



Australian Government

Department of Climate Change, Energy,  
the Environment and Water

# ACCU Scheme savanna fire management methods – exposure drafts supplementary material

August 2025



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### Acknowledgement of Country

We acknowledge the Traditional Owners of Country throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past and present.

### Version History

#### Version 1 August 2025

This document accompanies the Sequestration and Emissions Avoidance method and the forthcoming Emissions Avoidance method. A revised version 2 will be published when both methods are released for public consultation late in 2025.

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# Executive Summary

The Department of Climate Change, Energy, the Environment and Water (the department) are proposing changes to the Australian Carbon Credit Unit (ACCU) Scheme savanna fire management methods. The proposed changes are the result of a comprehensive review of the existing methods, informed by new scientific research and stakeholder feedback. Two new methods are under development and include a sequestration and emissions avoidance method, and an emissions avoidance method.

The proposed new methods incorporate over two decades of collaborative research and field data, including recent work by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) to improve the Full Carbon Accounting Model (FullCAM) and its application to savanna ecosystems. The department have developed the Savanna Carbon Accounting Model (SavCAM) to automate and scale abatement calculations for the new methods, ensuring consistency with national greenhouse gas reporting and the legislated Offsets Integrity Standards (OIS).

This supplementary material is authored by the department and accompanies an exposure draft of the proposed new *Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Sequestration and Emissions Avoidance) Methodology Determination 2025* (**the proposed new savanna sequestration method**). This method builds on previous savanna methods, in particular the *Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Sequestration and Emissions Avoidance) Methodology Determination 2018* (**the 2018 sequestration method**).

Key proposals for the new savanna sequestration method include:

- Expanding crediting to include carbon sequestration in living biomass and dead standing biomass, in addition to dead organic matter in fallen debris.
- Allowing existing emissions avoidance projects to be credited for accumulated sequestered carbon if they transfer to the new method and commit to permanence obligations.
- Extending the baseline period to 20 years for new projects to improve accuracy.
- Introducing a practical and science-based approach to weed management, particularly for invasive species like gamba grass.
- Formalising capacity building fire management to support participation by First Nations communities and other landholders.
- Continuing to apply sequestration buffers (25% for 25-year projects, 5% for 100-year projects) to ensure durability of credited carbon.

The SavCAM abatement tool has been validated through independent testing and model comparisons, confirming its accuracy and reliability. This tool is available publicly for user testing and will remain open for testing until the end of the public consultation period for the new savanna methods.

We invite you to review the proposed new savanna sequestration method, including its scientific basis, practical application, and alignment with broader climate and community goals.



# 1. Introduction

This supplementary material accompanies an exposure draft of the proposed new savanna sequestration method and sets out the proposed updates and underpinning evidence for the proposed new method. It is intended to help stakeholders understand the evidence base for the proposed method and rationale for changes from the 2018 savanna sequestration method.

The proposed new method provides an incentive for proponents to manage fire in Australian savannas to reduce greenhouse gas emissions and sequester carbon from the atmosphere in living and dead organic matter. The proposed new savanna sequestration method reflects the latest science and stakeholder feedback on existing methods. The method will continue to support emissions reduction and carbon sequestration through strategic fire management in northern Australian savannas.

The department is releasing the draft new savanna sequestration method now to enable stakeholders more time to review the method. The department will notify stakeholders when the formal public consultation period for the new savanna method has commenced.

Following release of the exposure draft savanna sequestration method, the ERAC will consider whether the exposure draft of the proposed new emissions avoidance savanna method is also ready for public consultation release. If the ERAC decides this new emissions avoidance method is ready for release, a notice will be published on the department's website, under section 123D of the *Carbon Credits (Carbon Farming Initiative) Act 2011*, inviting public submissions to the ERAC on exposure drafts of both new savanna methods. Once the notification is published, stakeholders will have 28 days to make a submission.

The SavCAM tool will be used to calculate abatement for the proposed new methods. SavCAM was [released for user testing](#) on 13 June 2025 and will remain available for testing and feedback until the end of formal consultation period for both proposed new savanna methods. The department released SavCAM ahead of the exposure drafts methods to provide users time to test the new tool and provide feedback on its useability. Issues identified during SavCAM user testing are posted on the "[About SavCAM](#)" webpage for the information of SavCAM users.

The department aims to support meaningful, informed consultation at every stage and is working with the Indigenous Carbon Industry Network to facilitate engagement with First Nations groups. We will host webinars and consultation sessions to support stakeholders to understand the proposed methods and associated material. Information about webinars and consultation sessions will be provided on the department's website and via email to stakeholders.

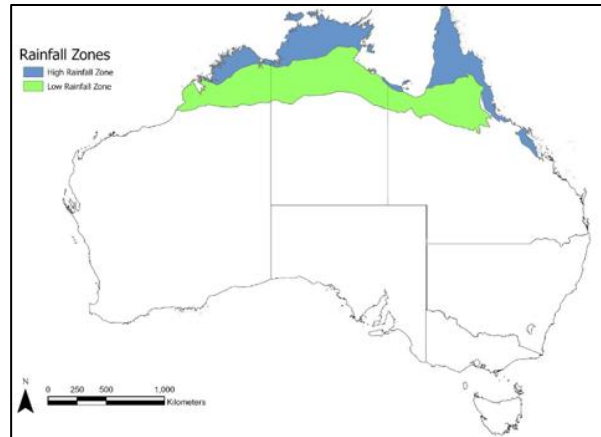
## 1.1 Overview of the ACCU Savanna Fire Management Methods

The ACCU Scheme is a national, legislated scheme for generating and issuing carbon credits in Australia. It enables individuals, businesses, and organisations to earn ACCUs by undertaking eligible

project activities that reduce greenhouse gas emissions or remove carbon from the atmosphere, such as reforestation, soil carbon improvement, or savanna fire management.

Each ACCU represents one tonne of carbon dioxide equivalent (CO<sub>2</sub>-e) abated. ACCUs can be sold to private buyers to offset emissions, or to the government. The Scheme is designed to support Australia's climate goals by encouraging credible, measurable, and verifiable emissions reductions across the economy.

Existing ACCU Scheme savanna fire management methods provide a framework for reducing greenhouse gas emissions by shifting the timing, frequency, and intensity of fires in Australia's tropical savanna ecosystems from the late dry season to the early dry season. Australia's savanna landscapes are located in far northern areas of Australia and are broken down into low rainfall (600-1000mm) and high rainfall (1000mm plus) zones (see Figure 1 where blue is the high rainfall zone and green the low rainfall zone.). Both rainfall zones have an early dry season and a late dry season.



**Figure 1.** Savanna fire management projects occur in Australia's savannas.

The two main approaches for shifting the timing, frequency and intensity of fires in the savanna fire management methods are through:

- an **emissions avoidance only method**, the [Carbon Credits \(Carbon Farming Initiative—Savanna Fire Management—Emissions Avoidance\) Methodology Determination 2018](#) (the 2018 emissions avoidance method), that focuses on reducing methane and nitrous oxide emissions through early dry season burns, which are cooler and more controlled than late dry season wildfires.
- a **sequestration and emissions avoidance method**, the [Carbon Credits \(Carbon Farming Initiative—Savanna Fire Management—Sequestration and Emissions Avoidance\) Methodology Determination 2018](#) (the 2018 sequestration method), that builds on the emissions avoidance only method by also accounting for the long-term storage of carbon in dead organic matter in fallen debris (e.g. dead burnt logs).

These methods enable eligible project proponents – including Indigenous ranger groups, land managers, and conservation organisations – to generate ACCUs for emissions reductions and removals.

Videos created under the former Emissions Reduction Fund (now the ACCU Scheme) with the North Australian Indigenous Land and Sea Management Alliance Ltd explain savanna fire management:

- [Video: Indigenous fire management in northern Australia savannas and greenhouse gas emissions reduction under the ACCU Scheme - DCCEEW](#)
- <https://www.ictv.com.au/video/2675-savanna-burning>
- <https://www.ictv.com.au/video/2676-savanna-burning-kriol>

## 1.2 Why the savanna methods are important

Tropical savannas are among the most frequently burned landscapes on Earth.<sup>1</sup> In Australia, they make up about 26% of the land area. The area burns regularly, with between 16% to 36% of land burning each year on average.<sup>2</sup> This means any point in the savanna landscape is likely to reburn every 3-5 years.

In recent years, traditional Indigenous fire management practices have been reintroduced. These involve lighting cool, patchy fires early in the dry season to reduce the risk of large, intense wildfires in the late dry season. This approach better protects the landscape and improves biodiversity while reducing emissions and increasing carbon storage in living plants and dead organic matter.

This shift in fire management has had a major impact on Australia's emissions. Between 1990 and 2015, the savanna region was a net source of emissions, releasing about 20 million tonnes of carbon dioxide equivalent (CO<sub>2</sub>-e) per year. But from 2016 to 2020, it became a net carbon sink, absorbing around -5.5 million tonnes of CO<sub>2</sub>-e per year. This change is largely due to the increased use of active and effective savanna fire management<sup>3</sup> most of which occurs via ACCU Scheme projects.

As at July there are 86 savanna fire management projects registered under the ACCU Scheme covering an area of 34.9 million hectares (equivalent to more than a quarter of the Northern Territory).<sup>4</sup> Savanna fire management projects provide positive benefits for First Nations people such as jobs on Country, direct income from the sale of ACCUs, and increased capacity to care for Country, culture and communities. 70% of the area registered under savanna projects is operated by First Nations communities and 74% of ACCUs from savanna emissions avoidance methods have been produced by Indigenous-owned carbon businesses.<sup>5</sup>

Savanna fire management is gaining increasing attention as a scalable nature-based approach to both mitigate climate change and deliver co-benefits. There is the potential for these co-benefits to be stacked in future with a method under the Nature Repair Market planned for development.

## 1.3 Why develop new savanna methods?

Changes to the existing savanna fire management methods will address:

- Scientific advancements: new research has improved our understanding and data on fire dynamics, carbon stocks, and emissions factors that can refine method accuracy.
- Consistency and integrity: ensuring alignment with the evolving requirements of the ACCU Scheme and international best practice.

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<sup>1</sup> van der Werf et al. (2017); Giglio et al. (2018).

<sup>2</sup> Edwards *et al.* (2021); Whitehead *et al.* (2014); Cook *et al.* (2020).

<sup>3</sup> Paul and Roxburgh 2024.

<sup>4</sup> as of 31 May 2025, Clean Energy Regulator, <[ACCU project and contract register | Clean Energy Regulator](#)>.

<sup>5</sup> As above.



- Scalability and equity: ensuring the methods support equitable access across project sizes and regions.

Work has been underway across government, academic institutions, non-government organisations and savanna fire management industry proponents to develop the new savanna methods for over a decade. The proposed new savanna sequestration method is a key step in the implementation of the [Savanna Fire Management Carbon Farming Roadmap](#), developed in close consultation with savanna fire management project proponents and stakeholders, and released in 2019. The roadmap outlined a long-term vision to expand and strengthen the savanna fire management sector across northern Australia by:

- Supporting method improvements that enhance integrity and adaptability to local contexts,
- Ensuring equitable participation by Traditional Owners and Indigenous ranger groups,
- Promoting integration with biodiversity, cultural, and land management goals, and
- Creating a more enabling environment for investment, governance, and capacity building.

The roadmap identified method refinement as a priority action to unlock the full potential of savanna fire management for climate action and community benefit. The new methods will help ensure the savanna projects remain scientifically robust, culturally appropriate, and capable of delivering real and durable abatement outcomes in line with the roadmap's objectives.

## 2. Method integrity

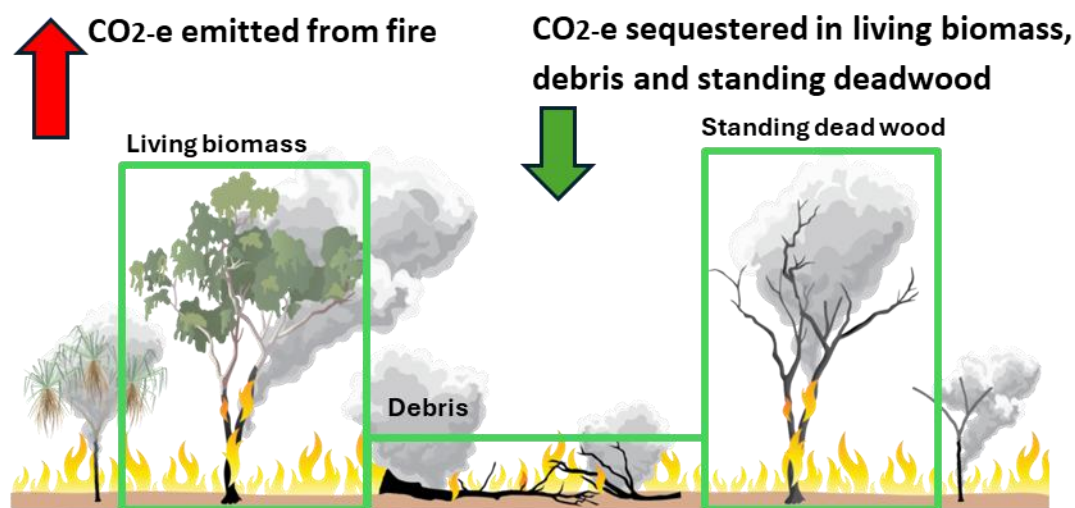
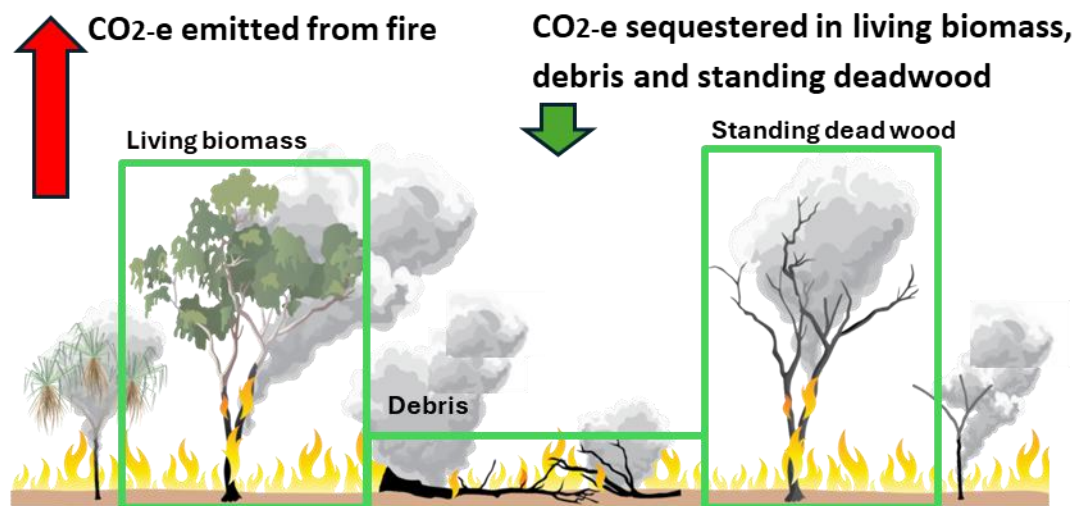
### 2.1 Requirements under the CFI Act

Methods are required to meet the Offset Integrity Standards (OIS) which are legislated under section 133 of the CFI Act. These include requirements to be measurable and verifiable, based on scientific evidence, and be additional carbon abatement that would otherwise be unlikely to occur (see the glossary for a summary of the OIS).

### 2.2 Net abatement calculations

In the proposed new savanna sequestration method, net abatement is the sum of 2 key components: emissions avoidance and carbon sequestration. Emissions from the fires and sequestration of carbon during the project are compared to the baseline scenario. Calculations can be performed using SavCAM or by following the equations in the method.

Abatement = mean baseline emissions – project year emissions



**Figure 2:** Illustration of how net abatement is calculated in the proposed new savanna sequestration method

For the emissions avoidance component:

- Abatement is calculated as the difference between baseline fire emissions and fire emissions in the project year.
- Abatement is adjusted using an uncertainty buffer, which accounts for inter-annual variability of fires and risk of over-crediting.
- The buffer is capped at 5% of average annual baseline emissions and the value for the uncertainty buffer is updated annually.

- If there is a year with negative abatement (e.g., more emissions released than avoided), credits are only issued again after the loss has been covered using buffer credits, and if needed, from positive abatement in future years.

For the sequestration component:

- Abatement is calculated as the change in carbon stock in living and dead biomass compared to the average carbon stock during the baseline period.
- For the first year, it's the difference between current carbon stock and the baseline average.
- For subsequent years, it's the difference between current and previous year's stock.
- It is adjusted using a sequestration buffer (25% for 25-year permanence, 5% for 100-year permanence) to account for the risk of reversal.
- As with the avoidance component, negative abatement is carried forward and deducted from future positive abatement.

Both components are calculated separately for each project area and rainfall zone. Negative values in one area cannot offset positive values in another. Extensive science sits behind the parameters used, see section 2.3.

## **2.3 CSIRO's national accounting framework for fire and carbon dynamics in Australian savannas**

Scientists, researchers and government have collaborated with First Nations communities, non-government organisations and industry peak bodies for over 2 decades to conduct extensive scientific research and improve our understanding of the abatement from savanna fire management activities.

To track the changes in emissions from savanna regions and more generally Australia's national greenhouse accounts, the Full Carbon Accounting Model (FullCAM) is used, which estimates carbon emissions and sequestration across the landscape using satellite data and other inputs. To help support its accuracy, FullCAM is calibrated with real-world data.

In 2024, CSIRO published a meta study<sup>6</sup> based on a comprehensive analysis of decades of research in Australia on savanna fire management and carbon accounting.<sup>7</sup> This review led to changes in FullCAM so it better reflects the current scientific understanding of how carbon is measured in savannas. A summary of the study and its findings are below. We encourage you to read CSIRO's report which is available publicly.

The CSIRO study aimed to improve FullCAM's accuracy by using detailed field data from different types of savanna vegetation. By refining how the model predicts carbon in living plants, dead wood,

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<sup>6</sup> Paul and Roxburgh (2024)

<sup>7</sup> See the Paul and Roxburgh (2024) for a full list of research provided.

and debris, the researchers hope to enhance national carbon reporting and support fire management projects that reduce emissions and boost carbon storage. The researchers:

- Used field data collected from over 1,000 savanna sites across Australia.
- Estimated how biomass is divided into parts like stems, branches, bark, and roots based on existing research that had established empirical relationships.
- Measured litterfall (leaves, twigs, bark falling to the ground) to estimate how fast live biomass turns into dead material using data from 61 stands across Australia’s savannas.
- Used existing decomposition studies to estimate how quickly dead material breaks down.
- Adjusted fire impact parameters (how much carbon is burned or transferred) based on observed fire effects.

They also ran simulations to test and fine-tune the model, to calibrate it using real-world data on biomass and fuel loads from the datasets outlined above. To see how fire management could reduce emissions, the researchers ran hypothetical scenarios:

- They simulated a 25-hectare area with different fire histories.
- They compared a baseline period with frequent late dry season fires to a project period with more early dry season fires.

The model was then calibrated to reflect how different fire types (early vs. late dry season and low vs. high intensity) affect vegetation using existing research. Fires in the late dry season had a much greater impact on live biomass than early dry season fires. For example, in high-rainfall shrublands, up to 25% of above-ground biomass could be lost in a high-intensity late dry season fire.<sup>8</sup>

Testing of the updated FullCAM model found it predicted above-ground biomass with 82–93% accuracy across all vegetation types. FullCAM also reliably estimated changes in dead wood and other fuel types over time, which are critical for calculating fire emissions.

The CSIRO study summarises the research done over decades that demonstrates that changing fire regimes – specifically, reducing the relative incidence of late dry season fires– can significantly reduce carbon emissions and increase carbon storage. On average, 65% of the carbon benefit came from sequestration (carbon stored in vegetation), and 35% from avoided emissions.

FullCAM is regularly reviewed through international scientific assessments of national carbon accounting methods. These reviews examine the data used to calibrate the model (Australia’s savanna data comes from decades of detailed research and fieldwork). As new data becomes available, FullCAM will be updated to better represent how carbon behaves in savannas including how fire affects plant mortality, decomposition, and regrowth.

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<sup>8</sup> Paul and Roxburgh (2024).

## 2.4 How the new savanna methods incorporate this data

The new methods use SavCAM to calculate how much greenhouse gas is abated through fire management. SavCAM is a web-based tool that automates FullCAM simulations for savanna projects and collates the output into reports suitable for submission with offset reports.

Savanna project areas are large and require simulations at a 250m x 250m resolution, as defined by the project's vegetation fuel type map. Due to the scale and complexity involved in manually running FullCAM simulations, SavCAM has been purpose built to automate calculations which reduces complexity when reporting on savanna fire management projects.

### How SavCAM Works

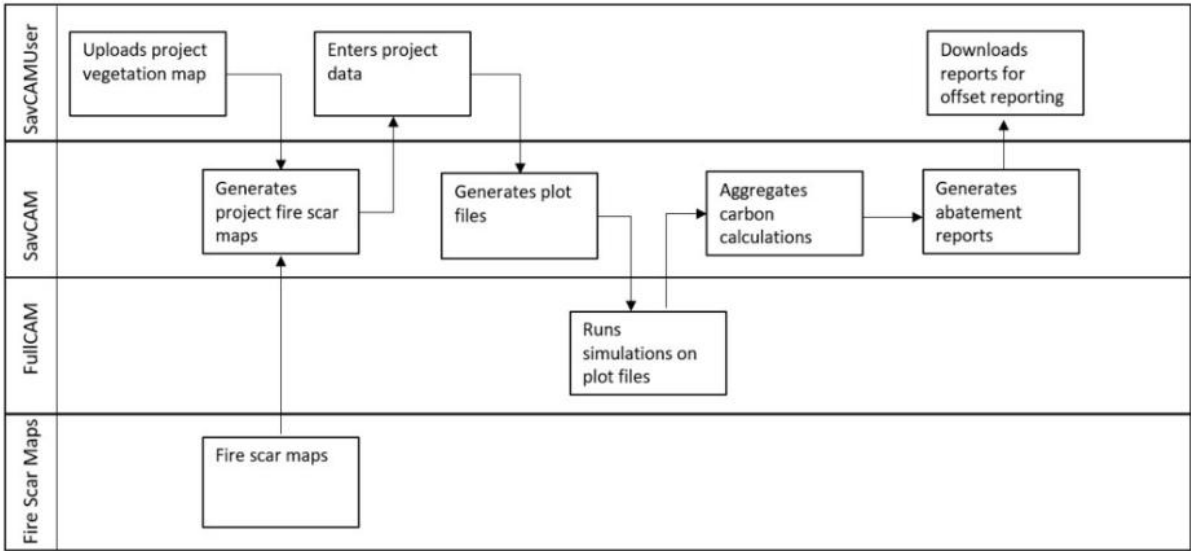
1. Input Preparation: Users upload a vegetation fuel type map for their project area and enter project-specific data (e.g. baseline years and project year).
2. Fire History Integration: SavCAM integrates fire history data (fire scar maps) for the project area.<sup>9</sup>
3. FullCAM Connection: SavCAM connects to FullCAM for each 250m x 250m pixel in the vegetation fuel map. FullCAM then uses the fire history and vegetation fuel type to model carbon stocks and flows across relevant carbon pools.
4. Abatement Estimation: Using FullCAM outputs, SavCAM collates greenhouse gas abatement for a single calendar year for emissions avoidance abatement and (for sequestration projects) sequestration abatement.

Schedules 1 and 2 of the proposed new savanna sequestration method set out the equations that underpin SavCAM. Proponents can choose to use resulting output tables from SavCAM and the equations in the schedules to manually calculate net abatement. Further information on how SavCAM works is in Appendix A of the Technical Guidance Document, available alongside the exposure draft on the department's website.

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<sup>9</sup> Fire history data (fire scar maps) are created using satellite remote sensing technology. The maps show areas that have been recently burned, by month and provide fire history data essential for calculating emissions reductions and carbon sequestration under savanna fire methods.





**Figure 3:** SavCAM logic flow showing interactions with FullCAM

## 2.5 Evidence validating SavCAM

The department contracted CSIRO to independently assess the accuracy of SavCAM. Their report is available alongside the exposure draft, on the department’s website. Separately, CSIRO researchers also re-analysed a 20-gridcell test area previously used in Roxburgh et al. (2024) comparing SavCAM outputs to Excel calculations using the method equations. The results were consistent after updates to SavCAM’s code and input files. They concluded that SavCAM accurately calculates carbon abatement (both emissions avoidance and sequestration) in line with the draft method.

In addition, SavCAM’s algorithms were replicated in a separate programming language and applied to a large project test area. The comparison showed close agreement in fire history, emissions, and sequestration, further validating SavCAM’s calculations (with differences generally within 2%).

The technical assessment of SavCAM found that carbon abatement outcomes – both in terms of carbon storage and fire emissions – are overwhelmingly driven by fire, not by natural climate fluctuations. Across 81 case study areas, researchers showed that changes in fire patterns accounted for over 94% of the year-to-year variation in carbon storage, while climate variation contributed just 1.3%. For fire emissions, climate explained around 9%, with fire remaining the dominant influence.

Even in drier regions where climate effects were slightly more pronounced, fire management still played the leading role. These findings confirm that SavCAM reliably attributes carbon abatement to deliberate fire management actions, rather than to changes in climate that are beyond human control. This distinction is critical for ensuring the integrity of carbon credits under the ACCU Scheme.

A model comparison between SavCAM and earlier SavBAT tools was also conducted across 81 savanna fire management project areas using standardized 50×50 km test zones. Each area was run through SavCAM, SavBAT 2.2, and SavBAT 3.0 using consistent baseline and project year settings for each test zone. Based on the analysis of a single project year for each test zone, emissions avoidance was on average 1.31× higher than SavBAT 2.2 and 3.77× higher than SavBAT 3.0. Sequestration was 1.69× higher than SavBAT 3.0.

In addition, the researchers separated carbon pools in SavCAM and analysed changes in each (live biomass, coarse fuel, heavy fuel). This revealed how fire management affects different components of the savanna ecosystem. They concluded that most carbon storage in SavCAM comes from changes in living biomass, which was not accounted for in earlier savanna methods. This helps explain the difference in estimates using SavCAM and the earlier SavBAT models.

## 2.6 Baselines and crediting periods

The proposed new savanna sequestration method extends the baseline period to 20 years for all new projects, regardless of rainfall zone. Previously, the baseline was 10 years in high rainfall areas and 15 years in low rainfall zones, based on typical fire return intervals. However, with satellite fire history data now available back to 1988, it is possible to use a longer timeframe to better capture variability in fire patterns and carbon stocks. For participants, this means providing fire history data over a longer period, but it ensures the baseline is more representative and robust. Projects that choose to transfer to the new savanna methods from the older methods will retain their original baseline period for continuity.

Field studies show carbon accumulation in savannas reaches a new equilibrium after about 25 years of improved fire management.<sup>10</sup> These recovery times are also consistent with findings from FullCAM. This supports the use of a 25-year crediting period for sequestration projects. It is unlikely that crediting for the sequestration proportion of savanna projects would continue after this period, given no new sequestration would accumulate.

## 2.7 Recognising additional carbon pools

Previous savanna fire management methods focused primarily on emissions avoidance, reducing methane and nitrous oxide emissions by shifting fire regimes from late to early dry season burning. This underestimated the full abatement benefit of improved fire management. In 2018, the department developed the 2018 savanna sequestration method which recognised that changing fire patterns also led to more biomass in the landscape. At the time, available research supported adding credits for carbon stored in dead organic matter. Living biomass (including trees, shrubs, and other vegetation) plays a critical role in carbon sequestration. When fire regimes are improved, vegetation has more time to grow and accumulate carbon. The 2018 sequestration method does not, therefore reflect the true emissions mitigation potential of the project since this carbon is not accounted for.

The proposed new savanna sequestration method accounts for carbon sequestration in living biomass as part of the net abatement amount. This is a significant evolution from earlier methods and ensures projects can be rewarded for the carbon they are storing in the landscape long-term.

Scientific research supports the inclusion of living biomass in abatement calculations. A range of studies across Australia show that frequent late dry season fires suppress tree growth and reduce biomass.<sup>11</sup> The smaller, lower intensity fires that occur in the early dry season promote tree growth

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<sup>10</sup> e.g. Cook et al. (2016, 2020).

<sup>11</sup> Russell-Smith et al. (2013); Cook et al. (2016, 2020); Ryan and Williams (2011); Murphy et al. (2023).

by reducing mortality that would otherwise occur during large, high intensity fires. This in turn promotes biodiversity and accumulation of carbon.

## 2.8 Accounting for accumulated carbon

The department is proposing to enable crediting of accumulated carbon for existing savanna projects currently only credited for emissions avoidance. This would apply to projects that choose to transfer to the proposed new savanna sequestration method and commit to a permanence obligation.<sup>12</sup> The approach recognises the carbon storage that has occurred since the project's baseline period and that this stored carbon will not remain unless projects continue to maintain fire management regimes in these areas.

Under this approach, projects would be credited in their first reporting period for the difference between current carbon stocks and the average carbon stock during the baseline period. Projects would then be required to maintain this carbon stock throughout the permanence period.

The additionality requirement under the Offsets Integrity Standards (OIS) requires carbon abatement credited under a method to be additional – that is, it would not have occurred in the ordinary course of events without the incentive provided by the ACCU Scheme. The department considers the approach in the proposed new savanna sequestration methods to crediting accumulated carbon can meet the OIS. While this carbon has accumulated to date under existing projects carrying out fire management, these projects do not currently have permanence obligations. In the absence of Scheme incentives, they would likely stop the fire management activities at the end of their crediting periods and the carbon accumulated to date would be lost.

This approach is consistent with the precedent set in the *Carbon Credits (Carbon Farming Initiative—Avoided Clearing of Native Regrowth) Methodology Determination 2015*, which uses a similar baseline comparison to determine creditable carbon storage.

### 2.8.1 Smoothing access to credits

Project proponents are not required to report emissions abatement every year. Instead, they can choose to report over longer periods (up to five years), allowing them to aggregate abatement and claim ACCUs in a single report.<sup>13</sup> This flexibility enables proponents to smooth their carbon credit claim, for example, by delaying a claim in a low-abatement year and combining it with a future high-abatement year. This is particularly useful in savanna burning projects where annual fire conditions and abatement outcomes can vary significantly due to weather, fuel loads, and operational constraints.

By choosing when to report and claim credits, proponents can align ACCU issuance with market conditions, contract obligations, or internal financial strategies, potentially increasing the value of credits or ensuring consistent revenue flow. Even when using partial reporting, projects must still comply with:

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<sup>12</sup> Proponents can choose to remain on the original methods for the duration of their crediting period.

<sup>13</sup> Section 27A, 27B and 27C of the *Carbon Farming Initiative Act 2011*

- The maximum reporting period (usually five years).
- The requirement to maintain accurate records and monitoring throughout the reporting period.

The proposed new savanna sequestration method also allows proponents to subdivide a larger project into multiple smaller project areas, report separately on each subdivided area, and claim ACCUs independently for each area based on its own fire management outcomes and abatement calculations. This can help proponents stage credit issuance over time, aligning with market conditions or contract obligations, rather than being locked into a single reporting schedule for the entire project. Proponents should be aware of the legal requirements associated with project subdivision, and carefully consider any information from the Clean Energy Regulator on transferring between methods including timing and information requirements. Careful consideration will also be needed on how subdivision of project areas and associated staged issuance can be administered by the Clean Energy Regulator to minimise administrative burden for government and proponents.

The department is interested in hearing from stakeholders on whether further mechanisms should be applied to help smooth the crediting of accumulated carbon over time. It may be possible for example, to ensure credits from accumulated credits are evenly distributed across reporting periods within the method.

## 2.9 Eligible vegetation types

Pindan vegetation is proposed to be included as an eligible vegetation type in the proposed new savanna sequestration method (and proposed new emissions avoidance method). Pindan vegetation is acacia-dominated shrublands located on the red sandy plains of Western Australia's low rainfall zone. Pindan tall Acacia shrublands are recognised as an eligible vegetation fuel type because they:<sup>14</sup>

- Are spatially distinct and can be reliably mapped using satellite imagery and vegetation classification protocols.
- Exhibit unique fuel characteristics, particularly a significantly higher shrubby biomass load, up to 2.8 times greater than Woodland with Hummock grass and 18.8 times greater than Woodland with Tussock grass five years post-fire.
- Experience frequent fire, with 37% of the area burnt annually, mostly in the late dry season (LDS), making them ecologically suitable for strategic early dry season (EDS) fire management.
- Offer high emissions abatement potential, with up to 24.43 t CO<sub>2</sub>-e/km<sup>2</sup>/year achievable through EDS burning, comparable to or exceeding other eligible low rainfall zone fuel types.

In contrast to other Acacia-dominated shrublands that are either ecologically inappropriate for burning or rarely experience fire, Pindan shrublands are fire-prone and ecologically resilient, with post-fire regeneration occurring within 3–7 years.

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<sup>14</sup> Lynch et al (2018).

In total, there are ten different savanna vegetation fuel types defined in FullCAM and the new proposed savanna methods (see Table 1). Of these, nine are the same as those in the 2018 savanna methods (four in the high rainfall zone, five in the low rainfall zone), with the new addition of pindan vegetation in the low rainfall zone.

**Table 11 - savanna fire management vegetation fuel types**

Rainfall Zone	Vegetation fuel type name
High	Open forest with mixed grassland, often on deep well drained soils
High	Woodland with mixed grassland, often on well drained soils in various situations
High	Woodland with hummock grassland, often on sandstone-derived soils
High	Shrublands with Hummock grasses in the high rainfall zone, often on sandstone-derived soils
Low	Woodland with Tussock grassland, often on deep well drained and fertile soils
Low	Woodland with Mixed grassland, often on deep well drained soils
Low	Woodland with Hummock grassland, often on rocky shallow soils
Low	Open woodland with mixed grassland
Low	Shrublands with Hummock grasses in the low rainfall zone
Low	Acacia-dominated shrublands located on the red sandy plains of Western Australia's low rainfall zone

## 2.10 Controlling weeds

Gamba grass and other invasive species are a major threat to the effectiveness of savanna fire management projects. Gamba grass grows to 4 metres tall and when burnt, results in very high intensity fires. These more severe fires:

- increase greenhouse gas emissions,
- kill trees and shrubs not normally killed by fire, reducing carbon sequestration, and
- damage ecosystems and reduce biodiversity.

The presence of weed species that change fire behaviour undermine carbon abatement. The presence of gamba grass can reverse the intended outcomes of strategic early dry season burning by promoting large, high-intensity fires including in the late dry season.

The proposed new savanna sequestration method estimates abatement as it would occur without the presence of Gamba grass. The proposed method includes rules for managing relevant weed



**Figure 2.** Gamba grass, Northern Territory

Source:

<https://www.katherinetimes.com.au/story/6571232/gamba-grass-needs-action-to-stop-it/>



species, similar to those in the 2018 savanna methods with some refinements. Stakeholder feedback indicated the weed rules in the 2018 methods were too rigid – requiring complete removal within a single reporting period, which was often unworkable due to persistent seedbanks.

The new method introduces more practical, science-backed provisions that allow for ongoing treatment and monitoring:

- At the time of project registration, the project area must be free of relevant weed species.
- If a relevant weed (e.g. gamba grass) is detected during the project:
  - The proponent has 18 months to treat all aboveground biomass using herbicide or mechanical removal (fire is not allowed).
  - Annual treatment must continue until the weed is eradicated (defined as no detection for 24 months).
  - If treatment is not feasible, the affected area must be removed from the project.
- Transferring projects must treat weeds within 12 months prior to transfer and continue management annually until eradicated.
- Weed-affected areas must be mapped and reported in geospatial format, and evidence of treatment must be submitted in offset reports.

Scientific evidence supports the inclusion of weed control in savanna fire management for several reasons:

1. Fire intensity and emissions: Studies demonstrate that gamba grass can increase fire intensity by up to 8 times compared to native grasses.<sup>15</sup> This leads to significantly higher emissions and loss of carbon stores.
2. Carbon sequestration loss: High intensity fires can kill trees and shrubs preventing the sequestration of additional biomass in this vegetation. This undermines the sequestration benefits normally seen in savanna projects.
3. Persistence of seedbanks: Gamba grass has a large and long-lived seedbank. Even after aboveground biomass is removed, seedlings can re-emerge for years.<sup>16</sup> The new method's requirement for ongoing treatment reflects this.
4. Ecosystem degradation: Invasive grasses outcompete native species, reduce biodiversity, and change the structure of savanna ecosystems – further reducing their carbon storage potential and resilience to fire.<sup>17</sup>

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<sup>15</sup> DCCEEW (2020a).

<sup>16</sup> Northern Territory Government (2020).

<sup>17</sup> DCCEEW (2020b); Head and Atchison (2015).

## 2.11 Permanence Periods and Discounts

In carbon accounting, a permanence period refers to the length of time carbon sequestered by a project must remain stored in the landscape to be considered genuine and durable. For savanna fire management projects this means ensuring the carbon stored in living biomass and dead organic matter as a result of improved fire regimes is not lost through future fires, decomposition, or land-use changes.

Generally, carbon stocks maintained for 100 years are considered equivalent to a permanent emission reduction.<sup>18</sup> CSIRO has noted *“long-term storage under savanna fire management requires ongoing application of the fire management treatment. A significant risk to sequestration is therefore the cessation of fire management through changes in land management, leading to the reversal of any sequestration gains.”*<sup>19</sup>

Under the ACCU Scheme, savanna sequestration projects are subject to permanence obligations under the CFI Act. The obligations include providing a credible plan for maintaining carbon stores throughout the permanence period at various points throughout the lifetime of the project. These obligations are designed to:

- Prevent short-term gains from being credited as long-term abatement.
- Ensure carbon stocks are maintained for the duration of the permanence period.
- Allow the Clean Energy Regulator to require relinquishment of ACCUs if there has been a significant reversal of carbon stocks.<sup>20</sup>

In the proposed new savanna sequestration method, permanence periods are directly linked to the sequestration buffer, which adjusts the amount of credited abatement to account for the risk of reversal of that abatement. Importantly, this buffer only applies to sequestration abatement (carbon stored), not to emissions avoidance (carbon not released).

The new proposed method continues to apply a sequestration buffer that reflects the permanence period chosen by the project proponent. These are:

- For a 25-year permanence period a 25% buffer where 75% of sequestration abatement is credited.
- For a 100-year permanence period a 5% buffer where 95% of sequestration abatement is credited.

The sequestration buffer accounts for the possibility stored carbon could be lost within a 100 year period due to unplanned fires, drought, or other disturbances or non-rectifiable compliance issues.

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<sup>18</sup> IPCC (2000).

<sup>19</sup> See [Fitch et al., \(2022\)](#), p70.

<sup>20</sup> Refer to the Clean Energy Regulator's website for more information about permanence obligations and circumstances where relinquishment may be required.

The 25% buffer for 25-year projects reflects a higher risk over a shorter timeframe, while the 5% buffer for 100-year projects reflects greater confidence in long-term stability.

The sequestration buffer replaces two discounts provided for in the CFI Act. The first is a 5% risk of reversal buffer, which acts like insurance for the carbon credited to sequestration across the Scheme. It was intended to protect against:

- Temporary carbon losses (like from fire or drought) while the carbon stores recover.
- Permanent losses caused by serious issues, such as if the project owner breaks the rules and the Clean Energy Regulator is unable to address the issue by requiring credits to be relinquished, for example, if the proponent leaves the country or is bankrupt.

This buffer was set lower than in some other carbon offset programs because in the savanna method, projects are effectively issued ACCUs based on average long-term carbon increases, not short-term spikes. In general, the risk against temporary carbon losses in the savanna method are low as the method requires carbon stocks to be calculated annually and adjusted for reversals. If carbon stocks decline, the model carries forward negative values, reducing future credits until the loss is offset. This kind of approach means crediting is conservative, helping maintain integrity of the ACCUs issued.

The second discount the buffer incorporates is the permanence discount of 20% which was imposed for 25-year projects. That discount was intended to offset the potential future cost to the government if it needs to take action to replace or compensate for lost carbon stores once the project ends and the carbon is no longer guaranteed to be stored.

Both discounts address the issues associated with needing to achieve and maintain carbon sequestration benefits for 100 years.

Crediting of emission avoidance activities could support ongoing fire management during this period. In 2018, when the previous sequestration method was first made, the ERAC considered this to be a practical consideration that made the buffer sufficiently conservative.<sup>21</sup>

The magnitude of discounting is consistent with other methods, and the requirements in the CFI Act.

## **2.12 Discounting for uncertainty in avoided emissions**

The uncertainty buffer manages the risk a savanna project might end with more emissions than it avoided. In calculating the net abatement from the emissions avoidance component of the activity, part of it is allocated to an uncertainty buffer which accounts for the risk emissions in some years may exceed the baseline average. The buffer generally starts at zero – unless the area is a transferring project area – and is capped at 5% of the mean annual baseline emissions. When emissions avoided during the calendar year are negative, the buffer is reduced. When emissions avoided during the calendar year are positive, the buffer is increased, up to the cap. Projects which continuously perform well would meet the threshold for the uncertainty buffer cap within the first

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<sup>21</sup> [ERAC advice to the minister - Savanna fire management methods 2018.](#)

few project years. In total, the uncertainty buffer for most projects will be 5% by the end of the project’s crediting period, acting as an overall discount to ensure the method is conservative.

If a project has a year with negative abatement, it must make up for that in future years before earning new credits. But if this happens near the end of the project, there may not be enough time to recover those losses. The buffer helps protect against this risk by holding back some credits.

This 5% buffer, has been carried over from the 2015 savanna emissions avoidance method, and is based on department modelling at the time. That analysis used existing project data to consider the chance the final crediting year could have negative abatement, meaning some ACCUs might need to be returned. The analysis then considered the likely variations around the baseline emissions average to understand how many ACCUs might need to be returned if that situation occurred.

In its report to the department verifying SavCAM, CSIRO identified limited impacts of climate on overall abatement outcomes (see section 2.5). Because of this no further climatic discount is proposed at this time. The department welcomes stakeholder feedback on this issue.

## 2.13 Appropriateness of further discounting

Discounting for uncertainty helps to ensure abatement estimates are conservative. This is especially important when the data used to calculate abatement is uncertain or limited.

The savanna fire management methods use FullCAM, a model that simulates vegetation growth, decay, and fire impacts using extensive datasets. FullCAM’s savanna calibration is based on a large volume of field data: over 673 site-based observations for growth, 452 transects for live biomass, and more than 600 transects for dead biomass and fuel types. This depth of data provides high confidence in the model’s average predictions, especially at regional or national scales. The model’s predictions at the individual project site level are less certain.

The department has decided against applying an additional discount for uncertainty in the savanna methods for two primary reasons:

1. **The nature of the uncertainty is different:** In soil methods, the uncertainty comes from potential sampling error – how well a small number of samples represent the whole area. This kind of uncertainty is well understood and can be quantified using statistical formulas. In FullCAM, the uncertainty arises from model structure and parameterization, and the outputs are temporally correlated (i.e., predictions at different times are not independent). This makes it harder to apply a simple statistical discount. In its advice to the department on accounting for uncertainties, CSIRO noted that understanding how uncertainty propagates through FullCAM is still an active area of research, and current methods for discounting (like those used in soil carbon) are not suitable.
2. **Consistency with other FullCAM-based methods:** FullCAM, which is calibrated over time, is used in other ACCU land sector sequestration methods – such as Environmental Plantings and Plantation Forestry – without applying an uncertainty discount. Introducing a discount for savanna methods would be inconsistent with the approach established through these methods.

The CSIRO report on uncertainty and discounting also highlighted the conservativeness in other areas of the savanna method. The measures that promote conservativeness include:

- Leaving out some carbon sources, like grass and leaf litter, and only allowing certain types of vegetation to count. This means the total carbon savings are likely underestimated.
- Not including soil carbon, as we do not yet fully understand how fire management affects it. This could mean the method is underestimating the impact of fire management on carbon sequestration.
- Applying discounts to both the emissions avoided and the carbon stored (see section 2.11 and 2.12) to ensure the credited amount is cautious and reliable.
- Using a 20-year baseline period to measure fire activity before the project. As climate change is making fires more frequent and intense, the counterfactual situation (what would happen without the project) is likely to be worse than the baseline used as a proxy, meaning the project might be doing more good than the numbers show.

## 3. Promoting participation and equity

### 3.1 Capacity Building Fire Management

The new savanna methods are proposed to include recognition of capacity building fire management. Earlier savanna methods do not include a preparatory phase following project registration where land managers could learn and practice strategic burning before the start of the crediting period. This can lead to suboptimal fire outcomes in the early years of a project, reducing ACCU earnings. The new methods would allow for a gap of up to 6 years between the end of the baseline and the start of crediting, during which training and strategic early dry-season burning can occur. The duration of the period being up to 6 years is proposed to cover multiple 2-to-3-year fire cycles. This is intended to enable sufficient time for rangers to be trained and become qualified and provide appropriate consultation and governance capacity-building for project operators.

Participants would be required to document these activities through project management plans and provide evidence such as fire permits or burn records. These requirements are intended to ensure the preparatory phase is not used to game method baseline settings. Further, given baseline settings are based on 20 years of data, we consider the integrity of these settings are high, even when capacity building fire management is permitted. This change is particularly important for First Nations groups and other community-led projects, where building local capacity is essential to successful project outcomes.

### 3.2 Transferring existing projects

The process to enable transfer of projects between methods is streamlined. Project proponents can expect clearer guidance and fewer administrative hurdles when choosing to move to the new methods. Transfers will be managed under existing provisions in the *Carbon Credits (Carbon Farming Initiative) Rule 2015* (CFI Rule). Transferring projects would have their crediting period start date set to 1 January 2015 or their current start date, whichever is later.



Projects registered under older savanna emissions avoidance methods can choose to transfer to the new proposed methods. This process must be in accordance with sections 30A and 30B of the CFI Rule, and consider:

- **Eligibility and Continuity:** Transferring project areas must have consecutive reporting years between the old and new methods. The baseline period from the previous method is preserved.
- **Crediting Period Adjustment:** For restarting transferring projects, the crediting period is adjusted to account for time already elapsed under the previous method. Specifically, the new crediting period is 25 years minus the time since 1 January 2015 or the start of the previous crediting period, whichever is later.
- **Weed Management:** Transferring projects must treat any known infestations of relevant weed species within 12 months prior to transfer and continue treatment annually.
- **Reporting Requirements:** Applications must identify transferring areas, provide project identifiers, and include relevant documentation.

These provisions ensure continuity, prevent double-counting, and maintain integrity in carbon accounting.

Existing savanna sequestration projects would be able to choose to transfer to the method using the processes in section 128 of the CFI Act. They would also need to comply with section 16 of the proposed determination. Proponents should refer to the Clean Energy Regulator's website for more information on transferring between methods.

## 4. Stakeholder feedback

The department has received some feedback from stakeholders that we have not incorporated into the proposed new savanna sequestration method. An explanation for this is below and we invite stakeholders to continue engaging with the department on these matters.

### **Fire Severity Classes**

There has been interest in determining net abatement based on fire severity classes, rather than using early dry season and late dry season as pseudo-indicators of fire severity. This was not feasible as FullCAM is not currently calibrated to account for fire severity, and research at Charles Darwin University in this area is still ongoing. Additionally, the integration of fire severity classes presents challenges, as the required satellite imagery used to create the fire severity maps is not available for the baseline years of some savanna projects.

### **Variability of Late Dry Season Start Date**

The department recognises regional variations in climatic factors impact the start and end of the early dry season and onset of the late dry season. The new proposed method has been designed to allow the dates of the start and end of the late dry season to be updated in the spatial data in the future, should supporting evidence become available, without requiring a method variation.

### **Extension of Eligible Project**

There has been interest in extending the eligible project region further south, beyond the current 600 mm+ annual rainfall zone. It is not feasible to incorporate these areas into the method at this time because FullCAM is not calibrated for these areas. Through the proponent-led method development process, the Indigenous Dessert Alliance is investigating whether an extension of range is possible. Depending on the proposed method design, this may sit within this method with a future variation or as a standalone method.

### **FullCAM estimates of biomass**

The department have heard some concerns about how FullCAM estimates maximum above-ground biomass (M), fire intensity and mortality, and decomposition and recovery rates. We have heard that recent research challenges some of FullCAM's assumptions, with suggestions there is a need for independent validation of FullCAM using high-resolution LiDAR to improve integrity and support development of a stand-alone, measurement-based, sequestration module. Stakeholders have noted this could mean savanna projects may be under-crediting due to differences between project and national accounting methods and potential regional fire management benefits not being captured.

We appreciate the continued engagement from stakeholders in the development of the new methods. The feedback received reflects the depth of expertise and commitment across the sector to high-integrity carbon abatement approaches.

The department considers SavCAM, which is built from and links to FullCAM, is scientifically robust and conservative. This conclusion is based on the extensive dataset underpinning FullCAM, including the (M) layer being derived from over 5,700 field sites across Australia. FullCAM is internationally peer reviewed and plays a central role in Australia's National Greenhouse Gas Inventory, which is subject to further review by UNFCCC experts.

We acknowledge the concerns regarding the definitional challenges of the (M) layer, the granularity of fire effects, and the potential for emerging technologies such as high-resolution LiDAR to be used for improved validation. Integration into the current method is not feasible at this stage due to the maturity of the technology, resource requirements, and timing constraints. The department recognises the value of these approaches and supports their exploration in future method development, particularly through the proponent-led pathway.

## 5. Consultation Questions

The following questions have been prepared by the department as a guide to assist stakeholders in considering their feedback on the Exposure Draft and draft Explanatory Statement, *in addition to* any feedback on the compliance of the draft method with the Offsets Integrity Standards.

In requesting feedback on the Offset Integrity Standards, the department understands the ERAC is particularly interested to hear views on whether allowing existing emissions avoidance projects to earn credits for stored carbon – if they switch to the new method and commit to permanence – would lead to genuine, additional abatement.

### Use of SavCAM

1. Do you consider the use of SavCAM to be a credible and practical approach for calculating abatement in savanna fire management projects?
2. Are there specific aspects of the FullCAM model (e.g. maximum biomass estimates, fire impact parameters) that you consider require further refinement or validation for savanna ecosystems?
3. What are your views on the department's decision not to apply an additional uncertainty discount to SavCAM outputs? Is there additional evidence or experience you can share regarding the risk of reversal in savanna fire management projects?

### Crediting Accumulated Carbon

4. Are the available avenues for smoothing the issuance of crediting sufficient to assist proponents to manage the crediting of accumulated carbon?

### Weed Management

5. Are the proposed weed management provisions practical to implement? Are the timeframes and treatment requirements workable?

### Baseline Periods

6. Do you support the extension of the baseline period to 20 years for all new projects? What benefits or challenges do you foresee with this change?

### Participation and Equity

7. Do you support the formal recognition of capacity building fire management? What additional support or guidance would help make this provision effective?
8. Are there any other environmental, social, or economic impacts of the proposed method, or barriers to participation, that you would like to raise?

### Transferring Existing Projects

9. Are the proposed rules for transferring projects, including regarding baseline periods, clear and workable? Do they support continuity and integrity in carbon accounting?

# Glossary

Term	Definition
ACCU	Australian Carbon Credit Unit
CFI Act	<a href="#">Carbon Credits (Carbon Farming Initiative) Act 2011</a>
CFI Rule	<a href="#">Carbon Credits (Carbon Farming Initiative) Rule 2015</a>
CO <sub>2</sub> -e	carbon dioxide equivalent
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEEW	Department of Climate Change, Energy, the Environment and Water
EDS	Early Dry Season
ERAC	Emissions Reduction Assurance Committee
FullCAM	Full Carbon Accounting Model
LDS	Late Dry Season
NAISMA	North Australian Indigenous Land and Sea Management Alliance Ltd
OIS	<p>Offsets Integrity Standards</p> <p>The Offset Integrity Standards (OIS) are the legislated criteria that all carbon abatement methods under the CFI Act must meet. They ensure carbon credits issued under methods represent real emissions reductions that may be counted towards meeting Australia's emissions reduction targets. There are six OIS contained in section 133 of the CFI Act:</p> <ol style="list-style-type: none"> <li>1. <b>Additionality:</b> A method should result in carbon abatement that is unlikely to occur in the ordinary course of events.</li> <li>2. <b>Measurable and verifiable:</b> A method involving the removal or reduction of emissions should be measurable and capable of being verified.</li> <li>3. <b>Eligible carbon abatement:</b> A method should provide abatement that is able to be used to meet Australia's emissions reduction targets.</li> <li>4. <b>Evidence-based:</b> A method should be supported by clear and convincing evidence of genuine carbon abatement.</li> <li>5. <b>Project emissions:</b> Material greenhouse gas emissions emitted as a direct result of the project should be deducted.</li> <li>6. <b>Conservative:</b> Where a method involves an estimate, projection, or assumption it should be conservative.</li> </ol>
SavCAM	Savanna Carbon Accounting Model
SFM	Savanna fire management
SFM 2018 emissions avoidance method	<a href="#">Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Emissions Avoidance) Methodology Determination 2018</a>
SFM 2018 sequestration method	<a href="#">Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Sequestration and Emissions Avoidance) Methodology Determination 2018</a>



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