Detailed lineage on the development of state and territory datasets for *Forests of Australia (2023)* dataset using the Multiple Lines of Evidence (MLE) method for publication in the *Australia's State of the Forests Report – 2023 update.*

Forests of Australia (2023) is a continental spatial dataset of forest extent, by national forest categories and types, assembled for *Australia's State of the Forests Report – 2023 update.* It was developed from multiple forest, vegetation and land cover data inputs, including contributions from Australian, state and territory government agencies and external sources.

For each state or territory, except for the ACT where there was no new data, intersection of the *Forests of Australia (2018)* dataset with a forest cover dataset supplied by the jurisdiction, and with other available and appropriate independent forest cover datasets, identified:
- High confidence areas – areas where all the examined datasets agreed with the *Forests of Australia (2018)* dataset that the areas were forest or non-forest. No further assessment was required for these areas.
- Moderate confidence areas – areas where the *Forests of Australia (2018)* dataset agreed with the forest cover dataset supplied by state or territory, and with external or independent datasets, that the areas were forest or non-forest. These areas were identified as potential errors and needed further analysis in order to determine the correct allocation (forest or non-forest). The required analyses and validation were conducted by ABARES, in consultation with relevant state and territory agencies, using various ancillary data including high-resolution imagery such as World Imagery by ESRI, Bing Maps and Google Earth Pro.
- Low confidence areas – areas where the *Forests of Australia (2018)* dataset disagreed with the forest cover dataset supplied by state or territory, and with external or independent datasets, that the areas were forest or non-forest. All such areas were identified as potential errors and needed further analysis in order to determine the correct allocation (forest or non-forest). The required analyses and validation were conducted by ABARES, in consultation with relevant state and territory agencies, using various ancillary data including high-resolution imagery such as World Imagery by ESRI, Bing Maps and Google Earth Pro.

External or independent datasets used include:
1. *H_Woody_Fuzzy_2_Class* dataset is based on the *NGGI* dataset produced by DCCEEW from Landsat data and was developed to support New South Wales Natural Resources Commission's (NRC) Monitoring, Evaluation and Reporting Program. NRC applied Fuzzy Logic and Probability modelling to the NGGI dataset to derive annual layers distinguishing between forest and non-forest at 25 m raster resolution. Each of five annual layers, 2015 to 2019, was resampled to a 100 m raster by classifying as forest the 100 m pixels that had more than half their area as forest as determined from 25 m pixels. The five annual layers were combined and every pixel in the combination that had been classified as forest in any year during 2015-2019 period was allocated as forest (and the balance non-forest). This approach was taken to prevent areas where the crown cover had reduced temporarily below 20%, through events such as fire, harvesting, drought or disease, from being incorrectly classified as non-forest.
2. *State-wide Land and Tree Study (SLATS)* dataset is based on data collected by the Landsat satellite. This dataset was available for Queensland only. Foliage Projective Cover (FPC) values of 11 or greater (equivalent to crown cover 20% or greater) were considered as forest candidates in this SLATS dataset. The

National Vegetation Information System (NVIS) version 6.0 dataset was used to identify areas in this SLATS dataset that met the height requirements of the forest definition used by the National Forest Inventory.

3. The *National Greenhouse Gas Inventory* (NGGI) dataset is produced from Landsat satellite Thematic Mapper™, Enhanced Thematic Mapper Plus (ETM+) and Operational Land Image (OLI) images for the Australian Government Department of the Climate Change, Energy, the Environment and Water (DCCEEW), and identifies woody vegetation of height or potential height greater than 2 metres, crown cover greater than 20%, and with a minimum patch size of 0.2 hectares (DISER, 2021a) . The dataset is compiled using time-series data since 1972, and is produced at a 25 m × 25 m resolution. The NGGI dataset used was developed from the five annual layers (2016-2020, inclusive) from the 'National forest and sparse woody vegetation data (Version 5.0) spatial dataset produced using the algorithms for land-use change allocation developed for the *National Inventory Reports* (DISER, 2021b). Each layer of the original 25 m resolution, three-class (forest, sparse woody and non-forest) dataset was resampled to a binary (forest and non-forest) 100 m raster by classifying as forest the 100 m pixels that had more than half their area as forest; the sparse woody and non-forest classes were combined into a non-forest class. The five annual layers were then combined and every pixel in the combination that had been classified as forest in any year during 2016-2020 period was allocated as forest (and the balance non-forest). This approach was taken to prevent areas where the crown cover had reduced temporarily below 20%, through events such as fire, harvesting, drought or disease, from being incorrectly classified as non-forest.

All input datasets were converted to 100m rasters (ESRI GRID format), aligning with relevant standard NFI state or territory masks (also known as NFI SNAP grids), in Albers projection. Where the input dataset was in polygon format, the **Polygon to Raster** tool was used to convert the polygon dataset to raster format, using the **Maximum_Combined_Area** option.

Validation assessment results were incorporated to give improved and high-confidence forest cover datasets for each state or territory.

Look-up tables translating the state or territory forest cover data to NFI forest types were used where provided. Where this information was not provided, it was derived by ABARES from translating Levels 5 and 6 of the *National Vegetation Information System (NVIS) version 6.0* attribute information to NFI forest types.

MLE input datasets to derive the 2023 forest cover update for Australian Capital Territory
No new forest cover dataset was available for the jurisdiction. The ACT Parks and Conservation Service recommended using the Forests of Australia (2018) to derive forest cover for the jurisdiction, except for commercial plantations. The *National Plantation Inventory (NPI) spatial (2021)* dataset was combined with the ACT component of the Forests of Australia (2018) dataset to produce an updated forest cover dataset for the SOFR 2023 update.

MLE input datasets to derive the 2023 forest cover update for New South Wales
The following four datasets were intersected as part of the MLE method:
1. *Forests of Australia (2018)*

2. *H_Woody_Fuzzy_2_Class* - this is the dataset provided by New South Wales for use in SOFR 2023 update
3. *NGGI (2016-20)*
4. *Global Mangrove Watch (2018)*

Areas of high confidence in forest or non-forest allocation in the state's dataset were not assessed further. Areas of moderate or low confidence in forest or non-forest allocation in the state's dataset were analysed and validated by ABARES, in consultation with staff from NSW New South Wales Natural Resources Commission (NRC), using high-resolution imagery from World Imagery by ESRI, Bing Maps and Google Earth Pro. The NVIS 6.0 dataset was used as an ancillary dataset – to identify and mask out ecosystems not capable of supporting forest cover, including: natural grasslands, shrub-lands, heathlands, marshes/wetlands and sedge/herb lands. In addition, the New South Wales 2017–18, 2018-19, and 2019-20 land clearing datasets were used to identify and classify as non-forest, cleared areas that had been incorrectly classified by the MLE process

The validated dataset was then combined with the *NPI spatial (2021)* dataset to capture plantation areas in New South Wales.

MLE input datasets to derive the 2023 forest cover update for Victoria
The following four datasets were intersected as part of the MLE method:
1. *Forests of Australia (2018)*
2. *Victorian Land Cover (2015-19)* - this is the dataset provided by Victoria for use in SOFR 2023 update
3. *NGGI (2016-20)*
4. *Global Mangrove Watch (2018)*

The Victorian Department of Environment, Land, Water and Planning (DELWP) nominated/recommended extracting the following cover types from the dataset and allocating them to forest:
- Treed native vegetation
- Conifer plantation
- Hardwood plantation
- Mangrove vegetation
- Perennial wetland

Areas of high confidence in forest or non-forest allocation in the state's dataset were not assessed further. Areas of moderate or low confidence in forest or non-forest allocation in the state's dataset were analysed and validated by ABARES, in consultation with staff from DELWP, using high-resolution imagery from World Imagery by ESRI, Bing Maps and Google Earth Pro. The NVIS 6.0 dataset was used as an ancillary dataset – to identify and mask out ecosystems not capable of supporting forest cover, including: natural grasslands, shrub-lands, heathlands, marshes/wetlands and sedge/herb lands.

The validated dataset was then combined with the *NPI spatial (2021)* dataset to capture plantation areas in Victoria.

MLE input datasets to derive the 2023 forest cover update for Tasmania
The following three datasets were intersected as part of the MLE method:
1. *Forests of Australia (2018)*
2. *Tasmania Forest Communities with NVIS Groups 2020* - this is the dataset provided by Tasmania for use in SOFR 2023 update
3. *NGGI (2016-20)*

Areas of high confidence in forest or non-forest allocation in the state's dataset were not assessed further. Areas of moderate or low confidence in forest or non-forest allocation in the state's dataset were analysed and validated by ABARES, in consultation with staff from Sustainable Timber Tasmania, using high-resolution imagery from World Imagery by ESRI, Bing Maps and Google Earth Pro. The NVIS 6.0 datasets was used as ancillary datasets – to identify and mask out ecosystems not capable of supporting forest cover, including: natural grasslands, shrub-lands, heathlands, marshes/wetlands and sedge/herb lands.

The validated dataset was then combined with the *NPI spatial (2021)* dataset to capture plantation areas in Tasmania.

MLE input datasets to derive the 2023 forest cover update for South Australia
There was no new forest cover dataset was available from the jurisdiction. The following three datasets were intersected as part of the MLE method:
1. *Forests of Australia (2018)*
2. *NGGI (2016-20)*
3. *Global Mangrove Watch (2018)*

Areas of high confidence in forest or non-forest allocation in the state's dataset were not assessed further. Areas of moderate or low confidence in forest or non-forest allocation in the state's dataset were analysed and validated by ABARES, in consultation with staff from Department of Primary Industries and Regions South Australia (PIRSA), using high-resolution imagery from World Imagery by ESRI, Bing Maps and Google Earth Pro. The NVIS 6.0 dataset was used as an ancillary dataset – to identify and mask out ecosystems not capable of supporting forest cover, including natural grasslands, shrub-lands, heathlands, marshes/wetlands and sedge/herb lands.

The validated dataset was then combined with the *NPI spatial (2021)* dataset to capture plantation areas in South Australia.

MLE input datasets to derive the 2023 forest cover update for Western Australia
The following three datasets were intersected as part of the MLE method:
1. *Forests of Australia (2018)*
2. *NGGI (2016-20)*
3. *Global Mangrove Watch (2018)*

Areas of high confidence in forest or non-forest allocation in the state's dataset were not assessed further. Areas of moderate or low confidence in forest or non-forest allocation in the state's dataset were analysed and validated by ABARES, in consultation with staff from Department of Biodiversity, Parks and Attractions, using high-resolution imagery from World Imagery by ESRI, Bing Maps and Google Earth Pro. The NVIS 6.0 dataset was used as an ancillary dataset – to identify and mask out ecosystems not capable of supporting forest cover, including: natural grasslands, shrub-lands, heathlands, marshes/wetlands and sedge/herb lands.

The validated dataset was then combined with the *NPI spatial (2021)* dataset to capture plantation areas in Western Australia.

MLE input datasets to derive the 2023 forest cover update for Northern Territory
The following three datasets were intersected as part of the MLE method:
1. *Forests of Australia (2018)*
2. *NGGI (2016-20)*

3. *Global Mangrove Watch (2018)*
4. *Land Use Mapping Project of the Northern Territory (LUMP), (2016-22)*

Areas of high confidence in forest or non-forest allocation in the state's dataset were not assessed further. Areas of moderate or low confidence in forest or non-forest allocation in the state's dataset were analysed and validated by ABARES, in consultation with staff from Department of Environment and Natural Resources, using high-resolution imagery from World Imagery by ESRI, Bing Maps and Google Earth Pro. The NVIS 6.0 dataset was used as an ancillary dataset – to identify and mask out ecosystems not capable of supporting forest cover, including: natural grasslands, shrub-lands, heathlands, marshes/wetlands and sedge/herb lands.

Sandalwood plantations in the territory were derived from the *LUMP* dataset.

The validated dataset was then combined with the *NPI spatial (2021)* dataset to capture plantation areas in Northern Territory.

MLE input datasets to derive the 2023 forest cover update for Queensland
The following four datasets were intersected as part of the MLE method:
1. *Forests of Australia (2018)*
2. *State-wide Land and Tree Study (SLATS) Woody Extent (2018)* - this is the dataset provided by Queensland for use in SOFR 2023 update
3. *NGGI 2016-20*
4. *Global Mangrove Watch (2018)*

Areas of high confidence in forest or non-forest allocation in the state's dataset were not assessed further. Areas of moderate or low confidence in forest or non-forest allocation in the state's dataset were analysed and validated by ABARES, in consultation with staff from Department of Environment and Science, using high-resolution imagery from World Imagery by ESRI, Bing Maps and Google Earth Pro. The NVIS 6.0 dataset was used as an ancillary dataset – to identify and mask out ecosystems not capable of supporting forest cover, including: natural grasslands, shrub-lands, heathlands, marshes/wetlands and sedge/herb lands. In addition, the *Queensland 2016–17, 2017-18*, and *2018-19 land clearing* datasets were used to identify and classify as non-forest, cleared areas that had been incorrectly classified by the MLE process.

The validated dataset was then combined with the *NPI spatial (2021)* dataset to capture plantation areas in Queensland.

Forests of Australia (2023) **–** All the validated state and territory datasets described above were merged to create a national dataset. The final step involved using the catchment-scale land-use dataset to identify and mask out (allocate as non-forest) areas in the national forest cover dataset that have the following land-uses: cropping, horticulture, irrigation, residential, industrial and utilities. This last step was achieved using the *Catchment scale land use and management (CLUM)* dataset (2020), also produced by ABARES. The output from these processes was the *Forests of Australia (2023)* dataset.