Department of Science, Information Technology and Innovation

Land use Summary 1999–2013

for the Cape York NRM region

including the 2013 Land use Summary for the Torres Strait Islands NRM region

Queensland Government

Prepared by

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Report updated in July 2016 to correct figures reporting the net land use changes, p. 8.

Cover photo: Cape York Peninsula, by Fabian Vaca © 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.

June 2015

Contents

List of tables

List of figures

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 Cape York and Torres Strait Islands NRM regions to 2013. This report presents and summarises land use mapping including:

- revised 1999 land use dataset including improvements and corrections to the original baseline for Cape York NRM region
- 2013 land use dataset
- land use change dataset from 1999–2013 for Cape York NRM region
- 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 baseline land use dataset formed the basis for the 2013 land use dataset. The 1999 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 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 period 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 is also undertaken to verify areas of uncertainty.

The Torres Strait Islands mapping was based on ancillary data provided by the Land and Sea Management Unit from Torres Strait Regional Authority. Verification of this data was dependent on the availability of current imagery. As such, areas without any available imagery may have introduced errors and omissions, specifically the Masig, Mer and Erub Islands.

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.

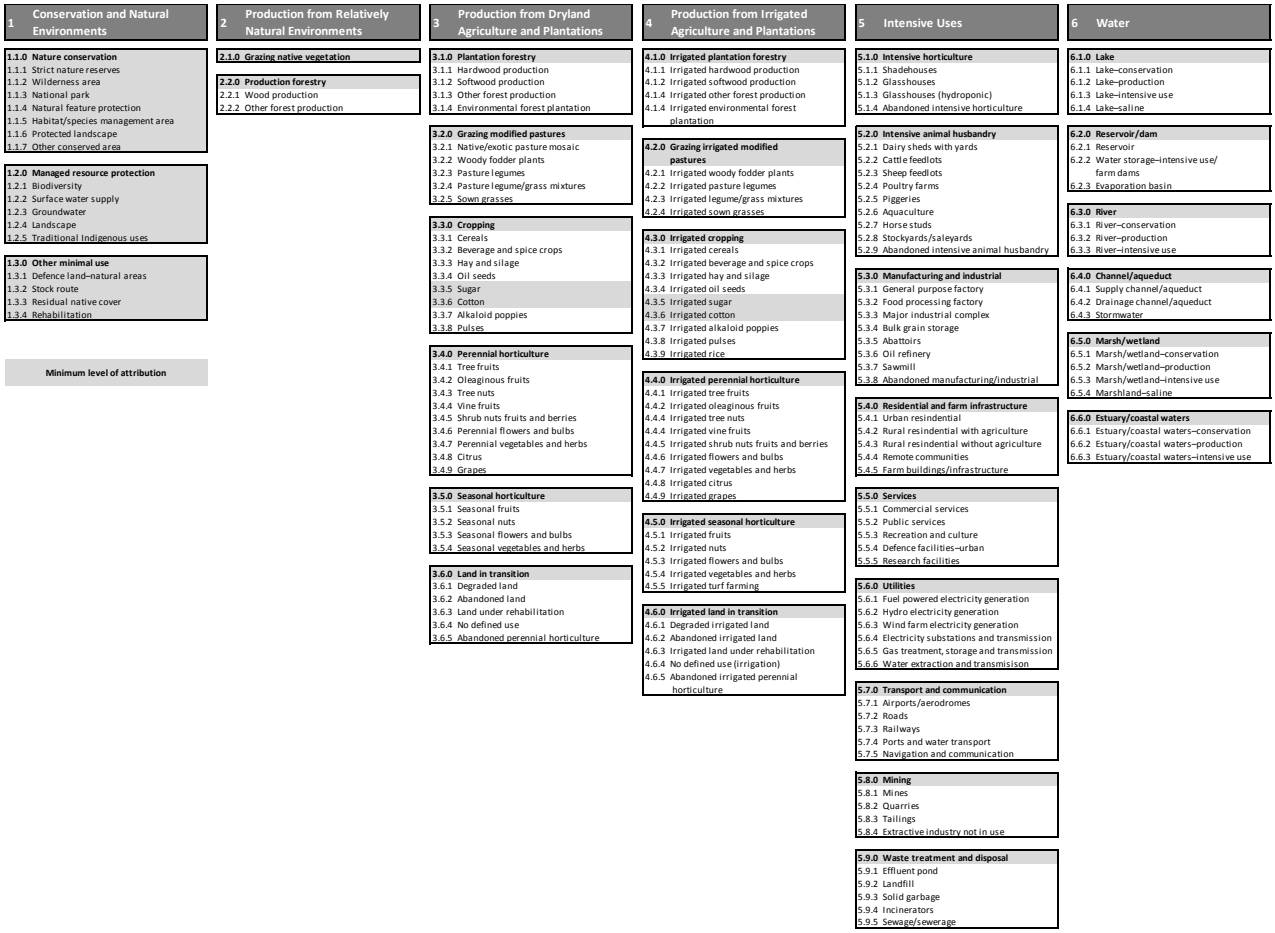

Figure 1: Australian Land Use and Management (ALUM) classification, Version 7

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*

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.

Field observations together with personal communication with NRM regional staff have confirmed that livestock grazing occurs within some of the *'conservation'* land use classes, specifically Nature Refuges—which are mapped within the *managed resource protection* and *traditional indigenous uses*. QLUMP map the primary land use and as such the conservation and indigenous status respectively for each of these land use classes takes precedence. This may therefore contribute to an under-estimation of grazing land uses in the Cape York NRM region.

The mapping of the *traditional indigenous uses* class relied on numerous ancillary datasets including: QVAS (valuation information), Indigenous Land Use Agreements and the National Tenancy Database Register. Parcels of land where the title is held by an Aboriginal Land Trust were mapped to the *traditional indigenous uses* class. In the absence of valuation information and also where image interpretation failed to specifically identify a land use these areas were also mapped to the *traditional indigenous uses* class.

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) as well as water entitlement (irrigation licences) information 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 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 the 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.

The *remote communities* land use class was derived from the Australian Standard Geographical Classification — Remoteness Areas (ASGC-RA) locator. According to the ASGC-RA, the distinction between remote communities and other residential classes is based on the amount of residences and proximity to main urban centres (goods and services) based on population size. Some of the areas mapped as *remote communities* are likely to have large number of residences however were attributed to this class based entirely in their geographical remoteness, including the towns of Bamaga, Laura and all populated places within the Torres Strait Islands.

A combination of the Queensland Herbarium's wetlands and regional ecosystem datasets provided the basis for mapping *marsh/wetlands*, *lakes*, *rivers* and *reservoir/dams*. Due to the vast and expansive nature of wetlands in north Queensland the Queensland Wetland Data Version 3.0 dataset provided additional input data. 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 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*.

Products

1999 and 2013 land use datasets

Land use datasets for the **Cape York NRM region** are presented at the secondary level of the ALUM classification (Figure 1 page 5) in:

- 1999 land use dataset — Figure 3 (page 9),
- 2013 land use dataset — Figure 4 (page 11)

Summary statistics for each are presented in:

- 1999 land use — Table 1 (page 10)
- 2013 land use — Table 2 (page 12)

Land use datasets for the **Torres Strait Islands NRM region** are presented at the secondary level of the ALUM classification (Figure 1 page 5) in:

- 2013 land use dataset — Figure 5 (page 13)

Summary statistics for each are presented in:

- 2013 land use — Table 3 (page 14)

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

Cape York NRM Region

Table 2 (page 12) shows that *grazing native vegetation* (43%) and *managed resource protection* (35%) were the major land use classes for 2013 in the Cape York NRM region. The *nature conservation* land use class accounts for a further 18%, leaving the remainder (4%) accounted for in all other land uses.

Analysis of the overall (net) land use change relative to the updated land use mapping for 1999–2013 for the primary land use classes shows that: (Tables 1 and 2, pages 10 and 12)

- *Conservation and natural environments* increased by 48% or 2,351,403ha
- *Production from relatively natural environments* decreased by 29% or 2,363,544ha
- *Production from dryland agriculture and plantations* increased by 78% or 4,482ha
- *Production from irrigated agricultural and plantations* increased by 148% or 2,080ha
- *Intensive uses* increased by 37% or 8,030ha

Figure 2 presents the overall (net) changes in land use within the Cape York NRM region by primary land use class. The graph shows the net reduction or gain for 1999–2013. Note that the series sums to zero.

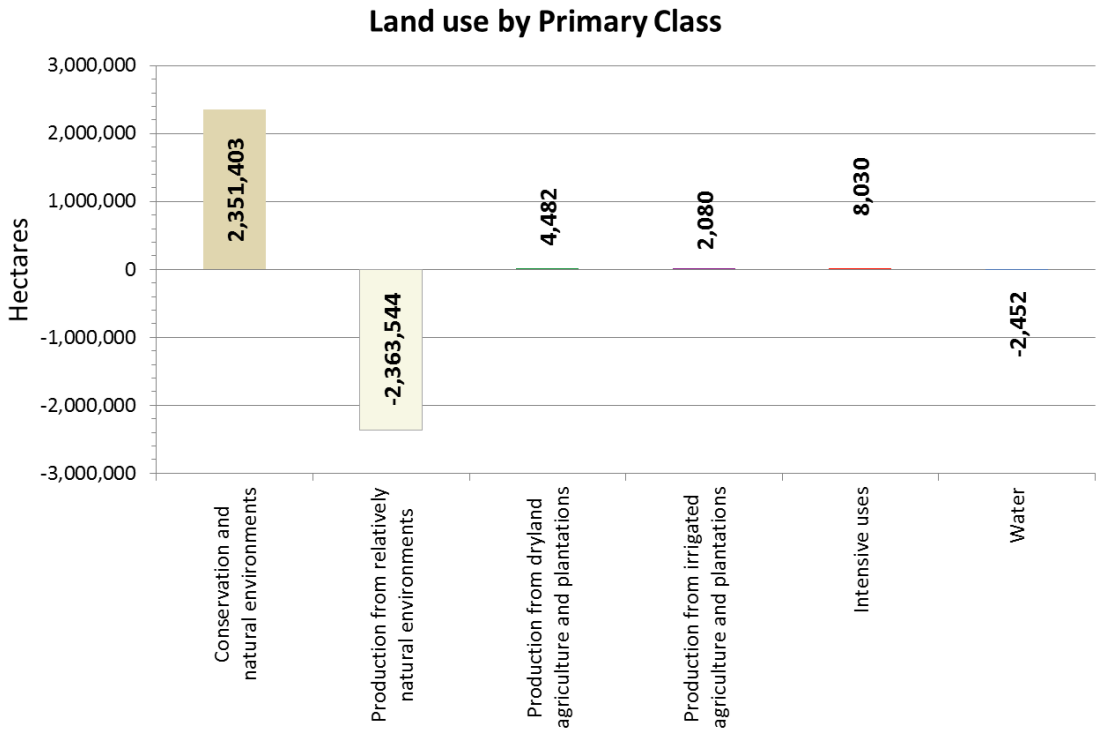

Figure 2: Net land use change by primary class (1999–2013) in the Cape York NRM region

At the secondary level of the classification, the *nature conservation* and *managed resource protection* land use classes both increased, by 60% (905,413ha) and 45% (1,477,925ha) respectively for 1999–2013.

The *grazing native vegetation* secondary land use class showed a large reduction of 28% (2,305,814ha) for 1999–2013.

The *land in transition* class (generally associated with mining activity) increased by 767% (3,928h) while *mining* also increased by 79% (7,911ha) for 1999–2013.

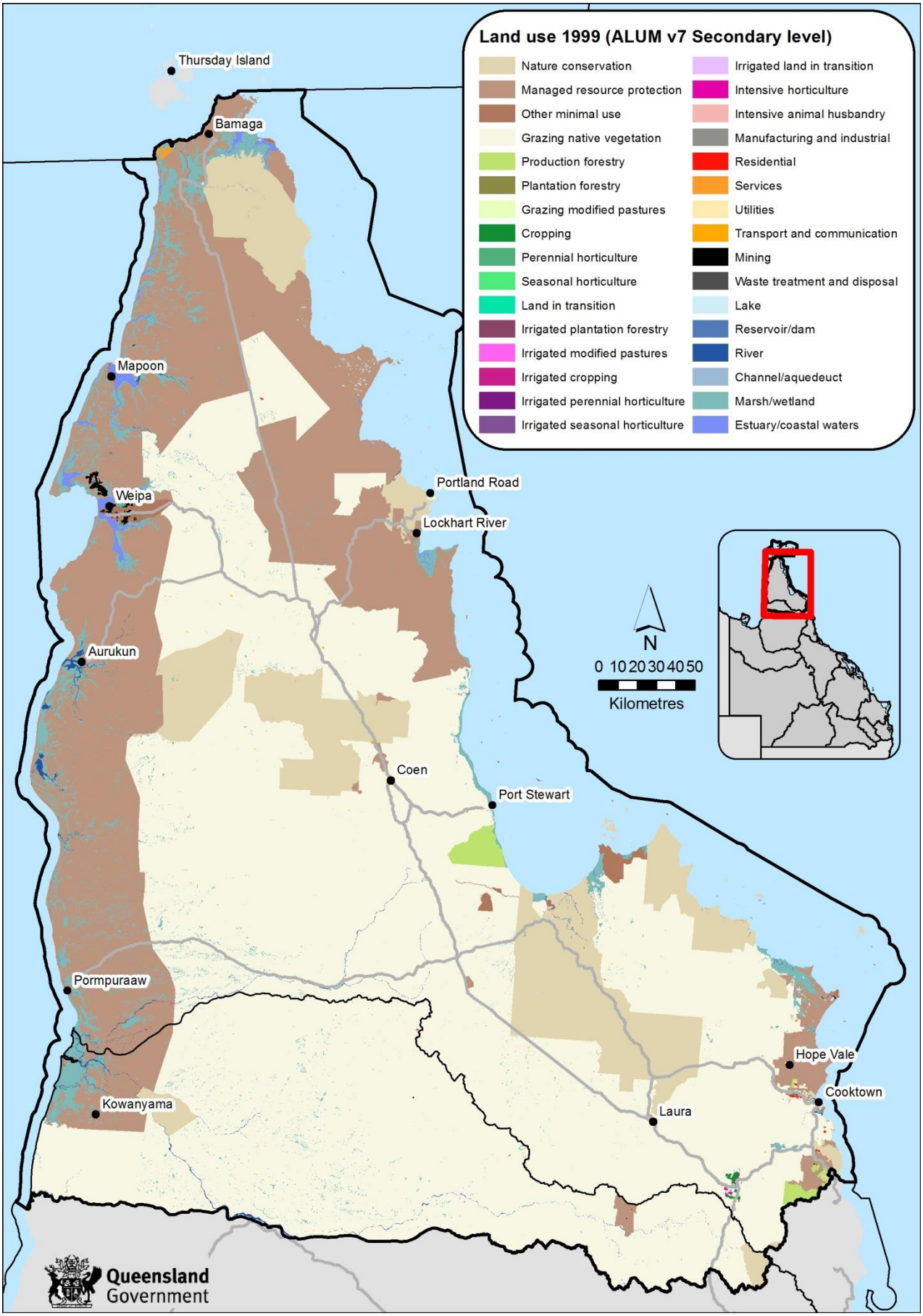

Figure 3: 1999 land use map for the Cape York NRM Region

Table 1: Summary statistics of land use in 1999 in the Cape York NRM Region

Land use code	Land use class	Area (ha)	Area %
1	Conservation and natural environments	4,851,577	35.41
1.1	Nature conservation	1,516,263	11.07
1.2	Managed resource protection[1]	3,273,860	23.90
1.3	Other minimal use	61,454	0.45
2	Production from relatively natural environments	8,224,140	60.03
2.1	Grazing native vegetation[2]	8,164,381	59.60
2.2	Production forestry	59,759	0.44
3	Production from dryland agriculture and plantations	5,742	0.04
3.2	Grazing modified pastures[3]	203	<0.01
3.3	Cropping	4,913	0.04
3.4	Perennial horticulture	80	<0.01
3.5	Seasonal horticulture	33	<0.01
3.6	Land in transition	512	<0.01
4	Production from irrigated agriculture and plantations	1,404	0.01
4.2	Irrigated grazing modified pastures[3]	105	<0.01
4.3	Irrigated cropping	1,075	0.01
4.4	Irrigated perennial horticulture	224	<0.01
5	Intensive uses	21,563	0.16
5.1	Intensive horticulture	7	<0.01
5.2	Intensive animal husbandry	133	<0.01
5.3	Manufacturing and industrial	116	<0.01
5.4	Residential and farm infrastructure	4,191	0.03
5.5	Services	4,836	0.04
5.6	Utilities	36	<0.01
5.7	Transport and communication	2,081	0.02
5.8	Mining	10,013	0.07
5.9	Waste treatment and disposal	148	<0.01
6	Water	595,084	4.34
6.1	Lake	5,179	0.04
6.2	Reservoir/dam	1,439	0.01
6.3	River	43,067	0.31
6.4	Channel/aqueduct	3	<0.01
6.5	Marsh/wetland	492,560	3.60
6.6	Estuary/coastal waters	52,838	0.39
	Grand Total	**13,699,510**	**100.00**

[1]*managed resource protection* includes Nature Refuges; and at the tertiary level the *traditional indigenous uses* land use class. Both of these are known to be (at times) grazed.

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

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

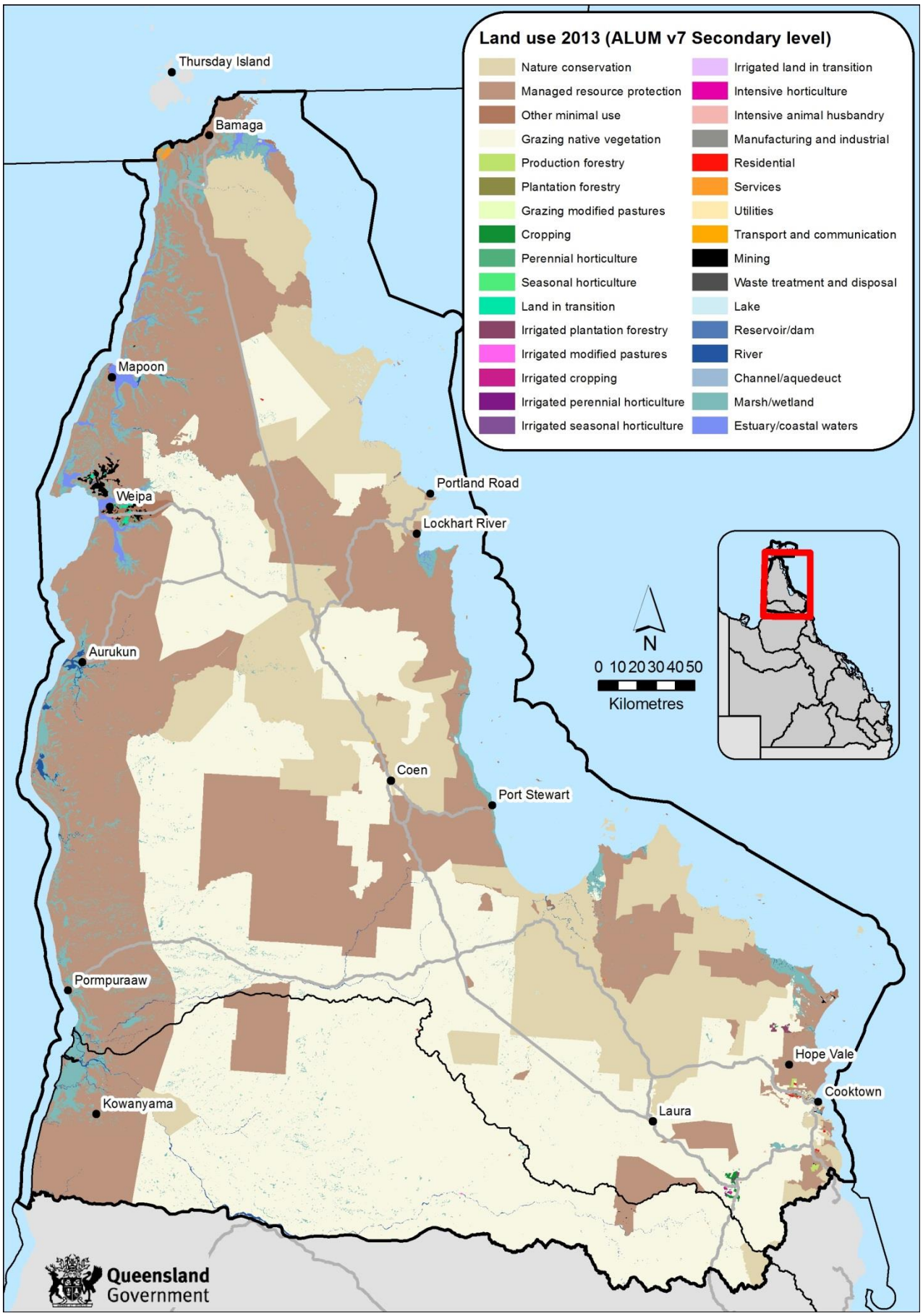

Figure 4: 2013 land use map for the Cape York NRM Region

Table 2: Summary statistics of land use in 2013 in the Cape York NRM Region

Land use code	Land use class	Area (ha)	Area %
1	Conservation and natural environments	7,202,980	52.58
1.1	Nature conservation	2,421,676	17.68
1.2	Managed resource protection[1]	4,751,785	34.69
1.3	Other minimal use	29,519	0.22
2	Production from relatively natural environments	5,860,596	42.78
2.1	Grazing native vegetation[2]	5,858,568	42.76
2.2	Production forestry	2,029	0.01
3	Production from dryland agriculture and plantations	10,224	0.07
3.1	Plantation forestry	104	<0.01
3.2	Grazing modified pastures[3]	203	<0.01
3.3	Cropping	5,268	0.04
3.4	Perennial horticulture	176	<0.01
3.5	Seasonal horticulture	33	<0.01
3.6	Land in transition	4,440	0.03
4	Production from irrigated agriculture and plantations	3,483	0.03
4.1	Irrigated plantation forestry	2,050	0.01
4.2	Irrigated grazing modified pastures[3]	105	<0.01
4.3	Irrigated cropping	844	0.01
4.4	Irrigated perennial horticulture	485	<0.01
5	Intensive uses	29,593	0.22
5.1	Intensive horticulture	7	<0.01
5.2	Intensive animal husbandry	133	<0.01
5.3	Manufacturing and industrial	116	<0.01
5.4	Residential and farm infrastructure	4,252	0.03
5.5	Services	4,838	0.04
5.6	Utilities	36	<0.01
5.7	Transport and communication	2,129	0.02
5.8	Mining	17,924	0.13
5.9	Waste treatment and disposal	157	<0.01
6	Water	592,633	4.33
6.1	Lake	5,179	0.04
6.2	Reservoir/dam	1,425	0.01
6.3	River	43,067	0.31
6.5	Marsh/wetland	490,124	3.58
6.6	Estuary/coastal waters	52,838	0.39
	Grand Total	**13,699,510**	**100.00**

[1]*managed resource protection* includes Nature Refuges; and at the tertiary level the *traditional indigenous uses* land use class. Both of these are known to be (at times) grazed.

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

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

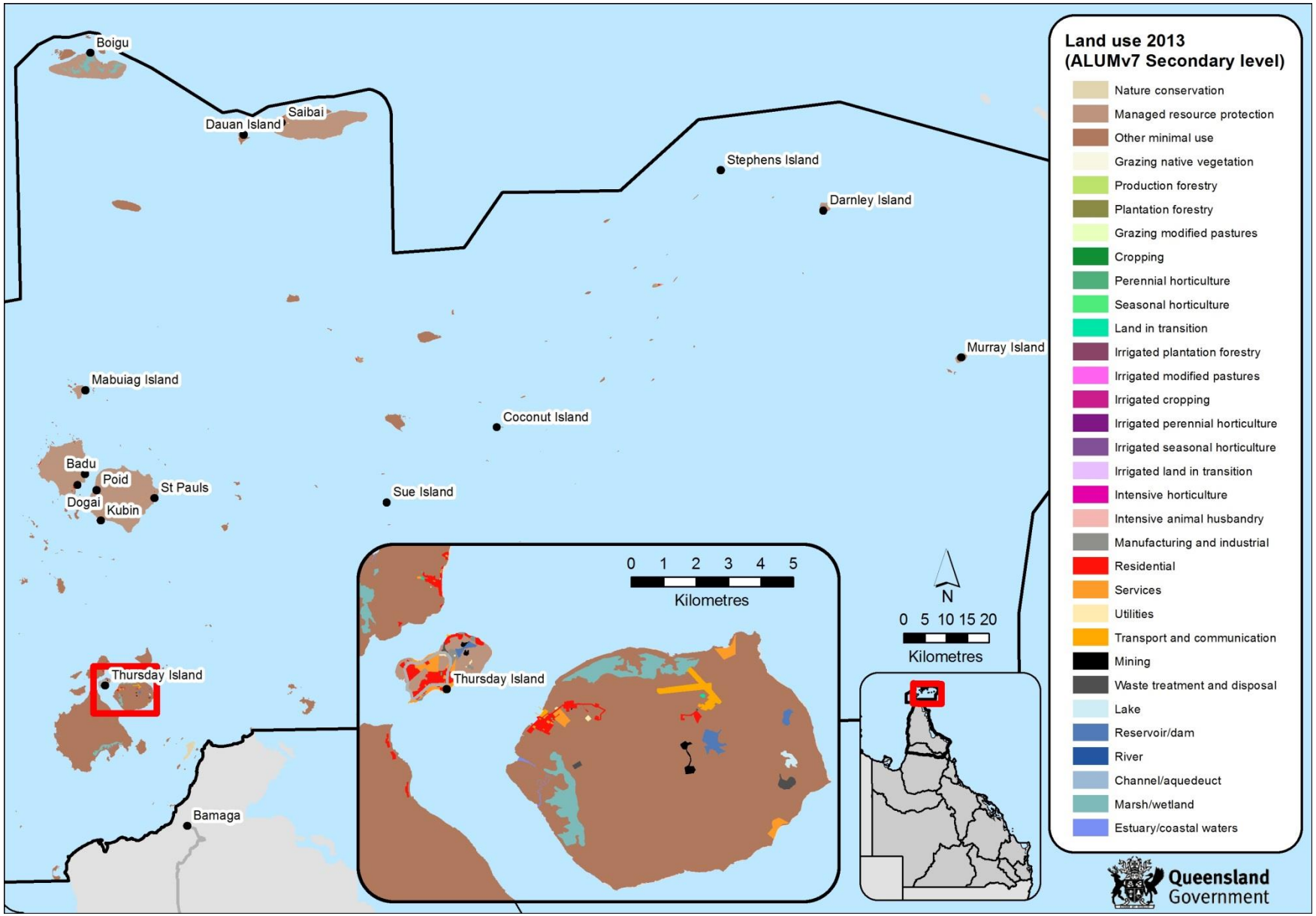

Figure 5: 2013 land use map for the Torres Strait Islands NRM Region

Torres Strait Islands NRM Region

Table 3 shows that *managed resource protection* (52%) and *other minimal use* (44%) are the major land use classes for 2013 in the Torres Strait Islands.

Table 3: Summary statistics of land use in 2013 in the Torres Strait Islands NRM Region

Land use code	Land use class	Area (ha)	Area %
1	Conservation and natural environments	83,134	96.08
1.1	Nature conservation	517	0.60
1.2	Managed resource protection	44,976	51.98
1.3	Other minimal use	37,642	43.50
3	Production from dryland agriculture and plantations	9	0.01
3.4	Perennial horticulture	2	<0.01
3.6	Land in transition	8	0.01
5	Intensive uses	1,123	1.30
5.2	Intensive animal husbandry	28	0.03
5.3	Manufacturing and industrial	40	0.05
5.4	Residential and farm infrastructure	516	0.60
5.5	Services	193	0.22
5.6	Utilities	44	0.05
5.7	Transport and communication	226	0.26
5.8	Mining	23	0.03
5.9	Waste treatment and disposal	53	0.06
6	Water	2,259	2.61
6.1	Lake	14	0.02
6.2	Reservoir/dam	55	0.06
6.5	Marsh/wetland	2,088	2.41
6.6	Estuary/coastal waters	104	0.12
	Grand Total	**86,526**	**100.00**

Land use change for Cape York NRM region (1999–2013)

Figure 7 (page 18) shows the land use change dataset for the Cape York NRM region. 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 has been compiled for 1999–2013. At the secondary level of the ALUM classification, the total area of land use change is 2,842,164ha (21% of the catchment). Of this 100,104ha (4% of the total change) is mapped as an increase in land use intensity, whilst 2,742,060ha (96%) is a decrease.

Summary statistics presenting the land use change at the secondary level for 1999–2013 is presented in Table 4.

Table 4: Summary statistics for land use change at secondary level for 1999–2013 in the Cape York NRM region (showing only the land use changes > 50ha)

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	1.2.0	Managed resource protection	1,679,443	12.26	59.09
2.1.0	Grazing native vegetation	1.1.0	Nature conservation	624,043	4.56	21.96
1.2.0	Managed resource protection	1.1.0	Nature conservation	347,264	2.53	12.22
1.1.0	Nature conservation	1.2.0	Managed resource protection	84,695	0.62	2.98
2.2.0	Production forestry	1.2.0	Managed resource protection	41,006	0.30	1.44
1.3.0	Other minimal use	1.2.0	Managed resource protection	27,486	0.20	0.97
2.2.0	Production forestry	1.1.0	Nature conservation	16,724	0.12	0.59
1.2.0	Managed resource protection	5.8.0	Mining	7,147	0.05	0.25
1.3.0	Other minimal use	5.8.0	Mining	4,028	0.03	0.14
5.8.0	Mining	3.6.0	Land in transition	3,369	0.02	0.12
6.5.0	Marsh/Wetland	1.1.0	Nature conservation	2,505	0.02	0.09
2.1.0	Grazing native vegetation	4.1.0	Irrigated plantation forestry	2,050	0.01	0.07
2.1.0	Grazing native vegetation	3.3.0	Cropping	461	<0.01	0.02
1.1.0	Nature conservation	2.1.0	Grazing native vegetation	373	<0.01	0.01
1.3.0	Other minimal use	3.6.0	Land in transition	333	<0.01	0.01
1.2.0	Managed resource protection	3.6.0	Land in transition	210	<0.01	0.01
4.3.0	Irrigated cropping	4.4.0	Irrigated perennial horticulture	163	<0.01	0.01
4.3.0	Irrigated cropping	3.1.0	Plantation forestry	104	<0.01	<0.01
2.1.0	Grazing native vegetation	5.8.0	Mining	81	<0.01	<0.01
3.3.0	Cropping	4.4.0	Irrigated perennial horticulture	79	<0.01	<0.01
1.1.0	Nature conservation	6.5.0	Marsh/wetland	66	<0.01	<0.01
2.1.0	Grazing native vegetation	3.4.0	Perennial horticulture	62	<0.01	<0.01
2.1.0	Grazing native vegetation	5.7.0	Transport and communication	53	<0.01	<0.01
Total				**2,842,164**	**20.75**	**100**

Figure 6 (page 17) presents the largest fluxes of land use change observed from 1999–2013 in the Cape York NRM region.

Collectively, all the land use change from the *grazing native vegetation* (Figure 6–a) land use class was 2,306,242ha or 81% of the total. Of this, 1,679,443ha (73%) went to the *managed resource protection* land use class—primarily in response to the many new Nature Refuges which have been established in Cape York, including: Holroyd River, Strathburn Cattle Station, Harkness, Rutland Plains, Astrea, and the Steve Irwin Wildlife Reserve. Almost all of the remaining land use change from *grazing native vegetation* land use class was to *nature conservation*. This consisted of the establishment of many new and expansion of existing National Parks in Cape York including: Jack River, Cape Melville, Alwal, Lama Lama and Kulla.

Analysis of the *managed resource protection* (Figure 6–b) land use class showed the majority of the land use change was to *nature conservation* (347,264ha or 98%). Analysis at the tertiary level showed that 280,736ha was mapped as *other conservation area*—this relates to a large parcel of land in the Cook Shire now set aside as an 'environmental purposes reserve'.

The land use changes observed to the *managed resource protection* (Figure 6–c) land use class were predominantly from *grazing native vegetation* (1,679,443ha or 92%). Of this 71% (1,194,044ha) was the result of the Nature Refuges, and 29% (485,399ha) was mapped as *traditional indigenous uses.* The largest of which were the Kulla Land Trust, Kalpower Aboriginal Land Trust, Ngulun Land Trust, Agayrra-Timara Land Trust, and Wulburjubur Bama Land Trust.

Also of interest is the land use change from *nature conservation* of some 84,695ha (5%)—relating to the Mungkan Kandju National Park which existed in 1999 and has since (in-part) become the Oyala Thumotang National Park. This land use change was also included 51,169ha which changed to *traditional indigenous uses* (Oyala Thumotang Land Trust) and 33,526ha which changed to *managed resource protection* (Yuukingga Nature Refuge)—each of which are shown in the land use change map (Figure 7, page 18) as the large area east of Aurukun of 'more intense' land use.

Analysis of the land use change to *nature conservation* (Figure 6–d) shows 63% (624,043ha) came from *grazing native vegetation.* Of this 459,914ha (74%) was to the *National Park* tertiary land use class, and the remainder of 164,128ha (26%) as *other conserved area*—which is a parcel of land now under management by the Australian Wildlife Conservancy.

Interestingly the establishment of new horticulture ventures throughout the Cape York NRM is reflected in the land use change from both *irrigated cropping* (163ha) and *cropping* (79ha) to the *irrigated perennial horticulture* land use class*.* The majority of which are banana plantations, in and around Lakeland.

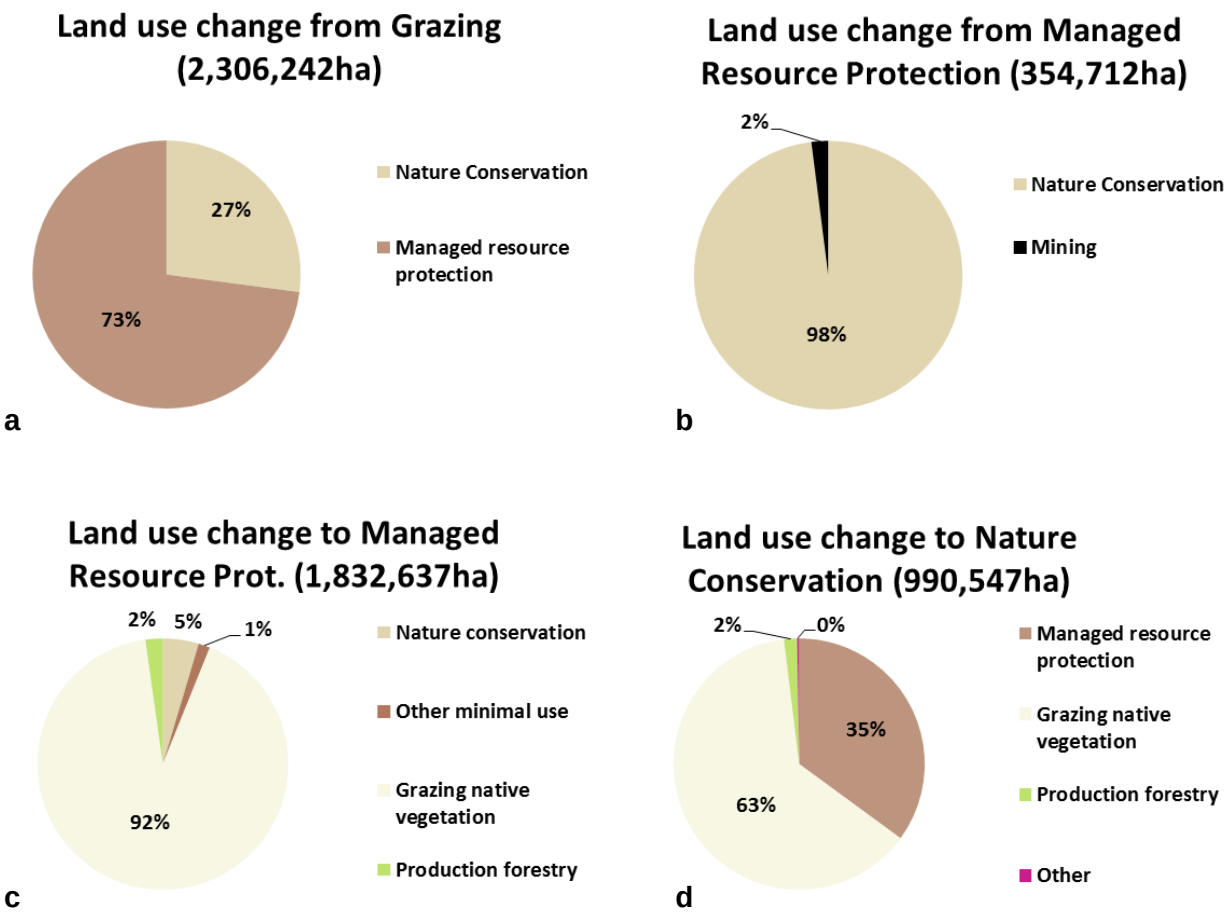

Figure 6: Charts (a–d) of the major 1999–2013 land use changes within the Cape York NRM region

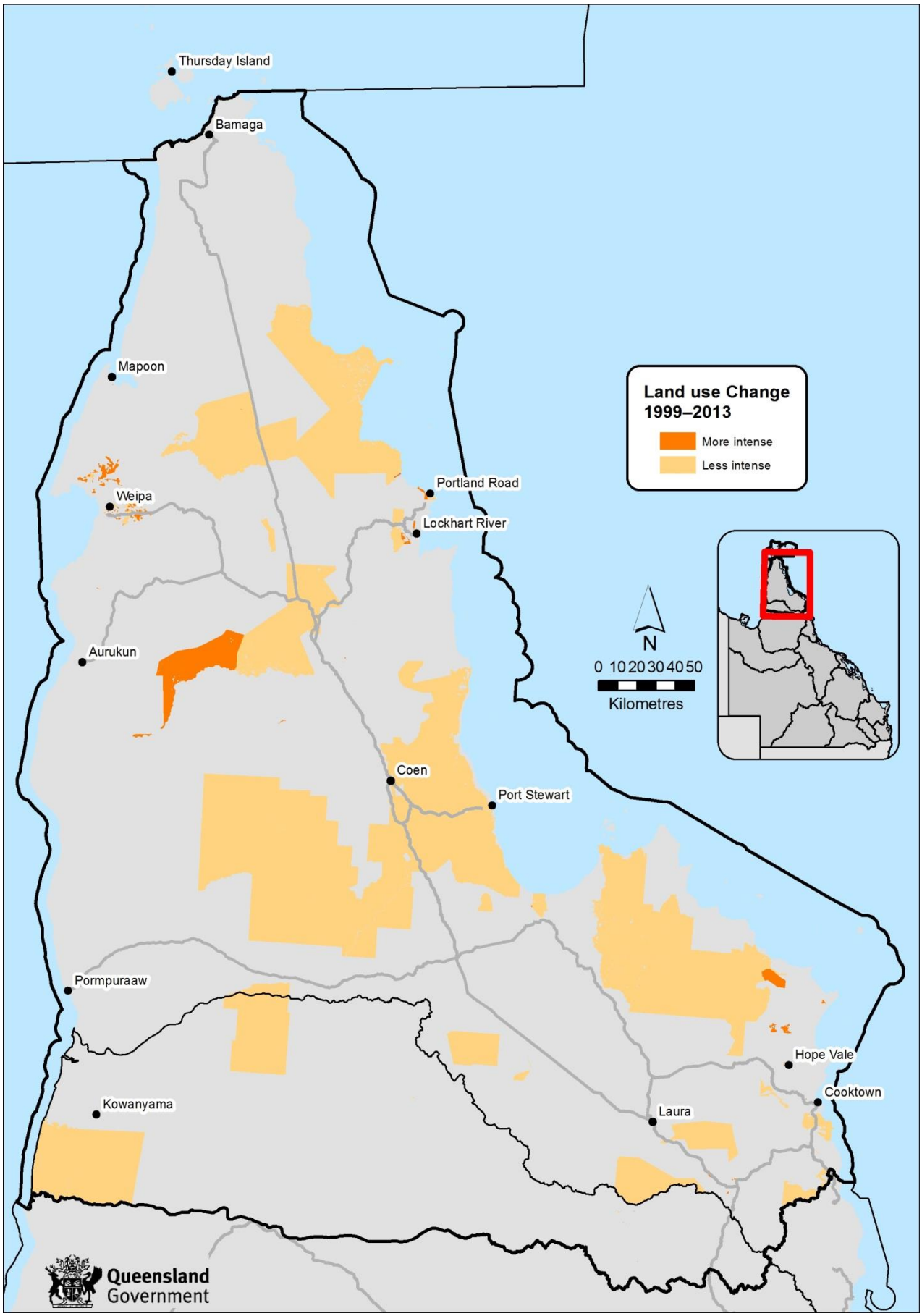

Figure 7: 1999–2013 land use change within the Cape York NRM region

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, after restricting your search to **“cadastral and land planning”** in the categories field. Metadata is also available from QSpatial: http://qld.spatial.information.qld.gov.au

The dataset comprises an ESRI vector geodatabase at a nominal scale of 1:50,000. Within this are five feature classes: 1999 improved land use for Cape York, 2013 updated land use for Cape York and Torres Strait, a combined 2013 land use layer for both and a 1999–2013 land use change layer for Cape York. 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.

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.

Updated data available at QSpatial.

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 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 summarised using an 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 land use and the land use change datasets were not accuracy assessed.

2013 land use dataset

The 2013 land use dataset for Cape York and Torres Strait Islands NRM regions 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 0.94 (0.88, 0.96) and Kappa is 0.91 (0.83, 0.95). As the lower bound of the confidence interval for total accuracy is greater than 0.8, the mapping meets the ACLUMP specification.

Table 5 (page 22) 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, *marsh/wetland* had 69 sample points identified. For 55 of those points, the map data was also *marsh/wetland* and therefore correct. For fourteen points the map data was incorrect, with ten points found to be *grazing native vegetation* and three points were found to be *managed resource protection* and for a single point *other minimal use*. The misclassification in this case is likely to be related to the difficulty in separating areas of *marsh/wetlands* from the surrounding land uses. The appearance of these can be highly variable and classification may therefore not be consistent.

The column ‘proportion’ in Table 5 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, *production forestry*, are removed from the total area before the proportions are calculated. This column will total 100%.

Table 6 (page 23) provides the user’s and producer’s accuracy for the 2013 Cape York and Torres Strait Islands NRM regions 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 0.969 and 0.930 respectively. The next largest class by area is *managed resource protection* which also returned very high user’s and producer’s accuracies of 0.949 and 0.995. The error matrix (Table 5, page 22) 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. Examples are *production forestry* and *plantation forestry.*

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 *reservoir/dam* is 0.326; however, from the 95% interval (0.005, 0.978) it can be seen that more sample points would be required to confidently determine class accuracy.

Table 5: Error matrix for the Cape York and Torres Strait Islands NRM regions 2013 land use dataset

Reference data																													
Map data	**2013 land use class**	Nature conservation	Other conserved area	Managed resource protect.	Other minimal use	Grazing native vegetation	Production forestry	Plantation forestry	Cropping	Perennial horticulture	Seasonal horticulture	Land in transition	Irrigated plantation forestry	Irrigated cropping	Irrigated perennial hort.	Intensive animal husbandry	Manufacturing and industrial	Residential & farm infras.	Services	Utilities	Transport & communications	Mining	Waste treatment & disposal	Lake	Reservoir/dam	River	Marsh/Wetland	Estuary/coastal waters	Total	Proportion (%)
	Nature conservation	**61**	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	61	14.33
	Other conserved area	0	**5**	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	3.23
	Managed resource protection	0	0	**67**	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	34.79
	Other minimal use	0	0	0	**9**	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	13	0.49
	Grazing native vegetation	0	0	0	0	**21**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	42.50
	Production forestry	0	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	0.01
	Plantation forestry	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	0	1	<0.01
	Cropping	0	0	0	0	0	0	5	**1**	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	7	0.04
	Perennial horticulture	0	0	0	1	2	0	0	0	**6**	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10	<0.01
	Seasonal horticulture	0	0	0	0	0	0	0	0	1	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	<0.01
	Land in transition	0	0	0	0	0	0	0	0	0	0	**7**	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	8	0.03
	Irrigated plantation forestry	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	0	1	0.01
	Irrigated cropping	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.01
	Irrigated perennial horticulture	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	1	0	0	0	0	0	0	0	0	0	1	<0.01
	Intensive animal husbandry	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	0	1	<0.01
	Manufacturing and industrial	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	**4**	0	1	0	0	0	0	0	0	0	0	0	10	<0.01
	Residential & farm infrastructure	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	**5**	0	0	0	0	0	0	0	0	0	0	10	0.03
	Services	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	0.04
	Utilities	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	**8**	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	1	0	0	**8**	0	0	0	0	0	0	0	9	0.02
	Mining	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	**11**	0	0	0	0	0	0	15	0.13
	Waste treatment and disposal	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**3**	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	0	**6**	0	0	2	0	9	0.04
	Reservoir/dam	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**6**	0	1	0	10	0.01
	River	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	0	15	0.31
	Marsh/wetland	0	0	3	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	**55**	0	69	3.57
	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	**15**	15	0.38
	Total	61	5	72	24	50	1	5	1	7	0	9	0	1	1	0	4	7	11	8	9	13	3	7	6	16	60	15	**396**	100

Table 6: User's and producer's accuracy for the Cape York and Torres Strait Islands NRM regions 2013 land use dataset

Class	User's			Producer's		
	Estimate	95% interval		Estimate	95% interval	
Nature conservation	0.989	0.942	1.000	0.999	0.933	1.000
Other conserved area	0.567	0.260	0.847	0.995	0.648	1.000
Managed resource protection	0.949	0.879	0.985	0.995	0.968	0.999
Other minimal use	0.652	0.393	0.865	0.876	0.236	0.957
Grazing native vegetation	0.969	0.838	0.999	0.930	0.880	0.962
Production forestry	NA	NA	NA	NA	NA	NA
Plantation forestry	NA	NA	NA	NA	NA	NA
Cropping	0.098	0.004	0.428	0.199	0.001	0.972
Perennial horticulture	0.550	0.267	0.812	0.049	0.001	0.721
Seasonal horticulture	NA	NA	NA	NA	NA	NA
Land in transition	0.805	0.475	0.970	0.431	0.023	0.826
Irrigated plantation forestry	NA	NA	NA	NA	NA	NA
Irrigated cropping	NA	NA	NA	NA	NA	NA
Irrigated perennial horticulture	NA	NA	NA	NA	NA	NA
Intensive animal husbandry	NA	NA	NA	NA	NA	NA
Manufacturing and industrial	0.359	0.123	0.668	0.031	0.000	0.756
Residential & farm infrastructure	0.456	0.190	0.744	0.523	0.015	0.952
Services	0.930	0.686	0.997	0.695	0.030	0.963
Utilities	0.743	0.457	0.932	0.031	0.000	0.752
Transport and communications	0.822	0.519	0.973	0.427	0.012	0.907
Mining	0.701	0.446	0.881	0.842	0.078	0.985
Waste treatment and disposal	0.263	0.069	0.567	0.030	0.000	0.751
Lake	0.609	0.301	0.867	0.614	0.022	0.974
Reservoir/dam	0.554	0.268	0.816	0.326	0.005	0.978
River	0.959	0.793	0.999	0.807	0.229	0.981
Marsh/wetland	0.789	0.685	0.873	0.965	0.723	0.991
Estuary/coastal waters	0.958	0.792	0.999	0.970	0.269	1.000