Manaaki Whenua
Landcare Research

MANAAKI WHENUA – LANDCARE RESEARCH

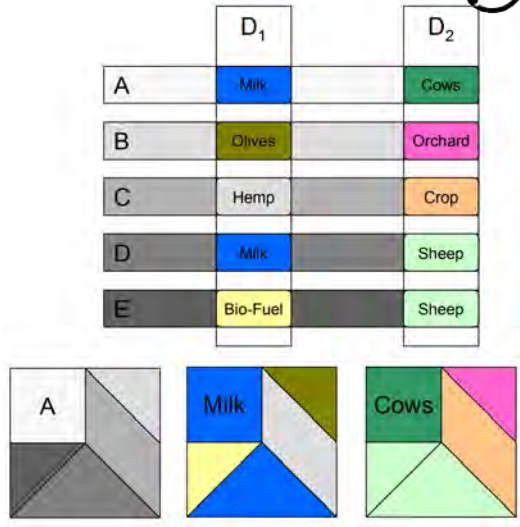
A proposal for classifying land-use

Richard Law

Outline

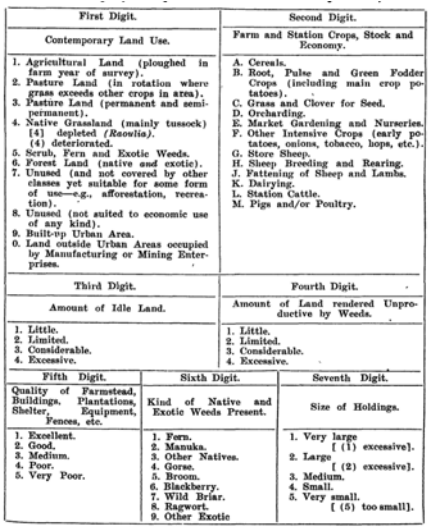
- Why do this again?
- Classification "framework" vs classification "system"
- Māori engagement
- Proposal for a NZ land use classification system
- What's next?

Manaaki Whenua Landcare Research



Rutledge, DT, Price, R, Briggs, C, Cowell, S. (2008). Geospatial land-use classification for New Zealand: review and recommendations. Official Statistics Research Series, 4. Available from www.statisphere.govt.nz/osresearch.

This old chestnut



First Digit.	Second Digit.
Contemporary Land Use.	Farm and Station Crops, Stock and Economy.
1. Agricultural Land (ploughed in farm year of survey). 2. Pasture Land (in rotation where grass exceeds other crops in area). 3. Pasture Land (permanent and semi-permanent). 4. Native Grassland (mainly tussock) [4] depleted *(Raoulia)*. (4) deteriorated. 5. Scrub, Fern and Exotic Weeds. 6. Forest Land (native *and* exotic). 7. Unused (and not covered by other classes yet suitable for some form of use—e.g., afforestation, recreation). 8. Unused (not suited to economic use of any kind). 9. Built-up Urban Area. 0. Land outside Urban Areas occupied by Manufacturing or Mining Enterprises.	A. Cereals. B. Root, Pulse and Green Fodder Crops (including main crop potatoes). C. Grass and Clover for Seed. D. Orcharding. E. Market Gardening and Nurseries. F. Other Intensive Crops (early potatoes, onions, tobacco, hops, etc.). G. Store Sheep. H. Sheep Breeding and Rearing. J. Fattening of Sheep and Lambs. K. Dairying. L. Station Cattle. M. Pigs and/or Poultry.

Third Digit.	Fourth Digit.
Amount of Idle Land.	Amount of Land rendered Unproductive by Weeds.
1. Little. 2. Limited. 3. Considerable. 4. Excessive.	1. Little. 2. Limited. 3. Considerable. 4. Excessive.

Fifth Digit.	Sixth Digit.	Seventh Digit.
Quality of Farmstead, Buildings, Plantations, Shelter, Equipment, Fences, etc.	Kind of Native and Exotic Weeds Present.	Size of Holdings.
1. Excellent. 2. Good. 3. Medium. 4. Poor. 5. Very Poor.	1. Fern. 2. Manuka. 3. Other Natives. 4. Gorse. 5. Broom. 6. Blackberry. 7. Wild Briar. 8. Ragwort. 9. Other Exotic	1. Very large [(1) excessive]. 2. Large [(2) excessive]. 3. Medium. 4. Small. 5. Very small. [(5) too small].

Cumberland, KM. (1944). The survey and classification of land in New Zealand: a basis for planning, Transactions of the Royal Society of New Zealand, 75:2, 185-195.

Manaaki Whenua Landcare Research

Why are land-use classification systems unimplemented, or unenduring?

Classification framework — Principles

1. Prioritise atomic data.
2. Be specific about purpose and scope.
3. Ensure extensibility.
4. Use hierarchies where they are appropriate, required, and logically consistent.
5. Improve over time.
6. Prioritise reproducible and transparent methodologies.
7. Accommodate multiple land uses.

`https://github.com/manaakiwhenua/nzsluc`

MANAAKI WHENUA – LANDCARE RESEARCH

Classification framework — Best practices

1. Purpose
2. Scope
3. Extensibility
4. Description of data quality
5. Semantic versioning
6. Metadata
7. Compatibility and re-use
8. Definition of land
9. Primary land use
10. Provenance

https://github.com/manaakiwhenua/nzsluc

MANAAKI WHENUA – LANDCARE RESEARCH

Te ao Māori

Manaaki Whenua Landcare Research

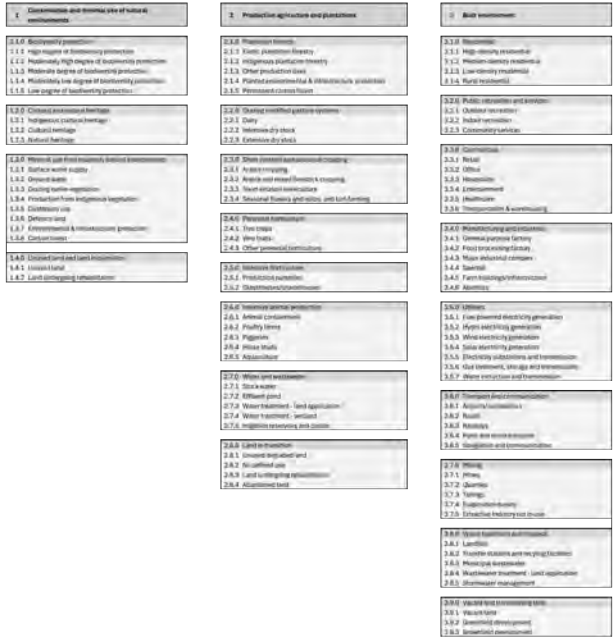
"There has been limited Māori participation in previous land-use frameworks and classifications, largely neglecting Māori cultural aspirations, knowledge, values, priorities and interests.
Māori would like to see a long-term national land use classification reflect their values, knowledge systems, and interests to support decision-making, planning and policy, especially at tribal, sector, and enterprise level." (Harcourt et al., 2024)

Harcourt, N, Finlay-Smits, S, Harmsworth, G, Awatere, S, Harris, L. 2024. Preliminary findings information synthesis: Māori perspectives about a land use classification framework. Manaaki Whenua – Landcare Research Contract Report LC4444.

1	Conservation and minimal use of natural environments
1.1.0	Biodiversity protection
1.2.0	Cultural and natural heritage
1.3.0	Minimal use from relatively natural environments
1.4.0	Unused land and land in transiiton

2	Production agriculture and plantations
2.1.0	Plantation forests
2.2.0	Grazing modified pasture systems
2.3.0	Short-rotation and seasonal cropping
2.4.0	Perennial horticulture
2.5.0	Intensive horticulture
2.6.0	Intensive animal production
2.7.0	Water and wastewater
2.8.0	Land in transition

3	Built environment
3.1.0	Residential
3.2.0	Public recreation and services
3.3.0	Commercial
3.4.0	Manufacturing and industrial
3.5.0	Utilities
3.6.0	Transport and communication
3.7.0	Mining
3.8.0	Waste treatment and disposal
3.9.0	Vacant and transitioning land


1 Conservation and minimal use of natural environments
1.1.0 Biodiversity protection
1.1.1 High degree of biodiversity protection
1.1.2 Moderately High degree of biodiversity protection
1.1.3 Moderate degree of biodiversity protection
1.1.4 Moderately low degree of biodiversity protection
1.1.5 Low degree of biodiversity protection
1.2.0 Cultural and natural heritage
1.2.1 Indigenous cultural heritage
1.2.2 Cultural heritage
1.2.3 Natural heritage
1.3.0 Water and flood mainly natural environment
1.3.1 Surface water supply
1.3.2 Ground water
1.3.3 Dooling native vegetation
1.3.4 Production from indigenous vegetation
1.3.5 Contributory use
1.3.6 Defence land
1.3.7 Environmental & conservation protection
1.3.8 Conservation
1.4.0 Unused land and land conservation
1.4.1 Unused land
1.4.2 Land undergoing rehabilitation
2 Production agriculture and plantations
2.1.0 Production forestry
2.1.1 Exotic plantation forestry
2.1.2 Indigenous plantation forestry
2.1.3 Other production trees
2.1.4 Planted arboretum/Rail & infrastructure protection
2.1.5 Permanent forest fallow
2.2.0 Grazing modified pasture systems
2.2.1 Dairy
2.2.2 Intensive dry stock
2.2.3 Extensive dry stock
2.3.0 Grain, pasture and perennial cropping
2.3.1 Arable cropping
2.3.2 Annual and mixed livestock & cropping
2.3.3 Short rotation horticulture
2.3.4 Seasonal flowers and vines, and turf farming
2.4.0 Perennial horticulture
2.4.1 Tree crops
2.4.2 Vine fruits
2.4.3 Other perennial horticulture
2.5.0 Intensive horticulture
2.5.1 Protection cultivation
2.5.2 Glasshouses/greenhouses
2.6.0 Intensive animal production
2.6.1 Animal containment
2.6.2 Poultry farms
2.6.3 Piggeries
2.6.4 Mixed stalls
2.6.5 Aquaculture
2.7.0 Water and wastewater
2.7.1 Stock water
2.7.2 Effluent pond
2.7.3 Water treatment - land application
2.7.4 Water treatment - wetland
2.7.5 Irrigation reservoirs and ponds
2.8.0 Land in transition
2.8.1 Unused developed land
2.8.2 So called idle
2.8.3 Land undergoing rehabilitation
2.8.4 Abandoned land
3 Built environment
3.1.0 Residential
3.1.1 High-density residential
3.1.2 Medium-density residential
3.1.3 Low-density residential
3.1.4 Rural residential
3.2.0 Public recreation and reserves
3.2.1 Outdoor recreation
3.2.2 Indoor recreation
3.2.3 Commodity services
3.3.0 Commercial
3.3.1 Retail
3.3.2 Office
3.3.3 Hospitality
3.3.4 Entertainment
3.3.5 Healthcare
3.3.6 Transportation & warehousing
3.4.0 Manufacturing and industrial
3.4.1 General purpose factory
3.4.2 Food processing factory
3.4.3 Major industrial complex
3.4.4 Special
3.4.5 Farm building/infrastructure
3.4.6 Abattoirs
3.5.0 Utilities
3.5.1 Fuel powered electricity generation
3.5.2 Hydro electricity generation
3.5.3 Wind electricity generation
3.5.4 Solar electricity generation
3.5.5 Electricity substations and transmission
3.5.6 Gas treatment, storage and transmission
3.5.7 Water extraction and transmission
3.6.0 Transport and communication
3.6.1 Airports/aerodromes
3.6.2 Roads
3.6.3 Railways
3.6.4 Ports and marine ancillary
3.6.5 Navigation and communication
3.7.0 Mining
3.7.1 Mines
3.7.2 Quarries
3.7.3 Tailings
3.7.4 Evaporation dams
3.7.5 Extractive industry not in use
3.8.0 Waste treatment and disposal
3.8.1 Landfills
3.8.2 Transfer stations and recycling facilities
3.8.3 Municipal wastewater
3.8.4 Wastewater treatment - land application
3.8.5 Stormwater management
3.9.0 Vacant and commissioning land
3.9.1 Vacant land
3.9.2 Greenfield development
3.9.3 Brownfield development

2. **Production agriculture and plantations**

This class includes land used principally for primary production, where native vegetation has largely been replaced by introduced species through clearing, the sowing of new species, the application of fertilisers or the dominance of volunteer species. The range of activities in this category includes plantation forests, pasture production for stock, cropping and fodder production, and a wide range of horticultural production. If there is evidence of irrigation infrastructure or water-take consents, land should have irrigation listed as a management practice, even if it appears that irrigation water has not been recently applied.

Fallow or ploughed land should be assigned to the most likely land use based on the dominant activity conducted in comparable nearby areas or other available evidence. Fallow or ploughed land should be allocated to the relevant pasture, cropping or horticultural class (rather than using land in transition). The fallow or ploughed status should be recorded in the management field.

▸ Expand

i. **Plantation forests**

This is land on which plantations of trees or shrubs (native or exotic species) have been established (i.e. planted) for production, or environmental and resource protection purposes. This includes farm forestry and may consist of monocultures or mixed species. Specific additional attributes that could be captured are plantation age, rotation number, and species.

a. **Exotic plantation forestry** – an area managed for pulpwood or saw-log production (exotic species).

b. **Indigenous plantation forestry** – an area managed for pulpwood or saw-log production (native species).

c. **Other production uses** – an area managed for non-pulpwood production, including oil, wildflowers, honey (e.g. kānuka/mānuka plantations).

d. **Planted environmental & infrastructure protection** – an area managed for environmental and indirect production uses (e.g. prevention of land

e. **Permanent carbon forest** – an area planted with indigenous or exotic trees for the purpose of gaining carbon credits (carbon farming).

ii. **Grazing modified pasture systems**

This class includes grazing pasture and/or forage, both annual and perennial, based on significant active modification or replacement of the natural vegetation. Land under pasture at the time of mapping may be in a rotation system, so that at another time the same area may be, for example, under cropping.

The ability to distinguish between dairy and dry-stock production is provided by including the relevant commodity information, such as `cattle dairy`, `cattle beef`, `sheep wool`, `sheep meat`, etc. Multiple commodities should be recorded if appropriate. Crops used in rotation should also be recorded as commodities, if known.

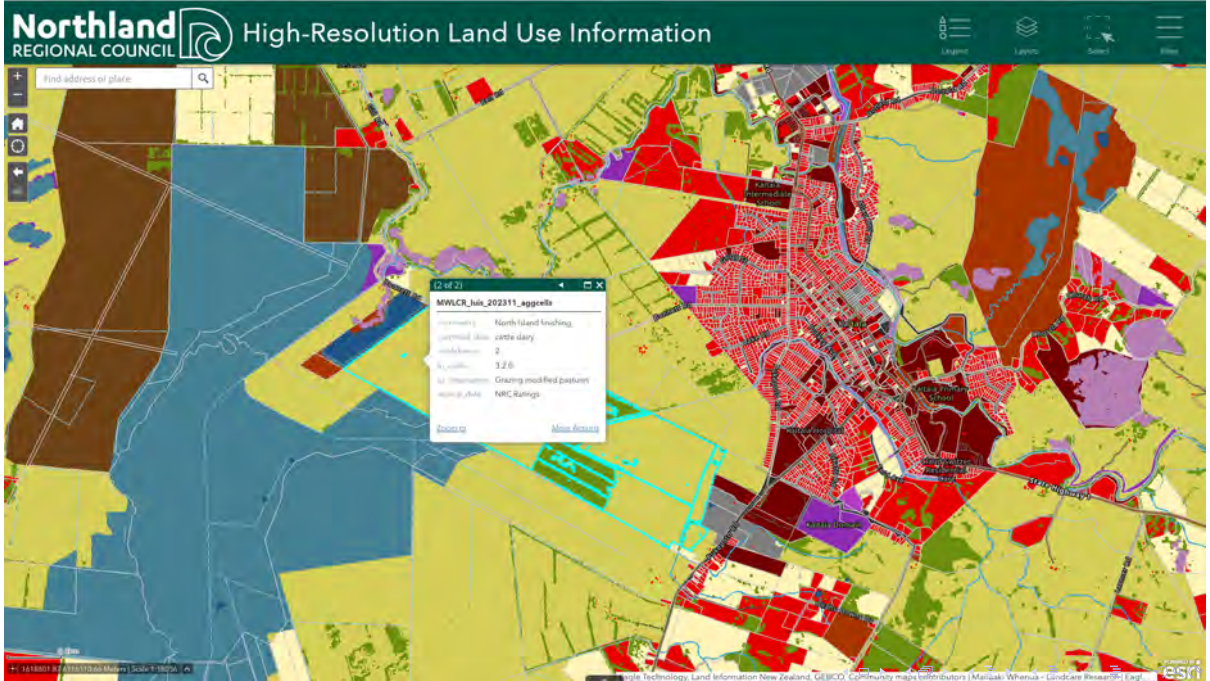
Dairy support is land that is used to support non-lactating dairy stock (dry cows, heifers and calves). It will include any feed required, and will often include winter crops and potentially summer crops (location/irrigation dependent), along with cereal crops, such as maize, barley, and wheat. It can also include feed that is cut and carried to the milking platform. Dairy support land that is not actively used for grazing should be classified as an arable use.

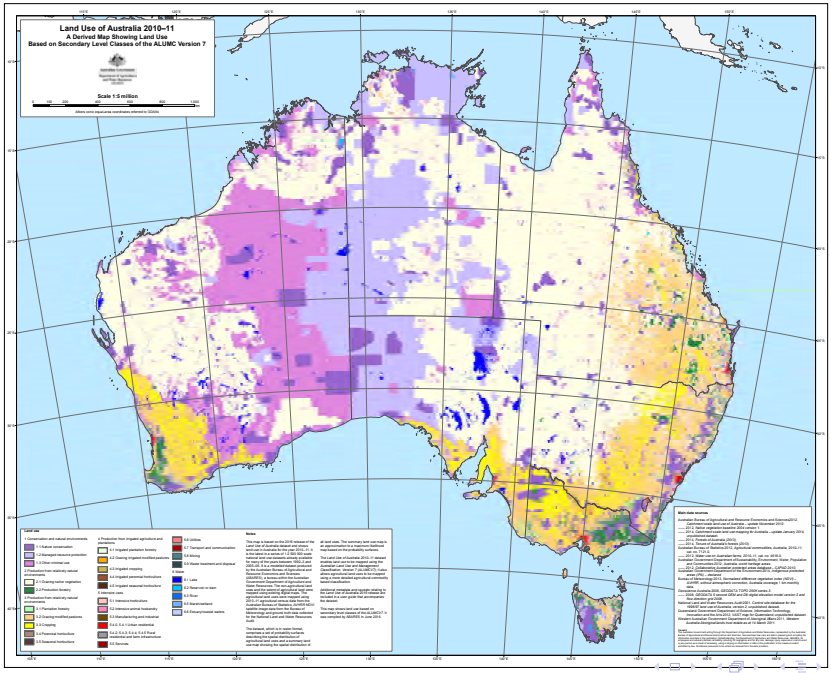
a. **Dairy** – the land on which milking cows (or other stock, such as goats or sheep) are grazed during the milking season. Dairy production systems can include rotations of grazed forage crops and maize for silage, and dry-stock grazing, but this class should only be used where dairy is the primary purpose of the land. Where the land is permanently used for dry- stock grazing, it should be classified under dry-stock land use.

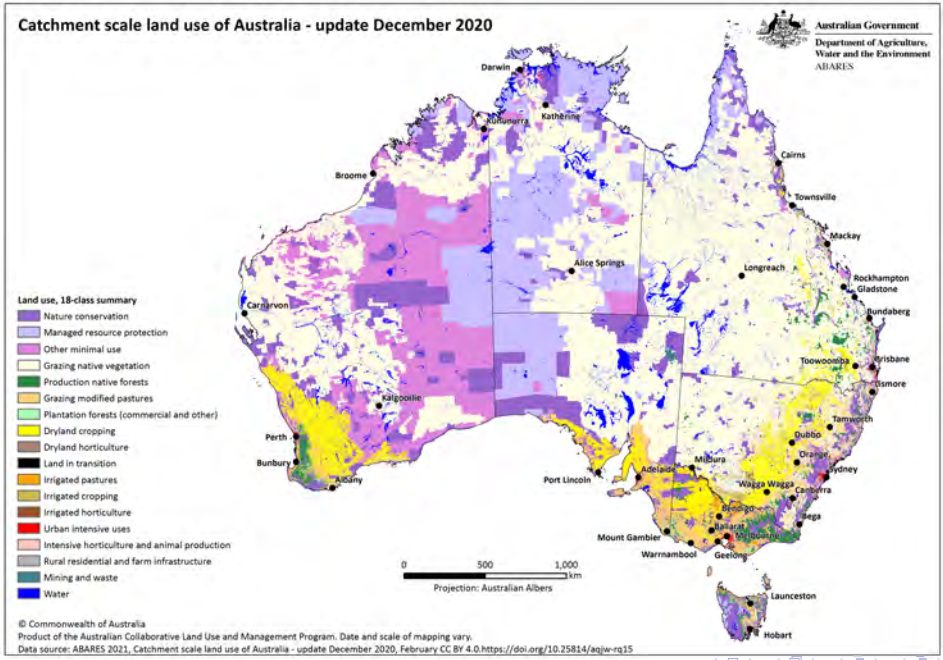
Attributes

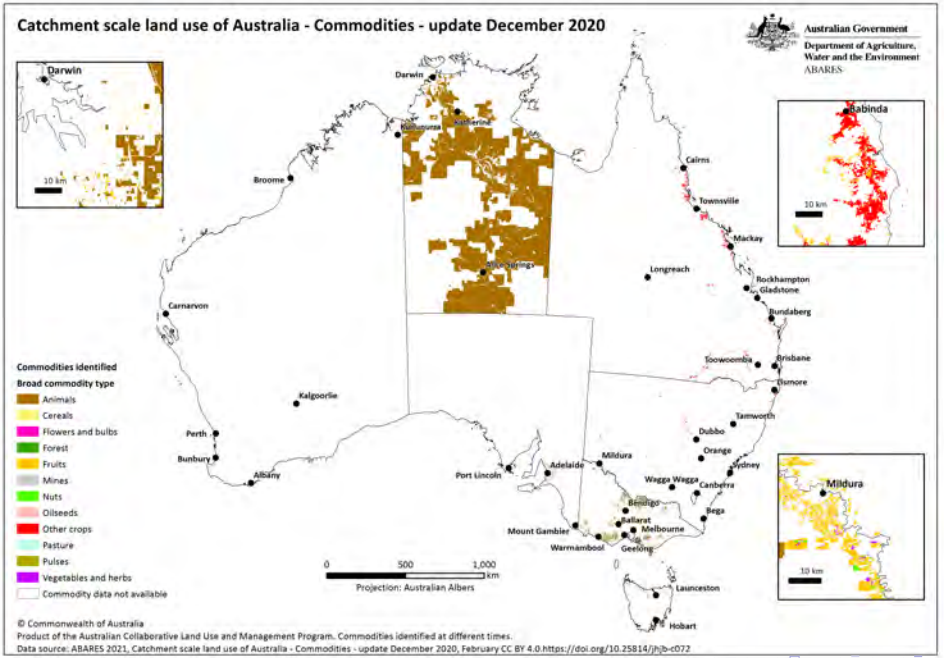
Manaaki Whenua Landcare Research

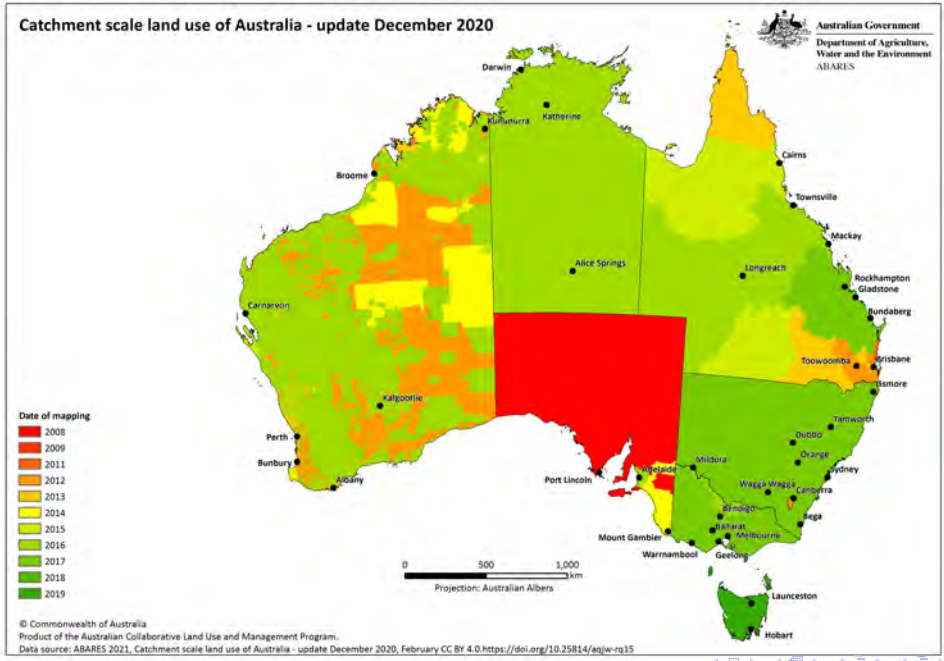
Attribute	Explanation	Example
Commodity	Commodity names	dairy cattle
Mgmt practices	Processes on land	irrigation spray
Tenure	Estate in land	leasehold
Zoning	Council zones	rural lifestyle
Land cover	Land cover at time of mapping	mānuka
Permeability	Permeability to water	unsealed
Water	Type of water feature (if not land)	lake

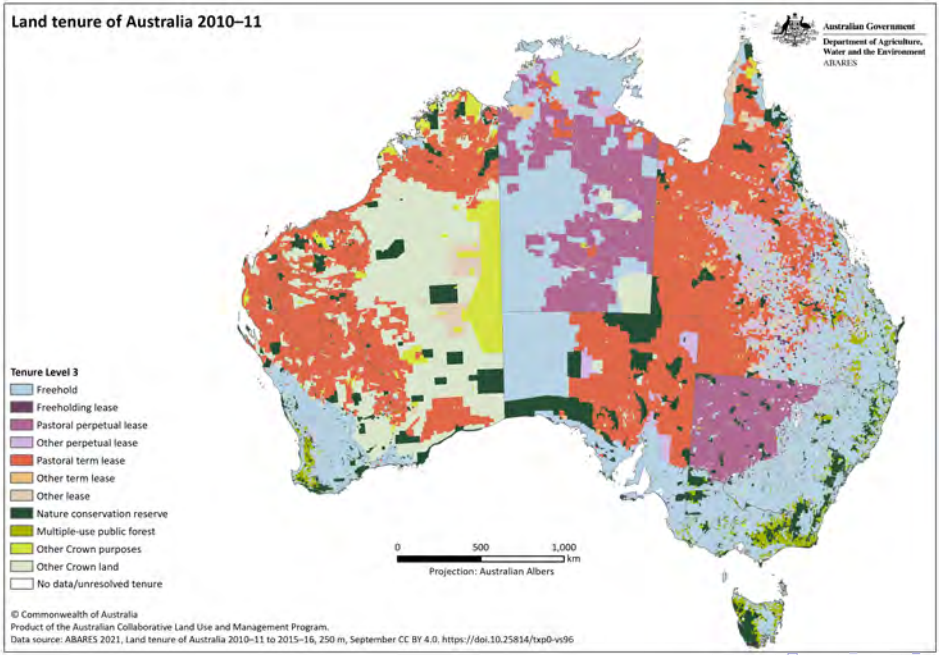

Northland
REGIONAL COUNCIL
High-Resolution Land Use Information
Find address or place
(2 of 2)
MWLCR_luis_202311_aggcells
North Island finishing
cattle dairy
2
3.2.6
Grazing modified pasturen
NRC Ratings
Zoom to
More Actions
Kaitaia Intermediate School
Kaitaia Primary School
Kaitaia Domain
Kaitaia Highway
Google Technology, Land Information New Zealand, GEBCO, Community maps contributors | Mailaaki Whenua - Landcare Research | Eagl...
esri


Land Use of Australia 2010–11
A Derived Map Showing Land Use
Based on Secondary Level Classes of the ALUMC Version 7
Scale 1:5 million
Albers conic equal-area coordinates referred to GDA94
Land use
1 Conservation and natural environments
1.1 Nature conservation
1.2 Managed resource protection
1.3 Other minimal use
2 Production from relatively natural environments
2.1 Grazing native vegetation
2.2 Production forestry
3 Production from relatively modified environments
3.1 Plantation forestry
3.2 Grazing modified pastures
3.3 Cropping
3.4 Perennial horticulture
3.5 Seasonal horticulture
4 Production from irrigated agriculture and plantations
4.1 Irrigated plantation forestry
4.2 Grazing irrigated modified pastures
4.3 Irrigated cropping
4.4 Irrigated perennial horticulture
4.5 Irrigated seasonal horticulture
5 Intensive uses
5.1 Intensive horticulture
5.2 Intensive animal husbandry
5.3 Manufacturing and industrial
5.4, 5.5, 5.6 Urban residential
5.4, 5.5, 5.6, 5.7, 5.8, 5.9 Rural residential and farm infrastructure
5.6 Services
5.8 Utilities
5.7 Transport and communication
5.9 Mining
5.8 Waste treatment and disposal
6 Water
6.1 Lake
6.2 Reservoir or dam
6.3 River
6.4 Marsh/wetland
6.5 Estuary/coastal waters
Notes
Sources
Australian Bureau of Agricultural and Resource Economics and Sciences(2012). Catchment scale land use of Australia – update December 2012
— 2011. Native vegetation baseline 2005 version 1
— 2012. Land use mapping at the regional scale for Australia – update January 2012, unpublished dataset
— 2013. Forests of Australia (2013)
— 2014. Census of Australia's horses (2010)
Australian Bureau of Statistics(2013). Agricultural commodities, Australia, 2010-11, cat. no. 7121.0
— 2012. Water use on Australian farms, 2010-11, cat. no. 4618.0
Australian Government Department of the Environment(2012). Population and Communities(2012). Australia's world heritage areas
Australian Government Department of the Environment(2012). EPBC(2012). Australian Government Department of the Environment(2012). Indigenous protected areas (IPA)
Bureau of Meteorology(2013). Normalised difference vegetation index (NDVI) – national 1 km resolution grid, unpublished dataset, Australian Water Resources Assessment 2012
Geoscience Australia(2006). GEOSCIENCE TOPO 250M series 3
— (2008). GEOSCIENCE 9 second DEM and DEI digital elevation model version 3 and flow direction grid (3DEM)
— (2009). Australian Coastline Accuracy Audit(2001). Control site database for the GEOSCIENCE coast of Australia, version 2, unpublished dataset
— (2009). Australian Coastline Accuracy Audit(2001). Control site database for the Interoception and Bio-Link(2). GAUT map for Queensland, unpublished dataset
Australian Government Department of Sustainability, Environment, Water, Population and Communities(2012). Australian Antarctic Division(2011). Western Australian Agricultural Region land areas as at 12 March 2011
Notes
This map is based on the 2010 release of the Land Use of Australia 2010–11 Version 7 land use of Australia. At the scale of 1:5 million, the map is based on the ALUMC Version 7 national land use datasets already available at the time of publication (see Table 1 in the ABARE–BRS). It is a modelled dataset produced by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), a bureau within the Australian Government Department of Agriculture, Water Resources. The two agricultural land use datasets were produced by ABARES and mapped using existing digital maps. The 2010–11 agricultural census data from the Australian Bureau of Statistics (ABS) and satellite image data from the Bureau of Meteorology and ground truth data collected by the National Land and Water Resources Audit.
The dataset, which is in raster format, consists of a single attribute layer describing the spatial distribution of agricultural land uses and a summary land use map showing the spatial distribution of all land uses. The summary land use map is derived from the land use dataset and is map based on the probability surfaces.
The Land Use of Australia 2010–11 dataset is described in detail in the publication The Australian Land Use and Management Classification, Version 7 (ALUMC V7),Land Use of Australia publication, which is available using a more detailed agricultural commodity and land use maps.
Additional metadata and spatial relating to the Land Use of Australia 2010–11 dataset are available from the Australian Bureau of Statistics.
This map shows land use based on secondary level classes of the ALUMC V7. It was compiled by ABARES in June 2013.
Scale
This map is at a scale of 1:5 million and is suitable for display at A3 size or smaller. Users should not attempt to display the data at a larger scale than the original source data.
Projection and datum
The map is in Albers conic equal-area coordinates referred to the Geocentric Datum of Australia 1994 (GDA94).
Data quality
Land use mapping is a complex process and the quality of the land use data varies. Land use data is derived from a variety of sources, including ABS agricultural census data, remote sensing data and ground truth data collected by the National Land and Water Resources Audit. Land use data is also derived from modelling and expert knowledge. Land use data is not suitable for property-level planning.
Land use data is not suitable for property-level planning.
Land use data is not suitable for property-level planning.


Catchment scale land use of Australia - update December 2020
Australian Government
Department of Agriculture, Water and the Environment
ABARES
Land use, 18-class summary
Nature conservation
Managed resource protection
Other minimal use
Grazing native vegetation
Production native forests
Grazing modified pastures
Plantation forests (commercial and other)
Dryland cropping
Dryland horticulture
Land in transition
Irrigated pastures
Irrigated cropping
Irrigated horticulture
Urban intensive uses
Intensive horticulture and animal production
Rural residential and farm infrastructure
Mining and waste
Water
Darwin
Katherine
Kununurra
Broome
Cairns
Townsville
Mackay
Alice Springs
Longreach
Rockhampton
Gladstone
Bundaberg
Carnarvon
Brisbane
Toowoomba
Kalgoorlie
Tamworth
Perth
Dubbo
Bunbury
Albany
Orange
Sydney
Mildura
Adelaide
Port Lincoln
Wagga Wagga
Canberra
Bega
Mount Gambier
Ballarat
Warrnambool
Geelong
0
500
1,000
km
Projection: Australian Albers
Launceston
Hobart
© Commonwealth of Australia
Product of the Australian Collaborative Land Use and Management Program. Date and scale of mapping vary.
Data source: ABARES 2021, Catchment scale land use of Australia - update December 2020, February CC BY 4.0.https://doi.org/10.25814/aqjw-rq15


Catchment scale land use of Australia - Commodities - update December 2020
Australian Government
Department of Agriculture, Water and the Environment
ABARES
Darwin
10 km
Darwin
Katherine
Tennant Creek
Alice Springs
Broome
Carnarvon
Kalgoorlie
Perth
Bunbury
Albany
Port Lincoln
Adelaide
Mount Gambier
Warrnambool
Geelong
Melbourne
Ballarat
Bendigo
Mildura
Wagga Wagga
Canberra
Sydney
Bega
Orange
Dubbo
Tamworth
Coffs Harbour
Port Macquarie
Newcastle
Brisbane
Toowoomba
Gladstone
Rockhampton
Bundaberg
Longreach
Mackay
Townsville
Cairns
Launceston
Hobart
Roma
10 km
Mildura
10 km
Commodities identified
Broad commodity type
Animals
Cereals
Flowers and bulbs
Forest
Fruits
Mines
Nuts
Oilseeds
Other crops
Pasture
Pulses
Vegetables and herbs
Commodity data not available
0
500
1,000
km
Projection: Australian Albers
© Commonwealth of Australia
Product of the Australian Collaborative Land Use and Management Program. Commodities identified at different times.
Data source: ABARES 2021, Catchment scale land use of Australia - Commodities - update December 2020, February CC BY 4.0.https://doi.org/10.25814/jhjb-c072


Catchment scale land use of Australia - update December 2020
Australian Government
Department of Agriculture, Water and the Environment
ABARES
Darwin
Katherine
Kununurra
Broome
Cairns
Townsville
Mackay
Alice Springs
Longreach
Rockhampton
Gladstone
Bundaberg
Carnarvon
Toowoomba
Brisbane
Lismore
Kalgoorlie
Tamworth
Dubbo
Perth
Bunbury
Orange
Mildura
Sydney
Albany
Port Lincoln
Adelaide
Wagga Wagga
Canberra
Bendigo
Bega
Ballarat
Melbourne
Mount Gambier
Warrnambool
Geelong
Launceston
Hobart
Date of mapping
2008
2009
2011
2012
2013
2014
2015
2016
2017
2018
2019
0
500
1,000
km
Projection: Australian Albers
© Commonwealth of Australia
Product of the Australian Collaborative Land Use and Management Program.
Data source: ABARES 2021, Catchment scale land use of Australia - update December 2020, February CC BY 4.0.https://doi.org/10.25814/aqjw-rq15


Land tenure of Australia 2010–11
Australian Government
Department of Agriculture, Water and the Environment
ABARES
Tenure Level 3
Freehold
Freeholding lease
Pastoral perpetual lease
Other perpetual lease
Pastoral term lease
Other term lease
Other lease
Nature conservation reserve
Multiple-use public forest
Other Crown purposes
Other Crown land
No data/unresolved tenure
0
500
1,000
km
Projection: Australian Albers
© Commonwealth of Australia
Product of the Australian Collaborative Land Use and Management Program.
Data source: ABARES 2021, Land tenure of Australia 2010–11 to 2015–16, 250 m, September CC BY 4.0. https://doi.10.25814/txp0-vs96

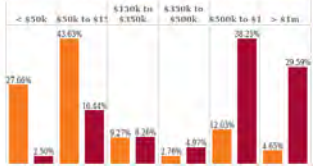
About my region dashboard by Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)

Agriculture sector

Top commodities by value

Number and type of farms

Estimated value of agricultural operations



Employment in agriculture

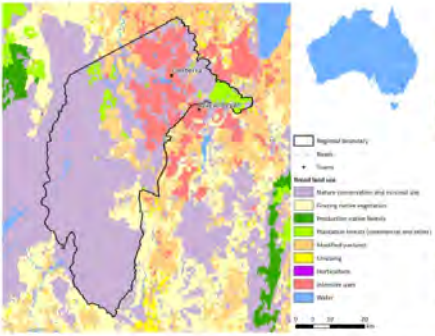
About my region dashboard

Australian Government
Department of Agriculture, Fisheries and Forestry
ABARES

Select a state or territory: Australian Capital Territory

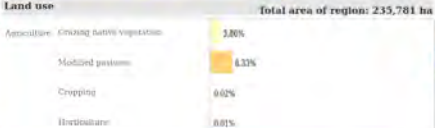
Select a region: Australian Capital Territory

Broad land use in Australian Capital Territory

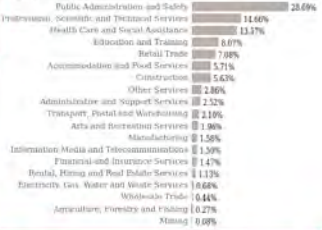


Land use

Total area of region: 235,781 ha



Employment profile



Forestry sector

Number of sawmills
1

Employment in forestry	
Forestry and Logging	32
Forestry Support Services	19
Pulp, Paper and Converted Paper Product Manufa	13
Wood Product Manufacturing	314
Total forestry sector	378

Forest category by tenure

Fisheries sector

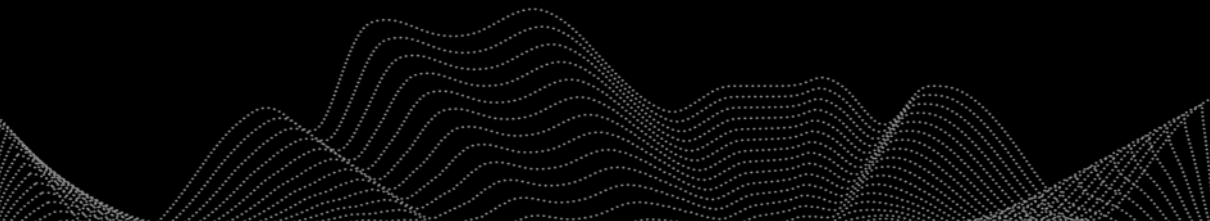
Ports
0

Employment on fisheries	
Aquaculture	0
Offshore Aquaculture	0
Onshore Aquaculture	1
Fish and Prawn Trawling, Seining or	0

Next steps

Manaaki Whenua Landcare Research

- Māori engagement
- Governance
- Advocacy
- Involvement & collaboration

Q&A

"Mā te whakaaro nui e hanga te whare. Mā te mātauranga e whakaū."
"Big ideas create the house. Knowledge maintains it."