## The quality of FullCAM data (v2024) and comparing it with v2020

Introduction

This doc evaluates the quality of tree growth carbon stock data simulated using FullCAM model, specifically between “Cached data + FullCAM-API” (thereafter refer as FullCAM-Cache) and “FullCAM data + FullCAM-API (thereafter referred as FullCAM-API). The report also compares FullCAM v2024 to v2020 for better an understanding of the updates in FullCAM model. The Overview of data assembling, visualization, and analysis is also included in this report.

Quick conclusion

Carbon stock from tree growth simulated by FullCAM-Cache and FullCAM-API are well aligned, suggesting the FullCAM-Cache results are acceptable to be used in LUTO.

Generally, the FullCAM of v2024 has HIGHER carbon stocks than v2020. The carbon stocks are LOWERED (~1/5 to 1/3) in >1,000mm precipitation regions and INCREASED (~1 to 3 times) in the rest of continental Australia, comparing v2024 to 2016.

Technical considerations

FullCAM model provides Web-UI and API access to simulate different tree species growth, and the later method is suitable for programmatically acquiring ~7 million requests of LUTO requirements.

FullCAM API server is inconsistent in providing biophysical data (i.e., returning differed temperature, evaporation data at the same location among different requests). The retry method (repeat request until get the same value for 5 times) is impractical because getting a single reliable data takes ~20s

FullCAM simulation API is reliable to produce the same results when providing the same inputs.

We assembled all necessary data (meteorological data from ANUclim, soil data from Australia landscape grid, …) to run FullCAM, so to circumvent the FullCAM Data-API issues.

We have simulated the Environmental Plantings and part of Carbon Plantings (Eucalyptus globulus are downloaded, but Mallee eucalypt species are expected to finish downloading on 10 Feb 2026) tree growth with FullCAM.

We randomly selected 1,000 locations across continental Australia, simulated the tree growth at year 2100 using both “Cached data + FullCAM-API” and “FullCAM data + FullCAM-API” methods (the FullCAM data are produced via repeatedly requesting until get 5 same results). By comparing them, we can assess the quality of the simulation with local assembled data.

1. The downloaded FullCAM data can confidently be used in LUTO

|  |  |
| --- | --- |
| Eucalyptus globulus (Belt) | Eucalyptus globulus (Block) |
|  |  |
| Environmental Plantings (BeltH) | Environmental Plantings (BlockES) |
|  |  |
| Environmental Plantings (Water) | Mallee eucalypt species (BeltHW) |
|  |  |
| Mallee eucalypt species (BlockES) |  |
|  |  |

2. Comparing FullCAM v2024 to v2020

2.1 Statistical comparison

|  |  |
| --- | --- |
| Eucalyptus globulus (Belt) | Eucalyptus globulus (Block) |
|  |  |
| Environmental Plantings (BeltH) | Environmental Plantings (BlockES) |
|  |  |
| Environmental Plantings (Water) | Mallee eucalypt species (BeltHW) |
|  |  |
| Mallee eucalypt species (BlockES) |  |
|  |  |

2.1 Spatial comparison

Figure shows the ratio of FullCAM v2024 over v2020.

|  |  |  |
| --- | --- | --- |
|  | Eucalyptus globulus (Belt) | Eucalyptus globulus (Block) |
| Trees |  |  |
| Debris |  |  |
|  | Soil |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Environmental Plantings (Belt) | Environmental Plantings (Block) | Environmental Plantings (Water) |
|  | Trees |  |  |
|  | Debris |  |  |
| Soil |  |  |  |

|  |  |  |
| --- | --- | --- |
|  | Mallee eucalypt species (BeltHW) | Mallee eucalypt species (BlockES) |
| Trees |  |  |
| Debris |  |  |
|  | Soil |  |

3. Carbon component structure

3.1 Statistical characteristics

|  |  |
| --- | --- |
| Eucalyptus globulus (Belt) | Eucalyptus globulus (Block) |
|  |  |
| Environmental Plantings (BeltH) | Environmental Plantings (BlockES) |
|  |  |
| Environmental Plantings (Water) | Mallee eucalypt species (BeltHW) |
|  |  |
| Mallee eucalypt species (BlockES) |  |
|  |  |

3.2 Spatial characteristics

Figure shows the percentage of different carbon stock components in FullCAM v2024. The largest carbon pool is the trees for Eucalyptus globulus, and soil for Environmental Plantings and Mallee eucalypt species.

|  |  |  |
| --- | --- | --- |
|  | Eucalyptus globulus (Belt) | Eucalyptus globulus (Block) |
| Trees |  |  |
| Debris |  |  |
|  | Soil |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Environmental Plantings (Belt) | Environmental Plantings (Block) | Environmental Plantings (Water) |
|  | Trees |  |  |
|  | Debris |  |  |
| Soil |  |  |  |

|  |  |  |
| --- | --- | --- |
|  | Mallee eucalypt species (BeltHW) | Mallee eucalypt species (BlockES) |
| Trees |  |  |
| Debris |  |  |
|  | Soil |  |