089	0		4.9089	64.4909	106.4100	236.4666	390.1699		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2019	8	31	2019.666	0	61.1839	5.3574	0		5.3574	66.5413	109.7931	243.9847	402.5748		
2019	9	30	2019.748	0	62.7254	5.8047	0		5.8047	68.5301	113.0746	251.2770	414.6070		
2019	10	31	2019.833	0	64.2798	6.2495	0		6.2495	70.5293	116.3734	258.6075	426.7024		
2019	11	30	2019.915	0	65.1116	6.6484	0		6.6484	71.7600	118.4040	263.1201	434.1482		
2019	12	31	2020	0	65.9681	7.0541	0		7.0541	73.0223	120.4867	267.7483	441.7847		
2020	1	31	2020.085	0	66.8183	7.4540	0		7.4540	74.2722	122.5492	272.3315	449.3470		
2020	2	29	2020.164	0	67.6065	7.8218	0		7.8218	75.4283	124.4566	276.5703	456.3410		
2020	3	31	2020.249	0	68.4459	8.2082	0		8.2082	76.6541	126.4792	281.0649	463.7571		
2020	4	30	2020.331	0	69.2552	8.5759	0		8.5759	77.8311	128.4213	285.3807	470.8781		
2020	5	31	2020.415	0	70.0882	8.9541	0		8.9541	79.0422	130.4197	289.8215	478.2054		
2020	6	30	2020.497	0	70.8911	9.3344	0		9.3344	80.2255	132.3721	294.1602	485.3643		
2020	7	31	2020.582	0	71.7174	9.7365	0		9.7365	81.4539	134.3990	298.6644	492.7962		
2020	8	31	2020.667	0	72.5403	10.1467	0		10.1467	82.6871	136.4337	303.1860	500.2568		
2020	9	30	2020.749	0	73.3334	10.5569	0		10.5569	83.8903	138.4190	307.5977	507.5362		
2020	10	31	2020.833	0	74.1495	10.9427	0		10.9427	85.0922	140.4021	312.0047	514.8078		
2020	11	30	2020.915	0	74.9350	11.2693	0		11.2693	86.2043	142.2371	316.0825	521.5361		
2020	12	31	2021	0	75.7420	11.5943	0		11.5943	87.3363	144.1049	320.2331	528.3847		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2021	1	31	2021.085	0	76.5455	11.9131	0		11.9131	88.4586	145.9567	324.3482	535.1745		
2021	2	28	2021.162	0	77.2681	12.1968	0		12.1968	89.4649	147.6171	328.0380	541.2626		
2021	3	31	2021.247	0	78.0647	12.5063	0		12.5063	90.5710	149.4421	332.0936	547.9544		
2021	4	30	2021.329	0	78.8322	12.8018	0		12.8018	91.6340	151.1961	335.9913	554.3857		
2021	5	31	2021.414	0	79.6216	13.1094	0		13.1094	92.7310	153.0062	340.0137	561.0226		
2021	6	30	2021.496	0	80.3820	13.4317	0		13.4317	93.8137	154.7926	343.9836	567.5729		
2021	7	31	2021.581	0	81.1642	13.7813	0		13.7813	94.9455	156.6601	348.1335	574.4204		
2021	8	31	2021.666	0	81.9426	14.1453	0		14.1453	96.0880	158.5452	352.3226	581.3323		
2021	9	30	2021.748	0	82.6918	14.5188	0		14.5188	97.2106	160.3975	356.4390	588.1243		
2021	10	31	2021.833	0	83.4613	14.8579	0		14.8579	98.3192	162.2266	360.5036	594.8310		
2021	11	30	2021.915	0	84.2024	15.1243	0		15.1243	99.3267	163.8891	364.1981	600.9268		
2021	12	31	2022	0	84.9646	15.3862	0		15.3862	100.3508	165.5788	367.9528	607.1221		
2022	1	31	2022.085	0	85.7230	15.6432	0		15.6432	101.3662	167.2542	371.6760	613.2654		
2022	2	28	2022.162	0	86.4048	15.8724	0		15.8724	102.2772	168.7574	375.0165	618.7773		
2022	3	31	2022.247	0	87.1561	16.1232	0		16.1232	103.2793	170.4108	378.6906	624.8395		
2022	4	30	2022.329	0	87.8796	16.3635	0		16.3635	104.2430	172.0010	382.2245	630.6704		
2022	5	31	2022.414	0	88.6235	16.6170	0		16.6170	105.2405	173.6469	385.8820	636.7052		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2022	6	30	2022.496	0	89.3398	16.8952	0		16.8952	106.2350	175.2877	389.5283	642.7217		
2022	7	31	2022.581	0	90.0758	17.2053	0		17.2053	107.2811	177.0138	393.3641	649.0507		
2022	8	31	2022.666	0	90.8073	17.5346	0		17.5346	108.3419	178.7641	397.2536	655.4684		
2022	9	30	2022.748	0	91.5116	17.8810	0		17.8810	109.3926	180.4977	401.1061	661.8250		
2022	10	31	2022.833	0	92.2357	18.1846	0		18.1846	110.4202	182.1934	404.8742	668.0424		
2022	11	30	2022.915	0	92.9329	18.4044	0		18.4044	111.3372	183.7064	408.2364	673.5901		
2022	12	31	2023	0	93.6496	18.6171	0		18.6171	112.2667	185.2400	411.6445	679.2134		
2023	1	31	2023.085	0	94.3627	18.8258	0		18.8258	113.1885	186.7610	415.0244	684.7902		
2023	2	28	2023.162	0	95.0035	19.0125	0		19.0125	114.0160	188.1264	418.0587	689.7968		
2023	3	31	2023.247	0	95.7095	19.2172	0		19.2172	114.9267	189.6291	421.3979	695.3065		
2023	4	30	2023.329	0	96.3892	19.4142	0		19.4142	115.8034	191.0755	424.6123	700.6103		
2023	5	31	2023.414	0	97.0875	19.6254	0		19.6254	116.7129	192.5762	427.9472	706.1128		
2023	6	30	2023.496	0	97.7591	19.8691	0		19.8691	117.6282	194.0866	431.3035	711.6508		
2023	7	31	2023.581	0	98.4495	20.1486	0		20.1486	118.5981	195.6869	434.8598	717.5187		
2023	8	31	2023.666	0	99.1362	20.4514	0		20.4514	119.5876	197.3196	438.4880	723.5052		
2023	9	30	2023.748	0	99.7974	20.7775	0		20.7775	120.5748	198.9485	442.1078	729.4778		
2023	10	31	2023.833	0	100.4770	21.0537	0		21.0537	121.5306	200.5256	445.6124	735.2604		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2023	11	30	2023.915	0	101.1312	21.2365	0		21.2365	122.3677	201.9067	448.6815	740.3245		
2023	12	31	2024	0	101.8037	21.4101	0		21.4101	123.2138	203.3027	451.7838	745.4433		
2024	1	31	2024.085	0	102.4143	21.5803	0		21.5803	123.9946	204.5911	454.6468	750.1672		
2024	2	29	2024.164	0	102.9335	21.7380	0		21.7380	124.6716	205.7081	457.1290	754.2629		
2024	3	31	2024.249	0	103.4861	21.9051	0		21.9051	125.3913	206.8956	459.7679	758.6171		
2024	4	30	2024.331	0	104.0179	22.0663	0		22.0663	126.0841	208.0388	462.3085	762.8090		
2024	5	31	2024.415	0	104.5649	22.2448	0		22.2448	126.8097	209.2360	464.9689	767.1988		
2024	6	30	2024.497	0	105.0919	22.4593	0		22.4593	127.5512	210.4595	467.6879	771.6850		
2024	7	31	2024.582	0	105.6341	22.7144	0		22.7144	128.3485	211.7751	470.6113	776.5087		
2024	8	31	2024.667	0	106.1739	22.9953	0		22.9953	129.1692	213.1291	473.6203	781.4734		
2024	9	30	2024.749	0	106.6940	23.2984	0		23.2984	129.9923	214.4873	476.6385	786.4535		
2024	10	31	2024.833	0	107.2290	23.5479	0		23.5479	130.7769	215.7819	479.5152	791.2001		
2024	11	30	2024.915	0	107.7444	23.6972	0		23.6972	131.4417	216.8788	481.9528	795.2221		
2024	12	31	2025	0	108.2747	23.8356	0		23.8356	132.1103	217.9820	484.4045	799.2674		
2025	1	31	2025.085	0	108.8026	23.9708	0		23.9708	132.7734	219.0760	486.8357	803.2788		
2025	2	28	2025.162	0	109.2774	24.0921	0		24.0921	133.3695	220.0597	489.0216	806.8856		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2025	3	31	2025.247	0	109.8008	24.2258	0		24.2258	134.0266	221.1439	491.4308	810.8608		
2025	4	30	2025.329	0	110.3044	24.3555	0		24.3555	134.6599	222.1889	493.7531	814.6926		
2025	5	31	2025.414	0	110.8225	24.5035	0		24.5035	135.3261	223.2880	496.1955	818.7226		
2025	6	30	2025.496	0	111.3217	24.6932	0		24.6932	136.0148	224.4245	498.7211	822.8898		
2025	7	31	2025.581	0	111.8352	24.9262	0		24.9262	136.7614	225.6564	501.4586	827.4067		
2025	8	31	2025.666	0	112.3464	25.1879	0		25.1879	137.5343	226.9316	504.2925	832.0827		
2025	9	30	2025.748	0	112.8389	25.4761	0		25.4761	138.3150	228.2198	507.1550	836.8058		
2025	10	31	2025.833	0	113.3456	25.7056	0		25.7056	139.0512	229.4344	509.8543	841.2596		
2025	11	30	2025.915	0	113.8337	25.8282	0		25.8282	139.6620	230.4422	512.0939	844.9549		
2025	12	31	2026	0	114.3359	25.9384	0		25.9384	140.2743	231.4527	514.3392	848.6598		
2026	1	31	2026.085	0	114.8358	26.0459	0		26.0459	140.8817	232.4548	516.5662	852.3343		
2026	2	28	2026.162	0	115.2854	26.1428	0		26.1428	141.4282	233.3566	518.5702	855.6408		
2026	3	31	2026.247	0	115.7810	26.2501	0		26.2501	142.0311	234.3513	520.7806	859.2880		
2026	4	30	2026.329	0	116.2580	26.3548	0		26.3548	142.6128	235.3111	522.9137	862.8075		
2026	5	31	2026.414	0	116.7487	26.4786	0		26.4786	143.2273	236.3250	525.1667	866.5251		
2026	6	30	2026.496	0	117.2214	26.6487	0		26.6487	143.8702	237.3858	527.5239	870.4144		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	**Month**	**Day**	**Dec. Year**	**CH_4 emitted due to fire (tCH_4/ha)**	**C mass of trees (tC/ha) [C_{ti}]**	**C mass of forest debris (tC/ha)**	**N_2O emitted due to fire (tN_2O/ha)**		***C_{di} [Equation A & B]***	**Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]**	**Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]**	**Total CO_2 equiv (tCO_2-e/ha) [Eq 11]**	**Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]**		**CEA Area (ha) [a_i]**
2026	7	31	2026.581	0	117.7078	26.8647	0		26.8647	144.5725	238.5446	530.0990	874.6634		
2026	8	31	2026.666	0	118.1919	27.1117	0		27.1117	145.3036	239.7510	532.7799	879.0869		
2026	9	30	2026.748	0	118.6584	27.3887	0		27.3887	146.0470	240.9776	535.5057	883.5845		
2026	10	31	2026.833	0	119.1382	27.6026	0		27.6026	146.7408	242.1223	538.0495	887.7817		
2026	11	30	2026.915	0	119.6005	27.7038	0		27.7038	147.3043	243.0521	540.1159	891.1912		
2026	12	31	2027	0	120.0761	27.7913	0		27.7913	147.8674	243.9813	542.1806	894.5979		
2027	1	31	2027.085	0	120.5496	27.8764	0		27.8764	148.4260	244.9029	544.2286	897.9772		
2027	2	28	2027.162	0	120.9754	27.9535	0		27.9535	148.9290	245.7328	546.0729	901.0202		
2027	3	31	2027.247	0	121.4448	28.0393	0		28.0393	149.4842	246.6489	548.1086	904.3792		
2027	4	30	2027.329	0	121.8967	28.1239	0		28.1239	150.0205	247.5339	550.0753	907.6243		
2027	5	31	2027.414	0	122.3615	28.2280	0		28.2280	150.5895	248.4727	552.1616	911.0667		
2027	6	30	2027.496	0	122.8093	28.3825	0		28.3825	151.1919	249.4666	554.3702	914.7108		
2027	7	31	2027.581	0	123.2700	28.5850	0		28.5850	151.8550	250.5608	556.8018	918.7229		
2027	8	31	2027.666	0	123.7287	28.8205	0		28.8205	152.5492	251.7062	559.3470	922.9226		
2027	9	30	2027.748	0	124.1706	29.0889	0		29.0889	153.2595	252.8782	561.9516	927.2201		
2027	10	31	2027.833	0	124.6252	29.2905	0		29.2905	153.9157	253.9608	564.3574	931.1898		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2027	11	30	2027.915	0	125.0632	29.3742	0		29.3742	154.4374	254.8217	566.2703	934.3461		
2027	12	31	2028	0	125.5138	29.4430	0		29.4430	154.9568	255.6787	568.1749	937.4886		
2028	1	31	2028.085	0	125.9624	29.5097	0		29.5097	155.4721	256.5289	570.0642	940.6060		
2028	2	29	2028.164	0	126.3802	29.5727	0		29.5727	155.9529	257.3224	571.8275	943.5153		
2028	3	31	2028.249	0	126.8249	29.6409	0		29.6409	156.4659	258.1687	573.7081	946.6184		
2028	4	30	2028.331	0	127.2531	29.7095	0		29.7095	156.9626	258.9883	575.5295	949.6237		
2028	5	31	2028.415	0	127.6935	29.7996	0		29.7996	157.4930	259.8635	577.4745	952.8329		
2028	6	30	2028.497	0	128.1178	29.9432	0		29.9432	158.0610	260.8007	579.5572	956.2693		
2028	7	31	2028.582	0	128.5544	30.1352	0		30.1352	158.6896	261.8378	581.8618	960.0720		
2028	8	31	2028.667	0	128.9891	30.3634	0		30.3634	159.3525	262.9316	584.2924	964.0825		
2028	9	30	2028.749	0	129.4078	30.6223	0		30.6223	160.0302	264.0498	586.7772	968.1824		
2028	10	31	2028.833	0	129.8387	30.8099	0		30.8099	160.6486	265.0702	589.0449	971.9241		
2028	11	30	2028.915	0	130.2538	30.8784	0		30.8784	161.1322	265.8681	590.8181	974.8498		
2028	12	31	2029	0	130.6809	30.9315	0		30.9315	161.6124	266.6605	592.5789	977.7552		
2029	1	31	2029.085	0	131.1061	30.9828	0		30.9828	162.0889	267.4467	594.3260	980.6378		
2029	2	28	2029.162	0	131.4885	31.0300	0		31.0300	162.5186	268.1556	595.9014	983.2373		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2029	3	31	2029.247	0	131.9101	31.0834	0		31.0834	162.9935	268.9393	597.6430	986.1109		
2029	4	30	2029.329	0	132.3161	31.1380	0		31.1380	163.4541	269.6992	599.3316	988.8972		
2029	5	31	2029.414	0	132.7337	31.2146	0		31.2146	163.9483	270.5146	601.1436	991.8870		
2029	6	30	2029.496	0	133.1361	31.3477	0		31.3477	164.4838	271.3983	603.1074	995.1271		
2029	7	31	2029.581	0	133.5501	31.5308	0		31.5308	165.0809	272.3835	605.2968	998.7397		
2029	8	31	2029.666	0	133.9623	31.7518	0		31.7518	165.7141	273.4283	607.6184	1002.5703		
2029	9	30	2029.748	0	134.3595	32.0055	0		32.0055	166.3649	274.5022	610.0048	1006.5079		
2029	10	31	2029.833	0	134.7681	32.1847	0		32.1847	166.9529	275.4722	612.1605	1010.0648		
2029	11	30	2029.915	0	135.1619	32.2408	0		32.2408	167.4027	276.2145	613.8099	1012.7863		
2029	12	31	2030	0	135.5670	32.2807	0		32.2807	167.8477	276.9487	615.4415	1015.4785		
2030	1	31	2030.085	0	135.9704	32.3188	0		32.3188	168.2892	277.6772	617.0604	1018.1497		
2030	2	28	2030.162	0	136.3332	32.3544	0		32.3544	168.6876	278.3345	618.5212	1020.5599		
2030	3	31	2030.247	0	136.7332	32.3952	0		32.3952	169.1283	279.0617	620.1371	1023.2263		
2030	4	30	2030.329	0	137.1183	32.4378	0		32.4378	169.5561	279.7676	621.7059	1025.8147		
2030	5	31	2030.414	0	137.5146	32.5029	0		32.5029	170.0175	280.5289	623.3976	1028.6060		
2030	6	30	2030.496	0	137.8965	32.6272	0		32.6272	170.5237	281.3641	625.2536	1031.6684		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2030	7	31	2030.581	0	138.2894	32.8030	0		32.8030	171.0923	282.3024	627.3386	1035.1086		
2030	8	31	2030.666	0	138.6806	33.0180	0		33.0180	171.6985	283.3026	629.5613	1038.7761		
2030	9	30	2030.748	0	139.0575	33.2675	0		33.2675	172.3250	284.3363	631.8584	1042.5664		
2030	10	31	2030.833	0	139.4454	33.4398	0		33.4398	172.8852	285.2606	633.9125	1045.9556		
2030	11	30	2030.915	0	139.8191	33.4853	0		33.4853	173.3044	285.9523	635.4496	1048.4919		
2030	12	31	2031	0	140.2037	33.5137	0		33.5137	173.7175	286.6338	636.9640	1050.9906		
2031	1	31	2031.085	0	140.5866	33.5406	0		33.5406	174.1272	287.3099	638.4664	1053.4696		
2031	2	28	2031.162	0	140.9311	33.5661	0		33.5661	174.4972	287.9204	639.8230	1055.7080		
2031	3	31	2031.247	0	141.3108	33.5959	0		33.5959	174.9068	288.5962	641.3248	1058.1859		
2031	4	30	2031.329	0	141.6766	33.6283	0		33.6283	175.3049	289.2530	642.7845	1060.5944		
2031	5	31	2031.414	0	142.0529	33.6835	0		33.6835	175.7364	289.9650	644.3667	1063.2051		
2031	6	30	2031.496	0	142.4155	33.8003	0		33.8003	176.2158	290.7561	646.1247	1066.1058		
2031	7	31	2031.581	0	142.7887	33.9698	0		33.9698	176.7585	291.6515	648.1145	1069.3889		
2031	8	31	2031.666	0	143.1602	34.1799	0		34.1799	177.3401	292.6112	650.2471	1072.9077		
2031	9	30	2031.748	0	143.5183	34.4261	0		34.4261	177.9444	293.6082	652.4627	1076.5635		
2031	10	31	2031.833	0	143.8867	34.5926	0		34.5926	178.4793	294.4909	654.4241	1079.7998		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2031	11	30	2031.915	0	144.2418	34.6288	0		34.6288	178.8706	295.1365	655.8588	1082.1670		
2031	12	31	2032	0	144.6071	34.6473	0		34.6473	179.2544	295.7698	657.2662	1084.4892		
2032	1	31	2032.085	0	144.9710	34.6642	0		34.6642	179.6352	296.3980	658.6623	1086.7928		
2032	2	29	2032.164	0	145.3099	34.6816	0		34.6816	179.9915	296.9860	659.9689	1088.9486		
2032	3	31	2032.249	0	145.6707	34.7020	0		34.7020	180.3727	297.6149	661.3665	1091.2547		
2032	4	30	2032.331	0	146.0182	34.7259	0		34.7259	180.7441	298.2278	662.7284	1093.5018		
2032	5	31	2032.415	0	146.3758	34.7747	0		34.7747	181.1506	298.8984	664.2187	1095.9609		
2032	6	30	2032.497	0	146.7205	34.8868	0		34.8868	181.6072	299.6519	665.8932	1098.7238		
2032	7	31	2032.582	0	147.0751	35.0521	0		35.0521	182.1272	300.5099	667.7999	1101.8698		
2032	8	31	2032.667	0	147.4282	35.2601	0		35.2601	182.6884	301.4358	669.8574	1105.2647		
2032	9	30	2032.749	0	147.7686	35.5009	0		35.5009	183.2695	302.3946	671.9881	1108.7803		
2032	10	31	2032.833	0	148.1188	35.6576	0		35.6576	183.7764	303.2311	673.8468	1111.8472		
2032	11	30	2032.915	0	148.4563	35.6850	0		35.6850	184.1413	303.8332	675.1848	1114.0550		
2032	12	31	2033	0	148.8037	35.6946	0		35.6946	184.4983	304.4222	676.4937	1116.2146		
2033	1	31	2033.085	0	149.1496	35.7029	0		35.7029	184.8525	305.0066	677.7924	1118.3574		
2033	2	28	2033.162	0	149.4608	35.7120	0		35.7120	185.1727	305.5350	678.9667	1120.2950		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2033	3	31	2033.247	0	149.8039	35.7239	0		35.7239	185.5278	306.1209	680.2686	1122.4431		
2033	4	30	2033.329	0	150.1345	35.7398	0		35.7398	185.8743	306.6926	681.5390	1124.5394		
2033	5	31	2033.414	0	150.4746	35.7811	0		35.7811	186.2557	307.3220	682.9377	1126.8472		
2033	6	30	2033.496	0	150.8024	35.8875	0		35.8875	186.6900	308.0385	684.5299	1129.4743		
2033	7	31	2033.581	0	151.1398	36.0484	0		36.0484	187.1882	308.8605	686.3567	1132.4885		
2033	8	31	2033.666	0	151.4758	36.2529	0		36.2529	187.7287	309.7523	688.3385	1135.7585		
2033	9	30	2033.748	0	151.7996	36.4914	0		36.4914	188.2910	310.6802	690.4003	1139.1606		
2033	10	31	2033.833	0	152.1329	36.6436	0		36.6436	188.7765	311.4812	692.1805	1142.0979		
2033	11	30	2033.915	0	152.4541	36.6638	0		36.6638	189.1179	312.0445	693.4321	1144.1630		
2033	12	31	2034	0	152.7846	36.6656	0		36.6656	189.4502	312.5928	694.6507	1146.1737		
2034	1	31	2034.085	0	153.1138	36.6661	0		36.6661	189.7799	313.1368	695.8597	1148.1684		
2034	2	28	2034.162	0	153.4100	36.6682	0		36.6682	190.0783	313.6291	696.9536	1149.9734		
2034	3	31	2034.247	0	153.7366	36.6726	0		36.6726	190.4093	314.1753	698.1673	1151.9761		
2034	4	30	2034.329	0	154.0513	36.6815	0		36.6815	190.7328	314.7091	699.3535	1153.9332		
2034	5	31	2034.414	0	154.3751	36.7160	0		36.7160	191.0912	315.3004	700.6676	1156.1016		
2034	6	30	2034.496	0	154.6873	36.8175	0		36.8175	191.5047	315.9828	702.1840	1158.6036		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2034	7	31	2034.581	0	155.0085	36.9743	0		36.9743	191.9828	316.7717	703.9371	1161.4962		
2034	8	31	2034.666	0	155.3284	37.1759	0		37.1759	192.5043	317.6321	705.8492	1164.6511		
2034	9	30	2034.748	0	155.6368	37.4125	0		37.4125	193.0493	318.5314	707.8475	1167.9484		
2034	10	31	2034.833	0	155.9542	37.5609	0		37.5609	193.5151	319.2999	709.5552	1170.7661		
2034	11	30	2034.915	0	156.2601	37.5745	0		37.5745	193.8346	319.8272	710.7270	1172.6996		
2034	12	31	2035	0	156.5750	37.5693	0		37.5693	194.1442	320.3380	711.8622	1174.5726		
2035	1	31	2035.085	0	156.8885	37.5628	0		37.5628	194.4513	320.8447	712.9883	1176.4306		
2035	2	28	2035.162	0	157.1707	37.5587	0		37.5587	194.7294	321.3036	714.0080	1178.1131		
2035	3	31	2035.247	0	157.4819	37.5564	0		37.5564	195.0382	321.8131	715.1402	1179.9813		
2035	4	30	2035.329	0	157.7817	37.5588	0		37.5588	195.3405	322.3118	716.2485	1181.8099		
2035	5	31	2035.414	0	158.0903	37.5873	0		37.5873	195.6776	322.8680	717.4844	1183.8493		
2035	6	30	2035.496	0	158.3877	37.6843	0		37.6843	196.0720	323.5188	718.9307	1186.2357		
2035	7	31	2035.581	0	158.6938	37.8377	0		37.8377	196.5315	324.2770	720.6157	1189.0158		
2035	8	31	2035.666	0	158.9988	38.0367	0		38.0367	197.0354	325.1084	722.4632	1192.0643		
2035	9	30	2035.748	0	159.2927	38.2717	0		38.2717	197.5644	325.9813	724.4029	1195.2647		
2035	10	31	2035.833	0	159.5952	38.4167	0		38.4167	198.0119	326.7196	726.0435	1197.9718		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2035	11	30	2035.915	0	159.8868	38.4245	0		38.4245	198.3113	327.2136	727.1414	1199.7833		
2035	12	31	2036	0	160.1870	38.4128	0		38.4128	198.5998	327.6897	728.1993	1201.5289		
2036	1	31	2036.085	0	160.4860	38.4000	0		38.4000	198.8860	328.1619	729.2486	1203.2601		
2036	2	29	2036.164	0	160.7646	38.3900	0		38.3900	199.1546	328.6051	730.2335	1204.8852		
2036	3	31	2036.249	0	161.0612	38.3816	0		38.3816	199.4429	329.0807	731.2905	1206.6293		
2036	4	30	2036.331	0	161.3471	38.3789	0		38.3789	199.7260	329.5479	732.3287	1208.3423		
2036	5	31	2036.415	0	161.6414	38.4044	0		38.4044	200.0458	330.0755	733.5011	1210.2769		
2036	6	30	2036.497	0	161.9250	38.4992	0		38.4992	200.4242	330.7000	734.8889	1212.5667		
2036	7	31	2036.582	0	162.2170	38.6509	0		38.6509	200.8678	331.4319	736.5154	1215.2504		
2036	8	31	2036.667	0	162.5078	38.8498	0		38.8498	201.3576	332.2400	738.3112	1218.2135		
2036	9	30	2036.749	0	162.7882	39.0807	0		39.0807	201.8688	333.0836	740.1857	1221.3065		
2036	10	31	2036.833	0	163.0767	39.2173	0		39.2173	202.2940	333.7852	741.7448	1223.8790		
2036	11	30	2036.915	0	163.3549	39.2190	0		39.2190	202.5740	334.2470	742.7712	1225.5725		
2036	12	31	2037	0	163.6413	39.2015	0		39.2015	202.8428	334.6907	743.7571	1227.1991		
2037	1	31	2037.085	0	163.9266	39.1830	0		39.1830	203.1096	335.1308	744.7351	1228.8129		
2037	2	28	2037.162	0	164.1833	39.1683	0		39.1683	203.3515	335.5300	745.6222	1230.2766		

From FullCAM									MSEP/Mallee Methodology Calculations						
Year	Month	Day	Dec. Year	CH_4 emitted due to fire (tCH_4/ha)	C mass of trees (tC/ha) [C_{ti}]	C mass of forest debris (tC/ha)	N_2O emitted due to fire (tN_2O/ha)		C_{di} [Equation A & B]	Total C mass (trees + debris) (tC/ha) [$C_{di} + C_{ti}$; Eq 12]	Total C mass (trees + debris) (tC for CEA) [C_{Di}; Eq 12]	Total CO_2 equiv (tCO_2-e/ha) [Eq 11]	Total CO_2 equiv (tCO_2-e for CEA) [Eq 12]		CEA Area (ha) [a_i]
2037	3	31	2037.247	0	164.4664	39.1542	0		39.1542	203.6206	335.9741	746.6090	1231.9049		
2037	4	30	2037.329	0	164.7393	39.1462	0		39.1462	203.8855	336.4111	747.5801	1233.5072		
2037	5	31	2037.414	0	165.0201	39.1668	0		39.1668	204.1869	336.9084	748.6854	1235.3309		
2037	6	30	2037.496	0	165.2909	39.2581	0		39.2581	204.5490	337.5058	750.0129	1237.5213		
2037	7	31	2037.581	0	165.5696	39.4070	0		39.4070	204.9766	338.2114	751.5808	1240.1083		
2037	8	31	2037.666	0	165.8473	39.6039	0		39.6039	205.4512	338.9945	753.3212	1242.9799		
2037	9	30	2037.748	0	166.1150	39.8337	0		39.8337	205.9486	339.8153	755.1450	1245.9893		
2037	10	31	2037.833	0	166.3905	39.9675	0		39.9675	206.3580	340.4907	756.6459	1248.4658		
2037	11	30	2037.915	0	166.6562	39.9643	0		39.9643	206.6205	340.9238	757.6084	1250.0539		
2037	12	31	2038	0	166.9297	39.9415	0		39.9415	206.8711	341.3374	758.5275	1251.5704		
2038	1	31	2038.085	0	167.2021	39.9177	0		39.9177	207.1198	341.7476	759.4391	1253.0745		
2038	2	28	2038.162	0	167.4473	39.8982	0		39.8982	207.3455	342.1200	760.2667	1254.4401		
2038	3	31	2038.247	0	167.7177	39.8791	0		39.8791	207.5968	342.5347	761.1882	1255.9606		
2038	4	30	2038.329	0	167.9784	39.8662	0		39.8662	207.8446	342.9436	762.0968	1257.4598		
2038	5	31	2038.414	0	168.2467	39.8822	0		39.8822	208.1290	343.4128	763.1395	1259.1802		
2038	6	30	2038.496	0	168.5054	39.9703	0		39.9703	208.4757	343.9849	764.4109	1261.2780		

From FullCAM									MSEP/Mallee Methodology Calculations						
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2038	7	31	2038.581	0	168.7717	40.1167	0		40.1167	208.8884	344.6659	765.9242	1263.7749		
2038	8	31	2038.666	0	169.0370	40.3119	0		40.3119	209.3490	345.4258	767.6130	1266.5614		
2038	9	30	2038.748	0	169.2928	40.5407	0		40.5407	209.8335	346.2253	769.3896	1269.4929		
2038	10	31	2038.833	0	169.5562	40.6719	0		40.6719	210.2281	346.8764	770.8364	1271.8800		
2038	11	30	2038.915	0	169.8101	40.6642	0		40.6642	210.4743	347.2827	771.7393	1273.3698		
2038	12	31	2039	0	170.0715	40.6365	0		40.6365	210.7080	347.6682	772.5961	1274.7835		
2039	1	31	2039.085	0	170.3319	40.6078	0		40.6078	210.9397	348.0506	773.4457	1276.1855		
2039	2	28	2039.162	0	170.5663	40.5840	0		40.5840	211.1503	348.3980	774.2178	1277.4594		
2039	3	31	2039.247	0	170.8248	40.5602	0		40.5602	211.3850	348.7853	775.0784	1278.8793		
2039	4	30	2039.329	0	171.0740	40.5429	0		40.5429	211.6169	349.1679	775.9286	1280.2823		
2039	5	31	2039.414	0	171.3306	40.5547	0		40.5547	211.8853	349.6108	776.9129	1281.9063		
2039	6	30	2039.496	0	171.5780	40.6398	0		40.6398	212.2178	350.1594	778.1319	1283.9177		
2039	7	31	2039.581	0	171.8327	40.7840	0		40.7840	212.6166	350.8175	779.5944	1286.3307		
2039	8	31	2039.666	0	172.0864	40.9777	0		40.9777	213.0641	351.5558	781.2350	1289.0378		
2039	9	30	2039.748	0	172.3311	41.2056	0		41.2056	213.5366	352.3354	782.9677	1291.8966		
2039	10	31	2039.833	0	172.5829	41.3345	0		41.3345	213.9174	352.9637	784.3639	1294.2004		

From FullCAM									MSEP/Mallee Methodology Calculations						
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2039	11	30	2039.915	0	172.8258	41.3227	0		41.3227	214.1485	353.3450	785.2111	1295.5983		
2039	12	31	2040	0	173.0759	41.2904	0		41.2904	214.3663	353.7044	786.0097	1296.9160		
2040	1	31	2040.085	0	173.3250	41.2572	0		41.2572	214.5822	354.0607	786.8015	1298.2224		
2040	2	29	2040.164	0	173.5572	41.2285	0		41.2285	214.7857	354.3964	787.5475	1299.4534		
2040	3	31	2040.249	0	173.8046	41.2003	0		41.2003	215.0049	354.7581	788.3514	1300.7798		
2040	4	30	2040.331	0	174.0430	41.1796	0		41.1796	215.2226	355.1173	789.1495	1302.0967		
2040	5	31	2040.415	0	174.2885	41.1902	0		41.1902	215.4787	355.5399	790.0887	1303.6464		
2040	6	30	2040.497	0	174.5252	41.2745	0		41.2745	215.7997	356.0696	791.2657	1305.5884		
2040	7	31	2040.582	0	174.7689	41.4181	0		41.4181	216.1870	356.7085	792.6857	1307.9313		
2040	8	31	2040.667	0	175.0118	41.6128	0		41.6128	216.6245	357.4305	794.2899	1310.5784		
2040	9	30	2040.749	0	175.2459	41.8369	0		41.8369	217.0828	358.1867	795.9703	1313.3511		
2040	10	31	2040.833	0	175.4870	41.9581	0		41.9581	217.4451	358.7845	797.2989	1315.5431		
2040	11	30	2040.915	0	175.7195	41.9417	0		41.9417	217.6612	359.1409	798.0910	1316.8501		
2040	12	31	2041	0	175.9589	41.9052	0		41.9052	217.8640	359.4757	798.8348	1318.0774		
2041	1	31	2041.085	0	176.1974	41.8679	0		41.8679	218.0653	359.8077	799.5726	1319.2948		
2041	2	28	2041.162	0	176.4121	41.8364	0		41.8364	218.2485	360.1100	800.2444	1320.4033		

From FullCAM									MSEP/Mallee Methodology Calculations						
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041	3	31	2041.247	0	176.6489	41.8043	0		41.8043	218.4532	360.4477	800.9950	1321.6417		
2041	4	30	2041.329	0	176.8773	41.7797	0		41.7797	218.6569	360.7839	801.7421	1322.8744		
2041	5	31	2041.414	0	177.1124	41.7868	0		41.7868	218.8992	361.1836	802.6303	1324.3400		
2041	6	30	2041.496	0	177.3391	41.8686	0		41.8686	219.2077	361.6927	803.7615	1326.2065		
2041	7	31	2041.581	0	177.5725	42.0103	0		42.0103	219.5828	362.3117	805.1371	1328.4762		
2041	8	31	2041.666	0	177.8052	42.2038	0		42.2038	220.0090	363.0148	806.6995	1331.0542		
2041	9	30	2041.748	0	178.0295	42.4273	0		42.4273	220.4567	363.7536	808.3414	1333.7632		
2041	10	31	2041.833	0	178.2604	42.5465	0		42.5465	220.8069	364.3314	809.6254	1335.8819		
2041	11	30	2041.915	0	178.4832	42.5265	0		42.5265	221.0096	364.6659	810.3687	1337.1084		
2041	12	31	2042	0	178.7125	42.4860	0		42.4860	221.1986	364.9777	811.0614	1338.2514		
2042	1	31	2042.085	0	178.9411	42.4449	0		42.4449	221.3859	365.2868	811.7484	1339.3849		
2042	2	28	2042.162	0	179.1468	42.4099	0		42.4099	221.5567	365.5686	812.3747	1340.4183		
2042	3	31	2042.247	0	179.3738	42.3740	0		42.3740	221.7478	365.8839	813.0753	1341.5742		