Department of Science, Information Technology and Innovation

Land use Summary 1999–2013

for the Maranoa and Balonne River Catchments

Queensland Government

Prepared by

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Report updated in July 2016 to correct figures reporting the net land use changes, p. 14-15.

Cover photo: Maranoa district, by Ray Cash Photography © The State of Queensland

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The QLUMP team includes staff from DSITI and four business centres of the Department of Natural Resource and Mines (DNRM) South Region. The input from the regions has been extremely valuable in respect of their mapping skills, local knowledge and capacity to engage regional experts in compiling updated land use mapping data.

October 2015

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Introduction

The Queensland Land use Mapping Program (QLUMP) is a joint initiative of the Department of Science, Information Technology and Innovation (DSITI) and the Department of Natural Resources and Mines (DNRM). 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, agricultural production and the environment. The availability of consistent and reliable spatial information regarding land use is critical for sustainable natural resource management by Australian, Queensland and local governments, Natural Resource Management (NRM) regional groups, industry groups, community groups and land managers.

QLUMP has updated land use mapping in the Maranoa and Balonne River catchments to 2013, forming part of the Queensland Murray-Darling Committee NRM region. This report presents and summarises land use mapping including:

- revised 1999 and 2006 land use datasets including improvements and corrections to the originals
- 2013 land use dataset
- land use change dataset from 1999–2006, 2006–2013 and 1999–2013
- summary statistics derived from the above spatial datasets
- results of the accuracy assessment of the 2013 land use dataset.

Methodology

Mapping is performed in accordance with ACLUMP guidelines. The methodology is accurate, reliable, cost-effective, and makes best use of available databases, satellite imagery and aerial photography. QLUMP maps each catchment with the most recent suitable imagery available.

The Australian Land use and Management (ALUM) classification (Figure 1, page 5) shows five primary classes, identified in order of increasing levels of intervention or potential impact of land use; water is included separately as a sixth primary class. Within the primary classes is a three-level hierarchical structure. Primary, secondary and tertiary levels broadly describe the potential degree of modification or impact of land use on the landscape. 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 infrastructure. For example, crops such as cereals or infrastructure such as urban residential. Where possible, class attribution is performed to the tertiary level. For instance, QLUMP consistently maps land use classes *sugar* and *cotton* (dryland and irrigated) to tertiary level.

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

The 1999 (or later where available) baseline land use dataset formed the basis for the 2013 land use dataset. The 1999 and 2006 land use maps were revised and improved in addition to

compiling an updated land use map for 2013. This was achieved primarily by interpretation of SPOT5 satellite imagery, high-resolution orthophotography, scanned aerial photography and inclusion of expert local knowledge. An ESRI ArcSDE geodatabase replication environment was used to overlay land use datasets on imagery and digitised or modified areas previously omitted or incorrectly mapped in 1999 and 2006, and mapped areas of actual land use change for 2013. Land use change maps were then derived (at the secondary level of the ALUM classification) for the periods 1999–2006, 2006–2013 and 1999–2013.

Some land uses are difficult to differentiate using satellite imagery and existing databases, for example, dryland and irrigated agriculture. Therefore, local expert knowledge provided by state government regional staff, natural resource management groups, shires, agricultural industries and landholders was an important component of the mapping methodology. Field survey was also undertaken to verify areas of uncertainty.

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.

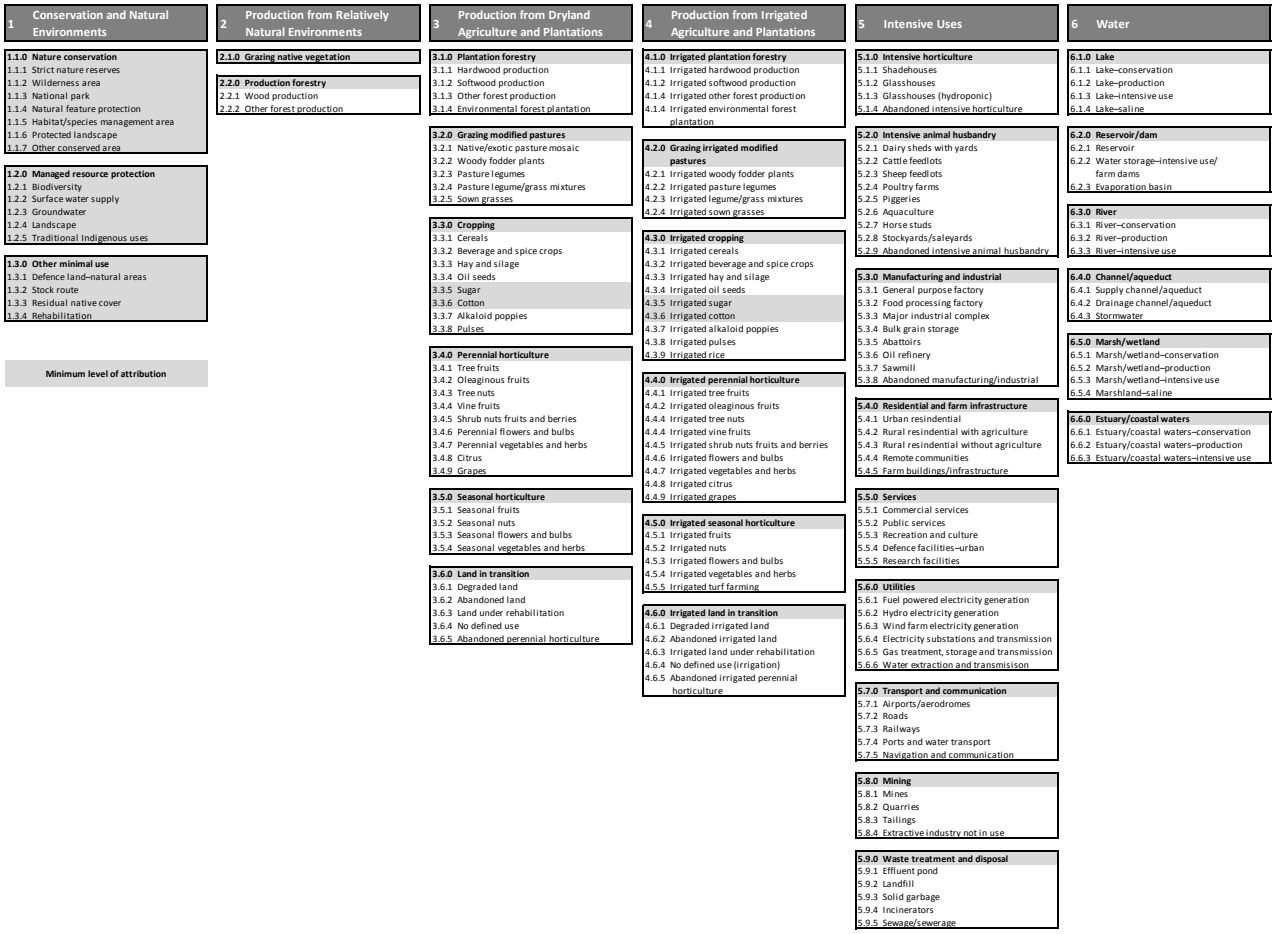

Figure 1: Australian Land use and Management (ALUM) classification, Version 7

Data Limitations

Land use features 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 within this land use type in Queensland. This is of relevance to the following land use classes:

- *transport and communication*
- *utilities*
- *rivers*
- *channel/aqueduct*

Similarly, land uses that fall under the QLUMP minimum mapping area of two 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* and *grazing native vegetation,* where tracks and farm infrastructure, road reserves, drainage lines, cleared and uncleared land adjacent to rivers, and land immediately adjacent to, or between, cropped paddocks are included.

Livestock grazing occurs on a range of pasture types including native and exotic as well as mixtures of both. Identifying and separating these pasture types using imagery, aerial photography and field observation is difficult and unreliable. Therefore, the ALUM classification secondary land use classes of *grazing modified pastures* and *grazing irrigated modified pastures* have not been mapped explicitly from the *grazing native vegetation* class. These two classes have been mapped with the benefit of field verification to identify, for example, dairy pastures and fodder crops. 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. The appearance of these can be highly variable therefore classification may 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. QLUMP undertook field surveys and together with local knowledge confirmed areas of irrigation as much as possible. An areas proximity to water sources (watercourse or dam) was also used. In addition, areas mapped as *irrigated cropping* are potentially only irrigated on a supplementary basis and may not have actually been irrigated in 1999, 2006 or 2013.

The *rural residential* land use class is a source of possible thematic error. Properties on the fringes of suburban settlements, hobby farms and subdivisions in isolated localities with comparatively small lot sizes were mapped to this class. The use of Queensland Valuation System (QVAS) was helpful in mapping this class, based on whether or not the land owner was classified as a primary producer. Residential features greater than 0.2 hectares and less than 16 hectares were mapped as rural residential. This class may be misclassified with *grazing native vegetation* and *other minimal use*, especially on larger properties.

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 as they may be present in one image and either absent or different in subsequent or previous dated imagery. As a result, there may be errors, omissions and disagreement in the mapping of features such as farm dams, reservoirs, lakes, wetlands and other water features. Many water features, whilst exceeding the minimum mappable area requirements, do not meet the criteria for linear or uniform features.

The 1999, 2006 and 2013 land use datasets are a snapshot of what was interpreted as the primary land use in these years**.** However, 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 that particular purpose in the year of interest, was still mapped as *cropping* in the 2013 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*.

The 1999 and 2006 land use mapping has been revised and improved through the interpretation of the most suitable imagery available. On occasion this will be Landsat (30m), which raises some uncertainty in respect of accurately classifying the intensive land use classes. The minimum mapping unit (2ha) also contributes through the aggregation of otherwise individual land use features, particularly at cadastral parcel level. These limitations may therefore lead to omission and commission errors in the classification of the intensive land use classes in earlier mapping products and the land use change products which are derived from them.

Products

1999, 2006 and 2013 land use datasets

Land use datasets for the Maranoa and Balonne River catchments are presented at the secondary level of the ALUM classification (Figure 1 page 5) in:

- 1999 land use dataset — Figure 2 (page 8),
- 2006 land use dataset — Figure 3 (page 10)
- 2013 land use dataset — Figure 4 (page 12)

Summary statistics for each are presented in:

- 1999 land use — Table 1 (page 9)
- 2006 land use — Table 2 (page 11)
- 2013 land use — Table 3 (page 13)

All statistics presenting the area of land use classes are reported in hectares (ha).

Grazing native vegetation and *cropping* are the dominant land use classes in the Maranoa and Balonne River catchments.

Table 1 (page 9) shows that for 1999 the *grazing native vegetation* land use class accounted for 84% of the catchments whilst *cropping* (dryland and irrigated) accounted for 8%. For 2006—Table 2 (page 11) shows slight changes in that *grazing native vegetation* consisted of 82% while the *cropping* land use classes had risen to 11%. Lastly for 2013—Table 3 (page13) shows the *grazing native vegetation* land use class had fallen to 81% and *cropping* remained at 11% of the catchments.

Analysis of the specific land use changes from one secondary class to another for 1999–2006 and 2006–2013 is presented in the section on page 15. Analysis of the land use change for 1999–2013 has been included as Appendix A, on page 23.

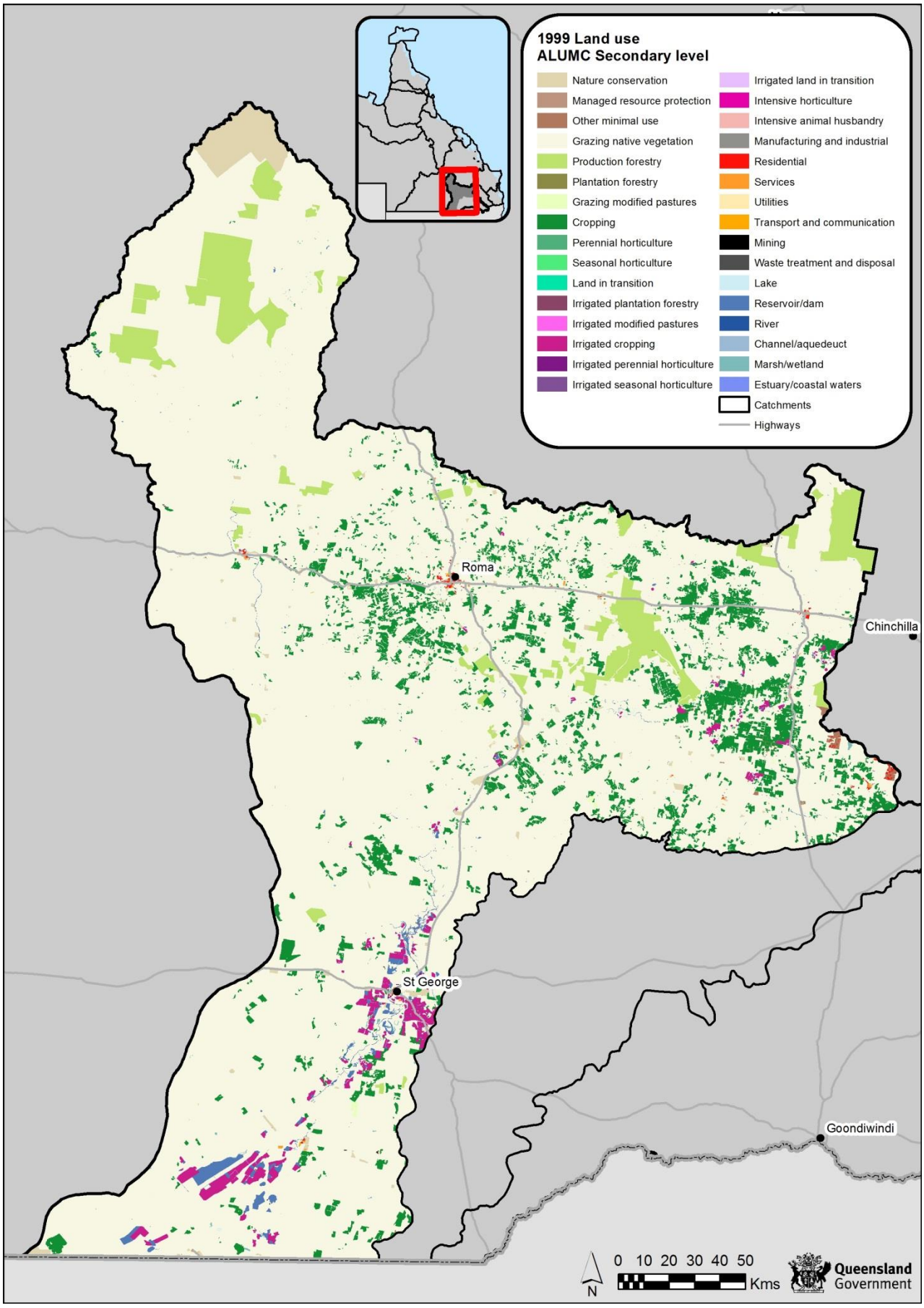

Figure 2: 1999 land use map for the Maranoa and Balonne River catchments

Table 1: Summary statistics of land use in 1999 in the Maranoa and Balonne River catchments

Land use code	Land use class	Area (ha)	Area %
1	Conservation and natural environments	100,289	1.58
1.1	Nature conservation	93,320	1.47
1.2	Managed resource protection	1	<0.01
1.3	Other minimal use	6,969	0.11
2	Production from relatively natural environments	5,649,097	89.25
2.1	Grazing native vegetation[1]	5,340,030	84.36
2.2	Production forestry	309,068	4.88
3	Production from dryland agriculture and plantations	452,702	7.15
3.2	Grazing modified pastures[2]	2,677	0.04
3.3	Cropping	449,803	7.11
3.3.6	Cropping – cotton[3]	4,256	0.07
3.4	Perennial horticulture	223	<0.01
4	Production from irrigated agriculture and plantations	70,204	1.11
4.3	Irrigated cropping	69,779	1.10
4.3.6	Irrigated cropping – cotton[3]	56,462	0.89
4.4	Irrigated perennial horticulture	425	0.01
5	Intensive uses	10,912	0.17
5.2	Intensive animal husbandry	292	<0.01
5.3	Manufacturing and industrial	591	0.01
5.4	Residential and farm infrastructure	5,830	0.09
5.5	Services	2,627	0.04
5.6	Utilities	70	<0.01
5.7	Transport and communication	769	0.01
5.8	Mining	611	0.01
5.9	Waste treatment and disposal	122	<0.01
6	Water	46,631	0.74
6.1	Lake	1,475	0.02
6.2	Reservoir/dam	37,006	0.58
6.3	River	3,112	0.05
6.4	Channel/aqueduct	1,996	0.03
6.5	Marsh/wetland	3,042	0.05
	Grand Total	**6,329,835**	**100.00**

[1]*grazing native vegetation* includes all pastures (modified and unmodified). No distinction is made in respect of tree cover.

[2]*grazing modified pastures and irrigated grazing modified pastures* are not mapped explicitly. In this case the areas mapped are generally dairy pastures.

[3]the area of c*ropping – cotton* and *irrigated cropping – cotton* are a subset of the total area of *cropping* and *irrigated cropping* respectively.

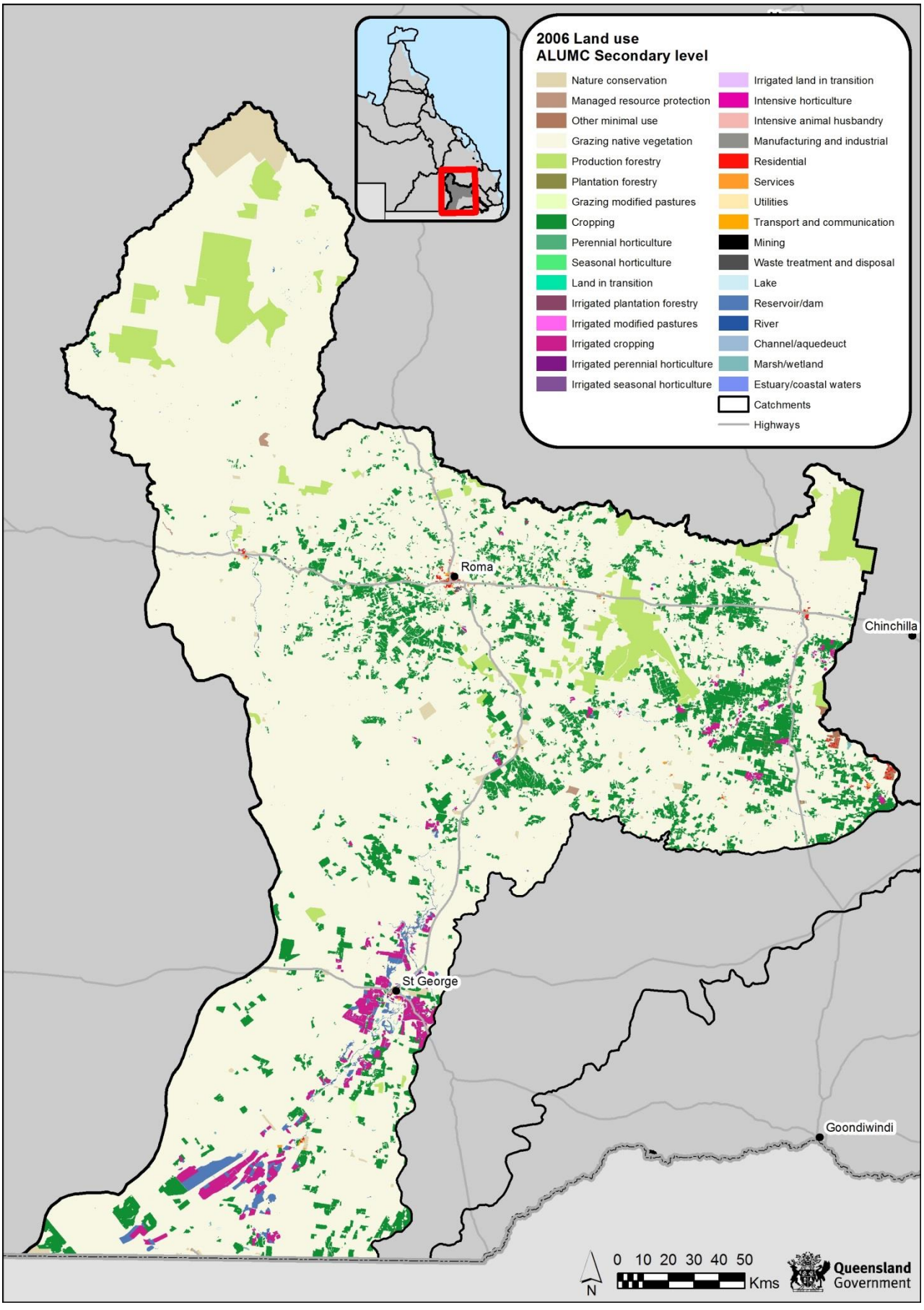

Figure 3: 2006 land use map for the Maranoa and Balonne River catchments

Table 2: Summary statistics of land use in 2006 in the Maranoa and Balonne River catchments

Land use code	Land use class	Area (ha)	Area %
1	Conservation and natural environments	103,863	1.64
1.1	Nature conservation	94,387	1.49
1.2	Managed resource protection	2,935	0.05
1.3	Other minimal use	6,541	0.10
2	Production from relatively natural environments	5,479,760	86.57
2.1	Grazing native vegetation[1]	5,170,129	81.68
2.2	Production forestry	309,631	4.89
3	Production from dryland agriculture and plantations	594,837	9.40
3.1	Grazing modified pastures[2]	3,022	0.05
3.2	Cropping	591,452	9.34
3.3.6	Cropping – cotton[3]	14,888	0.24
3.4	Perennial horticulture	321	0.01
3.6	Land in transition	42	<0.01
4	Production from irrigated agriculture and plantations	86,503	1.37
4.3	Irrigated cropping	85,967	1.36
4.3.6	Irrigated cropping – cotton[3]	69,316	1.10
4.4	Irrigated perennial horticulture	536	0.01
5	Intensive uses	11,962	0.19
5.2	Intensive animal husbandry	507	0.01
5.3	Manufacturing and industrial	635	0.01
5.4	Residential and farm infrastructure	6,261	0.10
5.5	Services	2,782	0.04
5.6	Utilities	80	<0.01
5.7	Transport and communication	776	0.01
5.8	Mining	715	0.01
5.9	Waste treatment and disposal	206	<0.01
6	Water	52,910	0.84
6.1	Lake	1,475	0.02
6.2	Reservoir/dam	42,798	0.68
6.3	River	3,112	0.05
6.4	Channel/aqueduct	2,483	0.04
6.5	Marsh/wetland	3,042	0.05
	Grand Total	**6,329,835**	**100.00**

[1]*grazing native vegetation* includes all pastures (modified and unmodified). No distinction is made in respect of tree cover.

[2]*grazing modified pastures* and *irrigated grazing modified pastures* are not mapped explicitly. In this case the areas mapped are generally dairy pastures.

[3]the area of c*ropping – cotton* and *irrigated cropping – cotton* are a subset of the total area of *cropping* and *irrigated cropping* respectively.

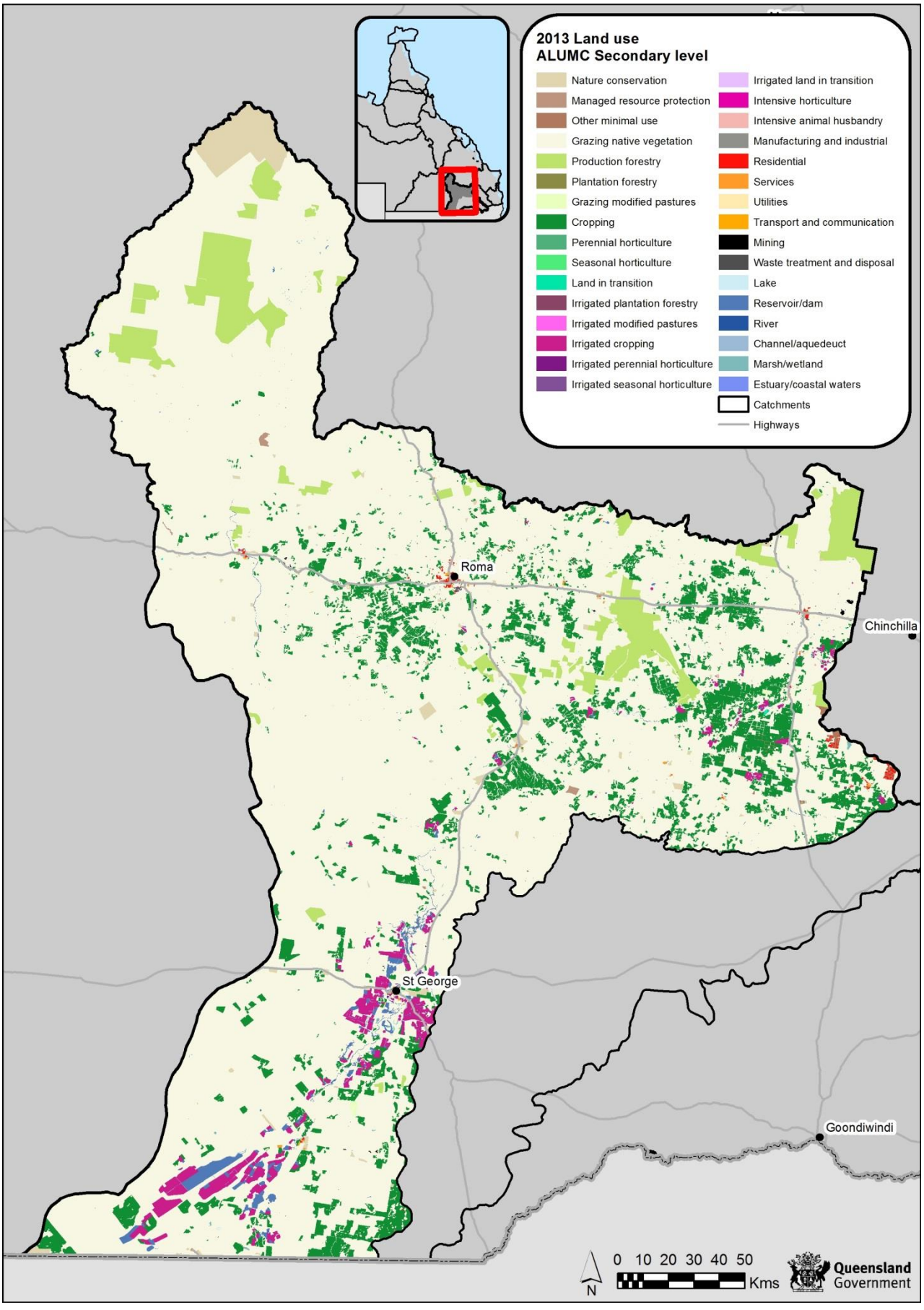

Figure 4: 2013 land use map for the Maranoa and Balonne River catchments

Table 3: Summary statistics of land use in 2013 in the Maranoa and Balonne River catchments

Land use code	Land use class	Area (ha)	Area %
1	Conservation and natural environments	101,954	1.61
1.1	Nature conservation	92,985	1.47
1.2	Managed resource protection	3,042	0.05
1.3	Other minimal use	5,926	0.09
2	Production from relatively natural environments	5,462,101	86.29
2.1	Grazing native vegetation[1]	5,152,475	81.40
2.2	Production forestry	309,626	4.89
3	Production from dryland agriculture and plantations	599,755	9.48
3.2	Grazing modified pastures[2]	2,473	0.04
3.3	Cropping	596,518	9.42
3.3.6	Cropping – cotton[3]	10,963	0.17
3.4	Perennial horticulture	323	0.01
3.6	Land in transition	441	0.01
4	Production from irrigated agriculture and plantations	97,063	1.53
4.3	Irrigated cropping	96,436	1.52
4.3.6	Irrigated cropping – cotton[3]	81,002	1.28
4.4	Irrigated perennial horticulture	627	0.01
5	Intensive uses	14,819	0.23
5.2	Intensive animal husbandry	600	0.01
5.3	Manufacturing and industrial	695	0.01
5.4	Residential and farm infrastructure	7,253	0.11
5.5	Services	2,831	0.04
5.6	Utilities	814	0.01
5.7	Transport and communication	795	0.01
5.8	Mining	1,613	0.03
5.9	Waste treatment and disposal	219	<0.01
6	Water	54,144	0.86
6.1	Lake	1,518	0.02
6.2	Reservoir/dam	43,869	0.69
6.3	River	3,112	0.05
6.4	Channel/aqueduct	2,604	0.04
6.5	Marsh/wetland	3,042	0.05
	Grand Total	**6,329,835**	**100.00**

[1]*grazing native vegetation* includes all pastures (modified and unmodified). No distinction is made in respect of tree cover.

[2]*grazing modified pastures* and *irrigated grazing modified pastures* are not mapped explicitly. In this case the areas mapped are generally dairy pastures.

[3]the area of c*ropping – cotton* and *irrigated cropping – cotton* are a subset of the total area of *cropping* and *irrigated cropping* respectively.

Overall (net) land use change

Figure 5 presents the overall (net) changes in land use within the Maranoa and Balonne River catchments by primary land use class. The graph shows the net reduction or gain for 1999–2006 and 2006–2013. Note that the first bar for each primary land use class is the 1999–2006, whilst the second is the 2006–2013 and each series sums to zero.

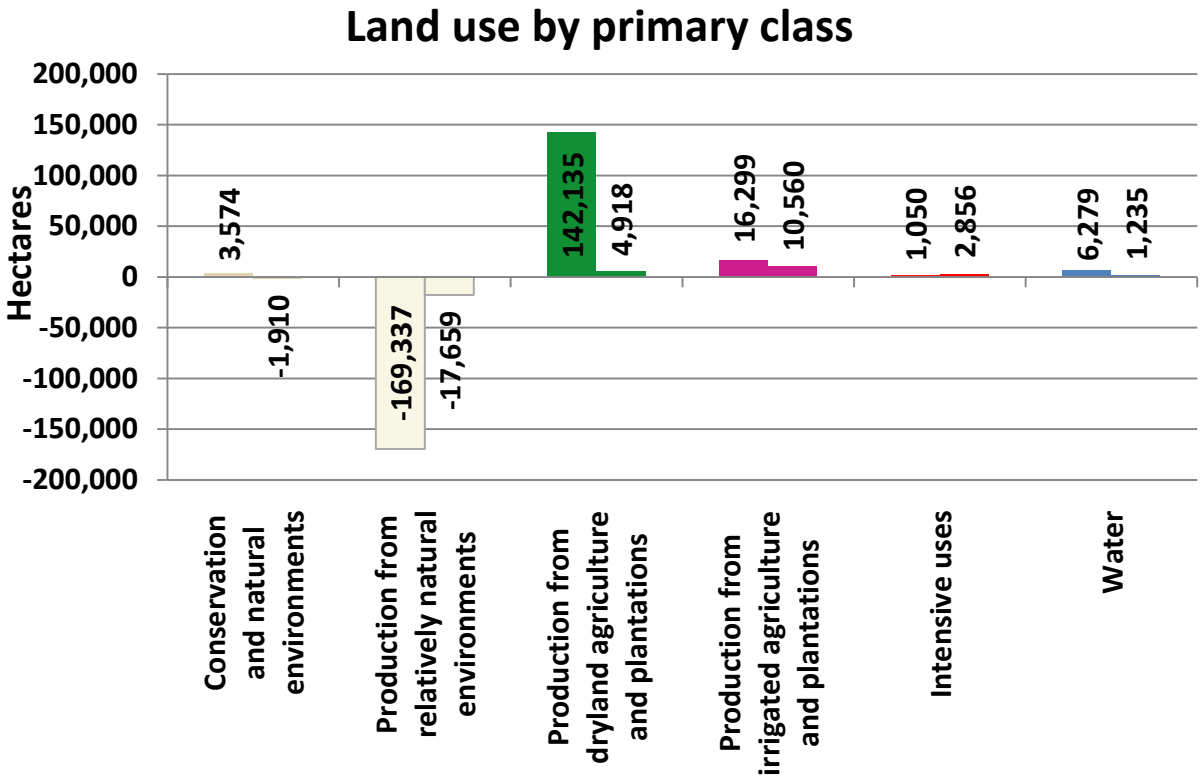

Figure 5: Net land use change by primary class (1999–2006 and 2006–2013) in the Maranoa and Balonne River catchments

Analysis of the major overall (net) land use changes relative to the updated land use mapping for each **primary class** shows:

- *Production from relatively natural environments* decreased by 3% or 169,337ha for 1999–2006 and a further slight reduction of 17,659ha for 2006–2013
- *Production from dryland agriculture and plantations* increased by 31% or 142,135ha for 1999–2006 and a further 1% or 4,918ha for 2006–2013
- *Production from irrigated agriculture and plantations—increased by* 23% or 16,299ha for 1999–2006 and 12% or 10,560ha for 2006–2013
- *Intensive uses* increased in each era—10% or 1,050ha in 1999–2006 and 24% or 2,856ha in 2006–2013
- *Water* increased by 13% or 6,279ha for 1999–2006 and a further 2% or 1,235ha in 2006–2013.

Further analysis of the net land use changes at the **secondary class** shows:

- *Dryland cropping* increased by 31% or 141,649ha for 1999–2006 and slightly again by 1% or 5,066ha in 2006–2013
- *Irrigated cropping* increased by 23% or 16,188ha in 1999–2006 and then again by 12% or 10,469ha in 2006–2013

- *Residential and farm infrastructure* increased by 7% or 431ha in 1999–2006 and 16% or 992ha in 2006–2013
- *Mining* increased by 17% or 104ha in 1999–2006 and 126% or 898ha in 2006–2013
- *Reservoir/dam* increased by 16% or 5,792ha in 1999–2006 and 3% or 1,071ha in 2006–2013

QLUMP consistently map the land use **tertiary class** of *cotton*. The net land use change was:

- *Dryland cotton* increased by 250% or 10,632ha for 1999–2006, then declined by 26% or 3,926ha for 2006–2013
- *Irrigated cotton* increased by 23% or 12,854ha for 1999–2006 and increased again by 17% or 11,686ha for 2006–2013

Land use change datasets (1999–2006, 2006–2013 and 1999–2013)

Figures 7, 9 and 11 (pages 18, 21 and 25) show the land use change datasets for the Maranoa and Balonne River catchments. The data has 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 1.1.0 (*nature conservation*) is a decrease. This is highlighted in the ALUM classification (Figure 1, page 5). Moving down and from left to right through the classification, the level of intervention or potential impact of land use increases.

Land use change mapping products have been compiled for three epochs (1999, 2006 and 2013). At the secondary level of the ALUM classification, the total area of land use change is:

- 1999–2006: 197,554ha (3% of the catchments). Of this 181,744ha (92% of the total change) is mapped as an increase in land use intensity, whilst 15,810ha (8%) is a decrease.
- 2006–2013: 204,540ha (3% of the catchments). Of this 116,293ha (57% of the total change) is mapped as an increase in land use intensity, whilst 88,247ha (43%) is a decrease.
- 1999–2013: 355,949ha (6% of the catchments). Of this 271,650ha (76% of the total change) is mapped as an increase in land use intensity, whilst 84,299ha (24%) is a decrease.

The land use change totals between the two eras (1999–2006 and 2006–2013) will not add up to match those compiled for the 1999–2013 era. This is because land use change mapping only accounts for land use at a specific moment in time; some change will result from rotation, whilst some may be the result of more than one change event. For example, an area mapped as *grazing native vegetation* in 1999 may have been mapped as *land in transition* in 2006 before finally becoming *residential* in 2013. These changes would be reflected in each of the land use change mapping products as change from *grazing native vegetation* to *land in transition* in the 1999–2006, and change from *land in transition* to *residential* in 2006–2013, and lastly change from *grazing native vegetation* to *residential* in 1999–2013.

Summary statistics presenting the land use change at the secondary level for 1999–2006 and 2006–2013 are shown in Tables 4 and 5 (pages 16 and 19). The change from 1999–2013 is presented in Appendix A (page 23).

The land use changes within the Maranoa and Balonne River catchments were predominantly within the grazing and cropping land use classes—and are two-way. Gains are often offset in part by reductions and vice versa. The pie charts presented in Figures 6 and 8, (pages 17 and 20) illustrate the major fluxes within each of these land use classes, for each change era.

1999–2006 Land use change

The 1999–2006 land use change shows that the change from *grazing native vegetation* to *cropping* accounted for 142,879ha or 72% of all the total change mapped, followed by 11,190ha (6%) of *grazing native vegetation* changing to *irrigated cropping – Cotton* (Table 4).

Table 4: Summary statistics for land use change at secondary level for 1999–2006 in the Maranoa and Balonne River catchments (showing only the land use changes > 85ha)

Land use code 1999	Land use class 1999	Land use code 2006	Land use class 2006	Area (ha)	Area Change (%)	Total change (%)
2.1.0	Grazing native vegetation	3.3.0	Cropping	142,879	2.26	72.32
2.1.0	Grazing native vegetation	4.3.6	Irrigated cropping – Cotton	11,190	0.18	5.66
2.1.0	Grazing native vegetation	3.3.6	Cropping – Cotton	10,899	0.17	5.52
3.3.0	Cropping	2.1.0	Grazing native vegetation	9,741	0.15	4.93
2.1.0	Grazing native vegetation	6.2.0	Reservoir/dam	5,459	0.09	2.76
2.1.0	Grazing native vegetation	4.3.0	Irrigated cropping	2,963	0.05	1.50
2.1.0	Grazing native vegetation	1.2.0	Managed resource protection	2,935	0.05	1.49
2.1.0	Grazing native vegetation	1.1.0	Nature conservation	2,729	0.04	1.38
1.1.0	Nature conservation	2.1.0	Grazing native vegetation	1,634	0.03	0.83
3.3.0	Cropping	4.3.6	Irrigated cropping – Cotton	1,129	0.02	0.57
3.3.0	Cropping	4.3.0	Irrigated cropping	1,106	0.02	0.56
2.1.0	Grazing native vegetation	3.2.0	Grazing modified pastures	594	0.01	0.30
2.1.0	Grazing native vegetation	2.2.0	Production forestry	564	0.01	0.29
3.3.0	Irrigated cropping	4.3.6	Irrigated cropping – Cotton	546	0.01	0.28
2.1.0	Grazing native vegetation	6.4.0	Channel/aqueduct	470	0.01	0.24
2.1.0	Grazing native vegetation	5.4.0	Residential	225	<0.01	0.11
3.3.6	Cropping – Cotton	4.3.6	Irrigated cropping – Cotton	215	<0.01	0.11
1.3.0	Other minimal use	5.4.0	Residential	204	<0.01	0.10
2.1.0	Grazing native vegetation	5.2.0	Intensive animal husbandry	204	<0.01	0.10
1.3.0	Other minimal use	2.1.0	Grazing native vegetation	188	<0.01	0.10
3.2.0	Grazing modified pastures	3.3.0	Cropping	163	<0.01	0.08
2.1.0	Grazing native vegetation	5.5.0	Services	155	<0.01	0.08
4.3.6	Irrigated cropping – Cotton	2.1.0	Grazing native vegetation	140	<0.01	0.07
3.3.0	Cropping	6.2.0	Reservoir/dam	128	<0.01	0.06
2.1.0	Grazing native vegetation	4.4.0	Irrigated perennial horticulture	121	<0.01	0.06
2.1.0	Grazing native vegetation	5.8.0	Mining	104	<0.01	0.05
2.1.0	Grazing native vegetation	3.4.0	Perennial horticulture	98	<0.01	0.05
4.3.0	Irrigated cropping	2.1.0	Grazing native vegetation	88	<0.01	0.04
3.2.0	Grazing modified pastures	2.1.0	Grazing native vegetation	85	<0.01	0.04
Total				**197,554**	**3.12**	**100**

Analysis of the 1999–2006 land use change within the *grazing native vegetation* and *cropping* land use classes is presented in Figure 6.

Figure 6a shows that the largest proportion of land use change from *grazing native vegetation* was to *cropping* (142,879ha or 78% of the total change from *grazing native vegetation*), followed by 11,190ha (6%) and 10,899ha (6%) changing to *irrigated cropping – cotton* and *irrigated cropping* respectively. Interestingly 5,459ha (3%) changed to *reservoir/dam.*

A total of 9,741ha or 80% of the total change from *cropping* went to *grazing native vegetation*, while 1,129ha (9%) changed to *irrigated cropping – cotton* and a further 1,106ha (9%) changed to *irrigated cropping* (Figure 6b).

The majority of land use change to *grazing native vegetation* was from *cropping*—9,741ha (82%) followed by 1,634ha (14%) from *nature conservation* (Figure 6c).

Almost all the land use change to *cropping* came from *grazing native vegetation*—142,879ha (Figure 6d).

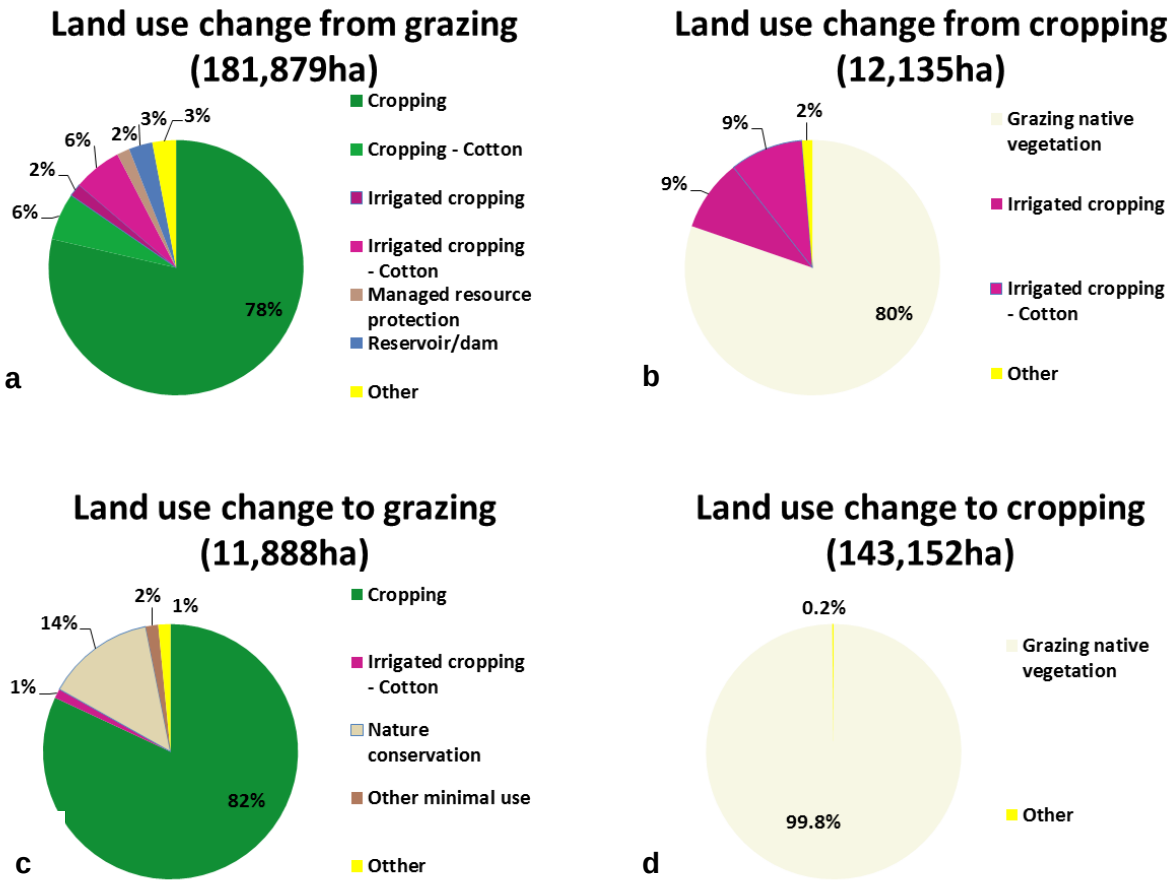

Figure 6: Charts (a–d) of 1999–2006 land use change within the grazing native vegetation and cropping land use classes

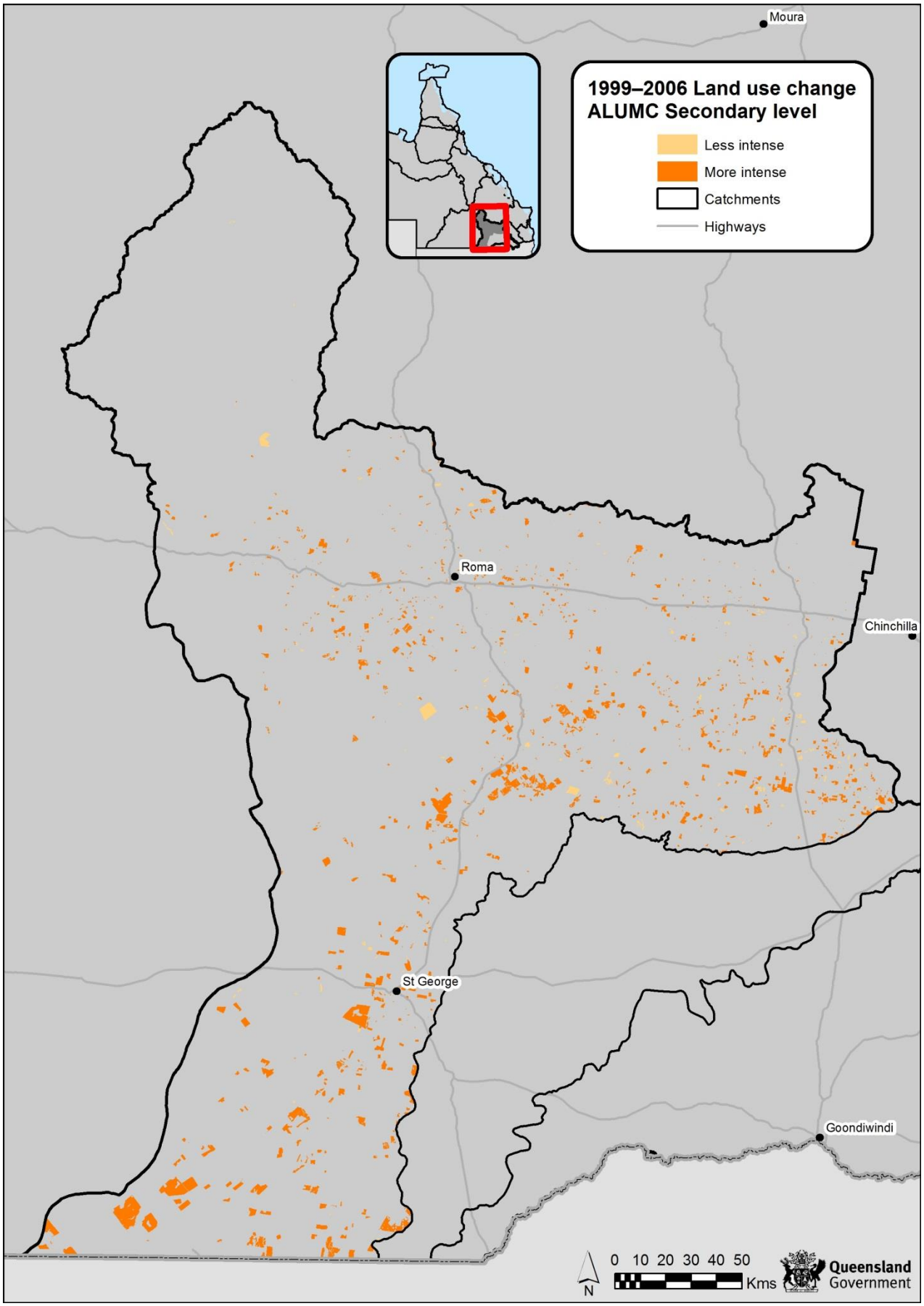

Figure 7: 1999–2006 land use change map at secondary level for the Maranoa and Balonne River catchments

2006–2013 Land use change

For 2006–2013, the largest land use change was observed from *grazing native vegetation* to *cropping* of 94,340ha or 46% of the total change mapped. This reduction of *cropping* was offset almost entirely by the change from *cropping* (84,144ha or 41%) to *grazing native vegetation* (Table 5).

Table 5: Summary statistics for land use change at secondary level for 2006–2013 in the Maranoa and Balonne River catchments (showing only the land use changes > 50ha)

Land use code 2006	Land use class 2006	Land use code 2013	Land use class 2013	Area (ha)	Area Change (%)	Total change (%)
2.1.0	Grazing native vegetation	3.3.0	Cropping	94,340	1.49	46.12
3.3.0	Cropping	2.1.0	Grazing native vegetation	84,144	1.33	41.14
2.1.0	Grazing native vegetation	4.3.6	Irrigated cropping – Cotton	6,068	0.10	2.97
3.3.6	Cropping – Cotton	4.3.6	Irrigated cropping – Cotton	5,243	0.08	2.56
2.1.0	Grazing native vegetation	3.3.6	Cropping – Cotton	1,438	0.02	0.70
1.1.0	Nature conservation	2.1.0	Grazing native vegetation	1,417	0.02	0.69
4.3.0	Irrigated cropping	2.1.0	Grazing native vegetation	1,141	0.02	0.56
3.3.0	Cropping	4.3.6	Irrigated cropping – Cotton	1,128	0.02	0.55
4.3.6	Irrigated cropping – Cotton	2.1.0	Grazing native vegetation	1,022	0.02	0.50
4.3.0	Irrigated cropping	3.3.0	Cropping	928	0.01	0.45
2.1.0	Grazing native vegetation	6.2.0	Reservoir/dam	925	0.01	0.45
2.1.0	Grazing native vegetation	5.8.0	Mining	850	0.01	0.42
2.1.0	Grazing native vegetation	4.3.0	Irrigated cropping	800	0.01	0.39
3.2.0	Grazing modified pastures	2.1.0	Grazing native vegetation	716	0.01	0.35
1.3.0	Other minimal use	5.4.0	Residential	602	0.01	0.29
3.3.0	Cropping	4.3.0	Irrigated cropping	452	0.01	0.22
2.1.0	Grazing native vegetation	5.6.0	Utilities	443	0.01	0.22
2.1.0	Grazing native vegetation	3.6.0	Land in transition	439	0.01	0.21
4.3.0	Irrigated cropping	4.3.6	Irrigated cropping – Cotton	401	0.01	0.20
3.3.0	Cropping	5.6.0	Utilities	265	<0.01	0.13
2.1.0	Grazing native vegetation	5.4.0	Residential	215	<0.01	0.10
2.1.0	Grazing native vegetation	3.2.0	Grazing modified pastures	161	<0.01	0.08
3.3.0	Cropping	5.4.0	Residential	133	<0.01	0.07
3.3.6	Cropping – Cotton	6.4.0	Channel/aqueduct	121	<0.01	0.06
4.3.6	Irrigated cropping – Cotton	6.2.0	Reservoir/dam	108	<0.01	0.05
2.1.0	Grazing native vegetation	1.2.0	Managed resource protection	107	<0.01	0.05
2.1.0	Grazing native vegetation	4.4.0	Irrigated perennial horticulture	103	<0.01	0.05
2.1.0	Grazing native vegetation	5.2.0	Intensive animal husbandry	99	<0.01	0.05
3.3.0	Cropping	3.2.0	Grazing modified pastures	89	<0.01	0.04
3.2.0	Grazing modified pastures	3.3.0	Cropping	83	<0.01	0.04
2.1.0	Grazing native vegetation	5.3.0	Manufacturing and industrial	82	<0.01	0.04
3.3.0	Cropping	6.2.0	Reservoir/dam	69	<0.01	0.03
3.3.0	Cropping	5.8.0	Mining	60	<0.01	0.03
Total				**204,540**	**3.23**	**100**

Figure 8 presents an analysis of the 2006–2013 land use change within the *grazing native vegetation* and *cropping* land use classes.

Figure 8a shows the largest land use change was from *grazing native vegetation* to *cropping* (94,340ha or 89% of the total change from *grazing native vegetation*), followed by 6,068ha (or 6%) changing to *irrigated cropping – cotton*.

The majority of this change was offset by 84,144ha (98%) of change from *cropping* to *grazing native vegetation*. For 2006–2012 this resulted in a net gain in *cropping* of 10,196ha (Figure 8b).

A total of 84,144ha or 95% of the total change to *grazing native vegetation* was from *cropping* (Figure 8c).

Almost all (99%) of the land use change to *cropping* came from *grazing native vegetation*— 94,340ha (Figure 8d).

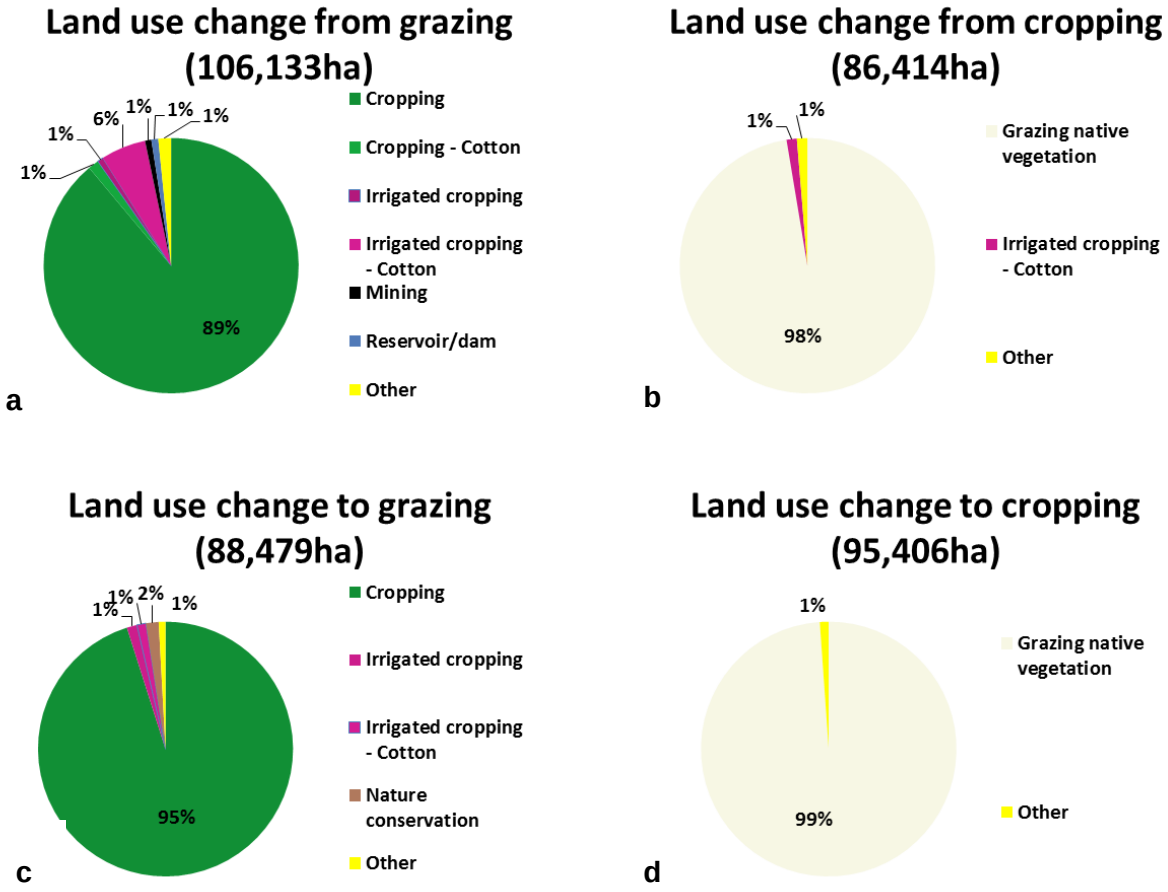

Figure 8: Charts (a–d) of 2006–2013 land use change within the grazing native vegetation and cropping land use classes

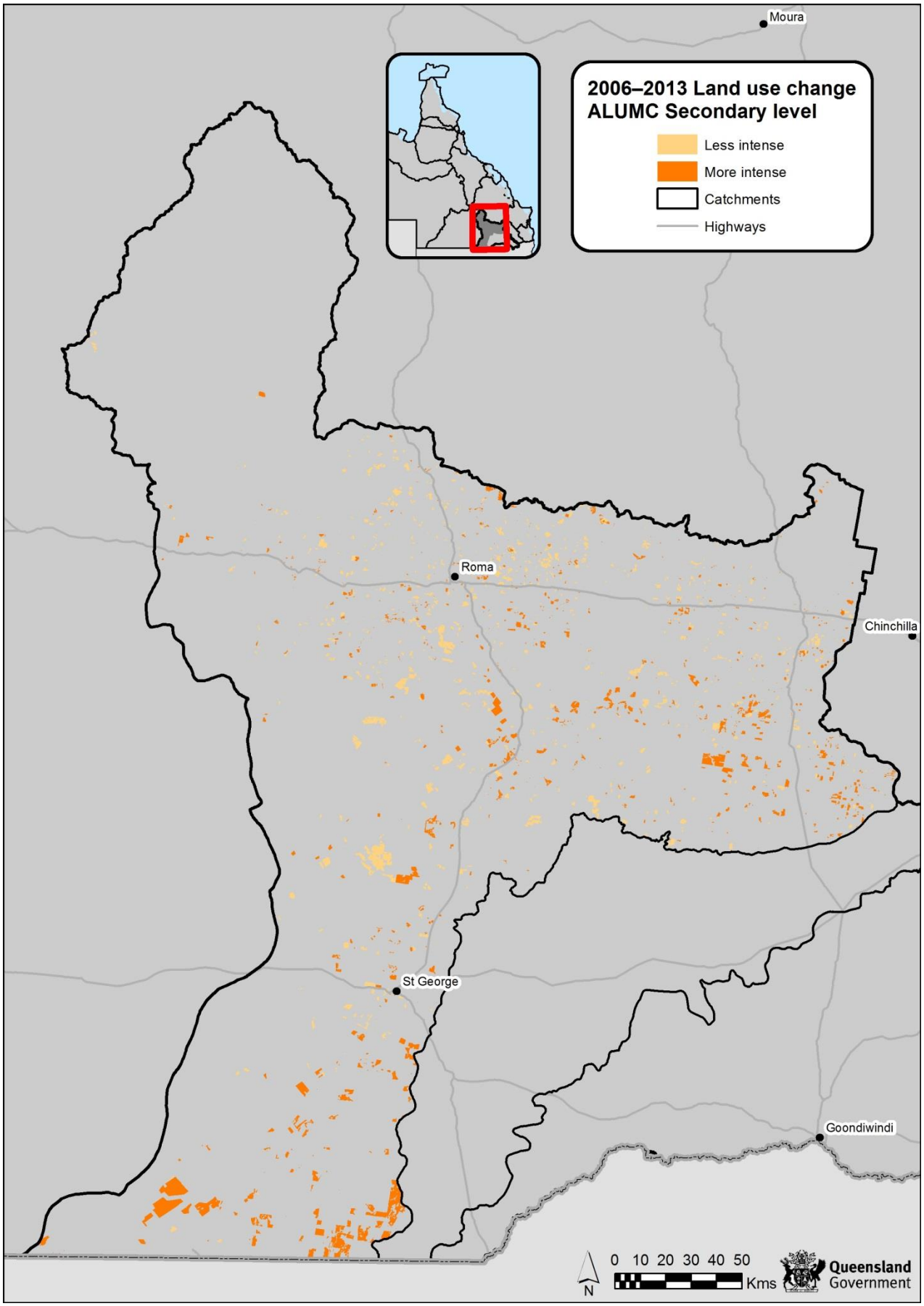

Figure 9: 2006–2013 land use change map at secondary level for the Maranoa and Balonne River catchments

Data format and availability

Download land use datasets

Use the Queensland Spatial Catalogue QSpatial to access land use data sets. Search for **"land use mapping"** in the search term field then refine your results by selecting the **“Planning Cadastre”** filter from the choose categories field. Metadata is also available from QSpatial.

The dataset comprises an ESRI vector geodatabase (10.2.2) at a nominal scale of 1:50,000. Within this are six feature classes: 1999 improved land use, 2006 improved land use, 2013 updated land use, 1999–2006 land use change layer, 2006–2013 land use change layer and 1999–2013 land use change layer. The feature classes are polygon datasets with attributes describing land use. Land use is classified according to the Australian Land Use and Management Classification (ALUMC) Version 7, May 2010. Note: a representation showing land use at secondary level is available when working within a geodatabase. Layer files are also available to present the land use mapping at primary, secondary or tertiary level.

Digital Data is supplied with a licence and by using the data you confirm that you have read the licence conditions included with the data and that you agree to be bound by its terms.

Request a land use map

It is possible to request a land use map from the QLUMP website based upon a specific location (Lot on Plan, Street address or Central latitude/longitude coordinates) in Queensland. The land use maps are emailed in portable document format (PDF).The maps present the most recent land use information available at the secondary level of the Australian Land Use and Management (ALUM) Classification.

View land use on the Queensland Globe

View the most recent Queensland land use information on the Queensland Globe. Use this application to browse spatial data in Queensland, including land use and up-to-date satellite imagery.

Land use is available for viewing within the Planning and Cadastre category globe.

Appendix A 1999–2013 Land use Change

For 1999–2013, the largest land use changes were observed from *grazing native vegetation* to *cropping* of 216,985ha (61% of all the total change mapped) and *cropping* to *grazing native vegetation* (74,982ha or 21%). A further 22,820ha (6%) of *grazing native vegetation* changed to *irrigated cropping – cotton*. Collectively, for 1999–2013 all the land use change to *cropping* accounts for 225,529ha or 63% of the total, and the land use change to *irrigated cropping* accounts for 30,277ha or 9% of the total. Some of this increase in cropping area has been offset in part by a reduction of *cropping* in other areas of the catchment, with collectively 76,518ha (21%) changing to *grazing native vegetation*.

Table 6: Summary statistics for land use change at secondary level for 1999–2013 in the Maranoa and Balonne River catchments (showing only the land use changes > 200ha)

Land use code 1999	Land use class 1999	Land use code 2013	Land use class 2013	Area (ha)	Area Change (%)	Total change (%)
2.1.0	Grazing native vegetation	3.3.0	Cropping	216,985	3.43	60.69
3.3.0	Cropping	2.1.0	Grazing native vegetation	74,982	1.18	21.07
2.1.0	Grazing native vegetation	4.3.6	Irrigated cropping – Cotton	22,820	0.36	6.41
2.1.0	Grazing native vegetation	3.3.6	Cropping – Cotton	7,191	0.11	2.02
2.1.0	Grazing native vegetation	6.2.0	Reservoir/dam	6,404	0.10	1.80
2.1.0	Grazing native vegetation	4.3.0	Irrigated cropping	3,639	0.06	1.02
1.1.0	Nature conservation	2.1.0	Grazing native vegetation	3,051	0.05	0.86
2.1.0	Grazing native vegetation	1.2.0	Managed resource protection	3,042	0.05	0.85
2.1.0	Grazing native vegetation	1.1.0	Nature conservation	2,729	0.04	0.77
3.3.0	Cropping	4.3.0	Irrigated cropping	1,464	0.02	0.41
4.3.0	Irrigated cropping	2.1.0	Grazing native vegetation	1,098	0.02	0.31
3.3.0	Cropping	4.3.6	Irrigated cropping – Cotton	1,080	0.02	0.30
2.1.0	Grazing native vegetation	5.8.0	Mining	954	0.02	0.27
4.3.0	Irrigated cropping	3.3.0	Cropping	946	0.01	0.27
4.3.0	Irrigated cropping	4.3.6	Irrigated cropping – Cotton	857	0.01	0.24
1.3.0	Other minimal use	5.4.0	Residential	815	0.01	0.23
3.2.0	Grazing modified pastures	2.1.0	Grazing native vegetation	801	0.01	0.23
2.1.0	Grazing native vegetation	3.2.0	Grazing modified pastures	755	0.01	0.21
2.1.0	Grazing native vegetation	6.4.0	Channel/aqueduct	577	0.01	0.16
2.1.0	Grazing native vegetation	2.2.0	Production forestry	564	0.01	0.16
2.1.0	Grazing native vegetation	5.4.0	Residential	473	0.01	0.13
2.1.0	Grazing native vegetation	5.6.0	Utilities	460	0.01	0.13
2.1.0	Grazing native vegetation	3.6.0	Land in transition	439	0.01	0.12
4.3.6	Irrigated cropping – Cotton	2.1.0	Grazing native vegetation	438	0.01	0.12
3.3.6	Cropping – Cotton	4.3.6	Irrigated cropping – Cotton	418	0.01	0.12
2.1.0	Grazing native vegetation	5.2.0	Intensive animal husbandry	302	<0.01	0.08
3.3.0	Cropping	5.6.0	Utilities	265	<0.01	0.07
3.2.0	Grazing modified pastures	3.3.0	Cropping	246	<0.01	0.07
2.1.0	Grazing native vegetation	4.4.0	Irrigated perennial horticulture	224	<0.01	0.06
Total				**355,949**	**5.62**	**100**

Figure 10 presents an analysis of the 1999–2013 land use change within the *grazing native vegetation* and *cropping* land use classes.

The largest proportion of land use change was from *grazing native vegetation* to *cropping* (216,985ha or 81% of the total change from *grazing native vegetation*), followed by 22,820ha (or 9%) changing to *irrigated cropping – cotton* (Figure 10a).

Figure 10b shows that the land use change from *cropping* was largely to *grazing native vegetation*—74,982ha or 96%.

Of all the land use change to *grazing native vegetation* 74,982ha or 93% of the total came from *cropping* (Figure 10c).

Almost all (99%) of the land use change to *cropping* came from *grazing native vegetation*—216,985ha (Figure 10d).

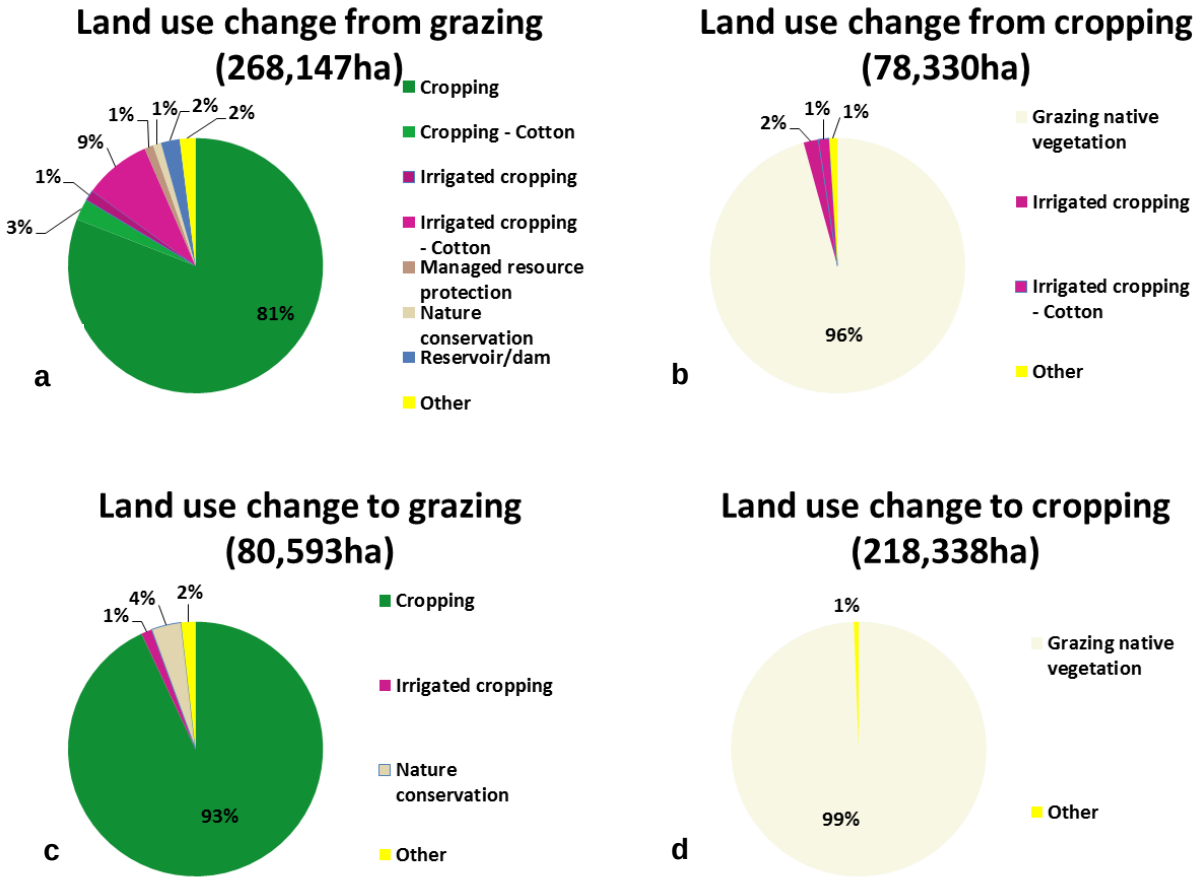

Figure 10: Charts (a–d) of 1999–2013 land use change within the grazing native vegetation and cropping land use classes

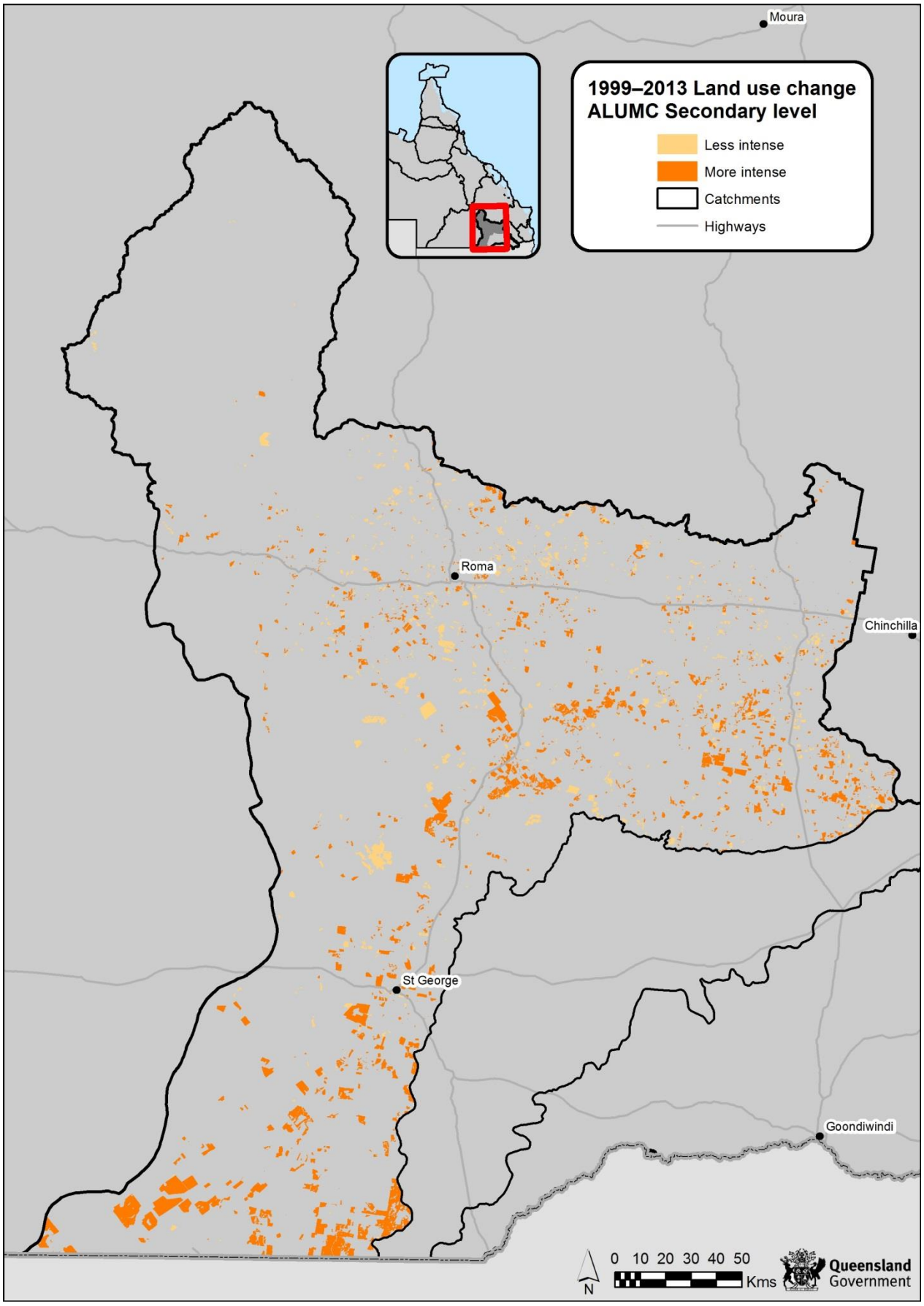

Figure 11: 1999–2013 land use change map at secondary level for the Maranoa and Balonne River catchments

Appendix B Accuracy assessment

The accuracy assessment provided reference data suitable for assessing the 2013 land use map. For each of the sample points, the true land use class was independently determined (this provided the reference data) based on desktop interpretation of the same imagery and ancillary datasets available to the mapper. These points were then compared to the mapped class (map data) and the information 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. However, the total accuracy may be misleading, particularly when a dominant class exists. 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 only marginally improved compared to 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 the user's accuracy of class A is estimated to be 0.84, then from a random sample of 100 points chosen from areas on the map in this class, approximately 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, approximately 84 would also be in class B according to the map. An accurate map should have both high user's and producer's accuracies.

The per-class estimates of accuracy are often not precise, as 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 may indicate a true misclassification problem rather than inadequacies in sample size.

Points that differ between the map and the reference data may be 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 is to assess the thematic accuracy of land use data. However, as described above, the separation of spatial and thematic errors may be difficult and were not undertaken. As a result, the accuracy assessment reflects properties of the land use data as a whole.

Note: the revised 1999 and 2006 land use and the land use change datasets were not accuracy assessed.

2013 land use dataset

The 2013 land use dataset was accuracy assessed with 396 points based on a random sampling strategy, using the map classes (area and frequency) as the strata. The stratified estimate of total accuracy is 0.97 (0.93, 0.98) and Kappa is 0.90 (0.81, 0.93). As the lower bound of the confidence interval for total accuracy is greater than 0.8, the mapping meets the ACLUMP specification.

Table 7 (page 28) shows the error matrix for the accuracy assessment of the 2013 land use data. For the majority of classes, the reference data agreed with the map data. For example, *residential and farm infrastructure* had 10 sample points identified. For 9 of those points, the map data was also *residential and farm infrastructure* and therefore correct. For one point the map data was incorrect, as the area was found to be *grazing native vegetation.*

The column ‘proportion’ in Table 7 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, *grazing modified pastures*, are removed from the total area before the proportions are calculated. This column will total 100%.

Table 8 (page 29) provides the user’s and producer’s accuracy for the 2013 Maranoa and Balonne River catchments land use dataset. This demonstrates the majority of land use classes in the catchment have been mapped accurately. The largest assessable land use class in this catchment is *grazing native vegetation* which has been mapped with very high user’s and producer’s accuracies of 0.991 and 0.993 respectively. The next largest class by area is *cropping* which also returned very high user’s and producer’s accuracies of 0.864 and 0.983. The error matrix (Table 7, page 28) provides more detail on the misclassifications.

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—an example being *managed resource protection.*

The user’s and producer’s accuracy results should be interpreted individually for their respective classes. It should be noted that the classes with a small area in proportion to the total 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. For example, the producer’s accuracy for *irrigated cropping* is 0.761; however, from the 95% interval (0.517, 0.923) it can be seen that more sample points would be required to confidently determine class accuracy.

Table 7: Error matrix for the Maranoa and Balonne River catchments 2013 land use dataset

		Reference data																										
	2013 land use class	**Nature conservation**	**Other conserved area**	**Managed resource protect.**	**Other minimal use**	**Grazing native vegetation**	**Production forestry**	**Cropping**	**Cropping – Cotton**	**Perennial horticulture**	**Land in transition**	**Irrigated cropping**	**Irrigated cropping - Cotton**	**Irrigated perennial hort.**	**Intensive animal husbandry**	**Manufacturing and industrial**	**Residential & farm infras.**	**Services**	**Utilities**	**Transport & communications**	**Mining**	**Waste treatment & disposal**	**Lake**	**Reservoir/dam**	**River**	**Channel/aqueduct**	**Marsh/wetland**	**Total**	**Proportion (%)**
Map data	**Nature conservation**	**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	14	1.03
	Other conserved area	0	**0**	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.44
	Managed resource protection	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.05
	Other minimal use	0	0	0	**6**	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	10	0.09
	Grazing native vegetation	0	0	0	0	**70**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	81.43
	Production forestry	0	0	0	0	0	**20**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	4.89
	Cropping	0	0	0	1	2	0	**61**	0	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	9.25
	Cropping – Cotton	0	0	0	0	0	0	5	**0**	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0.17
	Perennial horticulture	0	0	0	0	0	0	2	0	**0**	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.01
	Land in transition	0	0	0	0	0	0	0	0	0	**5**	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0.01
	Irrigated cropping	0	0	0	0	0	0	0	0	0	0	**12**	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0.24
	Irrigated cropping - Cotton	0	0	0	0	0	0	0	0	0	0	0	**14**	0	0	0	0	0	0	0	0	0	0	0	0	1	0	15	1.28
	Irrigated perennial horticulture	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	10	0.01
	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	10	0.01
	Manufacturing and industrial	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**9**	0	0	0	0	0	0	0	0	0	0	0	10	0.01
	Residential & farm infrastructure	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**9**	0	0	0	0	0	0	0	0	0	0	10	0.11
	Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0	0	0	1	0	0	0	0	10	0.04
	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	10	0.01
	Transport and communications	0	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	10	0.01
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**10**	0	0	0	0	0	0	10	0.03
	Waste treatment and disposal	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**7**	0	0	0	0	0	10	<0.01
	Lake	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	0	0	0	0	10	0.02
	Reservoir/dam	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**28**	0	1	1	30	0.69
	River	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**7**	0	3	10	0.05
	Channel/aqueduct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**10**	0	10	0.04
	Marsh/wetland	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**8**	10	0.05
	Total	**14**	**0**	**1**	**8**	**83**	**20**	**67**	**0**	**0**	**5**	**19**	**23**	**11**	**10**	**9**	**9**	**9**	**10**	**10**	**10**	**7**	**10**	**28**	**7**	**12**	**13**	**396**	**100**

Table 8: User's and producer's accuracy for the Maranoa and Balonne River catchments 2013 land use dataset

Class	User's			Producer's		
	Estimate	95% interval		Estimate	95% interval	
Nature conservation	0.956	0.771	0.998	0.988	0.623	1.000
Other conserved area	NA	NA	NA	NA	NA	NA
Managed resource protection	NA	NA	NA	NA	NA	NA
Other minimal use	0.548	0.262	0.814	0.264	0.051	0.816
Grazing native vegetation	0.991	0.950	1.000	0.993	0.987	0.998
Production forestry	0.967	0.830	0.999	0.998	0.908	1.000
Cropping	0.864	0.772	0.929	0.983	0.921	0.992
Cropping – Cotton	0.000	0.000	0.066	0.000	0.000	0.734
Perennial horticulture	0.000	0.000	0.111	0.000	0.000	0.089
Land in transition	0.453	0.185	0.736	0.187	0.005	0.938
Irrigated cropping	0.761	0.517	0.923	0.399	0.149	0.790
Irrigated cropping – Cotton	0.894	0.690	0.985	0.647	0.438	0.818
Irrigated perennial horticulture	0.936	0.699	0.998	0.369	0.015	0.905
Intensive animal husbandry	0.940	0.706	0.998	0.380	0.015	0.976
Manufacturing and industrial	0.843	0.558	0.976	0.385	0.014	0.978
Residential & farm infrastructure	0.844	0.560	0.975	0.869	0.132	0.998
Services	0.835	0.549	0.975	0.722	0.057	0.995
Utilities	0.936	0.711	0.998	0.464	0.020	0.985
Transport and communications	0.936	0.700	0.997	0.432	0.021	0.979
Mining	0.934	0.699	0.998	0.604	0.036	0.992
Waste treatment and disposal	0.653	0.351	0.885	0.133	0.004	0.910
Lake	0.840	0.551	0.976	0.510	0.033	0.928
Reservoir/dam	0.914	0.784	0.978	0.979	0.489	1.000
River	0.646	0.355	0.878	0.689	0.050	0.994
Channel/aqueduct	0.936	0.698	0.998	0.236	0.050	0.637
Marsh/wetland	0.747	0.450	0.933	0.347	0.056	0.647