

Savanna Fire Management Methods (2025)

Technical Guidance Document (DRAFT)

Version 1

Disclaimer

This *Savanna Fire Management Methods (2025) Technical Guidance Document* has been developed to accompany the savanna fire management methodology determinations: *Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Emissions Avoidance) Methodology Determination 2025* and *Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Sequestration and Emissions Avoidance) Methodology Determination 2025*.

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Glossary of Terms

Definitions provided in the relevant determination also are applicable to this *Savanna Fire Management Methods (2025) Technical Guidance Document*.

| Term | Definition and explanation |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relevant determination | Means either the <i>Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Emissions Avoidance) Methodology Determination 2025</i> or the <i>Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Sequestration and Emissions Avoidance) Methodology Determination 2025</i> , whichever the project is registered under. |
| Emissions determination | Means the <i>Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Emissions Avoidance) Methodology Determination 2025</i> . |
| GPS | Means a global positioning system. For the purposes of this document, this is taken to include any Global Navigation Satellite System (GNSS). This could be a GPS, or GLONASS, Galileo or other system. |
| Random sampling | For the purpose of this document means the selection of a subset of data points from a larger population such that each data point is chosen randomly and each individual has the same probability of being chosen at each stage of the sampling process. This is an unbiased surveying technique. |
| Sequestration determination | Means the <i>Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Sequestration and Emissions Avoidance) Methodology Determination 2025</i> . |
| Systematic sampling | For the purpose of this document systematic sampling involves first selecting a fixed starting point in the larger population and then obtaining subsequent observations by using a constant periodic interval between samples taken. This interval is calculated by dividing the population size by the desired sample size. For example, if the whole population was 1000 and 100 data points were required, then samples would be taken every tenth data point. The results are generally representative of the whole population. |
| Vectorised vegetation fuel type map | Means a raster map that has been converted to vector format. |
| Waypoint | Means a point in geographical space where information is collected, and that is defined by a set of coordinates. |
| Waypoint buffer | Means a circular area with a radius of 100 metres that surrounds a waypoint. |

1 Introduction

The *Savanna Fire Management Methods (2025) Technical Guidance Document* complements and provides further guidance on the operation of provisions in the following legislative instruments:

- *Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Sequestration and Emissions Avoidance) Methodology Determination 2025*
- *Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Emissions Avoidance) Methodology Determination 2025*
- *Carbon Credits (Carbon Farming Initiative) Act 2011* (the CFI Act);
- *Carbon Credits (Carbon Farming Initiative) Rule 2015* (the Rule); and
- any amendments to the above Act, Rule, or associated methods.

These documents are available on the Federal Register of Legislation website:

<https://www.legislation.gov.au/>.

While this document provides guidance, it does not override or alter the requirements under the CFI Act, the Rule or either of the above two determinations. When summarising provisions within these legal instruments, this guidance may at times oversimplify the provision for accessibility purposes. Proponents **must** familiarise themselves with the legal instruments, and their explanatory statements, and ensure they are operating in accordance with their requirements.

The guidance contained in this document applies only to projects registered under either of the following methodology determinations:

- *Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Sequestration and Emissions Avoidance) Methodology Determination 2025*, or
- *Carbon Credits (Carbon Farming Initiative—Savanna Fire Management—Emissions Avoidance) Methodology Determination 2025*.

Projects registered under earlier Savanna Fire Management methodology determinations must continue to report under those determinations unless they formally transfer to one of the 2025 methods.

This *Savanna Fire Management Methods (2025) Technical Guidance Document* must be used in accordance with section 8(1) of the relevant methodology determination, which specifies that the most recent version available at the end of the reporting period is applicable for the duration of that period. This document will be updated by the department from time to time in accordance with section 8(1) of the relevant methodology determination and as outlined in this document. As a result, some input values and requirements may change.

This document provides guidance on:

- **Section 2** – The process for updating this document
- **Section 3** – Classifying vegetation fuel types
- **Section 4** – Defining parameters used to estimate abatement (values are consistent with the latest National Inventory Report).
- **Section 5** – Requirements for creating, revising and validating vegetation fuel type maps
- **Section 6**– Monitoring for the presence of relevant weed species
- **Section 7**– Guidance for developing Project Management Plans

2 Process for updating this guidance document

Subsection 106(8) of the CFI Act allows for methodology determination to reference factors or parameters contained in subsidiary material that is external to the methodology determination.

Section 8 of the relevant determination defines subsidiary material that may be updated from time to time, including the *Savanna Fire Management Methods (2025) Technical Guidance Document*. Updates to factors in subsidiary material ensure methods continue to function as intended, maintain accurate abatement calculations, and uphold the legislated Offsets Integrity Standards. This provision helps ensure abatement estimates remain aligned with Australia's international greenhouse gas reporting commitments.

Section 8 of the relevant determination specifies that the version of this document in force at the end of a project's reporting period must be used for all calculations for that entire reporting period.

The relevant determination references values sourced from the most recent *National Inventory Report*, which are also duplicated in this guidance document. These values and methodologies are periodically updated to reflect Australia's international treaty obligations, including the principle of continuous improvement by maintaining consistency with international inventory requirements and research on emissions reporting. These updates are considered **supplementary updates**.

In addition to updates aligned with the *National Inventory Report*, other **supplementary updates** may be made to factors or parameters in this document that are not included in the National Inventory but improve the robustness of abatement estimates under the ACCU Scheme. These updates may:

- provide values for factors at a finer spatial or temporal resolution than is required at a national scale for international reporting obligations. Finer scales can be more appropriate for ACCU Scheme projects than for national accounting.
- improve monitoring of landscape change to help prevent over-crediting abatement. An example in the draft savanna methods is the invasion by exotic weed species that, when burnt, emit significantly more greenhouse gases than what is being estimated for native grasses eligible under the method.

The Department will consider the following before making any supplementary updates, and follow a transparent process:

- The robustness of the scientific evidence supporting the change;
- The effect of the change—or the absence of change—on compliance with Offsets Integrity Standards in consultation with the ERAC;
- Any relevant advice provided by the ERAC to the Minister;
- Any feedback received from stakeholders regarding the proposed change;
- Potential impacts on abatement estimates, regulatory burden, and Scheme integrity;
- Results of an independent technical review, if appropriate;
- Any views expressed by the Clean Energy Regulator; and
- The ability of the National Inventory to accommodate the proposed change.

3 Vegetation fuel types

The vegetation fuel type is defined by the dominant stratum and the grass type and its structural formation (i.e. canopy height and foliage projected cover; grass type). The characteristic descriptors are used as a guide to determine the correct classification.

There are ten vegetation fuel types for which abatement can be estimated – four in the high rainfall zone (Table 1) and six in the low rainfall zone (Table 2).

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Table 1: Vegetation fuel types in the High Rainfall Zone

| Vegetation fuel type code | Vegetation fuel type name | Dominant strata | | | Grasses | Characteristic descriptors | | |
|---------------------------|----------------------------------------|-----------------|-------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| | | Strata | Canopy height | Foliage Projected cover | | Canopy trees | Shrubs | Substrates |
| hOFM | Open forest with mixed grasses | Canopy Trees | Majority of trees >15 m | 30-70% | Dominated by native perennial and annual tussock grasses | Various <i>Eucalyptus</i> and <i>Corymbia</i> species (for example, <i>E. tetradonta</i> , <i>E. miniata</i> , <i>C. nesophila</i> , <i>C. stockeri</i>) | Various species—well developed shrub layer may/may not be present | Well drained deep soils, often sandy loams |
| hWMI | Woodland with mixed grasses | Canopy Trees | Majority of trees >8 m | 10-30% | Dominated by native perennial and annual tussock grasses; may be associated with hummock grasses (<i>Triodia</i> species) | Various <i>Eucalyptus</i> (for example, <i>E. tetradonta</i>) and <i>Corymbia</i> spp, often with other taxa (for example, <i>Erythrophleum</i> , <i>Terminalia</i> , <i>Callitris</i>). May contain <i>Melaleuca</i> . spp. | Various species—well developed shrub layer may/may not be present | Various situations, from well-drained gravelly sites to those with impeded drainage |
| hWHu | Woodland with hummock grasses | Canopy Trees | Majority of trees >8 m | 10-30% | Dominated by hummock (<i>Triodia</i>) grasses. A mixture of native perennial and annual tussock grasses may also be present | Various <i>Eucalyptus</i> and <i>Corymbia</i> often with other taxa (for example, <i>Erythrophleum</i> , <i>Terminalia</i> , <i>Xanthostemon</i>) May contain <i>Melaleuca</i> . spp. | Various species—well developed shrub layer may or may not be present. Where present, may include woody heath taxa as listed for hSHH | Rocky shallow soils derived typically from sandstone (quartzite); also lateritic hills and plateau |
| hSHH | Shrubland (heath) with hummock grasses | Shrubs | Majority of shrubs <5 m | 0-30% | The presence of hummock (<i>Triodia</i>) grasses, or other perennial members of the <i>Restionaceae</i> (<i>Lepyrodia</i> , <i>Dapsilanthus</i>), or sedges (<i>Schoenus sparteus</i>) or graminoids (for example, <i>Lomandra</i> , <i>Xanthorrhoea</i>) | Sparse trees | Conspicuous cover of heathy shrubs (for example, <i>Acacia</i> , <i>Calytrix</i> , <i>Grevillea</i> , <i>Hibbertia</i> , <i>Hibiscus</i> , <i>Jacksonia</i> , <i>Tephrosia</i> , <i>Verticordia</i>) | Shallow to rocky substrates derived typically from sandstone, metamorphosed sandstone (for example, quartzite), sometimes laterised; sand sheets |

Table 2: Vegetation fuel types in the Low Rainfall Zone

| Vegetation fuel type code | Vegetation fuel type name | Dominant strata | | | Grasses | Characteristic descriptors | | |
|---------------------------|-----------------------------------------------|-----------------|-------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | Strata | Canopy height | Foliage projected cover | | Canopy trees | Shrubs | Substrates |
| IWHu | Woodland with hummock grasses | Canopy Trees | Majority of trees >10 m | 10-30% | Hummock (<i>Triodia</i>) grasses usually dominant, tussock grasses may also occur | Various <i>Eucalyptus</i> and <i>Corymbia</i> often with other taxa (for example, <i>Erythrophleum</i> , <i>Terminalia</i> , <i>Xanthostemon</i>) May contain <i>Melaleuca</i> . spp. | Well-developed shrub layer may/may not be present; may include woody heath taxa | Rocky shallow soils derived typically from sandstone (quartzite); also lateritic hills and plateau |
| IWMi | Woodland with mixed tussock / hummock grasses | Canopy Trees | Majority of trees >10 m | 10-30% | Dominated by native perennial and annual tussock grasses; may be associated with hummock (<i>Triodia</i>) grasses. May include limited areas of open forest with tussock/mixed grass | Various <i>Eucalyptus</i> (for example, <i>E. tetradonta</i>) and <i>Corymbia</i> spp, often with other taxa (for example, <i>Erythrophleum</i> , <i>Terminalia</i> , <i>Callitris</i>) May contain <i>Melaleuca</i> . spp. | Well-developed shrub layer may/may not be present. | Various situations including undulating to hilly land types on imperfectly to well drained soils |
| IWTu | Woodland with tussock grasses | Canopy Trees | Majority of trees >10 m | 10-30% | Dominated by native perennial and annual tussock grasses | Various <i>Eucalyptus</i> (for example, <i>E. tectifica</i>) and <i>Corymbia</i> (for example, <i>C. opaca</i>) often with other taxa (for example, <i>Erythrophleum</i> , <i>Terminalia</i>) May contain <i>Melaleuca</i> . spp. | Well-developed shrub layer may/not be present. | Majority deep well drained soils to those with impeded drainage, typically on flat to undulating land types with fertile volcanic-derived substrates |

| Vegetation fuel type code | Vegetation fuel type name | Dominant strata | | | Grasses | Characteristic descriptors | | |
|---------------------------|----------------------------------|-----------------|-------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| | | Strata | Canopy height | Foliage projected cover | | Canopy trees | Shrubs | Substrates |
| IOWM | Open woodland with mixed grasses | Canopy Trees | Majority of trees <10 m | <10% | Dominated by hummock (<i>Triodia</i>) grasses, or codominant with tussock grasses | Various <i>Eucalyptus</i> and <i>Corymbia</i> , including <i>C. dichromophloia</i> , <i>E. leucophloia</i> , <i>E. brevifolia</i> , <i>E. pruinosa</i> , <i>E. tectifera</i> | Well-developed shrub layer may/may not be present. Where present, may include woody heath taxa | Shallow substrates on undulating stony rises and rocky hills |
| ISHH | Shrubland with hummock grasses | Shrubs | Majority of shrubs <5 m | <30% | Hummock (<i>Triodia</i>) grasses, and/or other perennial members of the <i>Restionaceae</i> (<i>Lepyrodia</i> , <i>Dapsilanthus</i>) sedges (<i>Schoenus sparteus</i>) or graminoids (for example, <i>Lomandra</i> , <i>Xanthorrhoea</i>) | Sparse trees. May include areas of low open <i>Melaleuca</i> hummock grassland | Conspicuous shrub (heath) layer, commonly <i>Acacia</i> species and various other taxa (for example, <i>Calytrix</i> , <i>Grevillea</i> , <i>Hibbertia</i> , <i>Hibiscus</i> , <i>Jacksonia</i> , <i>Tephrosia</i> , <i>Veritcordia</i>) | Sand plains often over laterite, or rocky, shallow substrates derived from sandstone |

| Vegetation fuel type code | Vegetation fuel type name | Dominant strata | | | Grasses | Characteristic descriptors | | |
|---------------------------|----------------------------|----------------------------|-------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| | | Strata | Canopy height | Foliage projected cover | | Canopy trees | Shrubs | Substrates |
| IPin | Acacia shrublands (Pindan) | Shrubs with emerging trees | Majority of shrubs and emergent trees >2m | 10 - 30% | Dominated by hummock and tussock grasses including, spinifex (<i>Triodia bitextura</i> or <i>T. pungens</i>) and ribbon grass (<i>Chrysopogon fallax</i>). | Emergent trees species commonly present including <i>Corymbia dampieri</i> , <i>C. zygophylla</i> , <i>C. polycarpa</i> and occasional <i>Eucalyptus</i> . Other scattered tree species present are <i>Erythrophleum chlorostachys</i> , <i>Bauhinia cunninghamii</i> , <i>Brachychiton diversifolius</i> | <i>Acacia</i> shrublands, dominated by <i>A. eriopoda</i> and <i>A. tumida</i> , with lesser representation of <i>A. colei</i> , <i>A. monticola</i> or <i>A. platycarpa</i> . | Occurs on extensive red sandy plains with dune fields; lower valley floors with clayey soils; and on alluvial clay plains |

3.1 Converting vegetation class to vegetation fuel type code in the High Rainfall Zone

Two earlier savanna methodology determinations used the term ‘*vegetation class*’ rather than ‘*vegetation fuel type*’. These determinations are:

1. *Carbon Farming (Reduction of Greenhouse Gas Emissions through Early Dry Season Savanna Burning) Methodology Determination 2012*; and
2. *Carbon Credits (Carbon Farming Initiative) (Reduction of Greenhouse Gas Emissions through Early Dry Season Savanna Burning—1.1) Methodology Determination 2013*.

A vegetation fuel type map created under one of these earlier determinations would have assigned mapping units a vegetation class in line with that determination. Those units must now be assigned the corresponding vegetation fuel type used in the current determinations (see Table 3).

Table 3: Conversion of vegetation classes (used in earlier determinations) to vegetation fuel type codes and names used in current determinations.

| Correspondence between vegetation class and vegetation fuel type code | | |
|-----------------------------------------------------------------------|---------------------------|----------------------------------------|
| Vegetation class | Vegetation fuel type code | Vegetation fuel type name |
| EOF | hOFM | Open forest with mixed grasses |
| EW | hWMI | Woodland with mixed |
| SW | hWHu | Woodland with hummock grasses |
| SH | hSHH | Shrubland (heath) with hummock grasses |

4 Savanna Parameters in FullCAM

This section provides the input parameters for estimating abatement in FullCAM. These parameters are consistent with the most recent National Inventory Report.

4.1 Burn Efficiency

Table 4: Burn efficiency (*BEF*) is the proportion of fuel that is combusted in early dry season (EDS) and late dry season (LDS) fires.

| Burn Efficiency (proportion) | | | | | | |
|----------------------------------------------|---------------|-------------|------|--------|-------|---------|
| Parameters | Rainfall Zone | Fire season | Stem | Branch | Bark | Foliage |
| Live biomass | High | EDS | 0.2 | 0.3 | 0.6 | 0.7 |
| | High | LDS | 0.3 | 0.4 | 0.7 | 0.8 |
| | Low | EDS | 0.1 | 0.2 | 0.6 | 0.7 |
| | Low | LDS | 0.11 | 0.3 | 0.7 | 0.8 |
| Standing dead (Heavy fuel) | High | EDS | 0.2 | 0.3 | 0.7 | 0.8 |
| | High | LDS | 0.3 | 0.4 | 0.8 | 0.9 |
| | Low | EDS | 0.1 | 0.2 | 0.7 | 0.8 |
| | Low | LDS | 0.1 | 0.3 | 0.8 | 0.9 |
| Debris pools (Coarse and fine fuel) | High | EDS | - | 0.20* | 0.75* | 0.8 |
| | High | LDS | - | 0.40* | 0.85* | 0.9 |
| | Low | EDS | - | 0.10* | 0.75* | 0.8 |
| | Low | LDS | - | 0.20* | 0.85* | 0.9 |
| Grass (live biomass component of grass fuel) | All | All | - | - | - | 0.93 |

| | | | | | | |
|-----------------------------------------------------|-----|-----|---|---|---|------|
| Grass debris (dead biomass component of grass fuel) | All | All | - | - | - | 0.99 |
|-----------------------------------------------------|-----|-----|---|---|---|------|

*60% of these components are assumed to be coarse fuel, with 40% contributing to fine fuel.

Values taken from A5.6.11.8 *National Inventory Report*¹

4.2 Patchiness

Table 5: Patchiness (*P*) is the proportion of a fire scar area that is burnt in a fire for the different fire seasons (EDS vs LDS) for the high rainfall zone and low rainfall zone.

| Patchiness (proportion burnt) | | |
|-------------------------------|-------------|-------|
| Rainfall Zone | Fire Season | |
| | EDS | LDS |
| High | 0.709 | 0.889 |
| Low | 0.790 | 0.970 |

Values taken from Table A5.6.11.1 *National Inventory Report 2023*¹

4.3 Mortality

Table 6: Mortality is the percentage of above ground biomass that is fire-affected (i.e. extent of top-kill) for the high rainfall zone and low rainfall zone and vegetation fuel types.

| Mortality (percentage) | | |
|------------------------|-------------|-----|
| Vegetation fuel type | Fire Season | |
| | EDS | LDS |
| hOFM, hWMMi, hWHu | 2.5 | 10 |
| hSHH | 7.5 | 20 |
| IWHu, IWMi, IWTu, IOWM | 0 | 5 |
| ISHH | 5 | 15 |
| Pindan | 5 | 15 |

Values taken from Table 5.6.11.3 *National Inventory Report 2023*¹

4.4 Proportional area occupied by grasses

Table 7: The proportional area assumed to be occupied by grass in the difference vegetation fuel type classes.

| Rainfall Zone | Vegetation fuel type | Proportional Area |
|---------------|----------------------|-------------------|
| High | hOFM | 0.40 |
| | hSHH | 0.75 |
| | All other fuel types | 0.70 |
| Low | IOWM | 0.90 |
| | ISHH | 0.90 |
| | Pindan | 0.70 |
| | All other fuel types | 0.80 |

Values taken from Table A5.6.11.4 *National Inventory Report 2023*¹

¹ National Inventory Report 2023, Volume II, Australian Government (2025), Department of Climate Change, Energy, the Environment and Water

4.5 Emissions factor for methane

Table 8: The emissions factor for methane for the different vegetation fuel types.

| Rainfall Zone | Vegetation Class | Emissions factor for methane | | | |
|---------------|------------------|------------------------------|--------|--------|--------|
| | | Fine | Coarse | Heavy | Shrub |
| High | hOFM | 0.0031 | 0.0031 | 0.010 | 0.0031 |
| | hWMI | 0.0031 | 0.0031 | 0.0100 | 0.0031 |
| | hWHu | 0.0031 | 0.0031 | 0.010 | 0.0031 |
| | hSHH | 0.0015 | 0.0015 | 0.010 | 0.0015 |
| Low | IWHu | 0.0015 | 0.0015 | 0.0146 | 0.0015 |
| | IWMI | 0.0015 | 0.0015 | 0.0146 | 0.0015 |
| | IWTu | 0.0015 | 0.0015 | 0.0146 | 0.0015 |
| | IOWM | 0.0015 | 0.0015 | 0.0146 | 0.0015 |
| | ISHH | 0.0013 | 0.0013 | 0.0111 | 0.0013 |
| | ISPM | 0.0013 | 0.0013 | 0.0111 | 0.0013 |

Values taken from Table A5.6.11.11 *National Inventory Report 2023*¹

4.6 Emissions factor for nitrous oxide

Table 9: The emissions factor for nitrous oxide for the different vegetation fuel types.

| Rainfall Zone | Vegetation class | Emissions factor for nitrous oxide | | | |
|---------------|------------------|------------------------------------|--------|--------|--------|
| | | Fine | Coarse | Heavy | Shrub |
| High | hWHu | 0.0075 | 0.0075 | 0.0036 | 0.0075 |
| | hSHH | 0.0066 | 0.0066 | 0.0036 | 0.0066 |
| | hWMI | 0.0075 | 0.0075 | 0.0036 | 0.0075 |
| | hOFM | 0.0075 | 0.0075 | 0.0036 | 0.0075 |
| Low | IWHu | 0.0075 | 0.0075 | 0.0146 | 0.0075 |
| | IWMI | 0.0075 | 0.0075 | 0.0146 | 0.0075 |
| | IWTu | 0.0075 | 0.0075 | 0.0146 | 0.0075 |
| | IOWM | 0.0075 | 0.0075 | 0.0146 | 0.0075 |
| | ISHH | 0.0059 | 0.0059 | 0.0146 | 0.0059 |
| | ISPM | 0.006 | 0.006 | 0.0146 | 0.0059 |

Values taken from Table A5.6.11.12 *National Inventory Report 2023*¹

4.7 Nitrogen to Carbon ratio in fuel burnt

Table 10: The Nitrogen: Carbon ratio for the different vegetation fuel types.

| Rainfall Zone | Vegetation class | N:C | | | |
|---------------|------------------|-------|--------|-------|-------|
| | | Fine | Coarse | Heavy | Shrub |
| High | hOFM | 0.010 | 0.008 | 0.008 | 0.009 |
| | hWHu | 0.010 | 0.008 | 0.008 | 0.009 |
| | hWMI | 0.010 | 0.008 | 0.008 | 0.009 |
| | hSHH | 0.010 | 0.008 | 0.008 | 0.009 |
| Low | IWHu | 0.011 | 0.004 | 0.015 | 0.004 |
| | IWMI | 0.011 | 0.004 | 0.015 | 0.004 |
| | IWTu | 0.011 | 0.004 | 0.015 | 0.004 |
| | IOWM | 0.011 | 0.004 | 0.015 | 0.004 |
| | ISHH | 0.011 | 0.004 | 0.015 | 0.004 |
| | ISPM | 0.011 | 0.004 | 0.015 | 0.004 |

Values taken from Table A5.6.11.10 National Inventory Report 2023¹

5 Requirements for creating, revising and validating vegetation fuel type maps

This section provides the requirements for creating and validating vegetation fuel type maps as set out in Division 5, Part 3 of the relevant determination.

5.1 Requirements for creating a vegetation fuel type map

Creation and Validation Requirement

Section 20 of the relevant determination requires that a vegetation fuel type map must be created and validated in accordance with the *Savanna Fire Management Methods (2025) Technical Guidance Document* for all new projects, and for any new project area part added to an existing project.

Use of Former Maps

Section 28A of the relevant determination permits a vegetation fuel type map that was created and validated under a former savanna determination to be used for the same project area that was transferred to the relevant determination. This map must have been approved by the Clean Energy Regulator under the former determination for it to be accepted under the relevant determination.

Conversion of Vegetation Class Codes

If the map was created using the former vegetation class codes (under either the *Carbon Farming (Reduction of Greenhouse Gas Emissions through Early Dry Season Savanna Burning) Methodology Determination 2012* or the *Carbon Credits (Carbon Farming Initiative) (Reduction of Greenhouse Gas Emissions through Early Dry Season Savanna Burning—1.1) Methodology Determination 2013*), then the map will require updating so that the vegetation fuel classes are converted to vegetation fuel types in accordance to section 3.1.1 of this guidance document.

Submitting Vegetation Fuel Type Maps to CER

Section 36(3) of the relevant determination specifies that the newly created and validated vegetation fuel type map, with an audit report for the validation of the map, must be submitted with the first offset report after the new project was registered or after the new project area was added.

Optional Inclusion of Pindan Vegetation

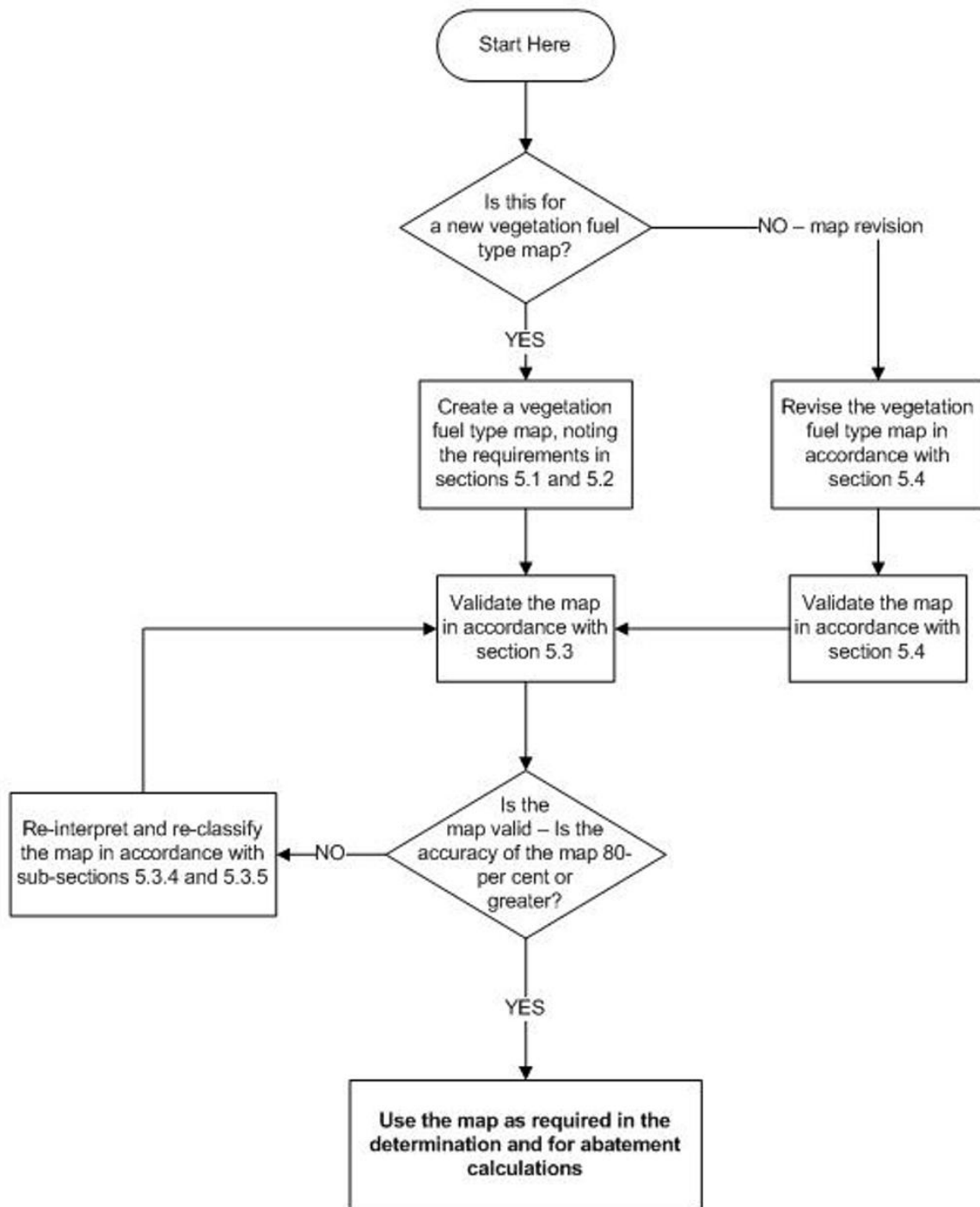
If an existing project has transferred to one of the relevant 2025 determinations and has already created a vegetation fuel type map that does not include Pindan vegetation, the project proponent has the option to update the map to include it. This update is not mandatory. A proponent might choose not to revise the map if the cost of updating and validating the map outweighs the potential increase in abatement from including Pindan vegetation. In such cases, the existing map may remain unchanged, provided it meets all other requirements of the determination (see section 21). Abatement from Pindan vegetation in the project area can only be credited if the map is updated.

5.1.1 Format of vegetation fuel type map

The relevant determination stipulates that a single vegetation fuel type map may cover a single project area or more than one project area part. Each project area must be covered by a single vegetation fuel type map.

The map must be in raster format. When using SavCAM, all mapping units must be 250m x 250m. Maps derived from multiple datasets must use similarly scaled data.

Figure 1: the steps for creating and validating a vegetation fuel type map for a new project area.



5.1.2 Classification of mapping units in a vegetation fuel type map

Each mapping unit must be classified as containing either a vegetation fuel type (defined in section 3 of this document) or otherwise classified as ineligible by assigning a code (Table 11). Ineligible areas

could include areas of land dominated by other vegetation fuel types, cleared land, or land used for agriculture or land containing relevant weeds.

Table 11: Codes to be assigned to each mapping unit.

| Map code | Vegetation fuel type code | Vegetation fuel type name |
|----------|---------------------------|-------------------------------------------------------------|
| 1 | hOFM | High rainfall Open Forest with mixed grasses |
| 2 | hWMi | High rainfall Woodland with mixed grasses |
| 3 | hWHu | High rainfall Woodland with hummock grasses |
| 4 | hSHH | High rainfall Shrubland heath with hummock grasses |
| 11 | IWHu | Low rainfall Woodland with mixed grasses |
| 12 | IWMi | Low rainfall Woodland with mixed grasses |
| 13 | IWTu | Low rainfall Woodland with tussock grasses |
| 14 | IOWM | Low rainfall Open woodland with mixed grasses |
| 15 | ISHH | Low rainfall Shrubland heath with hummock grasses |
| 16 | IPin | Pindan shrublands |
| 0 | ineligible | Vegetation that is not a vegetation fuel type, cleared land |
| 255 | NODATA | Mapping unit is outside the project area |

Section 3 of this document provides characteristics for vegetation species and substrates for each vegetation fuel type for which abatement estimates are made. The species composition of canopy trees and shrubs is given as a guide to help characterise vegetation fuel types.

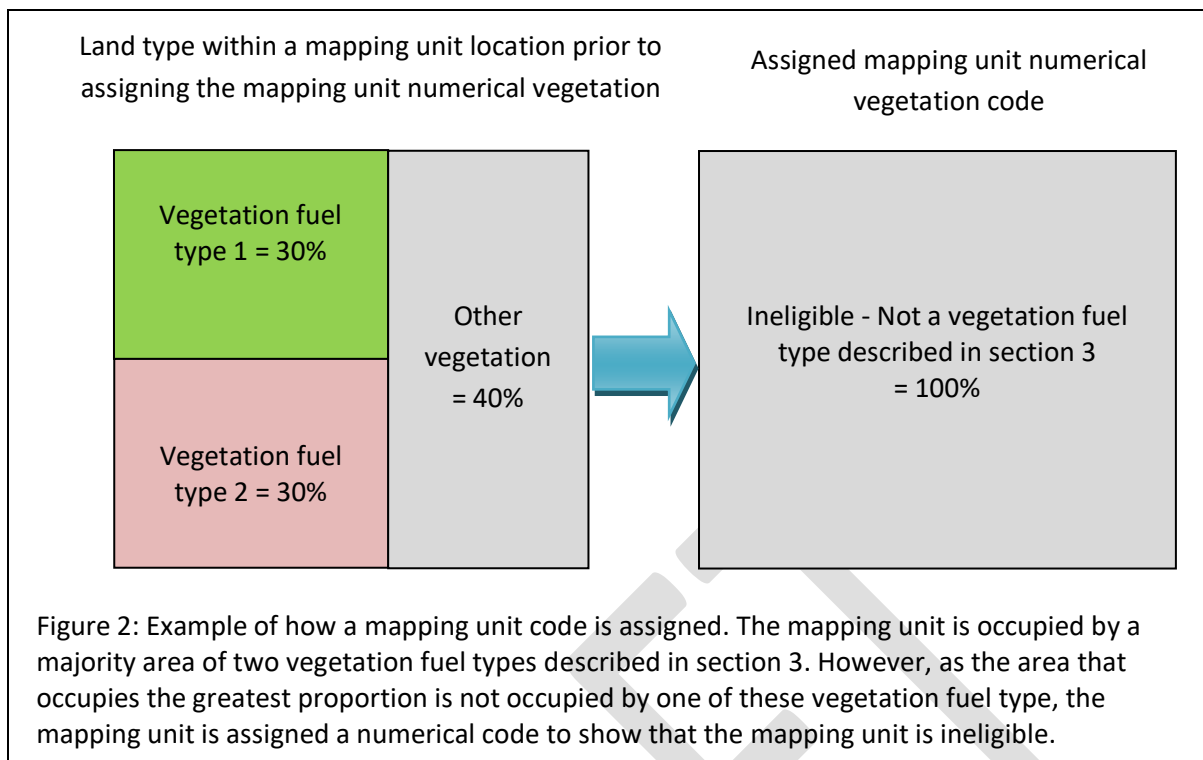
The mandatory elements include the structural formation (canopy height and projected foliage cover) of the dominant stratum and the grass type. The dominance of hummock grass relative to the dominance of tussock grass, or a variably dominated grass mix, assists in classifying the vegetation fuel type. There is no requirement to determine the percentage of grass cover to assign vegetation fuel types.

Definitions for projected foliage cover used in section 3 are based on those used by the National Vegetation Information System (NVIS)². Projected foliage cover is “*the proportion of the ground which would be shaded if sunshine came from directly overhead*”. Projected foliage cover is applied to a stratum or plot rather than an individual crown and includes branches and leaves. It is not directly measured in the field for the upper stratum and instead can be measured by various line interception methods for ground layer vegetation. Projected foliage cover may be estimated by canopy cover with relationships between the two being dependent on various factors including season, species, and age of vegetation.

5.1.3 Dominant vegetation fuel type

The dominant vegetation fuel type in each mapping unit is the vegetation fuel type that covers a greater area of land than is either occupied by any other vegetation fuel types or areas not occupied by a vegetation fuel type. For example, a mapping unit that contains more than one vegetation fuel type would be classified according to the vegetation fuel type that occupies a proportion of the mapping unit that is greater than the proportion that is occupied by any other vegetation fuel types (see Figure 2). If the area occupied by vegetation not included in section 3 of this document is greater than any other vegetation fuel type, then the mapping unit is classified as ineligible.

² Department of Climate Change, Energy, the Environment and Water (2024). *National Vegetation Information System (NVIS) Version 7.0 – Present Major Vegetation Groups and Subgroups*. Commonwealth of Australia. Available at: <https://www.dcceew.gov.au/environment/environment-information-australia/national-vegetation-information-system/data-products>



5.1.4 Creating a vegetation fuel type map

The approach used to create a vegetation fuel type map depends on the available data and the experience of the person creating the vegetation fuel type map.

The vegetation fuel type map may be derived by one or more of the following approaches:

1. *Remote-sensing data interpretation, using object-based image analysis techniques*

Object-based image analysis techniques derive the vegetation fuel type map by using suitable scale satellite imagery (e.g. MODIS (250 m) or Landsat (30 m)) that describe vegetation structure. Object-based image analysis techniques use image segmentation software, and can be used to segment imagery to create homogenous objects. An iterative process is used to group areas according to imagery digital signatures, contextual information and ancillary data. The final iteration selected for classification will create objects that best represent the vegetation fuel types.

The visible red and infra-red bands and colour composites can be used to discern vegetation from satellite imagery or specific vegetation indices such as Normalised Difference Vegetation Index. Other data products available are fractional cover or 'Persistent Green' - a foliage projective cover layer derived from a ten-year median Landsat data set, or 'Dynamic Land Cover' derived from MODIS using Enhanced Vegetation Index. These products provide a suitable base layer for the vegetation fuel type mapping but require the integration of ancillary information and calibration data to provide an accurate classification of the objects as vegetation fuel types.

Ancillary information can assist in the stratification and differentiation of land and vegetation types. Ancillary data may be geomorphology or land systems, including digital elevation models, soil, geomorphological and hydrological data. Known associations between vegetation fuel types and land types can be used to inform the classification of the generated objects that represent patterns on the ground.

2. *Reclassifying an existing vegetation map product*

Existing map data sets must be carefully interpreted to ensure correct re-classification into the vegetation fuel types listed in section 3 of this document. An example of suitable mapping is the

Regional Ecosystem mapping in Queensland. The mapping scale is 1:100,000 (i.e. minimum feature of 100 m width or four ha), and each Regional Ecosystem has a detailed description of the vegetation and the associated land type.

Existing vegetation maps at a spatial scale equal to or finer than that required may be re-classified to represent the vegetation fuel types. Classification scales of existing vegetation maps must be functionally equivalent to National Vegetation Information System (NVIS) Information Hierarchical level IV or higher (i.e. Sub-Formation, Association or Sub-Association)

3. Recent aerial photo interpretation (API)

A vegetation fuel type map may be created manually by manually interpreting aerial photographs. Aerial photo interpretation is resource intensive. The map is created by using expert knowledge to visually delineate patterns representing homogenous areas determined from contextual differences (e.g. shape, colour, texture). Aerial photographs must be current and taken in such a way that they can be used to accurately depict vegetation at the time of vegetation fuel type map production.

For the purposes of audit, project proponents are advised to retain evidence of the approach used to create a vegetation fuel type map and results of the validation process.

5.1.5 Vegetation map available in SavCAM

A vegetation fuel type base map available in the Savanna Carbon Accounting Model (SavCAM) provides broad scale approximations of vegetation fuel types in six zones over northern Australia savannas. The base map in SavCAM does not meet the methodology requirements, and cannot be used to estimate abatement in an offset report submitted to the Clean Energy Regulator. The base map functionality is provided in SavCAM to allow proponents to investigate potential abatement prior to registering projects.

5.2 Calibration of vegetation fuel type

Calibration data from the land covered by the vegetation fuel type map must be collected to assist in the interpretation and classification of the new vegetation fuel type map – regardless of the approach used to initially create it. Calibration data must be independent of the data used to validate the map.

5.3 Validating a vegetation fuel type map

Section 20 of the relevant determination requires that vegetation fuel type maps must be validated in accordance with this document when they are newly created.

Section 20 of the relevant determination requires that vegetation fuel type maps that have been revised must be validated in accordance with this document, and that any revisions and validations must be completed before the project area is next reported on.

Validation of vegetation fuel type maps requires using a number of independent waypoints to determine the accuracy of the created or revised vegetation fuel type map. If map validation identifies that the proportion of errors are greater than an acceptable level, then the map must be re-interpreted and re-classified with a different set of waypoints.

Aerial sampling is recommended over ground sampling as it provides a more geographical representative sample set. The data collector must have sufficient knowledge and experience to recognise the different vegetation fuel types described in section 3 of this document.

A number of steps must all be followed to validate a vegetation fuel type map. These are:

- 1. Convert a copy of the map into vector format (the vectorised map), without simplifying or smoothing the polygon boundaries*

The raster vegetation fuel type map must be converted to a vector map (the vectorised vegetation fuel type map). This assists with the format of the validation waypoint data.

Converting raster maps to vector maps is a standard function in GIS software. Most software will apply smoothing as a default, but for the purposes of validating the vegetation fuel type map care must be taken to ensure that the conversion does not simplify or smooth polygon boundaries. If conversion is correctly implemented, the vector boundaries will follow the same grid patterns as the raster map (i.e. vector boundaries at 250 m and 90 degree increments).

2. *Assign a numerical code to each polygon representing the code of the mapping unit or mapping units that comprise the polygon*

Each polygon is assigned a single code to denote the vegetation fuel type contained in the polygon, or the fact that it contains ineligible land.

3. *Select an assessment set of waypoints from the set referred above, having regard to:*
 - a. *all vegetation fuel types in the area covered by the map; and*
 - b. *if the area covered by the map corresponds to land in different project areas—each such project area*

Proponents must collect data for a set of validation waypoints (the assessment set). If a subset of a larger data set is used for validation, then the assessment set may be selected randomly or systematically, and must have regard to all vegetation fuel types and project areas in the vegetation fuel type map. The usual legal meaning of the expression 'having regard to' applies to this paragraph. Each validation waypoint observation must remain independent of other waypoint validation observations. Waypoints cannot be deleted to improve the accuracy of assessment.

For the purposes of audit, project proponents are advised to retain evidence that they did have regard to these matters when selecting waypoints, and that their decisions were fit for purpose.

5.3.1 Selection of waypoints

Validation waypoints must be:

1. Collected only within the area covered by the map that is being validated.
 - a. Validation must prioritise a series of waypoints that cover the range of vegetation fuel types and traverse the extent of the mapped area.
2. Independent of any waypoints that were part of the calibration process used to classify or re-classify the map.
 - a. One option that ensures that calibration and validation data are independent may include using different transects for the two purposes.
3. Identified by a unique label that includes:
 - a. a unique label;
 - b. the time of collection
 - c. the date of collection; and
 - d. the latitude and longitude of the waypoint derived from a GPS.
4. Selected having regard to transects that intersect, or a grid that intersects:
 - a. all vegetation fuel types in the area covered by the map that is being validated;
 - b. if the area covered by the map that is being validated corresponds to land in different project areas—each such project area; and

- c. Validation cannot use existing survey data where it cannot be shown that this did not have regard to the vegetation fuel types or the spatial extent of the mapped area.

5. Selected randomly or systematically.

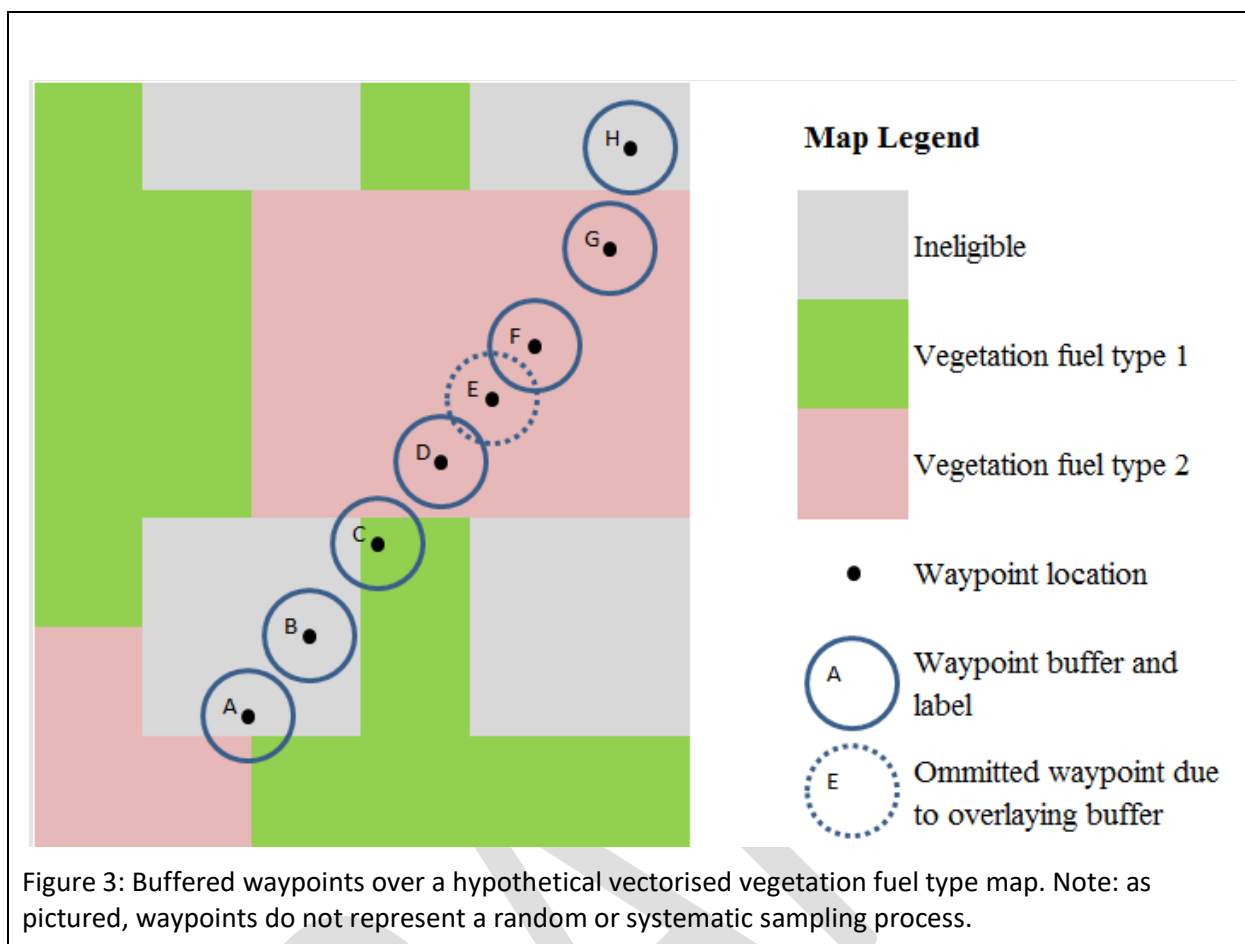
5.3.2 Waypoint buffers

Each waypoint must be surveyed using a circular buffer with a radius of 100 metres (totalling approximately 3.14 hectares) – the waypoint buffer. This allows for the waypoint to represent a homogenous area rather than a point, and ensures that the vegetation fuel type map validation is of a similar scale to the resolution of the map.

The waypoint buffer recognises that the survey is of a general area and not a point. The unique label, that includes the latitude and longitude of the waypoint derived from a GPS, represents the observation location.

Waypoint buffers cannot overlap. If waypoint buffers overlap, then an overlapping observation must be omitted from the validation data (see Figure 3). The selection of omitted waypoints is at the discretion of the mapper, and must be selected having regard to the spatial distribution of the remaining waypoints.

Each waypoint buffer should be surveyed to visually assess the dominant vegetation structure, defined by the dominant canopy trees (e.g. *Eucalyptus* or *Melaleuca* or other), and the dominant understorey graminoid life form. This information is used to define whether the waypoint represents an eligible vegetation fuel type or ineligible land under the relevant determination. The rules for assessing areas containing more than one vegetation fuel type are the same to those for creating a vegetation map.



Examples

The following example uses Figure 3 to identify how the rules apply.

Example A

Waypoint A has the code for vegetation fuel type 2 assigned to it. The waypoint latitude and longitude was recorded in the project area, and part of the waypoint buffer overlays an area of the vectorised vegetation fuel type map of the same code. The waypoint buffer does not overlap another waypoint buffer so this waypoint is both an assessed and verified waypoint.

Example B

Waypoint E buffer overlaps with the waypoint buffers of D and F. The mapper could delete waypoints D and F, leaving E, but chooses to delete only E. E becomes an omitted waypoint and does not contribute to either the number of assessed or verified waypoints. The waypoint buffers for waypoints D and F do not overlap with any other waypoint buffer so they are both included in the number of assessed waypoints. D and F are assigned the codes for vegetation type 1 but no part of their buffers overlap with an area of the vectorised vegetation fuel type map of the same code. Waypoints D and F are an assessed waypoint but not a verified waypoint.

5.3.3 Number of waypoints required for validation

Waypoints must be collected at approximately the same time as the vegetation fuel type map was created and validated – ideally within three years of the map creation or revision.

The minimum number of waypoints required to validate a new or revised vegetation fuel type map, regardless of the number of project areas it covers, is shown in Table 12.

Table 12: The minimum number of waypoints required to validate a new or revised vegetation fuel type map

| Area of vegetation fuel type map | Minimum number of waypoints |
|------------------------------------------------|-------------------------------------------------------------------------------|
| > 20,000 km ² | 500 plus 1 waypoint for every 100 km ² over 20,000 km ² |
| 10,000 km ² –20,000 km ² | 500 |
| < 10,000 km ² | 250 |

The number of waypoints used for validation is estimated to ensure an acceptable level of confidence in the accuracy of the vegetation fuel type map.

Vegetation fuel type maps used in the relevant determination must demonstrate 80 per cent accuracy or greater. The accuracy of the map (in percentage) is given by the following formula:

$$\text{accuracy} = \frac{\text{number of verified waypoints}}{\text{number of assessed waypoints}} \times 100$$

where:

assessed waypoint means a waypoint in the assessment set.

verified waypoint means a waypoint in the assessment set that has the same code in any part of the buffer area with an area of land that it overlaps in the vectorised vegetation fuel type.

A waypoint is a verified waypoint if any of the land in the waypoint has the same vegetation cover as that same area of land in the vegetation fuel type map being validated.

Example 1

A new project has two project areas mapped on a single vegetation fuel type map. Each project area is 4,000 km². The sum of these areas is 8,000 km² so at least 250 waypoints are required to validate the single vegetation fuel type map.

If the project areas were mapped separately, then a minimum of 250 waypoints would be required for each vegetation fuel type map representing a single project area (i.e. a total minimum of 500 waypoints).

Example 2

An existing project has one project area of 4,000 km². This vegetation fuel type map was validated using 300 waypoints. Several years later, the project decides to vary their declaration and add a second project area, also of 4,000 km². As this is a variation under section 29 of the Act, then the number of waypoints required to validate the new vegetation fuel type map must be a minimum of 250.

5.3.4 Re-interpretation and re-classification of a vegetation fuel type map

If validation of a vegetation fuel type map demonstrates an accuracy of less than 80 per cent, then the vegetation fuel type map must be re-interpreted and re-classified. Re-interpretation and re-classification can be achieved by refining the interpretation of the original vegetation fuel type map, such as refinement of the interpretation of remote sensing data. The revised map must be validated to an acceptable level of accuracy.

Validation of a re-interpreted and re-classified map must use the number of waypoints defined in Table 5.3.1. Waypoints must be selected in accordance with the guidelines provided in this section. These waypoints may be taken from the assessment set or may include new waypoints used for the purposes of this validation. Project proponent must not use the waypoints that were used when seeking to validate the corresponding seasonal fire scar map, nor information from them.

5.3.5 Timing of validation of new or revised vegetation fuel type maps

Initial map validation must occur no earlier than three years before the project or project area was added (e.g. at project commencement); and no later than when the first offsets report is submitted that relies on that map. Map validation of revised maps must also occur within these time frames.

5.4 Revising a vegetation fuel type map

Section 21 of the relevant determination defines when revisions to vegetation fuel type maps are required. A vegetation fuel type map must be revised if any mapping unit classified as containing a vegetation fuel type in the original map is later found to be incorrectly classified and should now be classified as ineligible (see subsection 21(1) of the relevant determination). This could occur if an error was made in the initial mapping of the land.

A vegetation fuel type map must also be revised if the classification is not, or is no longer, in accordance with the *Savanna Fire Management Methods (2025) Technical Guidance Document*. For example, the mapping unit may be classified as one vegetation fuel type, but should be classified as another vegetation fuel type.

It is optional to revise a vegetation fuel type map if any mapping unit classified as ineligible in the original map is later found to be classified incorrectly and should now be classified as a vegetation fuel type (see subsection 21(2) of the relevant determination). For example, a vegetation fuel type may be revised if a new vegetation fuel type is added to the Tables in section 3 of this document at a date later than when the original vegetation fuel type map was created.

If a vegetation fuel type map is revised, it must be validated in accordance with section 21(3) of the relevant determination and the *Savanna Fire Management Methods (2025) Technical Guidance Document*. If revisions are required, then the revision (and if necessary) validation must be completed before submitting an offsets report for the reporting period in which the project proponent became aware that the revision was required. If the revisions were made in accordance with subsection 21(2) of the relevant determination, then the revision (and if necessary) validation must be completed before submitting an offsets report for the first reporting period for which the revised map is used.

If a vegetation map is revised during the reporting period, then the revised map must be used for all years in the reporting period.

5.4.1 Validating revised vegetation fuel type maps

If a vegetation fuel type map is revised, then it may be required to be validated. The revisions are considered to require validation if, for at least one criteria below, the revisions comprise at least 2% of the defined area.

1. The extent of land covered by all revised mapping units cover at least 2% of the extent of land when compared to the extent of land containing all vegetation fuel types listed in section 3 of this document for that vegetation fuel type map – either before or after the map was revised, or
2. The extent of land covered by revisions to an individual vegetation fuel type cover at least 2% of the extent of land when compared to the extent of land covered by that vegetation fuel type – either before or after the map was revised, or
3. For a vegetation fuel type map that covers more than one project area, either of the above hold for any of the individual project areas, or
4. The cumulative impact of more than one map revision would have the same effect as any of the above provisions.

If at least 2% and less than 5% (the material amount) of the vegetation fuel type map has been revised in accordance with one or more of these criteria, then only the revised mapping units of the vegetation fuel type map that has been revised must be validated.

If 5% or greater (the material amount) of the vegetation fuel type map has been revised in accordance with one or more of these criteria, then the whole of the revised vegetation fuel type map must be validated.

If none of these criteria are met, then validation is not required.

Validation of revised maps must be undertaken in accordance with subsection 5.3 of this document. After revision, references to 'the map' in the relevant determination and accompanying material are taken to be references to 'the revised vegetation fuel type map'. The validation must be completed before the first offset report is submitted following the development of the revised map.

If there is any doubt about the materiality of the extent of map revisions as described in the circumstances above, then the map must be re-validated following the re-classification of mapping units.

All new validation waypoints must be independent of any waypoints that have previously been used to validate the map or any earlier version of the map. All newly selected waypoints must be selected with regard to subsection 5.3.1 of this document.

If the revised map is not valid, then it must be re-interpreted and re-classified according to subsection 5.3.4 of this document, without using waypoints that were used to validate the original or revised map, nor information from either.

6 Monitoring for the presence of relevant weed species

Relevant weed species are weeds which materially impact on estimations of net abatement under the relevant determination.

Invasive high biomass weed species in savanna project areas significantly alter fire behaviour. These weeds have considerably higher fuel loads than native grasses, resulting in more intense fires and increased greenhouse gas emissions and a reduction of carbon stored in living biomass and dead organic matter.

Areas containing relevant weed species must be excluded from project areas at registration and not included in abatement estimations.

Relevant weed species may be detected in the project area after the vegetation fuel type map has been created and validated. This may occur incidentally, through a process not specified in this document, or in accordance with the monitoring requirements provided in section 40 of the relevant determination. If this occurs, then to remain an eligible offsets project, the project proponent must either:

- Treat the relevant weed species appropriately—using herbicide or mechanical removal—within 18 months of detection and continue treatment annually until eradication (i.e., no detection for 24 months, as defined in section 14(5)); or
- Subdivide the project area in accordance with section 16 of the relevant determination and remove the subdivided area containing the relevant weed species from the project.

These requirements ensure compliance with section 14(2)(b) of the determination and maintain the integrity of abatement reporting.

To ensure that the relevant determination accounts for abatement estimates in accordance with the requirements set out in the CFI Act, the relevant determination requires regular monitoring of all project areas to detect the presence of relevant weed species. This monitoring must be carried out

in accordance with the requirements set out in this section of the *Savanna Fire Management Methods (2025) Technical Guidance Document*.

6.1 Relevant weed species table

Relevant weed species that must be monitored for in accordance with this section are listed in Table 13.

Table 13: Relevant weed species

| Relevant weed species | | |
|-----------------------|---------------------------|-------------------------------------|
| Common Name | Specific name | Mapping and Monitoring instructions |
| Gamba Grass | <i>Andropogon gayanus</i> | See Section 6.20 |

6.2 Frequency of monitoring for relevant weed species

If relevant weed species are detected in the project area, action must be taken in accordance with the relevant determination to actively manage the relevant weed species, or, if this is not possible then remove the area from the project area.

Relevant weed species may invade project areas at any time. Projects are required to monitor for the presence of relevant weed species at regular intervals throughout their project.

The frequency of monitoring required may depend on the existence of a Relevant Weeds Risk spatial data layer. If this spatial data layer exists it will define areas based on their relative risk of invasion by relevant weed species – as either high risk or low risk. Monitoring in high-risk areas will be more frequent than for low-risk areas.

If a Relevant Weeds Risk spatial data layer exists, then monitoring to detect the presence of relevant weed species in each project area must be carried out at least at the frequency defined in Table 14. Monitoring for each project area must occur at the highest frequency required for any area of land represented by a mapping unit in the project area. If it exists, a Relevant Weeds Risk spatial data layer will be available on the Department's website.

If a project area that is classified as being in the low-risk weed category is shown to contain a relevant weed species, then it must be reclassified and monitored as if it were in the high-risk category for the remainder of the project's crediting period.

Table 14: Relevant Weed Species Monitoring Schedule if a Relevant Weeds Risk spatial data layer exists.

| Relevant Weed Species Monitoring Schedule | | |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Highest Weed Risk category defined in the Relevant Weeds Risk spatial data layer | Required monitoring frequency during the crediting period | Required monitoring frequency during the permanence period, but after the crediting period |
| Low | The monitoring frequency will be determined at publication of an approach to monitoring and will be informed by the burden of the approach in a low-risk area | The monitoring frequency after the crediting period will be determined at publication of an approach to monitoring and will be informed by the burden of the approach in a low-risk area |

| | | |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High | The monitoring frequency will be determined at publication of an approach to monitoring and will be informed by the burden of the approach in a high-risk area | The monitoring frequency after the crediting period will be determined at publication of an approach to monitoring and will be informed by the burden of the approach in a high-risk area |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

If the Relevant Weeds Risk spatial data layer does not exist, then the frequency of monitoring will be defined in accordance with the Table below. Monitoring may be performed more frequently than the minimum requirements outlined in Table 15.

Table 15: Relevant Weed Species Monitoring Schedule if a Relevant Weeds Risk spatial data layer does not exist.

| Relevant Weed Species Monitoring Schedule | |
|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Required monitoring frequency during the crediting period | Required monitoring frequency during the permanence period, but after the crediting period |
| The monitoring frequency will be determined at publication of an approach to monitoring and will be informed by the burden of the approach. | The monitoring frequency after the crediting period will be determined at publication of an approach to monitoring and will be informed by the burden of the approach. |

6.3 Approach to monitor for the presence of relevant weed species

This section will describe an approach to monitor for the presence of relevant weed species.

At the time the relevant determinations were made, research was being undertaken to determine a suitable approach for monitoring for relevant weed species. A robust monitoring approach, most likely using remote sensing, is several years away. When a robust approach is developed, guidelines on the suitable approach will be described in this section in an updated version of this document. When this approach exists, then monitoring must be undertaken at the frequency defined in section 6.2 of this document.

As there is not yet an approach to monitoring for the presence of relevant weeds species specified in this document, formal monitoring of weeds is not yet required. Nevertheless, project proponents must consider section 14 of the determinations which requires that areas of land that are known to contain a relevant weed species must be excluded from the project area or that the relevant weed species are permanently removed. This applies whether or not an approach to monitoring is specified.

7 Guidance for developing Project Management Plans

Savanna fire management in project areas must be consistent with the project activity as described in section 17 of the relevant determination. Fire management must also comply with applicable bushfire legislation as required under the CFI Rule.

Section 18 of the determination requires that project proponents must develop a Project Management Plan for each project area, describing how they plan to undertake planned burning in each calendar year. The plan must be prepared before the commencement of planned burning and may be updated during the fire season to reflect changing circumstances. For example, above

average rainfall may prevent all planned burns occurring, and burns may be prioritised accordingly. Section 19 requires that any updates or revisions to the plan must be dated.

Projects have an offset reporting requirement in subsection 36(2)(c) of the relevant determination to provide their annual Project Management Plan for each project area along with any revisions or updates made during the year.

The requirements for a Project Management Plan may be satisfied by other documents already prepared by the project proponent, such as a fire management plan. In such cases, relevant sections of the other document may be submitted as part of the offset report.

Project Management Plans may be one or more of the following:

1. A written stand-alone document that may or may not include maps, figures and tables prepared prior to the commencement of the fire season, and updated during the fire season, if applicable.
2. Part of another document that has been completed for another audience or different purpose, provided it meets all the requirements for a Project Management Plan in the relevant determination and this guidance document. The relevant section of such a document, completed for other audiences or different purposes, can be submitted as the Project Management Plan, if it is fit for purpose.
3. If the requirements for a Project Management Plan are only partially fulfilled by material in another document, then that material, together with a shortened plan that contains the remaining information can form the Project Management Plan.
4. Part of a project offset reporting template prepared by the project proponent. This template could be structured to include information that satisfies the requirements for a Project Management Plan for each project area and each calendar year.

Box 1: Information included in each Project Management Plan.

Subsection 18(1) of the relevant determination specifies that fire management activities must include planned burning in each project area each calendar year.

1. The Project Management Plan *must* define each planned burning activity. This may be achieved through:

- describing the types of ignitions (e.g. aerial, ground)
- describing the timing of ignitions (e.g. the month and whether this is in the early or late dry season)
- defining the approximate location of planned fires and the anticipated area covered by the planned burn
- describing the weather conditions under which these burns would / would not be undertaken, and
- describing the objectives of the planned burn, including how they may contribute to achieving the objectives in section 11 of the relevant determination.

2. The Project Management Plan *may* prioritise the planned activities to identify which are more likely to occur if opportunities to undertake planned burning are limited (e.g. if it is wetter than average).

3. The Project Management Plan *may* describe the nature of any planned suppression activities, and what situations would trigger the use of suppression activities in the project activity.

- Describe the objectives of the suppression activities, including how they may contribute to achieving the objectives in section 11 of the relevant determination.

4. The Project Management Plan *may* describe the safety measures being implemented, including the experience of those undertaking the planned activities, the machinery planned to be used, and fire permits required to be issued.

* Project Management Plans could be prepared in consultation with neighbouring properties to enhance the potential for success of desirable outcomes.

** Maps may be used to show the location and size of proposed burns, but are not a requirement.

Appendix 1 The Savanna Carbon Accounting tool for estimating abatement for Savanna Fire Management Projects

Background

SavCAM is a web-based tool designed to automate FullCAM (Full Carbon Accounting Model) simulations for savanna fire management projects. It assists project proponents in calculating their net abatement under the Savanna Fire Management 2025 methods. SavCAM collates the results of the FullCAM simulations into reports suitable for submission with offset reports.

Savanna project areas are typically large, and manually running FullCAM simulations across these areas would be too complex and time consuming. SavCAM was purpose-built to automate the process, significantly reducing the complexity of reporting for savanna fire management projects.

Previously, savanna fire management methods used SavBAT (Savanna Fire Abatement Tools) to estimate carbon abatement. SavCAM builds on this foundation by integrating FullCAM, enabling more accurate simulation of carbon dynamics in savanna ecosystems. Much of the scientific research used in developing SavBAT has been incorporated into SavCAM's modelling approach.

SavCAM calculates net carbon abatement, which includes:

- Emissions avoidance: Reduction in methane (CH₄) and nitrous oxide (N₂O) emissions through strategic fire management.
- Carbon sequestration: Storage of carbon in living and dead biomass pools.

The model ensures alignment with Australia's National Greenhouse Gas Inventory (NIR), ensuring consistency between national reporting and the ACCU scheme.

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.
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.

Schedule 1 and 2 of the proposed new savanna sequestration method sets out the equations that underpin SavCAM.

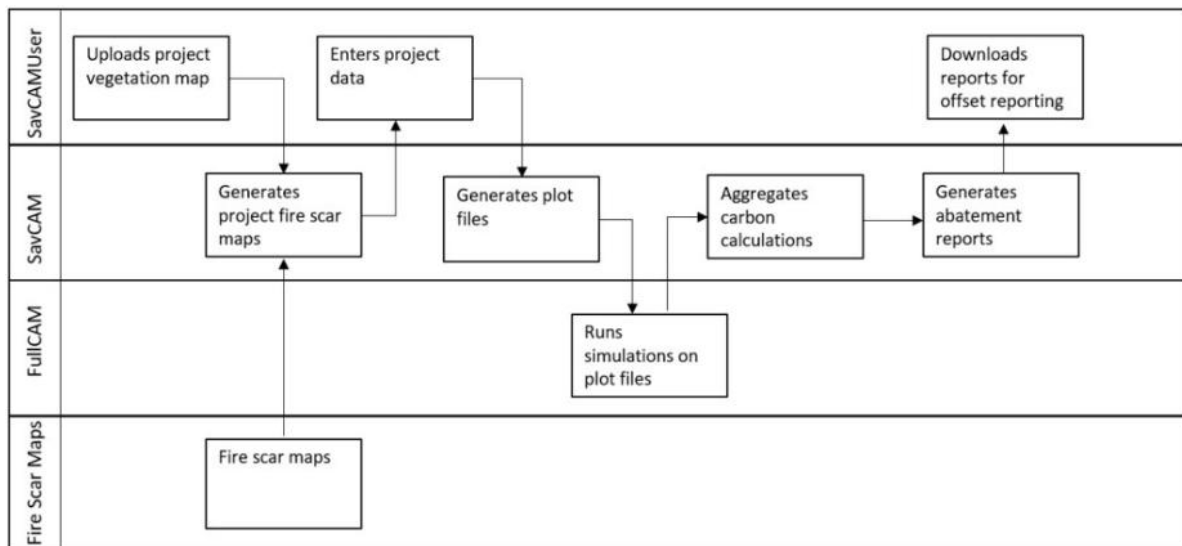


Figure 1: SavCAM logic flow showing interactions with FullCAM

Modelling savannas in FullCAM

FullCAM is Australia’s national carbon accounting model, used to estimate carbon stocks in biomass, litter, and soil across various land sectors. In savanna ecosystems, it simulates carbon flows driven by:

- Vegetation growth and turnover
- Fire events
- Mortality and decomposition

Recent enhancements by Paul and Roxburgh (2024) have improved FullCAM’s accuracy in estimating emissions and carbon sequestration for savanna ecosystems. A schematic diagram of how carbon is modelled in FullCAM is shown in Figure 2.

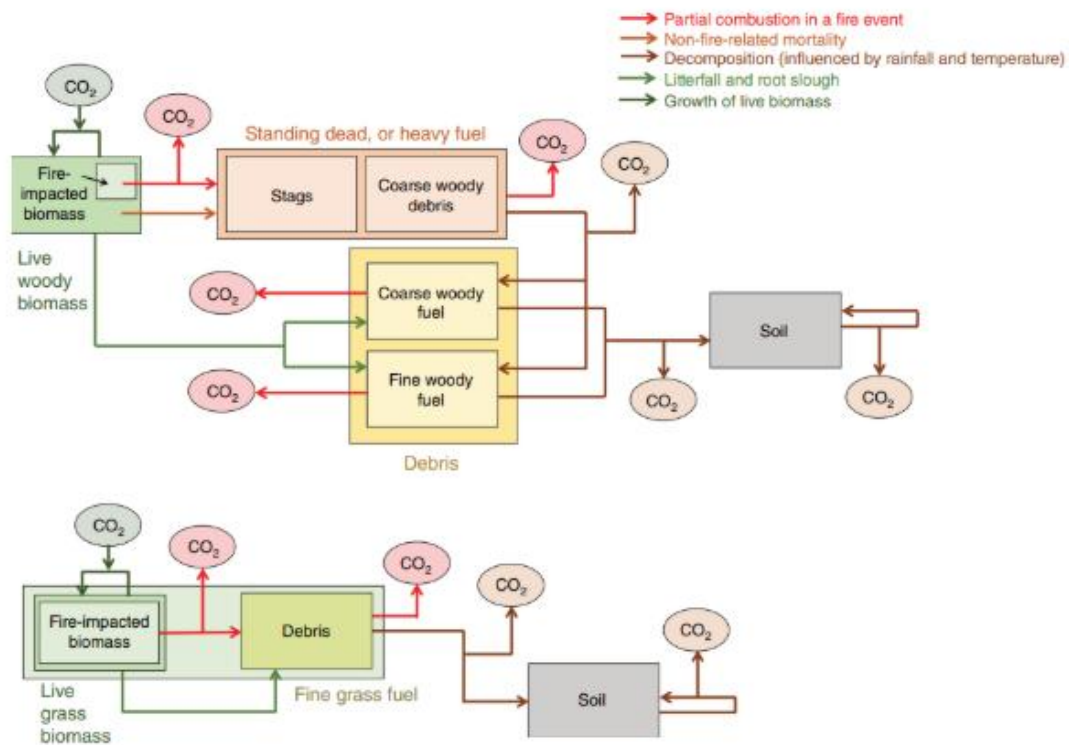


Figure 2: Flow of carbon in savanna system as simulated by FullCAM. (Source: Paul and Roxburgh 2024)³

The model accounts for the following fuel components:

- Live woody biomass (living biomass)
- Heavy woody fuel, including stags (standing dead trees) and coarse woody debris (large dead branches)
- Coarse woody fuel (branches and bark litter, 0.6–5 cm diameter)
- Fine woody fuel (leaf litter, twigs, and bark ≤ 0.6 cm diameter)
- Fine grass fuel

FullCAM uses the amount of CO_2 emitted to estimate the relative proportions of methane (CH_4) and nitrous oxide (N_2O) released during fire events. Only CH_4 and N_2O contribute to the emissions avoidance component, as CO_2 losses are rapidly offset by vegetation regrowth (see Table 1). Fire-related emissions are shown as red CO_2 flows, representing greenhouse gases released as smoke (Figure 1). Emissions associated with other processes such as from soil are not accounted for in the method (shown in brown in Figure 1).

Carbon sequestration in the SFM (2025) method is calculated for the following pools:

- Live woody biomass (living biomass)
- Heavy woody fuel (standing deadwood and coarse woody debris)

³ Paul Keryn I., Roxburgh Stephen H. (2024) A national accounting framework for fire and carbon dynamics in Australian savannas. *International Journal of Wildland Fire* 33, WF23104.

- Coarse woody fuel

Sequestration is not calculated for grasses, soil, or fine woody fuel (e.g. leaves and twigs ≤ 0.6 cm) see Table 1).

Table 1: Overview of gases accounted for in abatement calculations in the SFM methods.

Sequestration accounts for changes in carbon, whereas emissions avoidance accounts for emissions from CH₄ and N₂O.

| Fuel type | Sequestration (carbon stock) | Emissions (flow) | |
|---------------------|--------------------------------------|------------------|------------------|
| | Net C (reported as CO ₂) | CH ₄ | N ₂ O |
| Trees | Yes | Yes | Yes |
| Heavy woody debris | Yes | Yes | Yes |
| Coarse woody debris | Yes | Yes | Yes |
| Fine debris | No | Yes | Yes |
| Grass | No | Yes | Yes |

FullCAM output used in SavCAM

An input in determining the Net Abatement amount in the Savanna Fire Management determinations is output data some FullCAM which is collated in SavCAM. These variables are 1: total eligible carbon stock (C_y) for the project area for the Calendar year (Schedule 2 section 11) and 2 fire emissions (E_f) for the project area for the calendar year (Schedule 1 Section 4).

The following section provides a more detailed description of how sequestration and emissions are collated in SavCAM. These equations are not intended for use as an alternative abatement calculation method to SavCAM; but rather, to provide transparency to the main calculations that underpin SavCAM.

Calculating total eligible sequestration from FullCAM

Sequestration calculations are based on FullCAM output variables for living above-ground woody biomass (living biomass), and dead biomass (dead organic matter)s classified into 'heavy' and 'coarse' pools (Table 2). The decomposable deadwood and bark litter pools are excluded, because the predicted biomass of these pools is zero.

Table 2 FullCAM output variables for calculating sequestration. Units are all tC ha⁻¹.

| FullCAM output variable – short name | FullCAM output variable – long name | Savanna pool type |
|--------------------------------------|-------------------------------------------------|-------------------|
| treeCM | C mass of trees | Biomass |
| sDStemCMF | C mass of forest aboveground standing dead stem | Heavy |

| | | |
|-----------|---------------------------------------------------|-----------------|
| sDBranCMF | C mass of forest aboveground standing dead branch | Heavy |
| sDBlitCMF | C mass of forest aboveground standing dead bark | Heavy |
| sDLlitCMF | C mass of forest aboveground standing dead leaf | Heavy |
| rDdwdCMF | C mass of forest resistant deadwood | Coarse (branch) |
| rBlitCMF | C mass of forest resistant bark litter | Coarse (bark) |

Based on the output variables in Table 2, total per-ha carbon stock at a given year y for each of the three pool types (biomass, heavy and coarse) is calculated as:

$$C_{y,biomass} = \frac{44}{12} \times (\text{treeCM})$$

$$C_{y,heavy} = \frac{44}{12} \times (\text{sDStemCMF} + \text{sDBranCMF} + \text{sDBlitCMF} + \text{sDLlitCMF})$$

$$C_{y,coarse} = \frac{44}{12} \times (0.6 \times (\text{rDdwdCMF} + \text{rBlitCMF}))$$

where C_y has units $\text{tCO}_2\text{-e ha}^{-1}$, the 0.6 multiplier is a partitioning coefficient to separate the coarse and fine fuel components within the deadwood and bark litter pools, and $44/12$ converts units of C to $\text{tCO}_2\text{-e}$.

The total carbon stock at time t , in units of $\text{tCO}_2\text{-e}$ is then calculated as:

$$C_y = (C_{y,biomass} + C_{y,heavy} + C_{t,coarse}) \times A$$

Where A is the total eligible project area, in hectares.

Calculating total fire emissions from FullCAM

Emissions avoidance calculations require FullCAM output variables of the total carbon emissions due to fire from living above-ground woody biomass (living biomass), and dead biomass (dead organic matter) classified into 'heavy', 'coarse' and 'fine' pools (Table 2 and Table 3).

Table 1: FullCAM output variables for calculating emissions abatement. Units from FullCAM are tC ha^{-1} , but represent accumulated emission since the previously saved timestep, assumed to be 1 year for the purposes of the savanna burning calculations.

| FullCAM output variable – short name | FullCAM output variable – long name | Savanna pool type |
|---------------------------------------------|----------------------------------------------------------------------------|--------------------------|
| <i>flowCMTreeAtmsFireF</i> | <i>C mass emitted due to fire, from trees</i> | <i>Biomass</i> |
| <i>flowCMSDdwdAtmsFireF</i> | <i>C mass emitted from standing dead stem to atmosphere, due to fire</i> | <i>Heavy</i> |
| <i>flowCMSChwdAtmsFireF</i> | <i>C mass emitted from standing dead branch to atmosphere, due to fire</i> | <i>Heavy</i> |
| <i>flowCMSBlitAtmsFireF</i> | <i>C mass emitted from standing dead bark to atmosphere, due to fire</i> | <i>Heavy</i> |
| <i>flowCMSLlitAtmsFireF</i> | <i>C mass emitted from standing dead leaf to atmosphere, due to fire</i> | <i>Heavy</i> |
| <i>flowCMrDdwdAtmsFireF</i> | <i>C mass emitted due to resistant deadwood to atmosphere, due to fire</i> | <i>Coarse + Fine</i> |

| | | |
|-----------------------------|----------------------------------------------------------------------------------|----------------------|
| <i>flowCMrBlitAtmsFireF</i> | <i>C mass emitted due to resistant bark litter to atmosphere, due to fire</i> | <i>Coarse + Fine</i> |
| <i>flowCMdLlitAtmsFireF</i> | <i>C mass emitted due to decomposable leaf litter to atmosphere, due to fire</i> | <i>Fine</i> |
| <i>flowCMrLlitAtmsFireF</i> | <i>C mass emitted due to resistant leaf litter to atmosphere, due to fire</i> | <i>Fine</i> |
| <i>flowCMCropAtmsFireA</i> | <i>C mass emitted due to fire, from crops</i> | <i>Fine</i> |
| <i>flowCMDebrAtmsFireA</i> | <i>C mass emitted due to fire, from agricultural debris</i> | <i>Fine</i> |

Methane emissions

Emissions of CH₄ are calculated from the carbon loss fractions resulting from fire (Table 3Table 1) and converted to units of tCO₂-e through applying the general equation:

$$E_{CH_4} = E_{C_{i,j}} \times EF_{CH_4,i,j} \times 1.3333 \times 25$$

where $E_{C_{i,j}}$ are the emissions in units of carbon for pool type i and vegetation type j; $EF_{CH_4,i,j}$ are the emissions factors for methane that also varies by pool type i and vegetation type j (Table); 1.3333 is the elemental to molecular mass conversion factor for methane; and 25 is the global warming potential (Table).

For savanna projects, emissions of CH₄ at year y for each vegetation type (n = WH, WL, SH, PL or SL; **Error! Reference source not found.** Table 4) and pool type (biomass, heavy, coarse, fine) are given by:

$$E_{CH_4,y,biomass} = \sum_{i=1}^n (\text{flowCMTreeAtmsFireF} \times EF_{CH_4,i,biomass})$$

$$E_{CH_4,y,heavy} = \sum_{i=1}^n ((\text{flowCMsDdwdAtmsFireF} + \text{flowCMsChwdAtmsFireF} + \text{flowCMsBlitAtmsFireF} + \text{flowCMsLlitAtmsFireF}) \times EF_{CH_4,i,heavy})$$

$$E_{CH_4,y,coarse} = \sum_{i=1}^n (0.6 \times (\text{flowCMrDdwdAtmsFireF} + \text{flowCMrBlitAtmsFireF}) \times EF_{CH_4,i,coarse})$$

$$E_{CH_4,y,fine} = \sum_{i=1}^n ((0.4 \times (\text{flowCMrDdwdAtmsFireF} + \text{flowCMrBlitAtmsFireF}) + \text{flowCMdLlitAtmsFireF} + \text{flowCMrLlitAtmsFireF} + \text{flowCMCropAtmsFireA} + \text{flowCMDebrAtmsFireA}) \times EF_{CH_4,i,fine})$$

Total CH₄ carbon emissions at time t, in units of tCO₂-e are then calculated as:

$$E_{CH_4,y} = 1.3333 \times 25 \times (E_{CH_4,y,biomass} + E_{CH_4,y,heavy} + E_{CH_4,y,coarse} + E_{CH_4,y,fine}) \times A$$

Where A is the total eligible project area, in hectares.

Table 4: Default values applied for estimating the CO₂-e equivalent of methane (CH₄) and nitrous oxide (N₂O) gas emissions due to combustion of live and dead biomass in response to fire in Australian savannas, including the global warming potential, elemental to molecular mass conversion factor, the N:C ratio and the emission factors assumed for these gases during combustion of different fuels under different vegetation types. Sources: Meyer and Cook (2015)⁴; Meyer et al. (2015)⁵.

| Default | Fuel type | CH ₄ | N ₂ O |
|-----------------------------------------------------------|--------------------|-----------------|-------------------|
| <i>Global Warming Potential (GWP), based on 100 years</i> | | 25.0 | 298 |
| <i>Elemental to molecular mass conversion factor</i> | | 1.333330 | 1.571429 |
| <i>Emission factor (E_F) (and N:C ratio)</i> | | | |
| WH | Biomass | 0.0031 | 0.0075 (0.0093) |
| | Heavy fuel | 0.0100 | 0.0036 (0.0081) |
| | Coarse fuel | 0.0031 | 0.0075 (0.0081) |
| | Fine or grass fuel | 0.0031 | 0.0075 (0.0096) |
| WL | Biomass | 0.0015* | 0.0075 (0.0039) |
| | Heavy fuel | 0.0146* | 0.0146 (0.0150) |
| | Coarse fuel | 0.0015* | 0.0075* (0.0039) |
| | Fine or grass fuel | 0.0015* | 0.0075* (0.0110*) |
| SH | Biomass | 0.0015 | 0.0066 (0.0093) |
| | Heavy fuel | 0.0100 | 0.0036 (0.0081) |
| | Coarse fuel | 0.0015 | 0.0066 (0.0081) |
| | Fine or grass fuel | 0.0015 | 0.0066 (0.0096) |
| SL or PL | Biomass | 0.0013 | 0.0059 (0.0039) |
| | Heavy fuel | 0.0111 | 0.0146 (0.0150) |
| | Coarse fuel | 0.0013 | 0.0059 (0.0039) |

⁴ Meyer, C., & Cook, G. (2015). Biomass combustion and emission processes in the northern Australian savannas. In *Carbon Accounting and Savanna Fire Management* (pp. 185-217). CSIRO Publishing. <http://www.publish.csiro.au/book/7008>

⁵ Meyer CPM, Cook GD, Powell J (2015) Australia's National Greenhouse Gas Inventory 2013: Agriculture. Final Report to the Department of the Environment. (CSIRO Oceans and Atmosphere: Aspendale)

*Average value observed for the given vegetation type and fuel load.

Nitrous oxide emissions

Emissions of N₂O are calculated similarly to CH₄, with an additional term that reflects the nitrogen-to-carbon ratio of vegetation ($NC_{i,j}$):

$$E_{N_2O} = E_{C_{i,j}} \times EF_{N_2O,i,j} \times NC_{i,j} \times 1.5714 \times 298$$

where $E_{C_{i,j}}$ are the emissions in units of carbon for pool type i and vegetation type j; $EF_{N_2O,i,j}$ and $NC_{i,j}$ are the emissions factors and nitrogen-to-carbon ratios for N₂O methane that also both vary by pool type i and vegetation type j; 1.5714 is the elemental to molecular mass conversion factor for N₂O; and 298 is the global warming potential (Table 4).

Emissions of N₂O at year y for each vegetation type (n = WH, WL, SH, PL or SL) and pool type (biomass, heavy, coarse, fine) are given by:

$$E_{N_2O,y,biomass} = \sum_{i=1}^n (\text{flowCMTTreeAtmsFireF} \times EF_{N_2O,i,biomass} \times NC_{i,fine})$$

$$E_{N_2O,y,heavy} = \sum_{i=1}^n ((\text{flowCMsDdwdAtmsFireF} + \text{flowCMsChwdAtmsFireF} + \text{flowCMsBlitAtmsFireF} + \text{flowCMsLlitAtmsFireF}) \times EF_{N_2O,i,biomass} \times NC_{i,fine})$$

$$E_{N_2O,y,coarse} = \sum_{i=1}^n (0.6 \times (\text{flowCMrDdwdAtmsFireF} + \text{flowCMrBlitAtmsFireF}) \times EF_{N_2O,i,biomass} \times NC_{i,fine})$$

$$E_{N_2O,y,fine} = \sum_{i=1}^n ((0.4 \times (\text{flowCMrDdwdAtmsFireF} + \text{flowCMrBlitAtmsFireF}) + \text{flowCMdLlitAtmsFireF} + \text{flowCMrLlitAtmsFireF} + \text{flowCMCropAtmsFireA} + \text{flowCMDebrAtmsFireA}) \times EF_{N_2O,i,biomass} \times NC_{i,fine})$$

Total N₂O carbon emissions at time t, in units of tCO₂-e are then calculated as:

$$E_{N_2O,y} = 1.5714 \times 298 \times (E_{N_2O,y,biomass} + E_{N_2O,y,heavy} + E_{N_2O,y,coarse} + E_{N_2O,y,fine}) \times A$$

Where A is the total eligible project area, in hectares.

Total emissions

Total emissions due to fire (CH₄ + N₂O) are then:

$$E_{F,y} = E_{CH_4,y} + E_{N_2O,y}$$