Supplement of

Australia's terrestrial industrial footprint and ecological intactness

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Table S1. Scores assigned to each of the 16 pressures used to create the Australian Industrial Footprint Map.

Pressure	Score	Details and references
Intensive uses	10	All intensive-use areas are given a score of 10
Buildings	10	Areas with buildings that are within a 200m buffer from existing roads are given a score of 10
Mining/Quarrying	10	All mining and quarrying areas are given a score of 10
Population Density	0 -10 continuous	Pressure score = 3.333 x log (pop density + 1)
Croplands	7	All cropland areas are given a score of 7
Forestry (plantations)	7	All plantation forest areas are given a score of 7 (this study)
Reservoir/dams	8 direct impacts, 0–8 indirect impacts	All reservoir areas are given a score of 8, decreasing exponentially outwards 500 m.
Farm dams	5	All areas with farm dams are given a score of 5, including a 500 m buffer
Modified Pasturelands	6	All modified pasture areas are given a score of 6
Native Pasturelands	2	All intensive-use areas are given a score of 10
Roads - Sealed	8 direct impacts, 0–8 indirect impacts	All areas within a buffer of 300m of sealed roads have a score of 8, which then decreases exponentially outward 5 km.
Roads- Unsealed	3 direct impacts, 0–3 indirect impacts	All areas within a buffer of 300m of unsealed roads have a score of 3, which then decreases exponentially outward 5 km..
Railways	8 direct impacts	All areas along and within a 50m buffer on either side of railway lines have a score of 8
Pipelines	3 direct impacts, 0–3 indirect impacts	All areas within a buffer of 100 m from the pipelines have a score of 3. Then it decreases from 3 to 0.25 up to 2.75 km.
Transmission lines	3 direct impacts, 0–3 indirect impacts	All areas within a buffer of 100 m from the transmission lines have a score of 3. Then it decreases from 3 to 0 up to 2.75 km
Hiking trails	0.9	All areas along and within a 50 m buffer on either side of hiking trails have a score of 3
Navigable waterways	4	Areas directly alongside navigable waterways have a pressure of 4, which decreased exponentially outwards15 km (Venter et al. 2016)

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Table S2. Minin/Quarrying data layers used to complement the mining/quarrying data available in the CLUMP23 dataset.

State/Territory	Data	Resource	Description
Queensland	Mining leases	https://spatial-gis.information.qld.gov.au/arcgis/services/Economy/MinesPermitsCurrent/MapServer/WMSServer?request=GetCapabilities&service=WMS	This dataset includes the boundaries of Mining Leases in Queensland lodged since 1920. It was last updated in 2023. This dataset was compared to the land use layer from ACLUMP (last update between 2013-2017) through ground truthing. New polygons were drawn in ArcGIS Pro in the existing land use layer to capture new mine sites.
South Australia	Mineral tenements - production, Mineral Tenements - historical	https://map.sarig.sa.gov.au/	These datasets were last updated in 2023. They include information about current and historical extractive mineral leases. The datasets were compared with the land use mining layer, which was last updated in 2017. New polygons were drawn in ArcGIS Pro in the existing land use layer to capture new mine sites.
Victoria	Mines and Mineral Occurrence Sites	https://discover.data.vic.gov.au/dataset/mines-and-mineral-occurrence-sites1	The Current mining licences and leases show the extent of mining leases lodged with Earth Resources Regulations. Expired Mining Licences and Leases include expired mining licences. These datasets (last updated in 2023) were compared with the land use mining layer, which was last updated in 2017 through ground truthing. New polygons were drawn in ArcGIS Pro in the existing land use layer to capture new mine sites.
	Current mining licences and leases	https://discover.data.vic.gov.au/dataset/current-mining-licences-and-leases	
New South Wales	NSW Operating mines	https://gs.geoscience.nsw.gov.au/geoserver/gsnsw/ows?service=WFS&version=1.0.0&request=GetFeature&typeName=gsnsw:dw_opmines&outputFormat=shape-zip	The NSW Operating Mines dataset is a small subset of sites taken from the NSW Mineral Occurrence dataset, which represents an active mining operation. The NSW Current Exploration and Mining Applications Dataset includes all current applications for mineral and energy resource exploration, assessment, and production titles. This dataset (last updated in 2023) was compared to the land use mining layer, which was last updated in 2017 through ground truthing. New polygons were drawn in ArcGIS Pro in the existing land use layer to capture new mine sites.
	NSW Current Exploration and Mining Applications	https://gs.geoscience.nsw.gov.au/geoserver/gsnsw/ows?service=WFS&version=1.0.0&request=GetFeature&typeName=gsnsw%3Abl_titleappl&outputFormat=shape-zip	
Northern Territory	Northern Territory Mines	https://data.nt.gov.au/dataset/strike---northern-territory-mines	The data (last updated in 2023) includes the point location of operating mines in NT captured from company reports and fieldwork. This is a subset of the Mineral Occurrences Database (MODAT). This dataset was compared to the land use layer from ACLUMP (last update in 2020) through ground truthing. New polygons were drawn in ArcGIS Pro in the existing land use layer to capture new mine sites.

Tasmania	Mine Lease Data	https://www.thelist.tas.gov.au/app/content/data/geo-meta-data-record?detailRecordUID=0c7e5395-e5db-4e3b-a6dc-db9ec9437ad8	The data (last updated in 2024) includes polygon shapefiles mining leases in Tasmania. The layer includes Mining Lease polygons and production licence polygons for all mineral categories across Tasmania. This dataset was compared to the land use layer from ACLUMP (last update in 2021) through ground truthing. New polygons were drawn in ArcGIS Pro in the existing land use layer to capture new or historical mine sites.
	Exploration Licence Data	https://www.thelist.tas.gov.au/app/content/data/geo-meta-data-record?detailRecordUID=2f2dd404-2313-4262-a29d-7fc00fb1b2b8	
Western Australia	Western AU Abandoned Mines	https://catalogue.data.wa.gov.au/dataset/abandoned-mines	The data (last updates in 2023) includes point location of abandoned and operating mines in WA. The Operating Mine Map custom data extract is a regularly updated point representation of the State's mines that have a Status of either operating or under development that appear on an annually produced map. The mines are automatically selected by Status and updated regularly. This dataset was compared to the land use layer from ACLUMP (last update in 2018) through ground truthing. New polygons were drawn in ArcGIS Pro in the existing land use layer to capture new or historical mine sites.
	Western AU Operating Mines	https://catalogue.data.wa.gov.au/dataset/operating-mines	
Australia	Australian Operating Mines Map 2023	https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search#/metadata/149157	These two datasets include point locations of operating and closed major mining operations in Australia. The Australian mining layer was compared to these datasets to ensure any major mining operation had not been missed. New polygons were drawn in ArcGIS Pro in the final Australian mining layer to capture new or historical mine sites.
	Mines Under Care and Maintenance	https://portal.ga.gov.au/metadata/australian-minerals-data/mines-under-care-and-maintenance/1ee95e2e-2d59-4472-9592-59b1339dd836	

Table S3. Tertiary classes from the CLUMP 23 dataset were used to map the intensive use class.

Land use Code used by Abares	Tertiary classification	Secondary Classification	Primary classification
5.1.0	5.1.0 Intensive horticulture	5.1 Intensive horticulture	5 Intensive uses
5.1.1	5.1.1 Production nurseries	5.1 Intensive horticulture	5 Intensive uses
5.1.2	5.1.2 Shadehouses	5.1 Intensive horticulture	5 Intensive uses
5.1.3	5.1.3 Glasshouses	5.1 Intensive horticulture	5 Intensive uses
5.1.4	5.1.4 Glasshouses (hydroponic)	5.1 Intensive horticulture	5 Intensive uses
5.1.5	5.1.5 Abandoned intensive horticulture	5.1 Intensive horticulture	5 Intensive uses
5.2.0	5.2.0 Intensive animal production	5.2 Intensive animal production	5 Intensive uses
5.2.1	5.2.1 Dairy sheds and yards	5.2 Intensive animal production	5 Intensive uses
5.2.2	5.2.2 Feedlots	5.2 Intensive animal production	5 Intensive uses
5.2.3	5.2.3 Poultry farms	5.2 Intensive animal production	5 Intensive uses
5.2.4	5.2.4 Piggeries	5.2 Intensive animal production	5 Intensive uses
5.2.5	5.2.5 Aquaculture	5.2 Intensive animal production	5 Intensive uses
5.2.6	5.2.6 Horse studs	5.2 Intensive animal production	5 Intensive uses
5.2.7	5.2.7 Saleyards/stockyards	5.2 Intensive animal production	5 Intensive uses
5.2.8	5.2.8 Abandoned intensive animal production	5.2 Intensive animal production	5 Intensive uses
5.3.0	5.3.0 Manufacturing and industrial	5.3 Manufacturing and industrial	5 Intensive uses
5.3.1	5.3.1 General purpose factory	5.3 Manufacturing and industrial	5 Intensive uses
5.3.2	5.3.2 Food processing factory	5.3 Manufacturing and industrial	5 Intensive uses
5.3.3	5.3.3 Major industrial complex	5.3 Manufacturing and industrial	5 Intensive uses
5.3.4	5.3.4 Bulk grain storage	5.3 Manufacturing and industrial	5 Intensive uses

5.3.5	5.3.5 Abattoirs	5.3 Manufacturing and industrial	5 Intensive uses
5.3.6	5.3.6 Oil refinery	5.3 Manufacturing and industrial	5 Intensive uses
5.3.7	5.3.7 Sawmill	5.3 Manufacturing and industrial	5 Intensive uses
5.3.8	5.3.8 Abandoned manufacturing and industrial	5.3 Manufacturing and industrial	5 Intensive uses
5.4.0	5.4.0 Residential and farm infrastructure	5.4 Residential and farm infrastructure	5 Intensive uses
5.4.1	5.4.1 Urban residential	5.4 Residential and farm infrastructure	5 Intensive uses
5.4.2	5.4.2 Rural residential with agriculture	5.4 Residential and farm infrastructure	5 Intensive uses
5.4.3	5.4.3 Rural residential without agriculture	5.4 Residential and farm infrastructure	5 Intensive uses
5.4.4	5.4.4 Remote communities	5.4 Residential and farm infrastructure	5 Intensive uses
5.4.5	5.4.5 Farm buildings/infrastructure	5.4 Residential and farm infrastructure	5 Intensive uses
5.5.0	5.5.0 Services	5.5 Services	5 Intensive uses
5.5.1	5.5.1 Commercial services	5.5 Services	5 Intensive uses
5.5.2	5.5.2 Public services	5.5 Services	5 Intensive uses
5.5.3	5.5.3 Recreation and culture	5.5 Services	5 Intensive uses
5.5.4	5.5.4 Defence facilities - urban	5.5 Services	5 Intensive uses
5.5.5	5.5.5 Research facilities	5.5 Services	5 Intensive uses
5.6.0	5.6.0 Utilities	5.6 Utilities	5 Intensive uses
5.6.1	5.6.1 Fuel powered electricity generation	5.6 Utilities	5 Intensive uses
5.6.2	5.6.2 Hydro electricity generation	5.6 Utilities	5 Intensive uses
5.6.3	5.6.3 Wind electricity generation	5.6 Utilities	5 Intensive uses
5.6.4	5.6.4 Solar electricity generation	5.6 Utilities	5 Intensive uses
5.6.5	5.6.5 Electricity substations and transmission	5.6 Utilities	5 Intensive uses
5.6.6	5.6.6 Gas treatment, storage and transmission	5.6 Utilities	5 Intensive uses
5.6.7	5.6.7 Water extraction and transmission	5.6 Utilities	5 Intensive uses

5.7.1	5.7.1 Airports/aerodromes	5.7 Transport and communication	5 Intensive uses
5.7.4	5.7.4 Ports and water transport	5.7 Transport and communication	5 Intensive uses
5.7.5	5.7.5 Navigation and communication	5.7 Transport and communication	5 Intensive uses

Table S4. Tertiary classes from the CLUMP 23 dataset were used to map croplands

Land use Code used by Abares	Tertiary classification	Secondary Classification	Primary classification
3.3.0	3.3.0 Cropping	3.3 Cropping	3 Production from dryland agriculture and plantations
3.3.1	3.3.1 Cereals	3.3 Cropping	3 Production from dryland agriculture and plantations
3.3.2	3.3.2 Beverage and spice crops	3.3 Cropping	3 Production from dryland agriculture and plantations
3.3.3	3.3.3 Hay and silage	3.3 Cropping	3 Production from dryland agriculture and plantations
3.3.4	3.3.4 Oilseeds	3.3 Cropping	3 Production from dryland agriculture and plantations
3.3.5	3.3.5 Sugar	3.3 Cropping	3 Production from dryland agriculture and plantations
3.3.6	3.3.6 Cotton	3.3 Cropping	3 Production from dryland agriculture and plantations
3.3.8	3.3.8 Pulses	3.3 Cropping	3 Production from dryland agriculture and plantations
3.4.0	3.4.0 Perennial horticulture	3.4 Perennial horticulture	3 Production from dryland agriculture and plantations
3.4.1	3.4.1 Tree fruits	3.4 Perennial horticulture	3 Production from dryland agriculture and plantations
3.4.2	3.4.2 Olives	3.4 Perennial horticulture	3 Production from dryland agriculture and plantations
3.4.3	3.4.3 Tree nuts	3.4 Perennial horticulture	3 Production from dryland agriculture and plantations
3.4.4	3.4.4 Vine fruits	3.4 Perennial horticulture	3 Production from dryland agriculture and plantations
3.4.5	3.4.5 Shrub berries and fruits	3.4 Perennial horticulture	3 Production from dryland agriculture and plantations
3.4.6	3.4.6 Perennial flowers and bulbs	3.4 Perennial horticulture	3 Production from dryland agriculture and plantations
3.4.7	3.4.7 Perennial vegetables and herbs	3.4 Perennial horticulture	3 Production from dryland agriculture and plantations
3.4.8	3.4.8 Citrus	3.4 Perennial horticulture	3 Production from dryland agriculture and plantations
3.4.9	3.4.9 Grapes	3.4 Perennial horticulture	3 Production from dryland agriculture and plantations
3.5.0	3.5.0 Seasonal horticulture	3.5 Seasonal horticulture	3 Production from dryland agriculture and plantations

3.5.2	3.5.2 Seasonal flowers and bulbs	3.5 Seasonal horticulture	3 Production from dryland agriculture and plantations
3.5.3	3.5.3 Seasonal vegetables and herbs	3.5 Seasonal horticulture	3 Production from dryland agriculture and plantations
3.6.0	3.6.0 Land in transition	3.6 Land in transition	3 Production from dryland agriculture and plantations
3.6.1	3.6.1 Degraded land	3.6 Land in transition	3 Production from dryland agriculture and plantations
3.6.2	3.6.2 Abandoned land	3.6 Land in transition	3 Production from dryland agriculture and plantations
3.6.3	3.6.3 Land under rehabilitation	3.6 Land in transition	3 Production from dryland agriculture and plantations
3.6.5	3.6.5 Abandoned perennial horticulture	3.6 Land in transition	3 Production from dryland agriculture and plantations
4.3.0	4.3.0 Irrigated cropping	4.3 Irrigated cropping	4 Production from irrigated agriculture and plantations
4.3.1	4.3.1 Irrigated cereals	4.3 Irrigated cropping	4 Production from irrigated agriculture and plantations
4.3.2	4.3.2 Irrigated beverage and spice crops	4.3 Irrigated cropping	4 Production from irrigated agriculture and plantations
4.3.3	4.3.3 Irrigated hay and silage	4.3 Irrigated cropping	4 Production from irrigated agriculture and plantations
4.3.4	4.3.4 Irrigated oilseeds	4.3 Irrigated cropping	4 Production from irrigated agriculture and plantations
4.3.5	4.3.5 Irrigated sugar	4.3 Irrigated cropping	4 Production from irrigated agriculture and plantations
4.3.6	4.3.6 Irrigated cotton	4.3 Irrigated cropping	4 Production from irrigated agriculture and plantations
4.3.7	4.3.7 Irrigated alkaloid poppies	4.3 Irrigated cropping	4 Production from irrigated agriculture and plantations
4.3.8	4.3.8 Irrigated pulses	4.3 Irrigated cropping	4 Production from irrigated agriculture and plantations
4.3.9	4.3.9 Irrigated rice	4.3 Irrigated cropping	4 Production from irrigated agriculture and plantations
4.4.0	4.4.0 Irrigated perennial horticulture	4.4 Irrigated perennial horticulture	4 Production from irrigated agriculture and plantations
4.4.1	4.4.1 Irrigated tree fruits	4.4 Irrigated perennial horticulture	4 Production from irrigated agriculture and plantations

4.4.2	4.4.2 Irrigated olives	4.4 Irrigated perennial horticulture	4 Production from irrigated agriculture and plantations
4.4.3	4.4.3 Irrigated tree nuts	4.4 Irrigated perennial horticulture	4 Production from irrigated agriculture and plantations
4.4.4	4.4.4 Irrigated vine fruits	4.4 Irrigated perennial horticulture	4 Production from irrigated agriculture and plantations
4.4.5	4.4.5 Irrigated shrub berries and fruits	4.4 Irrigated perennial horticulture	4 Production from irrigated agriculture and plantations
4.4.6	4.4.6 Irrigated perennial flowers and bulbs	4.4 Irrigated perennial horticulture	4 Production from irrigated agriculture and plantations
4.4.7	4.4.7 Irrigated perennial vegetables and herbs	4.4 Irrigated perennial horticulture	4 Production from irrigated agriculture and plantations
4.4.8	4.4.8 Irrigated citrus	4.4 Irrigated perennial horticulture	4 Production from irrigated agriculture and plantations
4.4.9	4.4.9 Irrigated grapes	4.4 Irrigated perennial horticulture	4 Production from irrigated agriculture and plantations
4.5.0	4.5.0 Irrigated seasonal horticulture	4.5 Irrigated seasonal horticulture	4 Production from irrigated agriculture and plantations
4.5.1	4.5.1 Irrigated seasonal fruits	4.5 Irrigated seasonal horticulture	4 Production from irrigated agriculture and plantations
4.5.2	4.5.2 Irrigated seasonal flowers and bulbs	4.5 Irrigated seasonal horticulture	4 Production from irrigated agriculture and plantations
4.5.3	4.5.3 Irrigated seasonal vegetables and herbs	4.5 Irrigated seasonal horticulture	4 Production from irrigated agriculture and plantations
4.5.4	4.5.4 Irrigated turf farming	4.5 Irrigated seasonal horticulture	4 Production from irrigated agriculture and plantations
4.6.0	4.6.0 Irrigated land in transition	4.6 Irrigated land in transition	4 Production from irrigated agriculture and plantations
4.6.1	4.6.1 Degraded irrigated land	4.6 Irrigated land in transition	4 Production from irrigated agriculture and plantations
4.6.2	4.6.2 Abandoned irrigated land	4.6 Irrigated land in transition	4 Production from irrigated agriculture and plantations
4.6.3	4.6.3 Irrigated land under rehabilitation	4.6 Irrigated land in transition	4 Production from irrigated agriculture and plantations
4.6.5	4.6.5 Abandoned irrigated perennial horticulture	4.6 Irrigated land in transition	4 Production from irrigated agriculture and plantations

Table S5. Tertiary classes from the CLUMP 23 dataset were used to map modified pasturelands

Land use Code used by Abares	Tertiary classification	Secondary Classification	Primary classification
3.2.0	3.2.0 Grazing modified pastures	3.2 Grazing modified pastures	3 Production from dryland agriculture and plantations
3.2.1	3.2.1 Native/exotic pasture mosaic	3.2 Grazing modified pastures	3 Production from dryland agriculture and plantations
3.2.2	3.2.2 Woody fodder plants	3.2 Grazing modified pastures	3 Production from dryland agriculture and plantations
3.2.3	3.2.3 Pasture legumes	3.2 Grazing modified pastures	3 Production from dryland agriculture and plantations
3.2.4	3.2.4 Pasture legume/grass mixtures	3.2 Grazing modified pastures	3 Production from dryland agriculture and plantations
3.2.5	3.2.5 Sown grasses	3.2 Grazing modified pastures	3 Production from dryland agriculture and plantations
4.2.0	4.2.0 Grazing irrigated modified pastures	4.2 Grazing irrigated modified pastures	4 Production from irrigated agriculture and plantations
4.2.1	4.2.1 Irrigated woody fodder plants	4.2 Grazing irrigated modified pastures	4 Production from irrigated agriculture and plantations
4.2.2	4.2.2 Irrigated pasture legumes	4.2 Grazing irrigated modified pastures	4 Production from irrigated agriculture and plantations
4.2.3	4.2.3 Irrigated legume/grass mixtures	4.2 Grazing irrigated modified pastures	4 Production from irrigated agriculture and plantations
4.2.4	4.2.4 Irrigated sown grasses	4.2 Grazing irrigated modified pastures	4 Production from irrigated agriculture and plantations

Table S6. Scores assigned to pressures through the visual inspection of high-resolution satellite images

	Direct	Indirect				
Pressure	100 m	300	500	1000	2750	5000
Intensive Uses	10					
Croplands	7					
Native Pastures	2					
Modified Pastures	4					
Forestry	7					
Mining	10					
Buildings	10					
Population density	0,1,2,3					
Reservoirs/dams	1	2	3			
Farm Dams	5	5	5			
Roads- Sealed	8	8	4.5	1.5	0.325	0.25
Roads- Unsealed	8	8	1.35	0.65	0.25	0.25
Railways	8					
Pipelines	3	1.2	0.65	0.25	0.25	
Transmission lines	3	1.2	0.65	0.25	0.25	
Hiking Trails	0.9					
Navigable waterways	4	1.5	0.65	0.25	0.25	0.25

Figure S1. Validation plots. The square main plot (100mx100m) for recording direct pressure, and concentric buffers for assessing indirect pressures. The imagery displayed is World Imagery from ArcGIS Map Service, and the source is Esri, Maxar, Earthstar Geographics, and the GIS User Community.

Table S7. Pressure class total area, including standard error and confidence intervals calculated through the accuracy assessment.

	Area for each pressure class		
Pressure class	**Mapped area Km²**	**SE(+/-) (Km²)**	**CI 95% (Km²)**
No pressure	2,429,491	47,890	93,862
Very Low	223,451	34,133	66,900
Low	3,903,901	52,309	102,525
Moderate	255,383	24,926	48,853
High	879,820	29,218	57,266

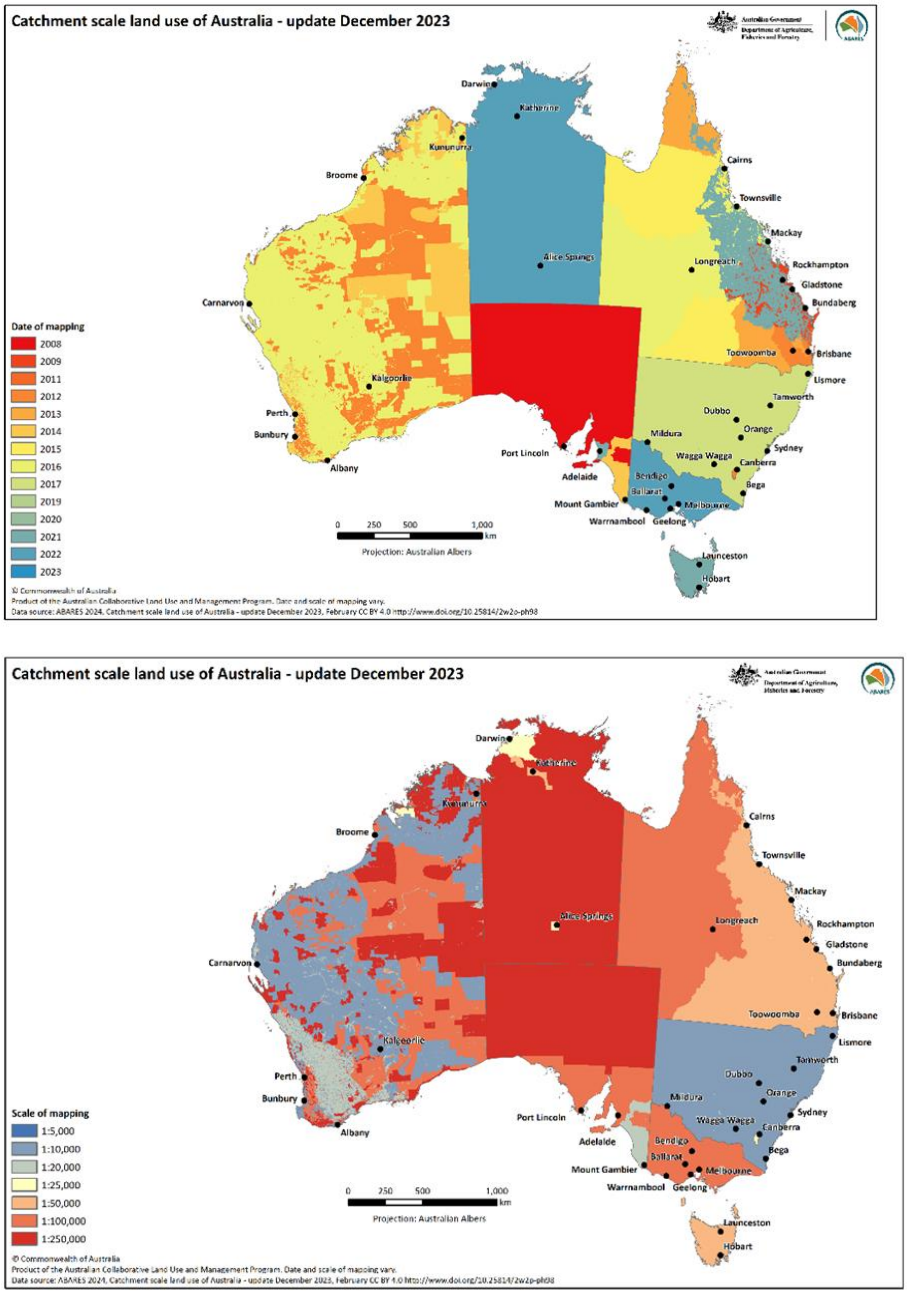

Figure S2. Year and resolution of mapping for the source vector data used to compile the ABARES 2023 Land Use of Australia layer. Maps taken from https://www.agriculture.gov.au/abares/aclump/land-use/catchment-scale-land-use-and-commodities-update-2023 (ABARES 2024).