

# Land use summary 1999–2009

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for the Fitzroy NRM region

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### Citation

DSITIA. 2012. Land use Summary 1999–2009: Fitzroy NRM Region. Queensland Department of Science, Information Technology, Innovation and the Arts, Brisbane.

### Acknowledgements

The Queensland Land Use Mapping Program (QLUMP) wishes to acknowledge the significant funding provided by the Queensland Government Reef Protection Package to compile updated land use for 2009, improved 1999 land use and 1999–2009 land use change mapping in the catchments adjacent to the Great Barrier Reef stretching from Wet Tropics in the north to the Burnett–Mary in the south.

We also wish to acknowledge the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) who coordinate the Australian Collaborative Land Use and Management Program (ACLUMP).

The QLUMP team includes staff from DSITIA in Brisbane and eight business centres of the Department of Natural Resource and Mines (NRM) throughout Queensland. The input from the regions has been extremely valuable because of their local knowledge and capacity to engage regional experts in compiling updated land use mapping.

June 2012

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## Introduction

The Queensland Land Use Mapping Program (QLUMP) is part of the Australian Collaborative Land Use and Management Program (ACLUMP) coordinated by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). ACLUMP promotes nationally consistent land use information.

Land use and land management practices have a profound impact on Queensland's natural resources, the environment and agricultural production. The availability of consistent and reliable spatial information on land use is critical for catchment modelling applications to monitor sediment, nutrient and water quality flows discharged to the Great Barrier Reef (GBR).

With the support of the Queensland Government Reef Protection Package, QLUMP has compiled updated land use mapping for the year 2009 in the catchments adjacent to the GBR—stretching from Wet Tropics in the north to the Burnett–Mary in the south. These include the Wet Tropics, Burdekin, Mackay–Whitsunday, Fitzroy and the Burnett–Mary Natural Resource Management (NRM) regions.

This report presents and summarises the land use mapping in the Fitzroy NRM region (which in area accounts for 41% of the priority GBR catchments) including:

- the revised 1999 land use dataset which includes improvements and corrections to the original 1999 dataset
- the 2009 land use dataset
- the land use change dataset from 1999–2009
- summary statistics derived from the above spatial datasets
- the results of the accuracy assessment of the 2009 land use dataset

## Methodology

Mapping is performed in accordance with ACLUMP guidelines. The methodology is accurate, reliable and cost-effective, and makes best use of available databases, satellite imagery and aerial photography.

The Australian Land Use and Management (ALUM) classification has a three-level hierarchical structure (Figure 1). Primary, secondary and tertiary classes are broadly structured by the potential degree of modification or impact in the landscape. The basis of the classification shows five primary classes, identified in order of increasing levels of intervention or potential impact. *Water* is included separately as a sixth primary class. The secondary level in the three-level hierarchical structure is the minimum attribution level for land use mapping in Queensland.

Primary and secondary levels relate to land use (i.e. the principal use of the land in terms of the objectives of the land manager). The tertiary level includes data on commodities or vegetation, (e.g. crops such as cereals and oil seeds). Where required<sup>1</sup> and possible, attribution is performed to tertiary level.

The mapping scale is 1:50 000 with a minimum mapping unit of 2 hectares and a width of 50 metres for linear features.

<sup>1</sup> QLUMP maps the land use classes of *sugar* and *cotton* (dryland and irrigated) to tertiary level.

The existing 1999 baseline (or later where available) land use dataset formed the basis for the 2009 land use dataset. The 1999, 2009 and 1999–2009 change datasets were then updated and improved primarily by interpretation of SPOT5 satellite imagery, high-resolution orthophotography, scanned aerial photography and inclusion of expert local knowledge. This was performed in an ESRI ArcSDE geodatabase replication environment, by overlaying the land use datasets on imagery and digitising or modifying areas previously omitted or incorrectly mapped in the 1999 mapping, as well as areas of actual land use change (2009).

Some land uses are difficult to differentiate using only satellite imagery and existing databases, for example dryland and irrigated *agriculture*. To overcome this, local expert knowledge has become an important component of the mapping methodology. This is provided by regional staff in state government agencies, natural resource management groups, shires, agricultural industries and landholders. A field survey is also undertaken to verify areas of uncertainty in the land use mapping.

The land use mapping methods used by QLUMP are described in full in the ABARES handbook: Guidelines for land use mapping in Australia: principles, procedures & definitions – Edition 4.

1 Conservation and Natural Environments	2 Production from Relatively Natural Environments	3 Production from Dryland Agriculture and Plantations	4 Production from Irrigated Agriculture and Plantations	5 Intensive Uses	6 Water
<b>1.1.0 Nature conservation</b> 1.1.1 Strict nature reserves 1.1.2 Wilderness area 1.1.3 National park 1.1.4 Natural feature protection 1.1.5 Habitat/species management area 1.1.6 Protected landscape 1.1.7 Other conserved area  <b>1.2.0 Managed resource protection</b> 1.2.1 Biodiversity 1.2.2 Surface water supply 1.2.3 Groundwater 1.2.4 Landscape 1.2.5 Traditional indigenous uses  <b>1.3.0 Other minimal use</b> 1.3.1 Defence land–natural areas 1.3.2 Stock route 1.3.3 Residual native cover 1.3.4 Rehabilitation	<b>2.1.0 Grazing native vegetation</b>  <b>2.2.0 Production forestry</b> 2.2.1 Wood production 2.2.2 Other forest production	<b>3.1.0 Plantation forestry</b> 3.1.1 Hardwood production 3.1.2 Softwood production 3.1.3 Other forest production 3.1.4 Environmental forest plantation  <b>3.2.0 Grazing modified pastures</b> 3.2.1 Native/exotic pasture mosaic 3.2.2 Woody fodder plants 3.2.3 Pasture legumes 3.2.4 Pasture legume/grass mixtures 3.2.5 Sown grasses  <b>3.3.0 Cropping</b> 3.3.1 Cereals 3.3.2 Beverage and spice crops 3.3.3 Hay and silage 3.3.4 Oil seeds 3.3.5 Sugar 3.3.6 Cotton 3.3.7 Alkaloid poppies 3.3.8 Pulses  <b>3.4.0 Perennial horticulture</b> 3.4.1 Tree fruits 3.4.2 Oleaginous fruits 3.4.3 Tree nuts 3.4.4 Vine fruits 3.4.5 Shrub nuts fruits and berries 3.4.6 Perennial flowers and bulbs 3.4.7 Perennial vegetables and herbs 3.4.8 Citrus 3.4.9 Grapes  <b>3.5.0 Seasonal horticulture</b> 3.5.1 Seasonal fruits 3.5.2 Seasonal nuts 3.5.3 Seasonal flowers and bulbs 3.5.4 Seasonal vegetables and herbs  <b>3.6.0 Land in transition</b> 3.6.1 Degraded land 3.6.2 Abandoned land 3.6.3 Land under rehabilitation 3.6.4 No defined use 3.6.5 Abandoned perennial horticulture	<b>4.1.0 Irrigated plantation forestry</b> 4.1.1 Irrigated hardwood production 4.1.2 Irrigated softwood production 4.1.3 Irrigated other forest production 4.1.4 Irrigated environmental forest plantation  <b>4.2.0 Grazing irrigated modified pastures</b> 4.2.1 Irrigated woody fodder plants 4.2.2 Irrigated pasture legumes 4.2.3 Irrigated legume/grass mixtures 4.2.4 Irrigated sown grasses  <b>4.3.0 Irrigated cropping</b> 4.3.1 Irrigated cereals 4.3.2 Irrigated beverage and spice crops 4.3.3 Irrigated hay and silage 4.3.4 Irrigated oil seeds 4.3.5 Irrigated sugar 4.3.6 Irrigated cotton 4.3.7 Irrigated alkaloid poppies 4.3.8 Irrigated pulses 4.3.9 Irrigated rice  <b>4.4.0 Irrigated perennial horticulture</b> 4.4.1 Irrigated tree fruits 4.4.2 Irrigated oleaginous fruits 4.4.3 Irrigated tree nuts 4.4.4 Irrigated vine fruits 4.4.5 Irrigated shrub nuts fruits and berries 4.4.6 Irrigated flowers and bulbs 4.4.7 Irrigated vegetables and herbs 4.4.8 Irrigated citrus 4.4.9 Irrigated grapes  <b>4.5.0 Irrigated seasonal horticulture</b> 4.5.1 Irrigated fruits 4.5.2 Irrigated nuts 4.5.3 Irrigated flowers and bulbs 4.5.4 Irrigated vegetables and herbs 4.5.5 Irrigated turf farming  <b>4.6.0 Irrigated land in transition</b> 4.6.1 Degraded irrigated land 4.6.2 Abandoned irrigated land 4.6.3 Irrigated land under rehabilitation 4.6.4 No defined use (irrigation) 4.6.5 Abandoned irrigated perennial horticulture	<b>5.1.0 Intensive horticulture</b> 5.1.1 Shadehouses 5.1.2 Glasshouses 5.1.3 Glasshouses (hydroponic) 5.1.4 Abandoned intensive horticulture  <b>5.2.0 Intensive animal husbandry</b> 5.2.1 Dairy sheds with yards 5.2.2 Cattle feedlots 5.2.3 Sheep feedlots 5.2.4 Poultry farms 5.2.5 Piggeries 5.2.6 Aquaculture 5.2.7 Horse studs 5.2.8 Stockyards/saleyards 5.2.9 Abandoned intensive animal husbandry  <b>5.3.0 Manufacturing and industrial</b> 5.3.1 General purpose factory 5.3.2 Food processing factory 5.3.3 Major industrial complex 5.3.4 Bulk grain storage 5.3.5 Abattoirs 5.3.6 Oil refinery 5.3.7 Sawmill 5.3.8 Abandoned manufacturing/industrial  <b>5.4.0 Residential and farm infrastructure</b> 5.4.1 Urban residential 5.4.2 Rural residential with agriculture 5.4.3 Rural residential without agriculture 5.4.4 Remote communities 5.4.5 Farm buildings/infrastructure  <b>5.5.0 Services</b> 5.5.1 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6.2.3 Evaporation basin  <b>6.3.0 River</b> 6.3.1 River–conservation 6.3.2 River–production 6.3.3 River–intensive use  <b>6.4.0 Channel/aqueduct</b> 6.4.1 Supply channel/aqueduct 6.4.2 Drainage channel/aqueduct 6.4.3 Stormwater  <b>6.5.0 Marsh/wetland</b> 6.5.1 Marsh/wetland–conservation 6.5.2 Marsh/wetland–production 6.5.3 Marsh/wetland–intensive use 6.5.4 Marshland–saline  <b>6.6.0 Estuary/coastal waters</b> 6.6.1 Estuary/coastal waters–conservation 6.6.2 Estuary/coastal waters–production 6.6.3 Estuary/coastal waters–intensive use

QLUMP maps sugar and cotton (dryland and irrigated) to tertiary level

Figure 1: Australian Land Use and Management (ALUM) classification, Version 7

## Data limitations

Land uses that are linear, such as roads and railways, are not mappable at a scale of 1:50 000 with a specified minimum mapping width of 50 metres. As a result, the area estimates of these **linear features** represent only a small proportion of the actual area under this land use in Queensland. This is relevant to the following land use classes:

- *transport and communication*
- *utilities*
- *rivers*.

Similarly, land uses that fall under the QLUMP minimum mapping area of 2 hectares are not explicitly mapped but aggregated into the surrounding land use class. This will have the effect of over-estimating the area of some land use classes, for example *cropping – sugar* and *grazing native vegetation*, whereby tracks and farm infrastructure, road reserves and drainage lines are included.

The ALUM secondary classes of *grazing modified pastures* and *irrigated grazing modified pastures* have not been mapped explicitly by QLUMP, due to the difficulty in identifying and separating these classes using satellite imagery and aerial photography alone. On occasion, generally with the benefit of field verification, these classes can be mapped (e.g dairy pastures and fodder crops including leucaena).

Livestock grazing occurs on a range of pasture types including native and exotic as well as mixtures of both. Identifying and separating these using imagery, aerial photography and field observation is difficult and unreliable. Areas of pasture which appeared to be harvested for fodder or grazed off were mapped as *cropping*. This may contribute to an over-estimation of cropping in the region. Other areas mapped as *grazing native vegetation* include road reserves, cleared and uncleared land adjacent to rivers, as well as land immediately adjacent to or between cropped paddocks. *Other minimal use* may also be confused with this class. The appearance of these can be highly variable and classification may therefore not be consistent.

The distinction between (dryland) *cropping* and *irrigated cropping* was not always evident and it is likely there is some misclassification in these classes. Proximity to water sources (watercourse or dam), water entitlements (irrigation licences), field survey and local knowledge were used to confirm areas of irrigation as much as possible. Potentially areas mapped as *irrigated cropping* are only irrigated on a supplementary basis and were not actually irrigated in either 1999 or 2009.

A combination of the Queensland Herbarium's wetlands and regional ecosystem datasets provided the basis for mapping *marsh/wetlands*, *lakes*, *rivers* and *reservoir/dams*. The ephemeral nature of many of these **water features** can lead to confusion in that they may be present in imagery of one date and either absent or of differing extent in imagery of subsequent or previous dates. As a result, there are likely to be errors and omissions and some disagreement in the mapping of features such as farm dams, reservoirs, lakes, wetlands and other water features. Many water features exceed the minimum mappable area requirements, but do not meet the criteria for linear or uniform features.

The 1999 and 2009 land use datasets are both a **snapshot in time** showing what was considered the land use for each of those years. However, some effort was given to distinguishing between an actual land use change and a rotation. For example, an area that is usually cropped, but is not used for a particular purpose in the year of interest, was still mapped as *cropping* in the 2009

dataset even though no crop was present in that year. This was not considered an actual land use change, but rather a rotation, as the primary land use for that paddock would still be *cropping*.

Please refer to the metadata for details on the mapping of specific classes.

## Products

### 1999 and 2009 land use datasets

Figure 2 and Figure 3 show the 1999 and 2009 land use datasets respectively, for the Fitzroy NRM region, presented at the secondary level of the ALUM classification (Figure 1). Table 1 and Table 2 provide the summary statistics for each. All statistics presenting the area of land use classes are reported in hectares (ha).

Table 2 shows that *grazing native vegetation* (77%) and *production forestry* (6%) are the major land use classes for 2009 in the Fitzroy NRM region.

Analysis of the overall change between the land use classes from 1999 to 2009 shows that *grazing native vegetation* has remained relatively static, decreasing only marginally by 1% or 155 575 ha, whilst *production forestry* has declined by 4% or 34 965 ha. Significant expansion of the *managed resource protection* land use class is evident, increasing by some 212% or 65 037 ha, since 1999. Other classes which have increased in area since 1999 include *mining*, which increased by 44% or 31 209 ha since 1999, where in area it accounted for 0.45% of the Fitzroy NRM region, increasing to 0.65% in 2009. *Irrigated cropping* has increased by 19% or 19 610 ha. The *residential and farm infrastructure* increased by 12% or 4870 ha since 1999, due almost exclusively to the expansion of urban and rural residential classes, at the tertiary level.

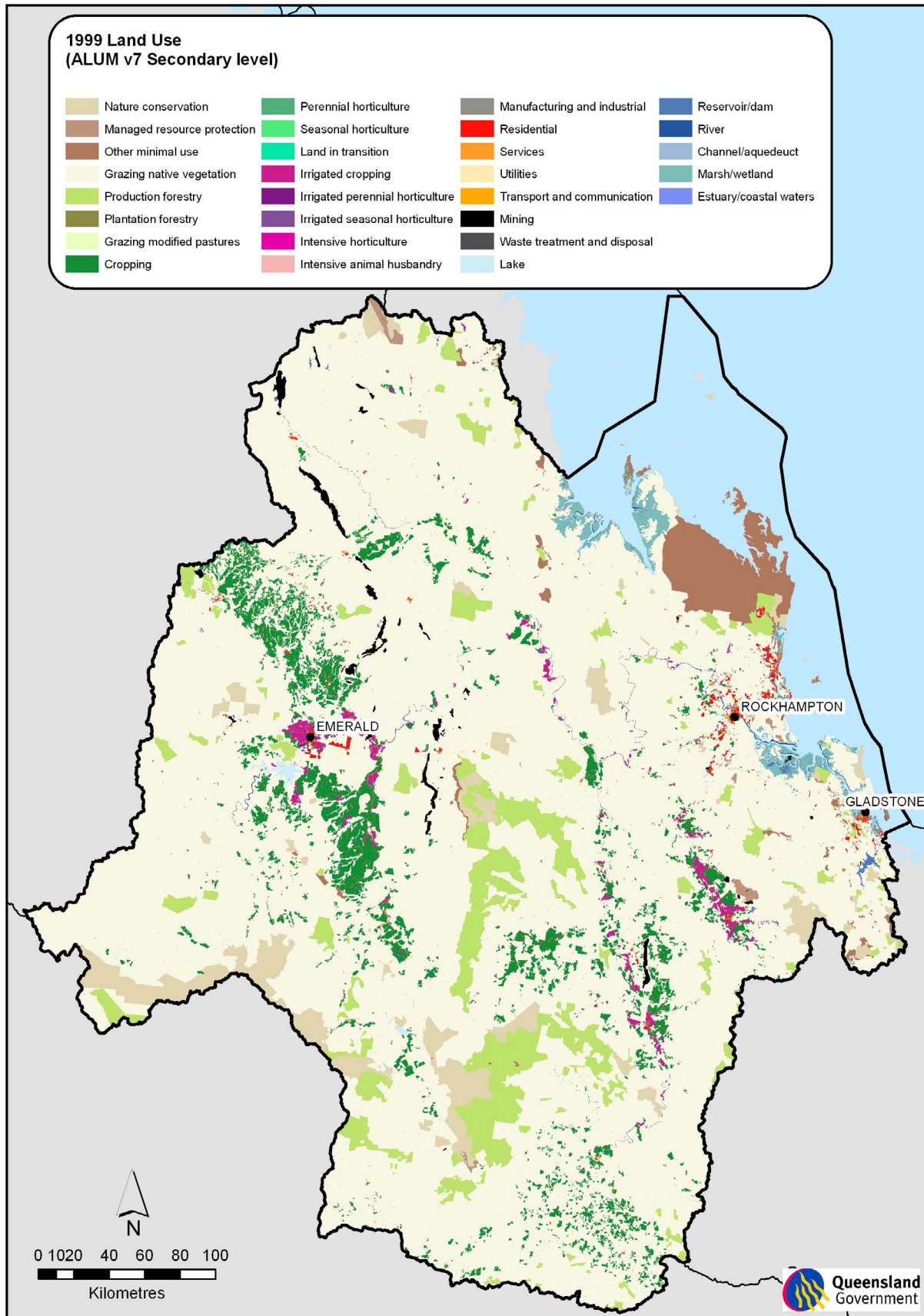


Figure 2: 1999 land use map for the Fitzroy NRM region



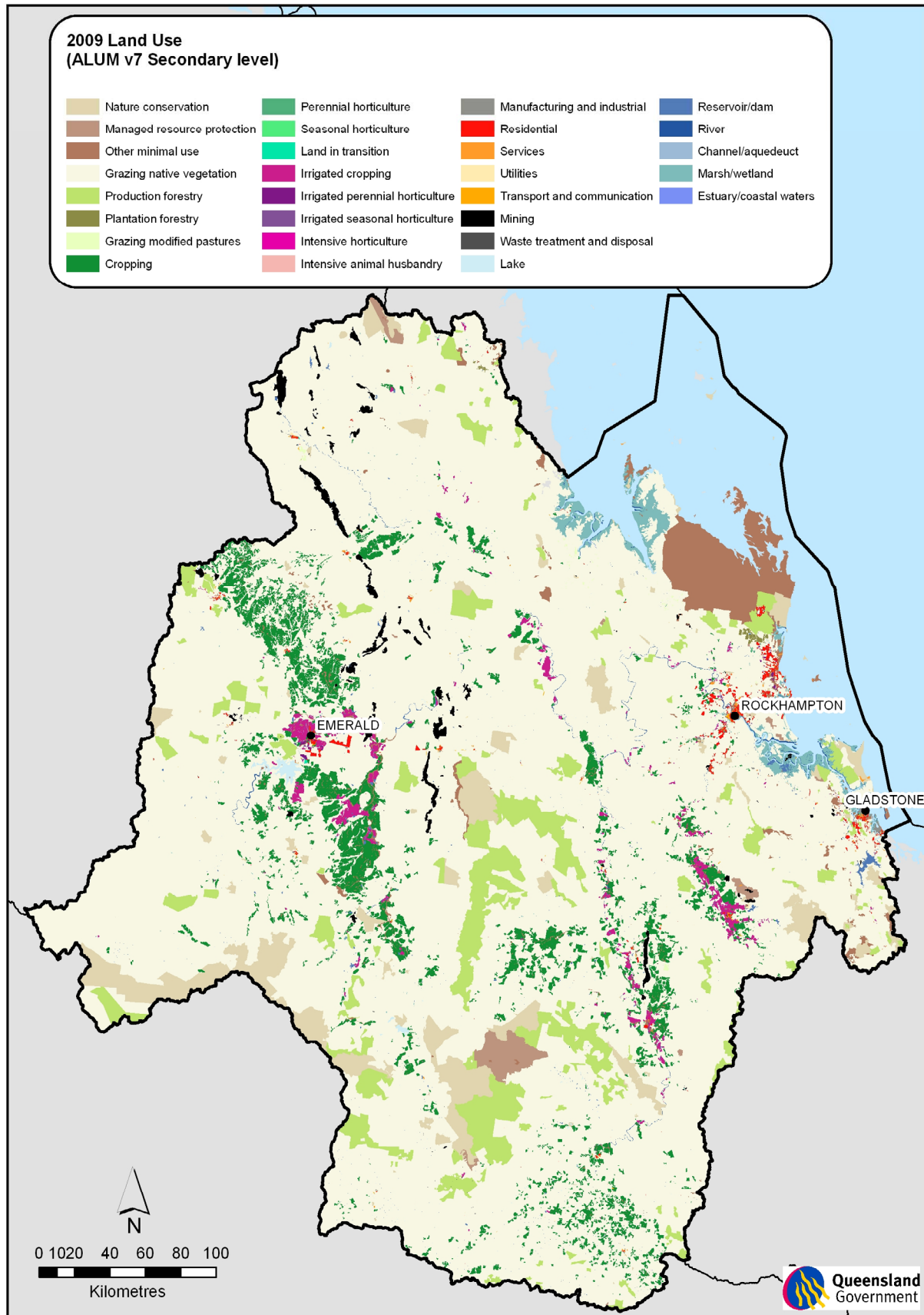


Figure 3: 2009 land use map for the Fitzroy NRM region

**Table 1: Summary statistics of land use in 1999 in the Fitzroy NRM region**

Land use code	Land use class	Area (ha)	Area %
1	Conservation and natural environments	1 091 819	6.95
1.1	Nature conservation	638 526	4.06
1.2	Managed resource protection	30 623	0.19
1.3	Other minimal use	422 670	2.69
2	Production from relatively natural environments	13 304 304	84.64
2.1	Grazing native vegetation	12 309 107	78.31
2.2	Production forestry	995 197	6.33
3	Production from dryland agriculture and plantations	809 698	5.15
3.1	Plantation forestry	292	<0.01
3.2	Grazing modified pastures <sup>1</sup>	3316	0.02
3.3	Cropping	805 403	5.12
3.4	Perennial horticulture	667	<0.01
3.5	Seasonal horticulture	9	<0.01
3.6	Land in transition	11	<0.01
4	Production from irrigated agriculture and plantations	105 428	0.67
4.3	Irrigated cropping	101 818	0.65
4.3.5	Irrigated cropping – sugar <sup>2</sup>	102	<0.01
4.3.6	Irrigated cropping – cotton <sup>2</sup>	24 014	0.15
4.4	Irrigated perennial horticulture	3483	0.02
4.5	Irrigated seasonal horticulture	127	<0.01
5	Intensive uses	133 977	0.85
5.1	Intensive horticulture	13	<0.01
5.2	Intensive animal production	1176	0.01
5.3	Manufacturing and industrial	6597	0.04
5.4	Residential and farm infrastructure	41 785	0.27
5.5	Services	9501	0.06
5.6	Utilities	768	<0.01
5.7	Transport and communication	2677	0.02
5.8	Mining	71 180	0.45
5.9	Waste treatment and disposal	280	<0.01
6	Water	273 515	1.74
6.1	Lake	17 683	0.11
6.2	Reservoir/dam	26 258	0.17
6.3	River	69 898	0.44
6.4	Channel/aqueduct	1269	0.01
6.5	Marsh/wetland	158 214	1.01
6.6	Estuary/coastal waters	193	<0.01
	<b>Total</b>	<b>15 718 746</b>	<b>100.00</b>

<sup>1</sup>Grazing modified pastures are not mapped explicitly. In this case the areas mapped are generally dairy pastures and fodder crops including leucaena.

<sup>2</sup>The area of irrigated cropping – sugar and irrigated cropping – cotton are subsets of the total area of irrigated cropping.

**Table 2: Summary statistics of land use in 2009 in the Fitzroy NRM region**

Land use code	Land use class	Area (ha)	Area %
1	Conservation and natural environments	1 220 176	7.76
1.1	Nature conservation	714 851	4.55
1.2	Managed resource protection	95 660	0.61
1.3	Other minimal use	409 664	2.61
2	Production from relatively natural environments	13 113 763	83.43
2.1	Grazing native vegetation	12 153 532	77.32
2.2	Production forestry	960 232	6.11
3	Production from dryland agriculture and plantations	807 806	5.14
3.1	Plantation forestry	6019	0.04
3.2	Grazing modified pastures <sup>1</sup>	5548	0.04
3.3	Cropping	794 301	5.05
3.3.5	Cropping – sugar <sup>2</sup>	238	<0.01
3.4	Perennial horticulture	826	0.01
3.5	Seasonal horticulture	9	<0.01
3.6	Land in transition	1102	0.01
4	Production from irrigated agriculture and plantations	129 038	0.82
4.3	Irrigated cropping	121 428	0.77
4.3.5	Irrigated cropping – sugar <sup>2</sup>	94	<0.01
4.3.6	Irrigated cropping – cotton <sup>2</sup>	25 021	0.16
4.4	Irrigated perennial horticulture	4849	0.03
4.5	Irrigated seasonal horticulture	255	<0.01
5	Intensive uses	171 579	1.09
5.1	Intensive horticulture	13	<0.01
5.2	Intensive animal husbandry	1227	0.01
5.3	Manufacturing and industrial	6773	0.04
5.4	Residential and farm infrastructure	46 655	0.30
5.5	Services	10 253	0.07
5.6	Utilities	1093	0.01
5.7	Transport and communication	2887	0.02
5.8	Mining	102 389	0.65
5.9	Waste treatment and disposal	291	<0.01
6	Water	276 365	1.76
6.1	Lake	17 704	0.11
6.2	Reservoir/dam	29 383	0.19
6.3	River	69 898	0.44
6.4	Channel/aqueduct	1288	0.01
6.5	Marsh/wetland	157 899	1.00
6.6	Estuary/coastal waters	193	<0.01
	<b>Total</b>	<b>15 718 746</b>	<b>100.00</b>

<sup>1</sup>Grazing modified pastures are not mapped explicitly. In this case the areas mapped are generally dairy pastures and fodder crops including leucaena.

<sup>2</sup>The area of cropping – sugar and irrigated cropping – sugar and cotton are subsets of the total area of cropping and irrigated cropping respectively.

## 1999–2009 land use change dataset

Figure 4 shows the 1999–2009 land use change dataset for the Fitzroy NRM region. The data have been presented relative to the **change in intensity** of the land use at the secondary level of the ALUM classification. For example, change from 2.1.0 (*grazing native vegetation*) to 2.2.0 (*production forestry*) is an increase in land use intensity, whilst change from 2.1.0 (*grazing native vegetation*) to 1.1.7 (*nature conservation*) is a decrease. See Figure 1 for the classification, noting that as you move down and from left to right in the classification the level of intervention or potential impact on the natural landscape increases.

The total area of land use change from 1999–2009 at the secondary level is 371 595 ha. This is equivalent to 2.36% of the region. Of this 166 396 ha (45% of the total change) is mapped as an increase in land use intensity, whilst 205 199 ha (55%) is a decrease.

Summary statistics presenting the land use change classes at the secondary level are shown in Table 3. The largest land use change at the secondary level was of 68 357 ha from *grazing native vegetation* to *nature conservation*, accounting for 18% of the total change, which can be attributed to the creation of new and expansion of existing *national parks* in the region. Some 65 135 ha of *production forestry* changed to *managed resource protection*, another 18% of the total change, the result of the Queensland Government's Statewide Forests Process. This conversion of state forests to protected areas directly contributes to the government's commitments to protect Queensland's biodiversity and to increase the state's total area of lands protected for conservation purposes. Other significant change was of some 28 140 ha from *grazing native vegetation* to *mining*, representing 8% of the total change. Interestingly, 5481 ha of *grazing native vegetation* changed to *plantation forestry*, which was observed in the field as predominately teak plantations.

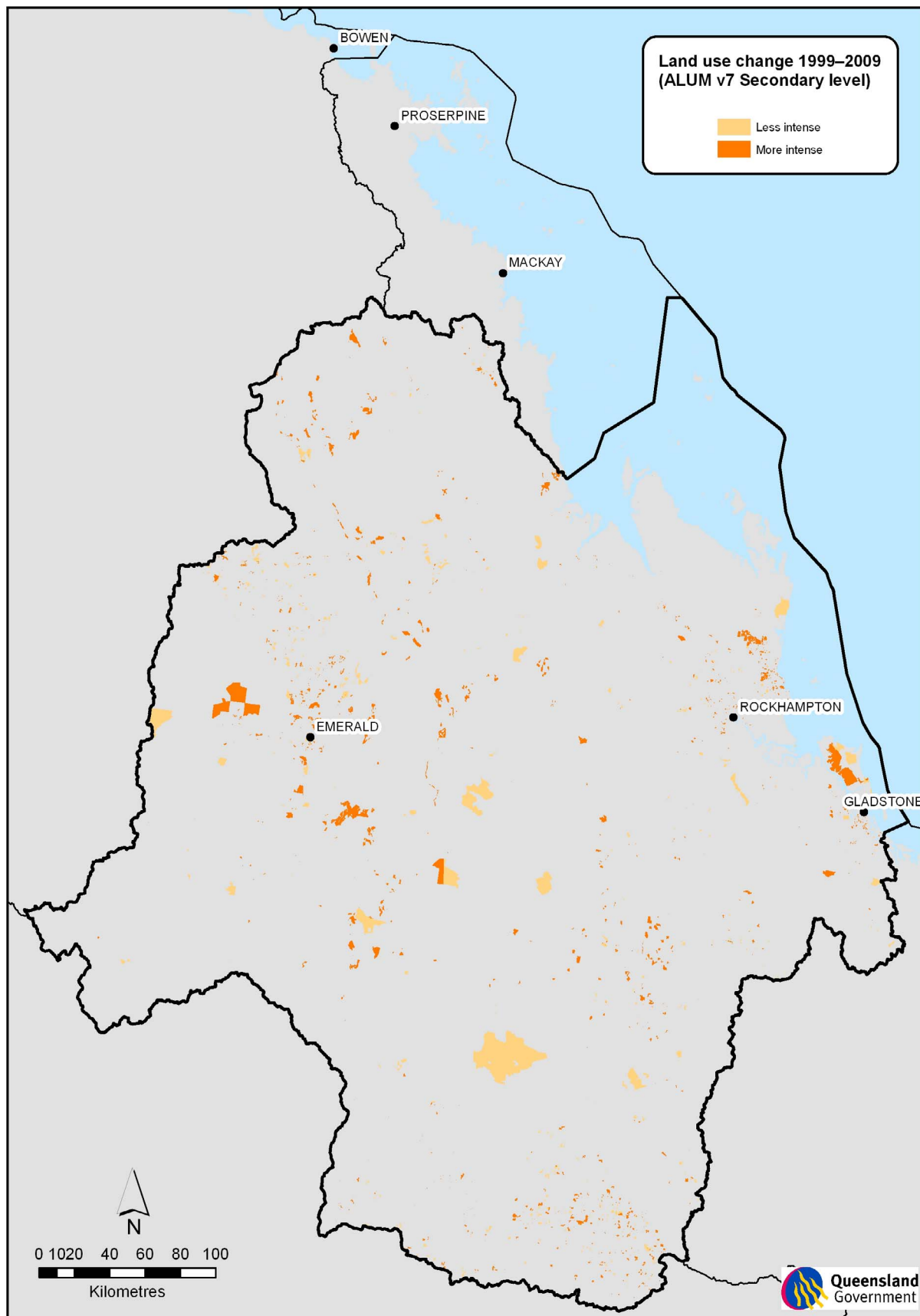


Figure 4: 1999–2009 land use change map at secondary level for the Fitzroy NRM region

**Table 3: Summary statistics for land use change at secondary level for 1999–2009 in the Fitzroy NRM region (showing only the land use changes >225 ha)**

Land use code 1999	Land use class 1999	Land use code 2009	Land use class 2009	Area (ha)	Area (%)	Total change (%)
2.1.0	Grazing native vegetation	1.1.0	Nature conservation	68 357	0.43	18.40
2.2.0	Production forestry	1.2.0	Managed resource protection	65 135	0.41	17.53
2.1.0	Grazing native vegetation	3.3.0	Cropping	42 565	0.27	11.45
3.3.0	Cropping	2.1.0	Grazing native vegetation	35 585	0.23	9.58
2.1.0	Grazing native vegetation	5.8.0	Mining	28 140	0.18	7.57
2.1.0	Grazing native vegetation	2.2.0	Production forestry	25 344	0.16	6.82
1.1.0	Nature conservation	2.2.0	Production forestry	21 085	0.13	5.67
2.2.0	Production forestry	1.1.0	Nature conservation	16 078	0.10	4.33
3.3.0	Cropping	4.3.0	Irrigated cropping	14 265	0.09	3.84
1.3.0	Other minimal use	1.1.0	Nature conservation	10 622	0.07	2.86
2.1.0	Grazing native vegetation	4.3.0	Irrigated cropping	6246	0.04	1.68
2.1.0	Grazing native vegetation	3.1.0	Plantation forestry	5481	0.03	1.47
2.1.0	Grazing native vegetation	5.4.0	Residential & farm infrastructure	4254	0.03	1.14
2.1.0	Grazing native vegetation	6.2.0	Reservoir/dam	2719	0.02	0.73
2.1.0	Grazing native vegetation	4.1.0	Irrigated plantation forestry	2477	0.02	0.67
3.3.0	Cropping	5.8.0	Mining	2152	0.01	0.58
2.1.0	Grazing native vegetation	1.2.0	Managed resource protection	2076	0.01	0.56
1.2.0	Managed resource protection	1.1.0	Nature conservation	1718	0.01	0.46
2.1.0	Grazing native vegetation	4.4.0	Irrigated perennial horticulture	1204	0.01	0.32
3.3.0	Cropping	3.2.0	Grazing modified pastures	1181	0.01	0.32
2.1.0	Grazing native vegetation	3.2.0	Grazing modified pastures	1049	0.01	0.28
1.3.0	Other minimal use	2.1.0	Grazing native vegetation	1005	0.01	0.27
4.3.0	Irrigated cropping	3.3.0	Cropping	989	0.01	0.27
3.3.0	Cropping	4.3.6	Irrigated cropping – cotton	921	0.01	0.25
2.1.0	Grazing native vegetation	5.5.0	Services	866	0.01	0.23
2.1.0	Grazing native vegetation	3.6.0	Land in transition	814	0.01	0.22
1.3.0	Other minimal use	3.3.0	Cropping	743	<0.01	0.20
4.3.0	Irrigated cropping	2.1.0	Grazing native vegetation	656	<0.01	0.18
1.3.0	Other minimal use	5.4.0	Residential & farm infrastructure	546	<0.01	0.15
1.2.0	Managed resource protection	5.8.0	Mining	476	<0.01	0.13
3.3.0	Cropping	6.2.0	Reservoir/dam	448	<0.01	0.12
1.3.0	Other minimal use	5.8.0	Mining	399	<0.01	0.11
2.1.0	Grazing native vegetation	3.4.0	Perennial horticulture	339	<0.01	0.09
3.3.0	Cropping	1.3.0	Other minimal use	331	<0.01	0.09
2.1.0	Grazing native vegetation	5.3.0	Manufacturing and industrial	321	<0.01	0.09
6.5.0	Marsh/wetland	1.1.0	Nature conservation	315	<0.01	0.08
2.1.0	Grazing native vegetation	1.3.0	Other minimal use	309	<0.01	0.08
3.3.0	Cropping	1.1.0	Nature conservation	307	<0.01	0.08
2.1.0	Grazing native vegetation	3.3.5	Cropping – sugar	238	<0.01	0.06
3.3.0	Cropping	4.4.0	Irrigated perennial horticulture	227	<0.01	0.06
<b>Total</b>				<b>371 595</b>	<b>2.36</b>	<b>100</b>

## Data format and availability

To access land use datasets we recommend using the Queensland Government Information Service (QGIS) and simply search for **land use mapping** in the type of data search, after restricting your search to **cadastral and land planning** in the topic category field. Metadata is also available from QGIS.

The dataset comprises an ESRI vector geodatabase at a nominal scale of 1:50 000. The feature classes are each a polygon dataset with each class having attributes describing land use. Land use is classified according to the Australian Land Use and Management Classification (ALUMC) Version 7, May 2010. Note that a representation showing land use at the secondary level is available when working within a geodatabase.

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## Appendix A Accuracy assessment

The accuracy assessment provided reference data suitable for assessing the 2009 land use map. For each of the sample points, the true land use class was determined (reference data) based on aerial photograph interpretation, landholder contact or expert knowledge. These points were then compared to the mapped class (map data) and the information was summarised in the error matrix. The accuracy is summarised in terms of total accuracy, Kappa and user's and producer's accuracies. Each accuracy parameter is reported using a point estimate and a 95% posterior interval. Accuracy figures are provided as probabilities between 0 and 1.

Total accuracy provides an estimate of the overall accuracy of the map, and can be expressed as the probability that a point is mapped correctly. Total accuracy can be misleading, particularly when one class dominates the others. The Kappa statistic attempts to overcome this problem by adjusting for chance agreement. A common rule of thumb suggests a value of Kappa between 0.6 and 0.8 represents moderate agreement between the map and the ground truth; a value greater than 0.8 suggests strong agreement. Values less than 0.2 suggest the map is little better than a map produced by random allocation.

The user's and producer's accuracies summarise the map's accuracy on a per-class basis. User's accuracy for class A is the probability that a point mapped as A is truly in class A. If we estimated the user's accuracy of class A to be 0.84, then from a random sample of 100 points chosen from areas on the map in this class, around 84 would be found to be correct when checked in the field. Producer's accuracy for class B is the conditional probability that the map will show a site as class B given its true state is class B. If the producer's accuracy for class B were 0.84, then from a random sample of 100 points known to be in class B around 84 would also be in class B according to the map. An accurate map should have both high user's and producer's accuracies.

Within the user and producer accuracy assessment, the per-class estimates of accuracy are often not very precise, since only part of the total sample points are used to estimate them. As a guide, if the upper bound of the interval for either user's or producer's accuracy is less than 0.5, this can indicate a true misclassification problem, rather than one due to inadequacies in sample size.

Sometimes points that differ between the map and the reference data are due to positional or spatial errors. Inaccurate registration of datasets is an example of spatial error. Thematic errors are the incorrect labelling of an area due to difficulties in determining the true land use in that area, or by oversight or other operational errors. Spatial errors influence thematic accuracy. The purpose here is to assess the thematic accuracy of land use data. However, the separation of spatial and thematic errors can be difficult and has not been undertaken. As a result, the accuracy assessment reflects properties of the land use data as a whole.

Note that the revised 1999 land use data and the 1999–2009 land use change datasets were not accuracy assessed.

### 2009 land use dataset

The 2009 land use dataset was accuracy assessed with 609 points based on a random sampling strategy, using the map classes (area and frequency) as the strata. The stratified estimate of total accuracy is 0.87 (0.81, 0.92) and Kappa is 0.69 (0.58, 0.79). As the lower bound of the confidence interval for total accuracy is greater than 0.8, the mapping meets ACLUMP specification.



Table 4 provides the error matrix for the accuracy assessment of the 2009 land use data. For the majority of classes, the reference data agreed with the map data. For example, *cropping* had 67 sample points identified. For 55 of those points, the map data was also *cropping* and therefore correct. For 12 of the points the map data was incorrect with ten points falling onto the mapped class *grazing native vegetation*, and two points in the class *irrigated cropping*.

The column 'proportion' in Table 4 is the relative proportion in area of the classes that were assessed, not of the catchment as a whole. The areas of other classes that are not amenable to assessment—for example, *nature conservation*—are removed from the total area before the proportions are calculated. This column will thus sum to 100%.

The error matrix (Table 4), shows that several classes have been misclassified in the mapping. *Managed resource protection* has been incorrectly mapped as *other conserved area*, specifically relating to nature refuges. Note that this was corrected in the final mapping products. Also evident is the confusion between dryland and irrigated *plantation forestry*. The limitations in distinguishing these classes has been noted in the data limitations (page 6). Within the primary land use class of *water*, some misclassification between the land use classes of *lake* and *reservoir/dam*, and also *river* and *estuary/coastal waters* is evident.

Table 5 provides the user's and producer's accuracy for the 2009 Fitzroy NRM land use dataset. The majority of land use classes in this catchment have been mapped accurately. The largest assessable land use class in this catchment is *grazing native vegetation* which has been mapped with a high user's and producer's accuracies of 0.880 and 0.984 respectively. The next largest class by area is *other minimal use* which also returned a high user's and producer's accuracy. *Cropping* returned with user's and producer's accuracies of 0.813 and 0.975. This suggests that some areas mapped as *cropping* were actually a different land use. The error matrix (Table 4) provides more detail on the misclassifications. The very high producer's accuracy suggests that most areas of actual *cropping* have been captured in the map.

Accuracy estimates based on samples with fewer than two points are not considered sufficiently reliable, and are presented as NA (not available) in the table. Examples of this are *managed resource protection*.

The user's and producer's accuracy results should be interpreted individually for their respective classes—noting that the smaller classes proportionally to the overall area assessed, and also a small sample size will return a wide confidence interval. The overall accuracy shows a much tighter confidence interval as it effectively summarises the accuracy results for all the assessable classes.

Some classes with low accuracies have insufficient sample points to provide precise estimates. The producer's accuracy for *residential and farm infrastructure* is 0.950; however, from the 95% interval (0.335, 0.997) we see that more sample points would be required to confidently determine how accurate this class is. The other classes with a relatively low accuracy and very large confidence intervals constitute a small proportion (<0.2% each) of the area assessed.

**Table 4: Error matrix for the Fitzroy NRM region 2009 land use dataset**

		Reference data																												
2009 land use class	Other conserved area	Managed resource protection	Other minimal use	Grazing native vegetation	Production forestry	Plantation forestry	Cropping	Perennial horticulture	Land in transition	Irrigated plantation forestry	Irrigated cropping	Irrigated cropping – cotton	Irrigated perennial horticulture	Intensive animal husbandry	Manufacturing and industrial	Residential & farm infrastructure	Services	Utilities	Transport and communication	Mining	Waste treatment and disposal	Lake	Reservoir/dam	River	Channel/aqueduct	Marsh/wetland	Estuary/coastal waters	Total	Proportion (%)	
	Other conserved area	1	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0.38
Managed resource protection	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.20
Other minimal use	0	0	62	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69	2.72	
Grazing native vegetation	0	0	0	71	0	7	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	81.09	
Production forestry	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	6.42	
Plantation forestry	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.03	
Cropping	0	0	0	10	0	0	55	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	5.31	
Perennial horticulture	0	0	0	0	0	0	1	7	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	10	0.01	
Land in transition	0	0	2	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.01	
Irrigated plantation forestry	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.01	
Irrigated cropping	0	0	1	1	0	0	2	0	0	0	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0.63	
Irrigated cropping – cotton	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0.16	
Irrigated perennial horticulture	0	0	0	0	0	0	0	0	0	3	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0.03	
Intensive animal husbandry	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.01	
Manufacturing and industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	0	0	0	0	0	0	9	0.05	
Residential & farm infrastructure	0	0	0	2	0	0	1	0	0	0	0	0	0	0	24	2	0	0	0	0	0	0	0	0	0	0	0	29	0.31	
Services	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	29	0.07	
Utilities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	10	0.01	
Transport and communication	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	9	0.02	
Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	24	0	0	0	0	0	0	0	0	25	0.68	
Waste treatment and disposal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	9	<0.01	
Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	8	0	0	0	0	15	0.12		
Reservoir/dam	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	0	0	0	30	0.18		
River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	7	15	0.46		
Channel/aqueduct	0	0	0	0	0	0	0	0	0	0	1	0	6	0	0	0	0	0	0	0	0	0	0	3	0	0	10	0.03		
Marsh/wetland	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	69	0	0	70	1.05		
Estuary/coastal waters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<0.01		
<b>Total</b>	<b>1</b>	<b>14</b>	<b>66</b>	<b>94</b>	<b>30</b>	<b>27</b>	<b>59</b>	<b>9</b>	<b>8</b>	<b>0</b>	<b>14</b>	<b>18</b>	<b>5</b>	<b>17</b>	<b>9</b>	<b>26</b>	<b>31</b>	<b>10</b>	<b>9</b>	<b>24</b>	<b>9</b>	<b>7</b>	<b>35</b>	<b>8</b>	<b>3</b>	<b>69</b>	<b>7</b>	<b>609</b>	<b>100</b>	

**Table 5: User's and producer's accuracy for the Fitzroy NRM region 2009 land use dataset**

Class	User's			Producer's		
	50%	95% interval		50%	95% interval	
Other conserved area	0.046	0.002	0.221	0.589	0.012	0.993
Managed resource protection	NA	NA	NA	NA	NA	NA
Other minimal use	0.890	0.800	0.947	0.976	0.817	0.996
Grazing native vegetation	0.880	0.801	0.939	0.984	0.976	0.990
Production forestry	0.978	0.888	0.999	0.999	0.935	1.000
Plantation forestry	0.937	0.697	0.998	0.004	0.002	0.009
Cropping	0.813	0.708	0.893	0.975	0.882	0.994
Perennial horticulture	0.647	0.353	0.884	0.002	0.001	0.013
Land in transition	0.744	0.448	0.934	0.315	0.011	0.963
Irrigated plantation forestry	0.000	0.000	0.042	0.000	0.000	0.102
Irrigated cropping	0.566	0.325	0.793	0.664	0.320	0.905
Irrigated cropping – cotton	0.956	0.793	0.999	0.605	0.228	0.880
Irrigated perennial horticulture	0.565	0.249	0.848	0.580	0.033	0.990
Intensive animal husbandry	0.937	0.700	0.998	0.143	0.013	0.329
Manufacturing and industrial	0.825	0.525	0.972	0.452	0.071	0.899
Residential & farm infrastructure	0.806	0.644	0.919	0.950	0.335	0.997
Services	0.945	0.824	0.992	0.609	0.122	0.866
Utilities	0.938	0.704	0.998	0.350	0.014	0.968
Transport and communication	0.932	0.669	0.998	0.599	0.035	0.988
Mining	0.934	0.801	0.991	0.983	0.572	1.000
Waste treatment and disposal	0.930	0.670	0.998	0.120	0.004	0.907
Lake	0.437	0.220	0.675	0.815	0.091	0.997
Reservoir/dam	0.881	0.737	0.964	0.673	0.218	0.801
River	0.500	0.265	0.737	0.957	0.338	0.999
Channel/aqueduct	0.260	0.070	0.551	0.349	0.011	0.976
Marsh/wetland	0.977	0.926	0.997	0.989	0.678	1.000
Estuary/coastal waters	NA	NA	NA	NA	NA	NA

Table 4: Error matrix for the Fitzroy NRM Region 2009 land use dataset

		Reference data																													
2009 land use class	Other conserved area	Managed resource protection	Other minimal use	Grazing native vegetation	Production forestry	Plantation forestry	Cropping	Perennial horticulture	Land in transition	Irrigated plantation forestry	Irrigated cropping	Irrigated cropping – cotton	Irrigated perennial horticulture	Intensive animal husbandry	Manufacturing and industrial	Residential & farm infrastructure	Services	Utilities	Transport and communication	Mining	Waste treatment and disposal	Lake	Reservoir/dam	River	Channel/aqueduct	Marsh/wetland	Estuary/coastal waters	Total	Proportion (%)		
	Other conserved area	1	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0.38
Managed resource protection	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.20
Other minimal use	0	0	62	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69	2.72	
Grazing native vegetation	0	0	0	71	0	7	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80	81.09	
Production forestry	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	6.42	
Plantation forestry	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.03	
Cropping	0	0	0	10	0	0	55	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	5.31	
Perennial horticulture	0	0	0	0	0	0	1	7	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	10	0.01	
Land in transition	0	0	2	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.01	
Irrigated plantation forestry	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.01	
Irrigated cropping	0	0	1	1	0	0	2	0	0	0	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0.63	
Irrigated cropping – cotton	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0.16	
Irrigated perennial horticulture	0	0	0	0	0	0	0	0	0	0	3	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0.03	
Intensive animal husbandry	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.01	
Manufacturing and industrial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	0	0	0	0	0	0	9	0.05	
Residential & farm infrastructure	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	24	2	0	0	0	0	0	0	0	0	0	0	0	29	0.31	
Services	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	29	0.07	
Utilities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	10	0.01	
Transport and communication	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	9	0.02	
Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	24	0	0	0	0	0	0	0	25	0.68	
Waste treatment and disposal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	9	<0.01	
Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	8	0	0	0	0	0	15	0.12	
Reservoir/dam	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	0	0	0	0	0	30	0.18	
River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	7	15	0.46		
Channel/aqueduct	0	0	0	0	0	0	0	0	0	0	0	1	0	6	0	0	0	0	0	0	0	0	0	0	0	3	0	0	10	0.03	
Marsh/wetland	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	69	0	0	70	1.05	
Estuary/coastal waters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<0.01	
<b>Total</b>	<b>1</b>	<b>14</b>	<b>66</b>	<b>94</b>	<b>30</b>	<b>27</b>	<b>59</b>	<b>9</b>	<b>8</b>	<b>0</b>	<b>14</b>	<b>18</b>	<b>5</b>	<b>17</b>	<b>9</b>	<b>26</b>	<b>31</b>	<b>10</b>	<b>9</b>	<b>24</b>	<b>9</b>	<b>7</b>	<b>35</b>	<b>8</b>	<b>3</b>	<b>69</b>	<b>7</b>	<b>609</b>	<b>100</b>		