

bitre

Chapter 8

Natural resources



Chapter 8 Natural resources

This chapter discusses natural resources within Northern Australia. It does so by considering land types and usage; rainfall and temperature trends and long-term outlooks; cyclone activity; minerals and energy resources; soil characteristics; groundwater; and fisheries.

In terms of land use, the largest area under dry cropping was in northern Queensland's Mackay Region. Conservation and natural environments occupy large proportions of land in the Darwin-East Arnhem and Pilbara regions. Lakes, reservoirs and rivers (many are seasonal) are the largest proportions of land in the Kimberley and Pilbara regions. Mines occupy relatively sizable areas in the Pilbara, Darwin-East Arnhem, Mackay, Northern Queensland, Far North Queensland and Gladstone regions.

During the period 1961–1990, 50 per cent of Australia's rainfall occurred within Northern Australia. The far northern parts of Western Australia, the Northern Territory, and north-east Queensland all experience particularly high levels of average rainfall. Northern Australia's subregions receive the majority of their rainfall during the wet season, from approximately November through April. Little rainfall occurs during the dry season, from May through October.

Higher temperatures are observed across Northern Australia in comparison to the rest of Australia. Temperatures are warm throughout the year in Northern Australia, with particularly high maximums observed during the wet season and slightly lower, but still comparatively high, temperatures observed during the dry seasons.

According to the Commonwealth Scientific and Industrial Research Organisation (CSIRO), based on modelling associated with current emission trends, by the year 2030 annual rainfall within Northern Australia is predicted to increase in parts of the Kimberley and Mackay regions, and in the Darwin-East Arnhem and Far North regions. It is predicted that most other parts of Northern Australia will experience a decrease in annual rainfall.

The CSIRO predicts that there will be an increase in the average winter and summer temperatures across Northern Australia by 2030, particularly in inland areas.

On average there are about thirteen cyclones which form in the Australia region each cyclone season, although many do not make landfall. The majority of cyclone activity across Australia occurs within regions in Northern Australia, particularly in the regions around north-east Queensland and north-west Western Australia.

Mineral and energy resources of Northern Australia are abundant and new discoveries and improvements in technology result in continuous upgrading of many minerals' *economic documented reserves*.

Northern regions of Western Australia and the Northern Territory types of soil support pastoral uses and some irrigated cropping while Queensland's northern regions are suitable for sugar cane cropping and other uses facilitated by higher water availability in most regions.

Groundwater capacity varies considerably over the Northern Australian region. Across much of the Northern Territory's interior and the northern Kimberley in Western Australia, groundwater basins have a sustainable yield of less than 500 gigalitres per year. Meanwhile, much of the Arnhem and Gulf coastal area of the Northern Territory have underground reserves which can produce a sustainable yield of between 2000 and 2500 gigalitres per year.

The Great Artesian Basin stretches across much of Queensland (particularly the North West and Far North regions within Northern Australia), with a sustainable yield of between 200 000 and 500 000 megalitres of water per year.

Availability of groundwater in many rural and urban communities leads to an increasing reliance on supplies from this source for irrigated agriculture, urban consumption, mining, and aquaculture demands.

Fisheries in Northern Australia are subject to the same management rules as the rest of Australia. The Australian Fisheries Management Authority manages more than twenty fisheries, nine of which include waters off Northern Australia. Of these nine, four fisheries are exclusively associated with Northern Australia.

8.1 Land use

Land use information provided in Table 8.1.1 illustrates the types of land resource availability in each subregion of Northern Australia and their main utilisation. The largest share of land use in Northern Australia was grazing natural vegetation (57.4 per cent), followed by conservation and natural environments (40.2 per cent). Grazing natural vegetation was particularly high within Northern Queensland (82.1 per cent). Much of this land use can be attributed to the beef industry. Rangelands grazing across much of this terrain is seasonally variable and opportunistic, requiring relatively large tracts of country per animal. For the most part, average stocking rates do not exceed 10 steers per square kilometre (Western Australia Department for Planning and Infrastructure 2005 p.2, Rural Management Partners 2005 p.6).

The highest share of land use in northern Western Australia was in conservation and natural environments (57.3 per cent). The largest area under dry cropping was in Queensland's Mackay Region (see Map 8.1.6), whilst only a very small area was used for dry cropping in the Darwin-East Arnhem Region (see Map 8.1.3).

Mine land use is high in the Pilbara (see Map 8.1.1), Darwin-East Arnhem, Mackay, Northern (see Map 8.1.7) and Far North region (see Map 8.1.8), relative to the rest of Australia. Although the total area of mines in Northern Australia represent only a very small share of total land area (0.01 per cent), they occupied 35.5 thousand hectares.

Lakes, reservoirs and rivers (many seasonal) have higher proportions of land surface in the Kimberley (see Map 8.1.2) and Pilbara regions, as compared with other regions. Relative to other regions, lakes are a more significant proportion of land area in the Barkly-Central NT Region (see Map 8.1.5) of the Northern Territory, Northern and North West regions in Queensland.

Details on land tenure, including Indigenous ownership, may be found in Chapter 1. More land use data can be found in the background tables.

Table 8.1.1 Northern Australia—selected land use (per cent), by region, 2001

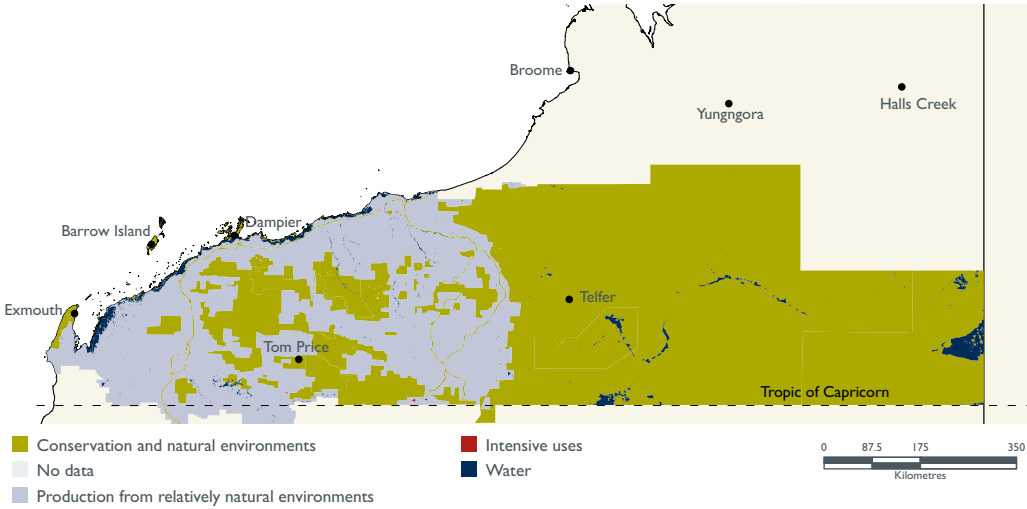
Region	Land use (percentage)										
	Grazing natural vegetation	Cropping	Irrigated cropping	Irrigated perennial horticulture	Irrigated seasonal horticulture	Mining	Lake	Reservoir	River	Conservation and natural environments	Other Uses
Northern Australia (WA)	40.8	0.00	0.00	0.00	0.00	0.01	0.64	0.09	0.08	57.3	1.07
Pilbara Region	31.6	0.00	0.00	0.00	0.00	0.01	0.97	0.00	0.08	66.6	0.70
Kimberley Region	52.7	0.00	0.00	0.00	0.00	0.00	0.21	0.21	0.07	45.3	1.55
Northern Australia (NT)	53.3	0.00	0.00	0.01	0.00	0.00	0.30	0.00	0.07	45.2	1.11
Darwin-East Arnhem Region	19.1	0.01	0.00	0.04	0.00	0.02	0.02	0.03	0.22	74.7	5.83
Katherine-Lower Top End Region	66.0	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.10	32.9	0.98
Barkly-Central NT Region	54.6	0.00	0.00	0.00	0.00	0.00	0.49	0.00	0.01	44.8	0.10
Northern Australia (QLD)	82.1	0.30	0.18	0.02	0.00	0.03	0.05	0.04	0.09	13.5	3.70
Mackay Region	76.0	1.45	0.32	0.03	0.02	0.21	0.00	0.11	0.16	12.7	9.01
Northern Region	81.9	0.40	1.35	0.03	0.01	0.01	0.18	0.21	0.05	8.5	7.30
Far North Region	62.5	0.37	0.11	0.04	0.00	0.01	0.01	0.02	0.17	31.5	5.23
North West Region	94.9	0.00	0.00	0.00	0.00	0.00	0.08	0.01	0.03	3.9	1.13
Longreach Region	91.6	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	8.4	0.01
Northern Australia total	57.4	0.09	0.05	0.01	0.00	0.01	0.34	0.04	0.08	40.2	1.84

Notes: This table shows the land use as a percentage of the total land use for the region. Due to rounding, zeros may indicate very small land area used for a particular land use.

Conservation and natural environments includes nature conservation, managed resource protection and other minimal use.

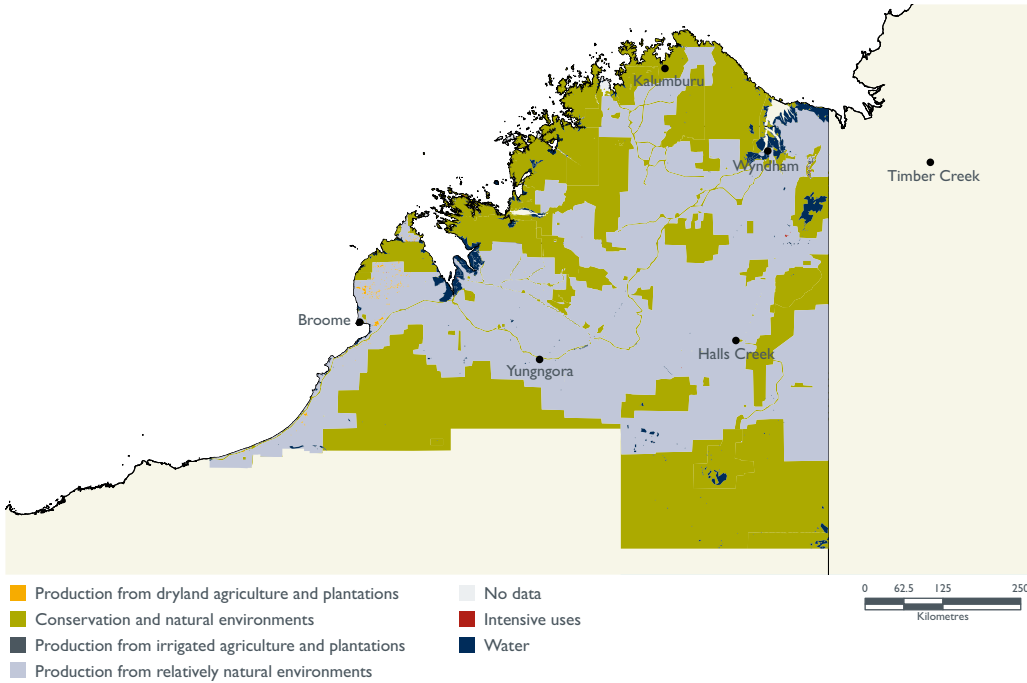
Source: Bureau of Rural Sciences (BRS) (2008).

Map 8.1.1 Land use in the Pilbara Region (Western Australia), 2001



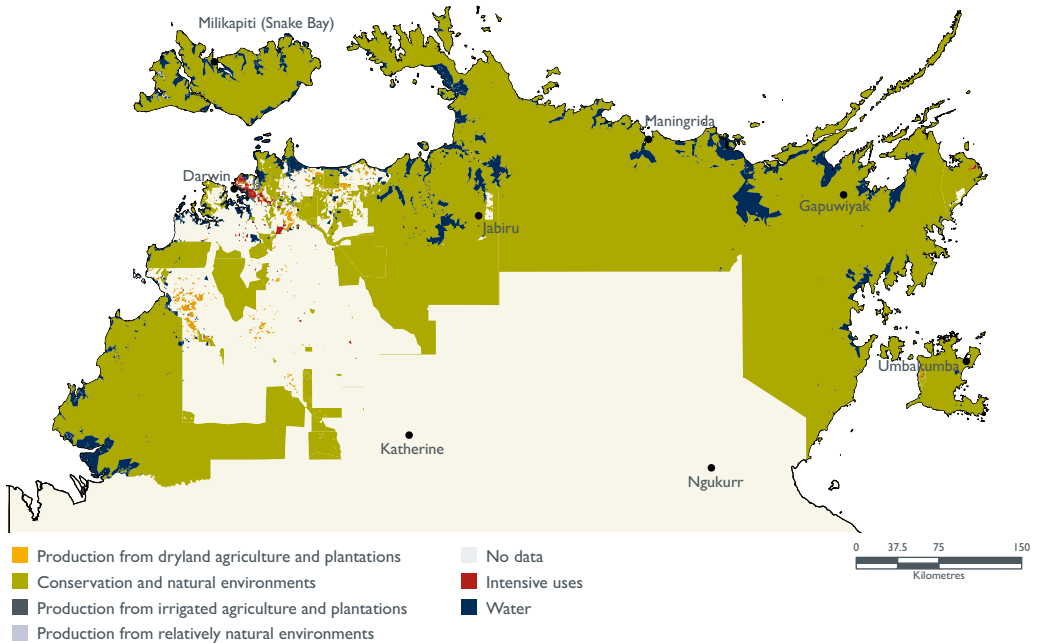
Source: BITRE map drawn from BRS data (2009) available from www.brs.gov.au.

Map 8.1.2 Land use in the Kimberley Region (Western Australia), 2001



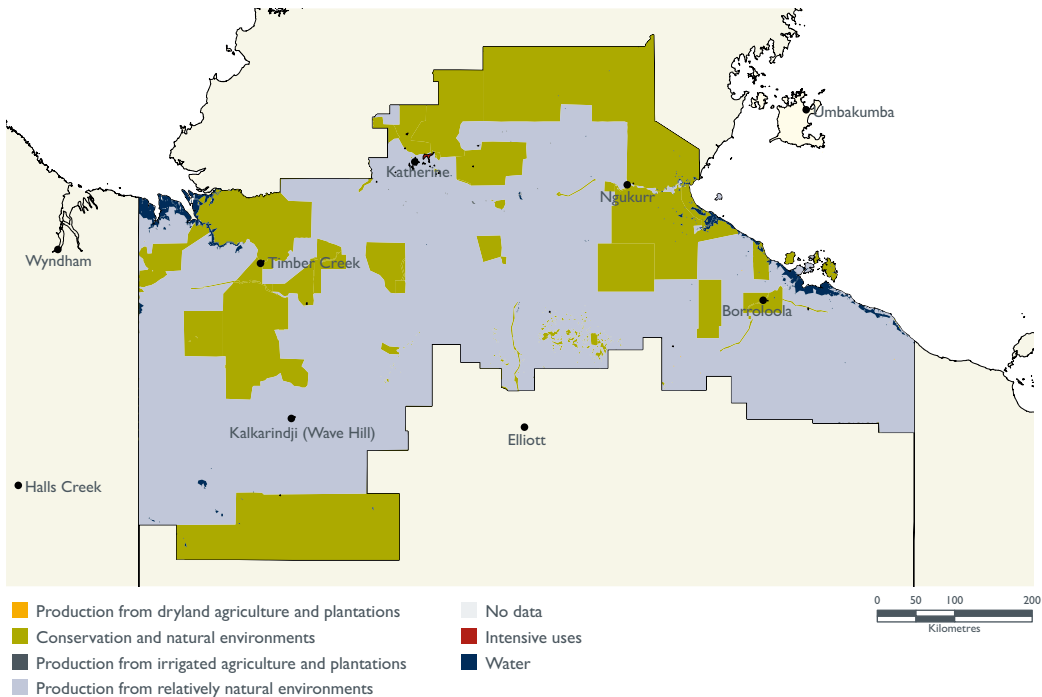
Source: BITRE map drawn from BRS data (2009) available from www.brs.gov.au.

Map 8.1.3 Land use in the Darwin-East Arnhem Region (Northern Territory), 2001



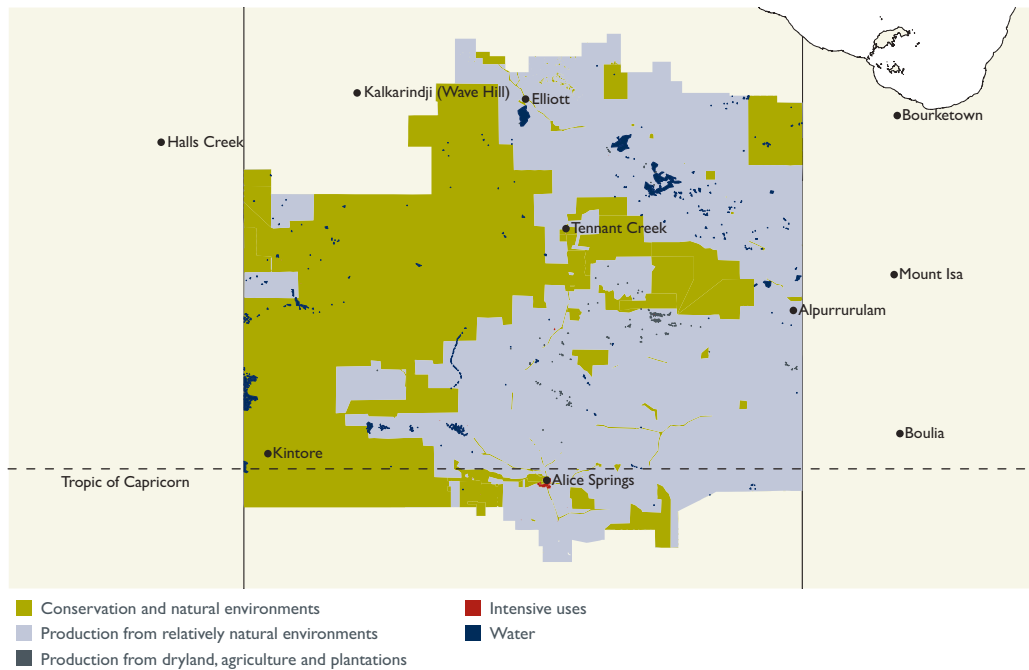
Source: BITRE map drawn from BRS data (2009) available from www.brs.gov.au.

Map 8.1.4 Land use in the Katherine-Lower Top End Region (Northern Territory), 2001



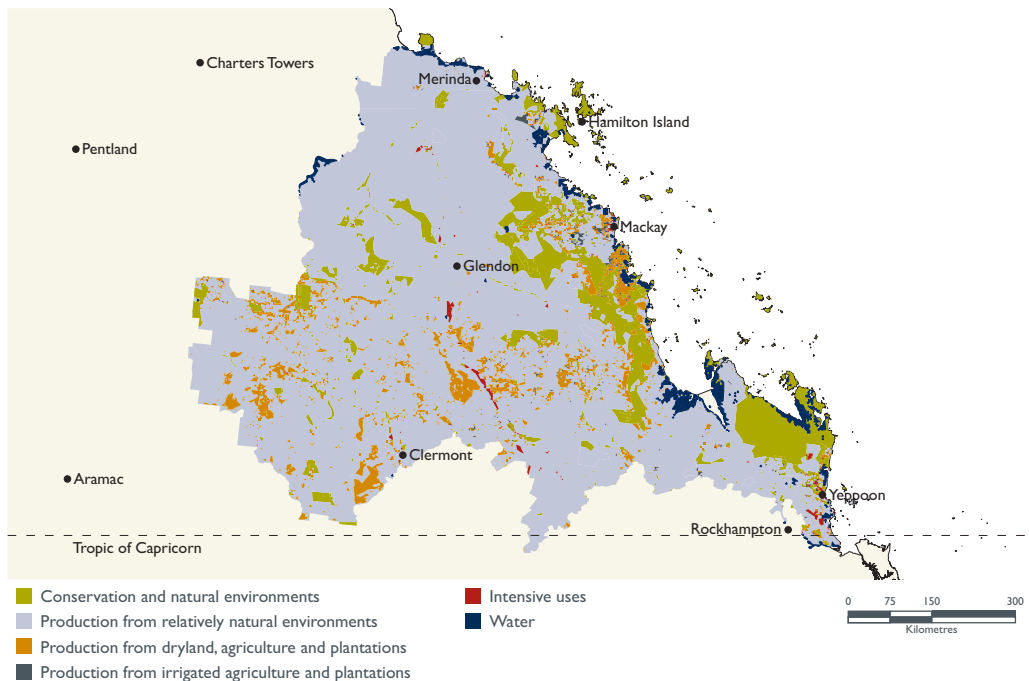
Source: BITRE map drawn from BRS data (2009) available from www.brs.gov.au.

Map 8.1.5 Land use in the Barkly-Central NT Region (Northern Territory), 2001



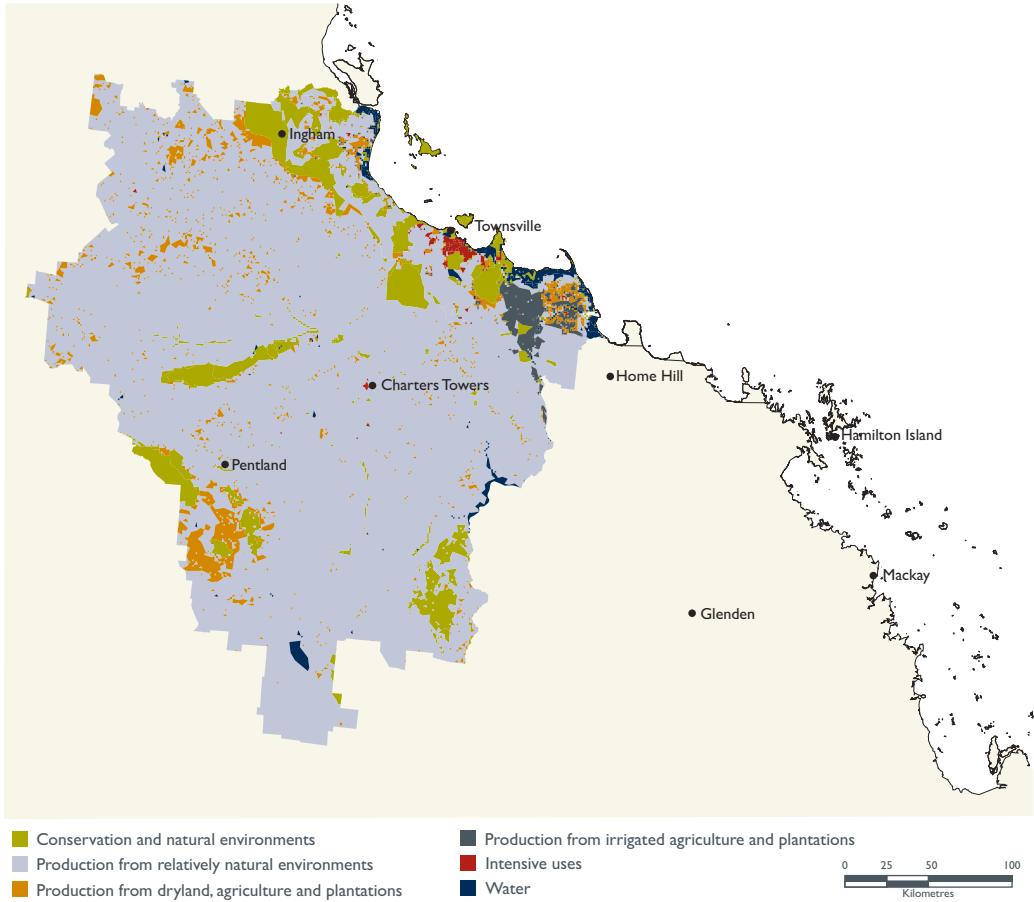
Source: BITRE map drawn from BRS data (2009) available from www.brs.gov.au.

Map 8.1.6 Land use in the Mackay Region (Queensland), 2001



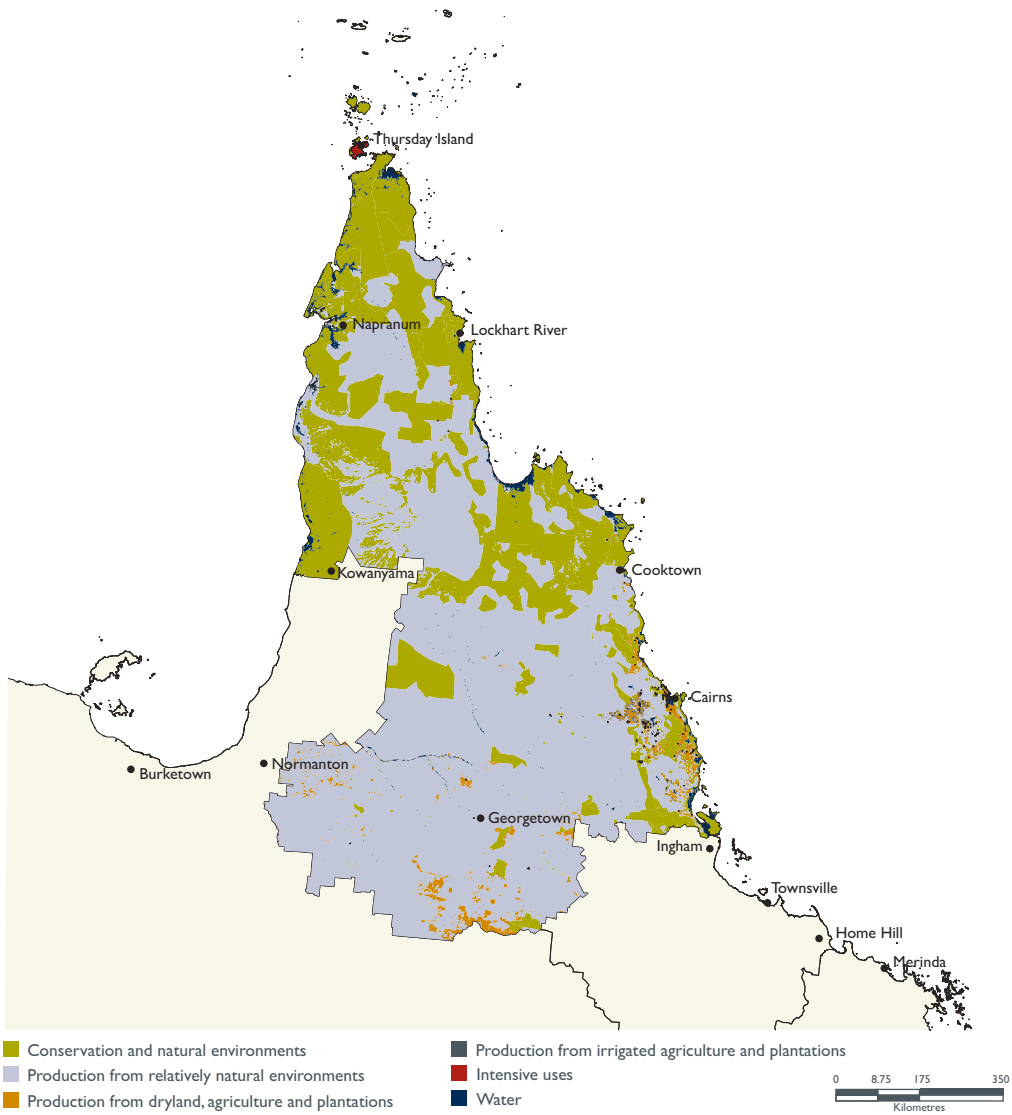
Source: BITRE map drawn from BRS data (2009) available from www.brs.gov.au.

Map 8.1.7 Land use in the Northern Region (Queensland), 2001



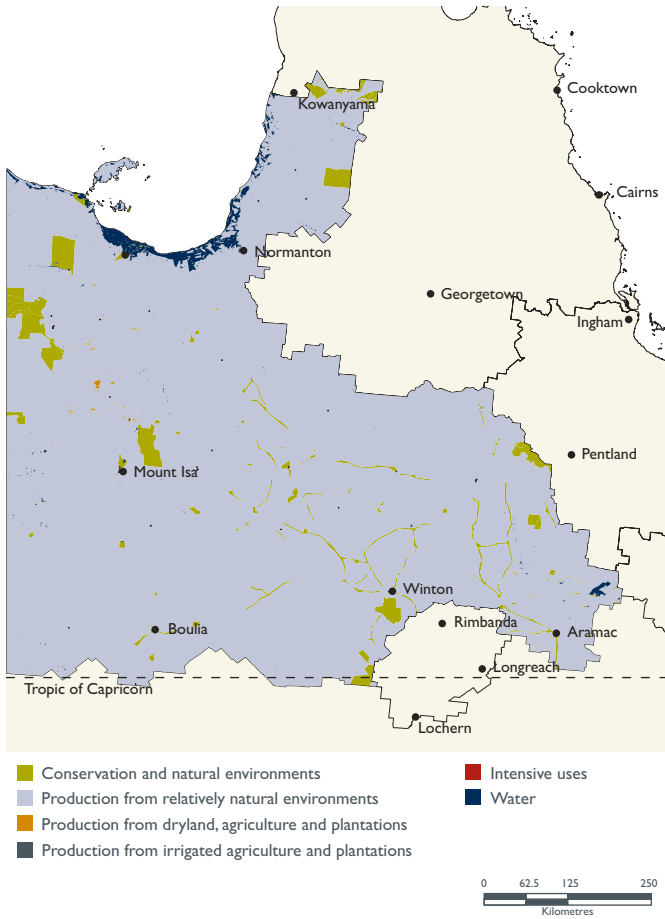
Source: BITRE map drawn from BRS data (2009) available from www.brs.gov.au.

Map 8.1.8 Land use in the Far North Region (Queensland), 2001



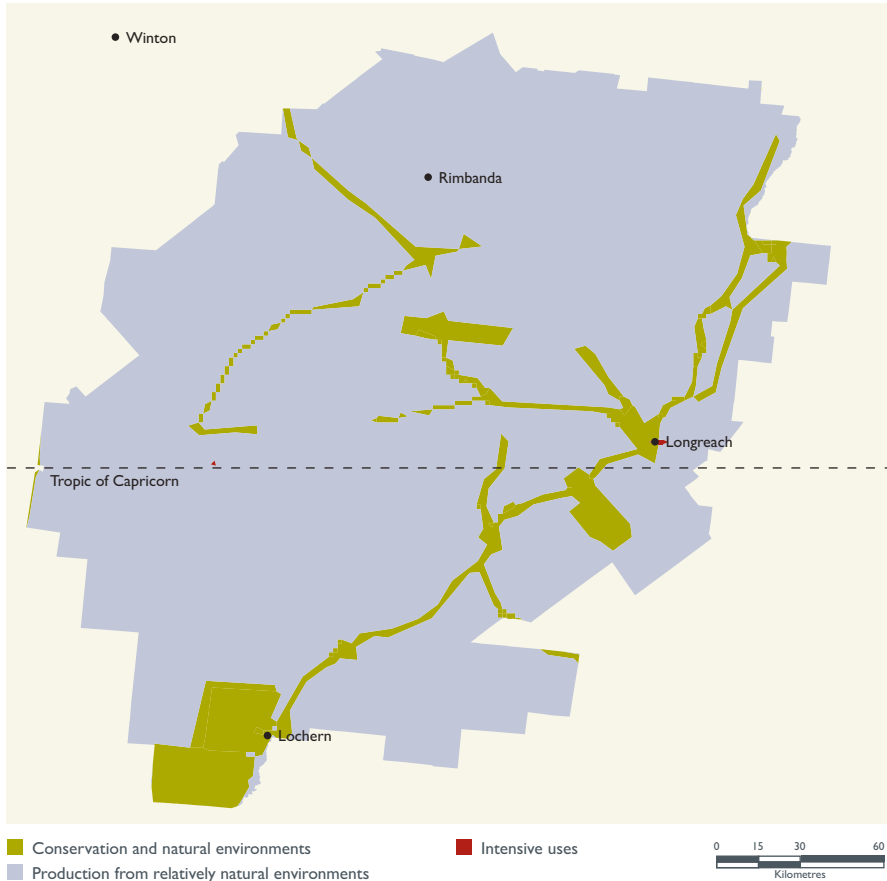
Source: BITRE map drawn from BRS data (2009) available from www.brs.gov.au.

Map 8.1.9 Land use in the North West Region (Queensland), 2001



Source: BITRE map drawn from BRS data (2009) available from www.brs.gov.au.

Map 8.1.10 Land use in the Longreach Region (Queensland), 2001



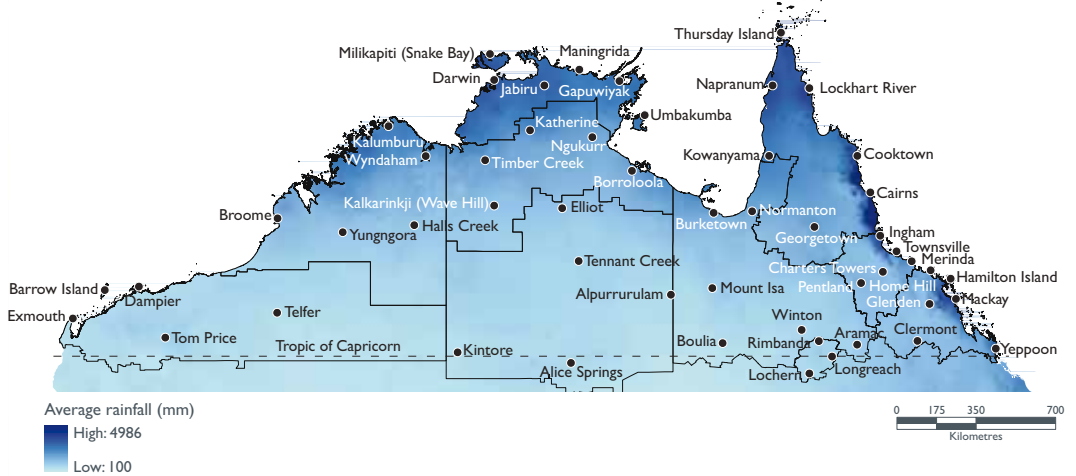
Source: BITRE map drawn from BRS data (2009) available from www.brs.gov.au.

8.2 Rainfall and temperature

The tables and maps show the mean rainfall, maximum and minimum temperatures over a thirty year period in Northern Australia. Overall, 50 per cent of Australia's rain fell within Northern Australia during this thirty year period. As can be seen in Map 8.2.1, the far northern parts of Western Australia, the Northern Territory, and north-east Queensland experienced high levels of average rainfall. On the other hand, much of northern Western Australia, the southern parts of the Northern Territory, and the western parts of Northern Queensland all experienced low levels of rainfall.

At the regional level, the lowest levels of annual rainfall were experienced in the Pilbara Region, where Roebourne experienced 277 mm of annual rainfall, while on average there were 301 mm of rainfall in Alice Springs—Stuart (Barkly-Central NT Region). The Darwin-East Arnhem, Far North, and Mackay regions all experienced high levels of rainfall annually, with around 2000 mm of rain experienced in many parts of the Far North Region. These levels of rainfall are among the highest seen across Australia.

Map 8.2.1 Northern Australia—annual average rainfall (mm), 1961–1990



Source: BITRE map drawn from Bureau of Meteorology (BOM) data (2009).

The rainfall patterns across Northern Australia during the year reflect the wet and dry seasons. The wet season lasts for about four months between December and March. As seen in Maps 8.2.2 and 8.2.5, this is a period which is characterised by high levels of rain. For example, on average the majority of rainfall in the Darwin-East Arnhem Region falls between February and November. High levels of rainfall are observed as proximity to the coast increased within regions in northern Queensland. However, rainfall does not increase with proximity to the coastline in many areas at similar latitude in Western Australia.

Maps 8.2.3 and 8.2.4 illustrate that many of the regions experienced little rainfall during the dry season (between May and October). In contrast to parts of southern Australia, extensive areas across Northern Australia are very dry during the winter months. For example, in the Katherine-Lower Top End and Kimberley regions, the highest average rainfall experienced during August was just 2 mm.

Table 8.2.1 Northern Australia — mean rainfall, maximum and minimum temperature, 1961–90

Region/SIA name	Name	February			May			August			November			Annual rain (mm)
		Max temp (°C)	Min temp	Average rain (mm)	Max temp (°C)	Min temp	Average rain (mm)	Max temp (°C)	Min temp	Average rain (mm)	Max temp (°C)	Min temp	Average rain (mm)	
Northern Australia (WA)														
Pilbara Region														
	Telfer	39	24	72	28	15	25	28	12	8	39	22	16	295
	Barrow Island	36	26	76	30	20	56	28	17	11	34	21	1	372
	Ashburton (S)	37	24	31	28	16	52	26	12	17	34	19	3	292
	Exmouth (S)	37	23	77	25	14	32	24	11	12	36	21	9	378
	Tom Price	37	26	60	31	18	35	29	14	6	37	22	0	277
	Dampier	37	26	60	31	18	35	29	14	6	37	22	0	277
Kimberley Region														
	Wyndham-East Kimberley (S)	36	26	191	34	21	13	34	19	0	39	27	54	820
	Halls Creek (S)	36	24	129	30	17	14	30	15	2	38	25	34	550
	Derby-West Kimberley (S)	37	25	132	33	16	13	32	13	0	40	24	10	469
	Broome (S)	33	26	158	32	18	24	30	15	2	34	25	8	604
	Wyndham-East Kimberley (S)	34	24	310	33	18	19	34	16	0	37	25	81	1 206
Northern Australia (NT)														
Darwin-Kakadu Region														
	Darwin	32	24	318	32	22	25	32	20	9	34	25	126	1 686
	Jabiru (T)	33	24	358	33	21	14	33	18	0	37	24	116	1 463
	East Arnhem-Bal	31	24	289	31	22	44	30	18	4	33	24	75	1 389
	Groote Eylandt	32	24	276	30	19	45	30	16	4	34	23	76	1 365
	Tiwi Islands (CGC)	31	25	325	31	22	43	30	20	1	32	25	123	1 565
	(Snake Bay)													
	Maningrida	32	24	260	32	21	27	31	18	0	33	25	57	1 277
Katherine-Lower Top End Region														
	Daguragu (CGC)	36	24	135	31	16	9	31	13	0	39	24	44	517
	Kalkarindji (Wave Hill)													
	Borroloola (CGC)	34	25	187	31	17	16	30	14	2	37	24	56	826
	Timber Creek (CGC)	35	24	192	33	18	9	33	16	0	39	25	72	839
	Yugul Mangi (CGC)	35	25	180	32	18	14	32	15	0	39	25	49	793
	Katherine (T)	34	24	230	32	18	5	33	16	1	38	25	93	991
Barkly-Central NT Region														
	Alice Springs (T)-Stuart	35	20	38	23	8	18	22	5	11	33	17	29	301
	Alpurrulam (CGC)	37	24	67	28	13	17	27	10	6	38	21	19	338
	Tennant Creek (T)	36	24	89	28	16	13	27	14	2	36	23	29	421
	Tanami	36	22	59	25	11	23	24	8	11	35	20	30	334
	Elliott District (CGC)	36	24	142	30	16	7	31	14	1	39	24	40	525

(continued)

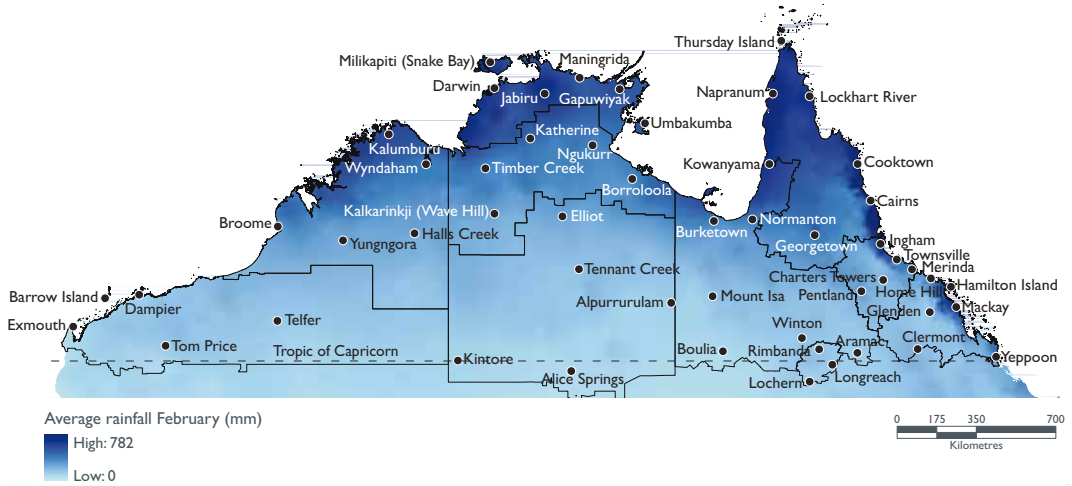
Table 8.2.1 Northern Australia—mean rainfall, maximum and minimum temperature, 1961—90 (continued)

Region/SLA name	Name	February			May			August			November			Annual rain (mm)
		Max temp (°C)	Min temp	Average rain (mm)	Max temp (°C)	Min temp	Average rain (mm)	Max temp (°C)	Min temp	Average rain (mm)	Max temp (°C)	Min temp	Average rain (mm)	
Northern Australia (Qld)														
Northern Region														
Mackay Region	Mackay	30	23	327	25	17	97	23	14	25	29	22	104	1 662
Mackay (C)—Pt A	Clermont	33	21	101	26	12	47	25	9	19	33	19	62	629
Belyando (S)	Hamilton Island	30	24	319	25	18	145	23	15	32	29	22	67	1 731
Whitsunday (S)	Yeppoon	30	23	188	25	16	104	23	12	35	29	21	86	1 204
Livingstone (S)—Pt B	Merinda	31	24	176	27	18	48	26	15	17	31	22	46	874
Bowen (S)	Glenden	30	21	88	24	13	42	23	9	15	31	19	69	652
Northern Region														
Northern Region	Home Hill	32	23	190	27	16	44	26	13	15	32	21	53	926
Burdekin (S)	Townsville	31	24	231	27	18	41	26	15	14	31	23	53	1 042
West End	Charters Towers	32	22	113	27	15	34	26	12	12	34	20	53	711
Charters Towers (C)	Ingham	32	24	412	28	18	115	27	15	33	31	22	102	1 987
Hinchinbrook (S)	Pentland	33	22	112	27	14	34	26	11	12	35	20	41	658
Dairympole (S)														
Far Northern Region														
Far Northern Region	Kowanyama	33	24	347	32	19	10	32	16	1	36	24	75	1 206
Kowanyama (S)	Cooktown	31	24	439	27	22	94	26	20	19	31	24	68	1 881
Cook (S)	Georgetown	34	23	209	30	17	11	30	13	3	37	22	62	834
Etheridge (S)	Cairns	31	24	443	27	20	115	27	17	23	31	22	103	2 153
Cairns (C)—City	Lockhart River	31	24	368	29	22	114	28	20	27	32	23	64	1 996
Lockhart River (S)	Napranum	31	24	433	32	21	16	32	19	2	35	23	114	1 819
Napranum (S)	Thursday Island	30	24	373	29	24	48	28	22	8	31	25	42	1 790
Torres (S)														
North West Region														
North West Region	Burketown	34	25	204	31	18	9	30	15	1	36	24	46	781
Burke (S)	Winton	36	23	79	27	13	20	27	9	6	37	21	23	390
Winton (S)	Normanton	34	25	203	32	20	6	31	17	0	37	25	39	799
Carpentaria (S)	Boulia	38	24	41	27	13	14	26	10	7	37	21	16	238
Boulia (S)	Mount Isa	35	23	74	27	14	14	27	11	3	36	21	24	384
Mount Isa (C)	Aramac	35	23	66	27	13	24	26	10	16	36	20	32	453
Aramac (S)														
Longreach Region														
Longreach Region	Longreach	36	23	69	27	12	29	26	8	11	36	20	24	392
Longreach (S)	Rimbanda	36	23	80	27	12	24	26	9	8	36	20	24	443
Longreach (S)	Lochern	37	23	60	26	12	28	25	8	5	36	20	16	319
Longreach (S)														

Note: The period of measurement for both rainfall and temperature was taken for four months throughout the year.

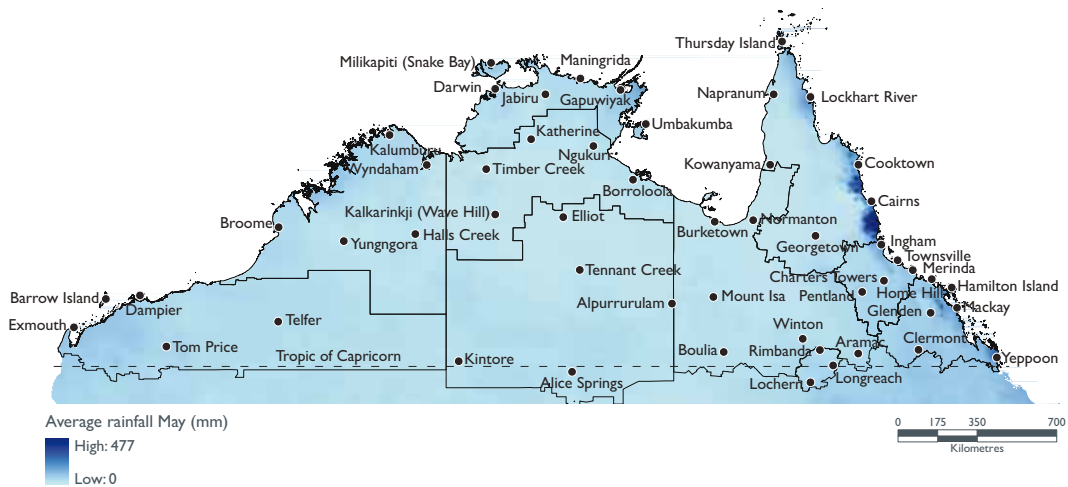
Source: Bureau of Meteorology (2007a).

Map 8.2.2 Northern Australia – February average rainfall (mm), 1961–90



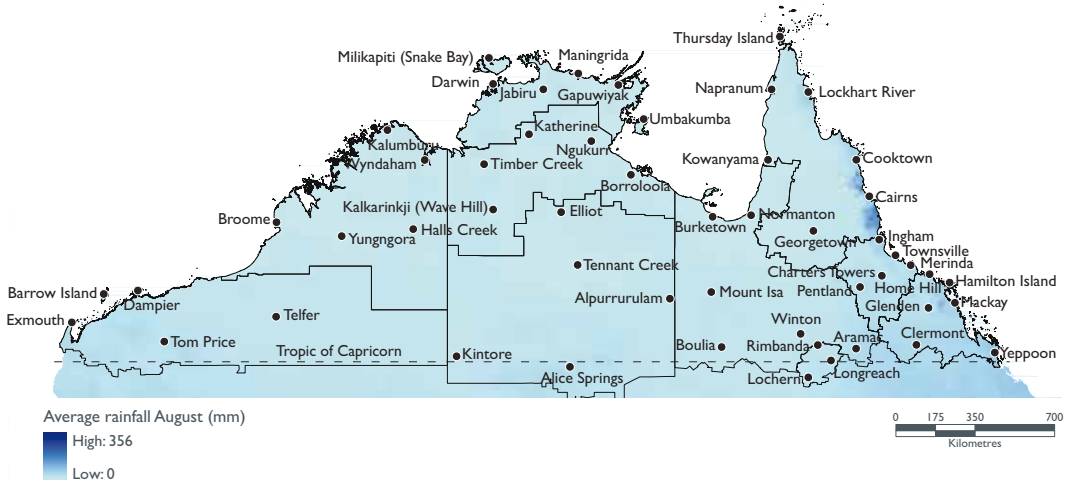
Source: BITRE map drawn from BOM data (2009).

Map 8.2.3 Northern Australia – May average rainfall (mm), 1961–90



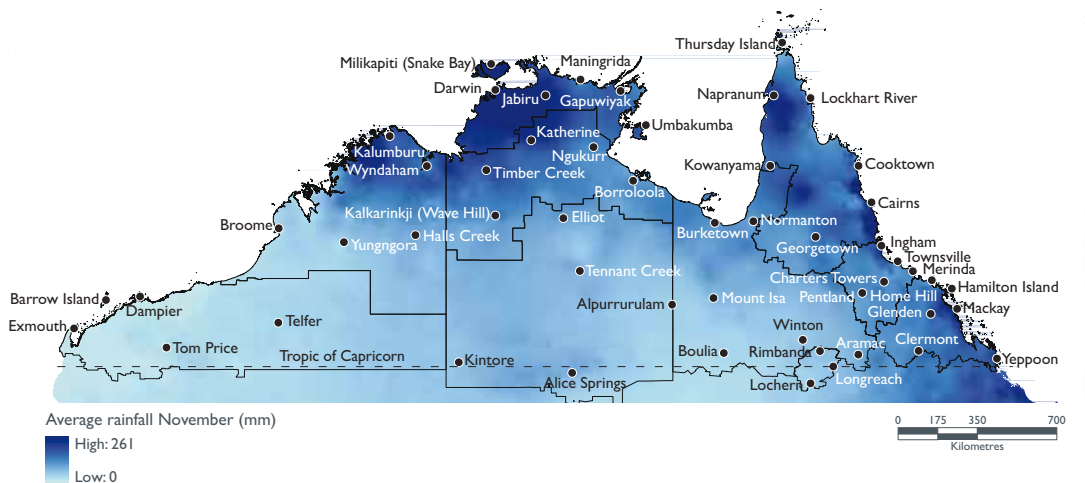
Source: BITRE map drawn from BOM data (2009).

Map 8.2.4 Northern Australia—August average rainfall (mm), 1961–90



Source: BITRE map drawn from BOM data (2009).

Map 8.2.5 Northern Australia—November average rainfall (mm), 1961–90

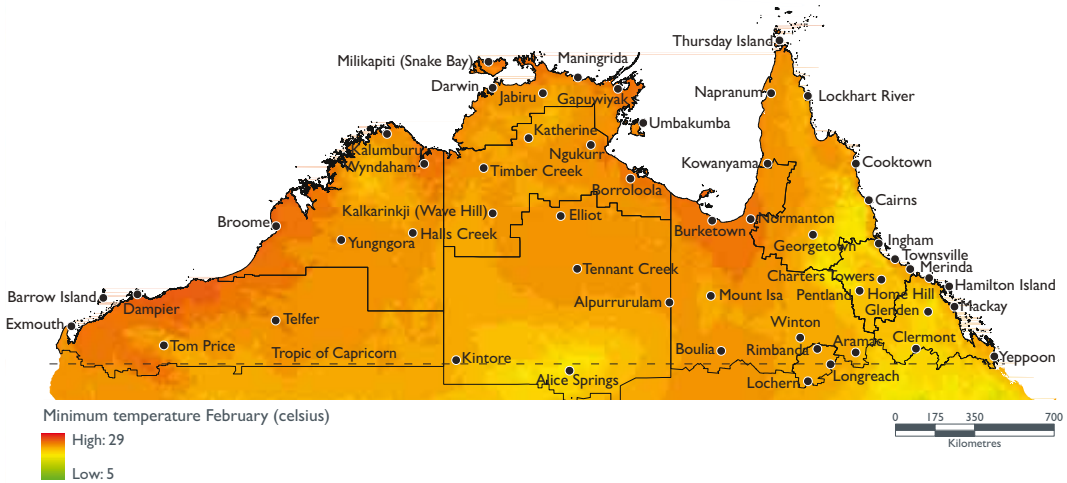


Source: BITRE map drawn from BOM data (2009).

Similar to the rainfall patterns, the average minimum and maximum temperatures throughout Northern Australia reflect the wet and dry seasons. Higher temperatures were observed during the wet season across many regions, while in contrast lower temperatures were experienced during the dry season.

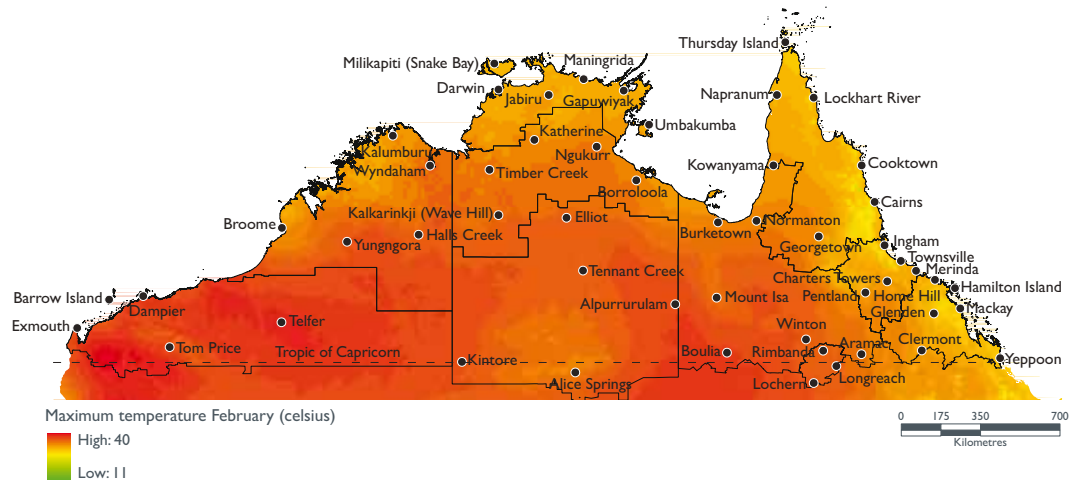
The average minimum temperature for February is higher across Northern Australia than it is across the rest of Australia. As can be seen in Map 8.2.6, particularly high averages are observed in many areas within northern Western Australia, as well as in much of the northern Northern Territory. High values are also observed for February’s maximum temperature throughout Northern Australia. This is particularly the case in the Pilbara, Barkly-Central NT and North West regions, where the average temperatures approaches 40 degrees celsius.

Map 8.2.6 Northern Australia—February minimum temperature (celsius), 1961–90



Source: BITRE map drawn from BOM data (2009).

Map 8.2.7 Northern Australia—February maximum temperature (celsius), 1961–90

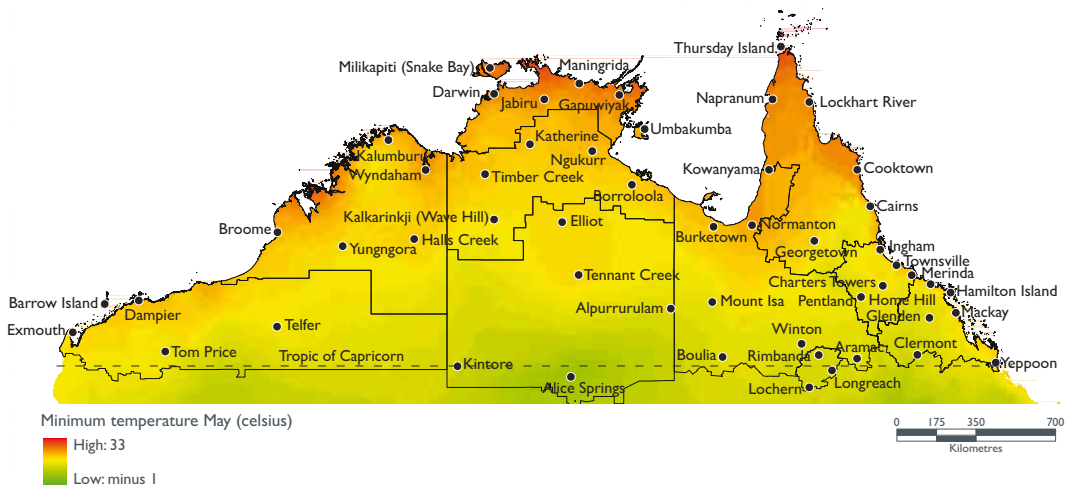


Source: BITRE map drawn from BOM data (2009).

The trend of higher temperatures within Northern Australia in comparison to the rest of Australia continues to be seen throughout May and August, although the temperatures are lower than in the wet season. As can be seen in Maps 8.2.9 and 8.2.11, there are particularly high maximum temperatures within northern Western Australia, north-western Queensland and the northern Northern Territory, where the temperatures are around 30 degrees celsius or higher. At the regional level there are particularly high maximum temperatures in the Kimberley, North West, Darwin-East Arnhem and Katherine-Lower Top End regions during May and August.

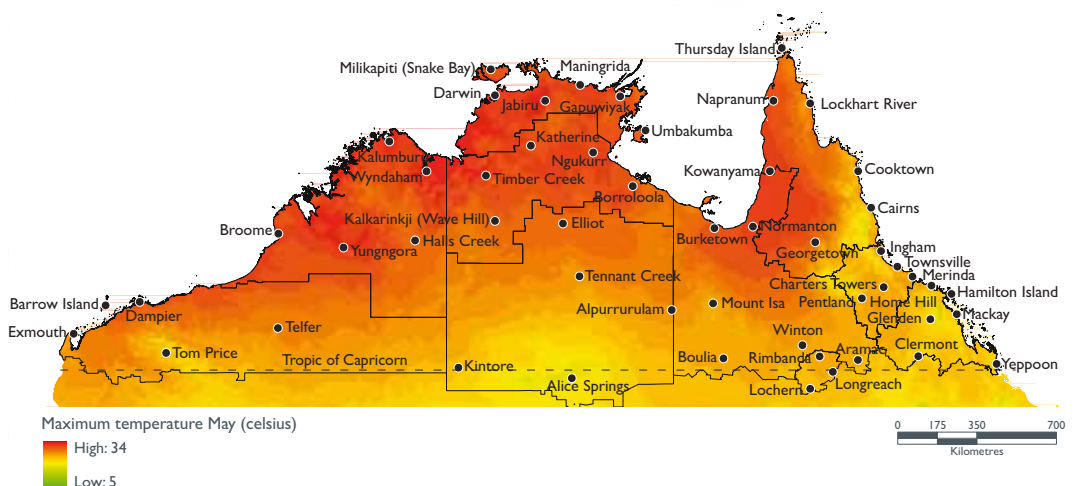
The minimum temperatures for May and August are higher in the more northern parts of Western Australia, Queensland and the Northern Territory, where temperatures approach an average of 24 degrees celsius (see Maps 8.2.8 and 8.2.10). However, far lower temperatures are observed in areas closer to the Tropic of Capricorn, particularly in some parts of the Pilbara, Longreach and Barkly-Central NT regions, where the minimum temperature range from 8 to 16 degrees celsius. Many of these areas contain deserts where temperatures can drop dramatically during the night.

Map 8.2.8 Northern Australia—May minimum temperature (celsius), 1961–90



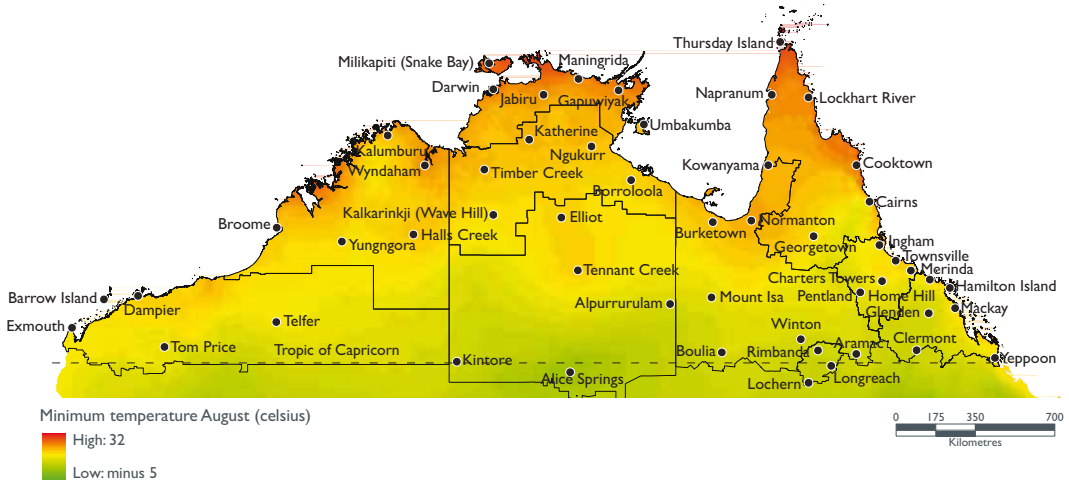
Source: BITRE map drawn from BOM data (2009).

Map 8.2.9 Northern Australia—May maximum temperature (celsius), 1961–90



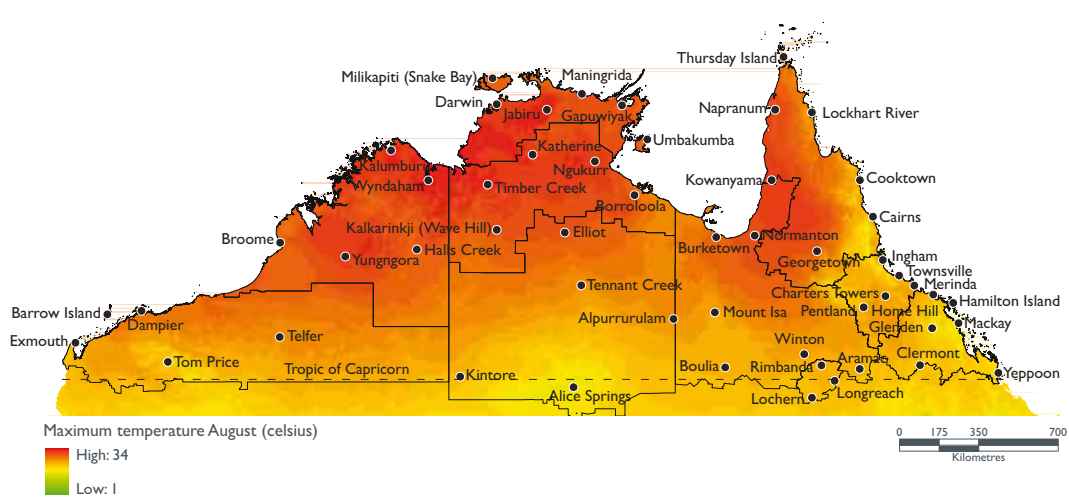
Source: BITRE map drawn from BOM data (2009).

Map 8.2.10 Northern Australia—August minimum temperature (celsius), 1961–90



Source: BITRE map drawn from BOM data (2009).

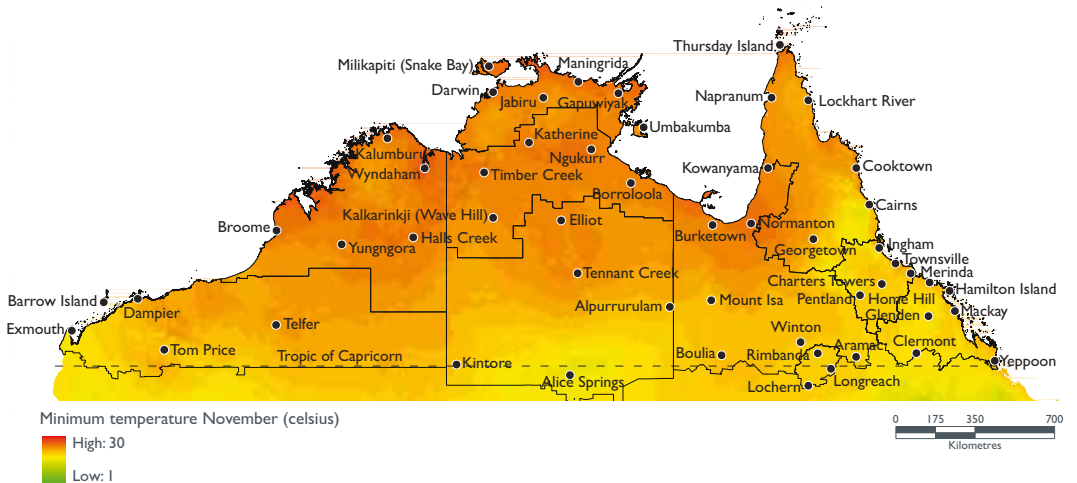
Map 8.2.11 Northern Australia—August maximum temperature (celsius), 1961–90



Source: BITRE map drawn from BOM data (2009).

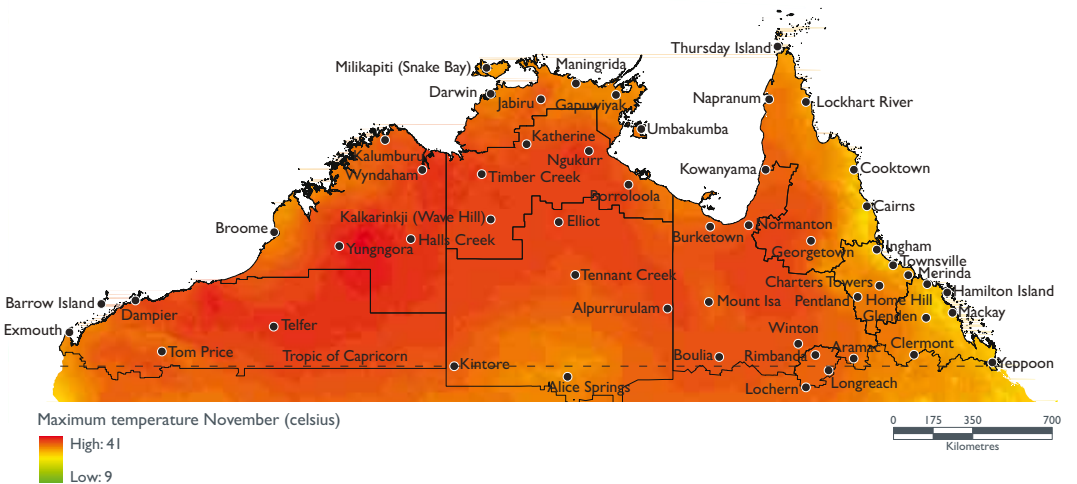
Similar to February, in many parts of Northern Australia the average temperatures during November are very high, reflecting the wet season. As can be seen in Maps 8.2.12 and 8.2.13, the minimum and maximum temperatures during this month are higher than the rest of Australia. Of particular note are the average maximum temperatures, which are close to 41 degrees celsius in most of northern Western Australia, the more northern parts of the Northern Territory, and the inland parts of Queensland such as the North West Region.

Map 8.2.12 Northern Australia—November minimum temperature (celsius), 1961–90



Source: BITRE map drawn from BOM data (2009).

Map 8.2.13 Northern Australia—November maximum temperature (celsius), 1961–90



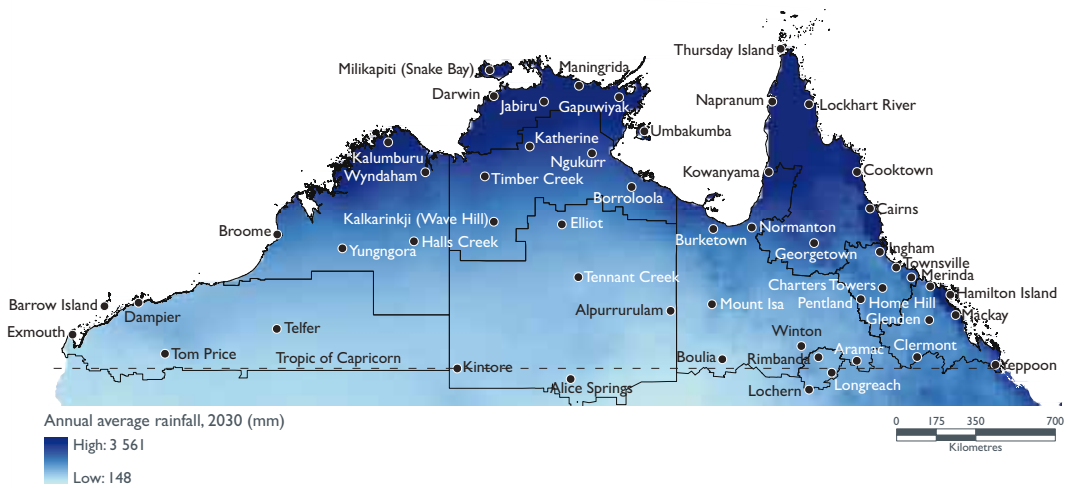
Source: BITRE map drawn from BOM data (2009).

8.3 Predicted future rainfall and temperature

The maps below illustrate the predicted mean rainfall, maximum and minimum temperature for the year 2030, based on moderate global warming. These predictions were calculated by the CSIRO, using different data than section 8.2. Consequently, the predictions should only be compared in a general way with data in the previous section.

As can be seen in Map 8.3.1, the annual rainfall within Northern Australia in the year 2030 is predicted to be highest in the far northern areas of Queensland, Western Australia and the Northern Territory. In particular, an increase in rainfall is predicted in parts of the Kimberley and Mackay regions, and in the Darwin-East Arnhem and Far North regions. Aside from these regions, the predictions suggest that most other parts of Northern Australia will experience a decrease in annual rainfall (see Table 8.3.1). The lowest levels of rainfall in the year 2030 are predicted to be within the Pilbara, Barkly-Central NT, North West and Longreach regions.

Map 8.3.1 Northern Australia—predicted average annual rainfall (millimetres), 2030



Notes: Map 8.3.1 illustrates the predicted average annual rainfall for the year 2030, based on moderate global warming and moderate rainfall.

Source: BITRE map based on CSIRO and BOM data available at www.climatechangeinaustralia.gov.au.

It should be noted that Maps 8.2.1 and 8.3.1 use different keys to show average rainfall; the map of annual rainfall (Map 8.2.1) has values ranging from 100–4986, while the map of predicted annual rainfall (Map 8.3.1) has values ranging from 148–3561. Thus, care should be taken when comparing the two maps.

Table 8.3.1 Northern Australia—predicted mean rainfall, summer and winter surface temperature, 2030

Region/SLA Name	Name	Prediction, 2030		
		Average summer surface temp (°C)	Average winter surface temp (°C)	Annual rain (mm)
Northern Australia (WA)				
Pilbara Region				
East Pilbara (S)	Telfer	33	19	337
Ashburton (S)	Barrow Island	31	21	314
Exmouth (S)	Exmouth	30	19	261
Ashburton (S)	Tom Price	31	21	314
Roebourne (S)	Dampier	32	21	365
Kimberley Region				
Wyndham-East Kimberley (S)	Wyndham	31	24	883
Halls Creek (S)	Halls Creek	31	22	566
Derby-West Kimberley (S)	Yunggora	32	22	558
Broome (S)	Broome	30	22	663
Wyndham-East Kimberley (S)	Kalumburu	31	24	883
Northern Australia (NT)				
Darwin-Kakadu Region				
City-Inner	Darwin	29	25	1 696
Jabiru (T)	Jabiru	29	24	1 364
East Arnhem-Bal	Gapuwiyak	29	24	1 242
Groote Eylandt	Umbakumba	30	23	1 062
Tiwi Islands (CGC)	Milikapiti (Snake Bay)	29	25	1 799
West Arnhem	Maningrida	29	24	1 306
Katherine-Lower Top End Region				
Daguragu (CGC)	Kalkarindji (Wave Hill)	31	21	614
Borroloola (CGC)	Borroloola	31	22	786
Timber Creek (CGC)	Timber Creek	30	22	838
Yugul Mangi (CGC)	Ngukurr	31	23	871
Katherine (T)	Katherine	30	23	956
Barkly-Central NT Region				
Alice Springs (T)—Stuart	Alice Springs	29	14	295
Alpurrurulam (CGC)	Alpurrurulam	32	18	342
Tennant Creek (T)	Tennant Creek	31	19	378
Tanami	Kintore	31	16	315
Elliott District (CGC)	Elliott	32	21	549
Northern Australia (Qld)				
Mackay Region				
Mackay (C)—Pt A	Mackay	27	18	1 401
Belyando (S)	Clermont	28	16	611
Whitsunday (S)	Hamilton Island	27	19	1 654
Livingstone (S)—Pt B	Yeppoon	27	17	838
Bowen (S)	Merinda	26	17	1 360
Nebo (S)	Glenden	27	18	548
Northern Region				
Burdekin (S)	Home Hill	28	19	778
West End	Townsville	28	20	841
Charters Towers (C)	Charters Towers	29	19	587
Hinchinbrook (S)	Ingham	27	19	1 084
Dalrymple (S)	Pentland	29	18	611

(continued)

Table 8.3.1 Northern Australia—predicted mean rainfall, summer and winter surface temperature, 2030 (continued)

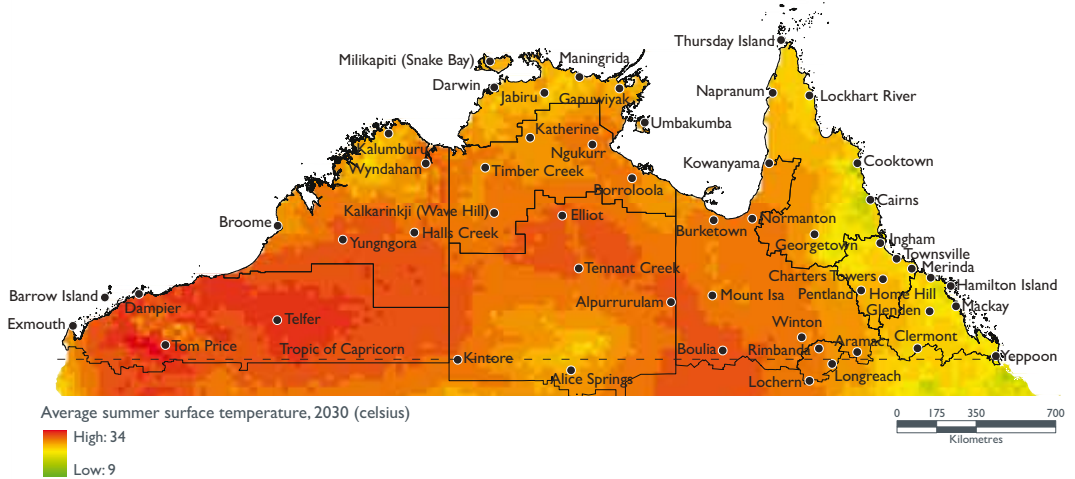
Region/SLA Name	Name	Prediction, 2030		
		Average summer surface temp (°C)	Average winter surface temp (°C)	Annual rain (mm)
Far Northern Region				
Kowanyama (S)	Kowanyama	30	24	1 242
Cook (S)	Cooktown	27	22	2 588
Etheridge (S)	Georgetown	29	20	795
Cairns (C)–City	Cairns	26	20	3 381
Lockhart River (S)	Lockhart River	27	23	1 749
Napranum (S)	Napranum	29	25	1 852
Torres (S)	Thursday Island	28	26	1 952
North West Region				
Burke (S)	Burketown	31	22	766
Winton (S)	Winton	31	17	431
Carpentaria (S)	Normanton	31	23	752
Bouliā (S)	Bouliā	32	17	248
Mount Isa (C)	Mount Isa	30	18	489
Aramac (S)	Aramac	30	17	490
Longreach Region				
Longreach (S)	Longreach	30	16	444
Longreach (S)	Rimbānda	30	16	444
Longreach (S)	Lochern	30	16	444

Notes: The predictions for the year 2030 are based on average rainfall with moderate warming. The predictions for average surface temperature are given for winter and summer, and are based on moderate global warming.

Source: CSIRO and BOM data available at www.climatechangeinaustralia.gov.au.

The predicted temperatures for 2030 indicate that there will be an increase in the average winter and summer temperatures across Northern Australia, particularly in the more inland areas. The Pilbara, Kimberley, Barkly-Central NT, North West and Longreach regions are predicted to have the highest average temperatures during summer (with average temperatures above 30 degrees celsius). On the other hand, lower temperatures within Northern Australia over the summer period are predicted to be in the eastern parts of Northern Queensland, especially in the Gladstone region, and sections of Mackay and Far North regions.

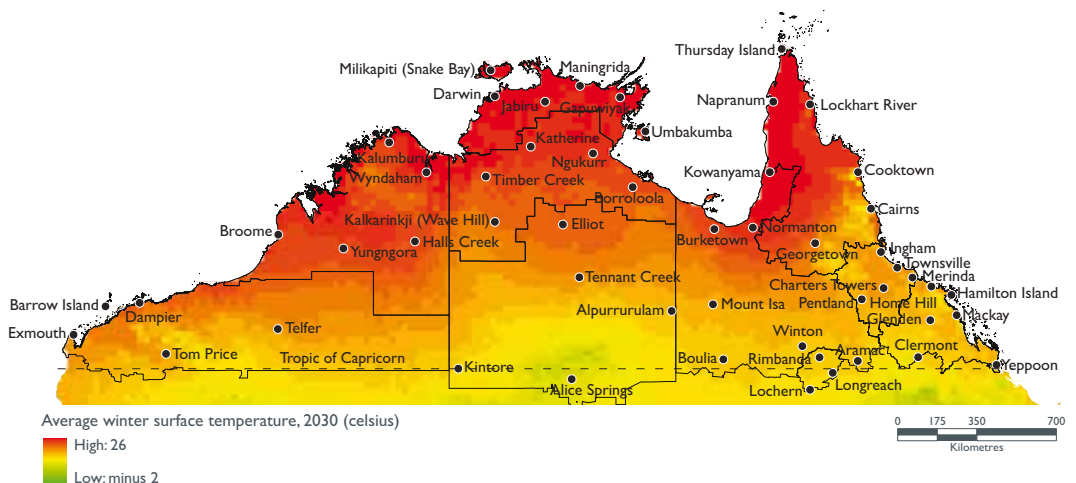
Map 8.3.2 Northern Australia—predicted average summer temperature (celsius), 2030



Source: BITRE map based on CSIRO and BOM data available at www.climatechangeinaustralia.gov.au.

As can be seen in Map 8.3.3, the highest temperatures in Northern Australia during the winter period are predicted to be in the Kimberley, Katherine-Lower Top End, Darwin-East Arnhem and Far North regions. The lowest temperatures are predicted to be in parts of the Barkly-Central NT and Gladstone regions (with average temperatures of approximately 14 degrees celsius).

Map 8.3.3 Northern Australia—predicted average winter temperature (celsius), 2030



Source: BITRE map based on CSIRO and BOM data available at www.climatechangeinaustralia.gov.au.

8.4 Cyclone activity

Table 8.4.1 and Map 8.4.1 show the cyclone occurrences within Northern Australia, over a thirty year period. On average there are about thirteen cyclones which form in the Australia region each cyclone season, although many do not make landfall (BOM 2009a). The majority of cyclone activity across Australia occurs within regions in Northern Australia.

In an average season, cyclones are most likely to occur in regions around north-east Queensland and also in regions around the north-west in Western Australia. At the regional level, areas within northern Western Australia were hit the most times by cyclones between 1970 and 2007. For example, in the Pilbara Region there were 67 cyclones, which resulted in 109 different SLAs being hit. In Far North Queensland, 95 SLAs were hit by cyclones between 1970 and 2007.

Tropical cyclones bring with them severe winds and rainfall, often with devastating effect. During the observed thirty year period, Cyclone Tracy (1974) and Cyclone Larry (2006) were among the most destructive cyclones. Cyclone Tracy hit Darwin causing 250 mm of rain in twelve hours and estimated winds of 240 kilometres per hour (BOM 2009b). This resulted in the highest level of property damage ever experienced in Australia as a result of a cyclone; with at least 90 per cent of Darwin homes badly damaged or destroyed (BOM 2009b). The cyclone also resulted in 71 deaths, and thousands of injuries (Australian Government 2008).

In 2006, Cyclone Larry hit the Far North Region in Queensland, with winds reaching 290 kilometres per hour (BOM 2007). This resulted in major damage to agricultural crops, homes, and other buildings in the area. Access to the region via road and rail was disrupted for several days due to the flooding which occurred in the area, meaning that food drops were required to several townships (BOM 2007). The affected area was declared a national disaster zone and the estimated cost of the damage to the region was \$A1.5 billion (Australian Government 2008).

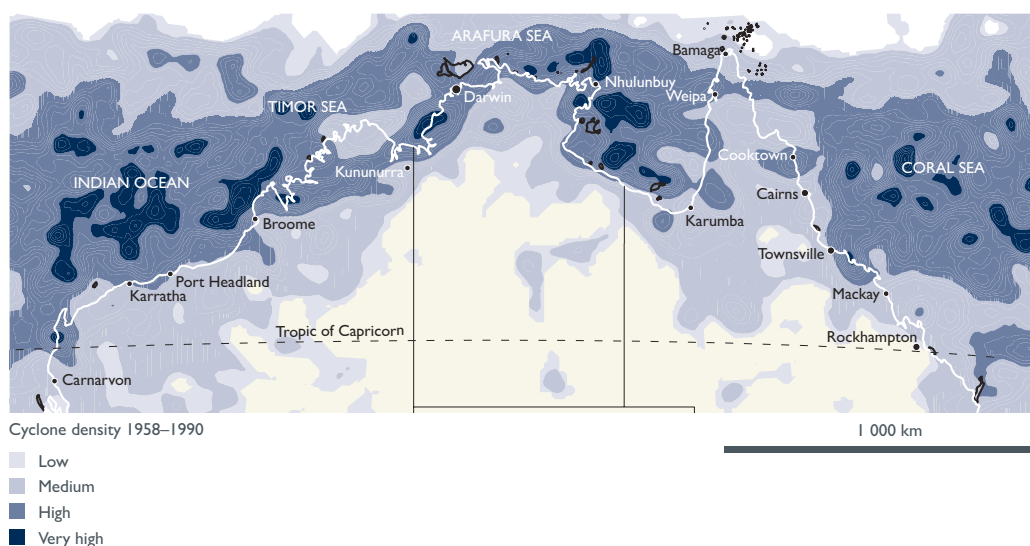
As can be seen in Map 8.4.1, there was a substantial cyclonic activity within the Northern Territory. This was particularly the case in the more northern regions (Darwin-East Arnhem and Katherine-Lower Top End). High cyclone density was also observed in northern Queensland, particularly around the Far North and North West regions (see Map 8.4.1). On the other hand, some parts of northern Queensland, such as the Longreach Region, which is located inland and further south, was less likely to be hit by cyclones.

Table 8.4.1 Northern Australia—cyclone occurrences between January 1970 and 30 June 2007

Region ¹	Number of cyclones ²	Number of SLAs in which those cyclones occurred in ³	Total number of cyclone occurrences ⁴
Northern Australia (WA)	123	198	667
Pilbara Region	67	109	347
Kimberley Region	56	89	320
Northern Australia (NT)	75	136	304
Darwin-East Arnhem Region	32	62	120
Katherine-Lower Top End Region	30	55	122
Barkly-Central NT Region	13	19	62
Northern Australia (QLD)	93	170	349
Mackay Region	12	21	34
Northern Region	9	10	15
Far North Region	47	95	194
North West Region	24	43	104
Longreach Region	1	1	2
Northern Australia subtotal	291	504	1 320

1. Northern Australia is based on regions which fall above the Tropic of Capricorn. Areas with latitude greater than -24 degrees were excluded. Where the data did not precisely meet this definition, approximations are given.
2. The number of different cyclones which affected each subregion.
3. Total number of SLAs which a cyclone was observed in. Each cyclone is assigned one name, meaning one cyclone occurrence may hit multiple SLAs with cyclonic strength.
4. The total number of times the SLAs were hit by cyclones. Each cyclone is assigned one name, meaning a cyclone may last for a longer time period and may hit an individual area multiple times with cyclonic strength.

Source: Bureau of Meteorology (2008).

Map 8.4.1 Northern Australia—cyclone density, 1958–90

Source: Department of the Environment, Water, Heritage and the Arts (2003).

8.5 Minerals and energy resources

Mineral and energy resources of Northern Australia are abundant and new discoveries and improvements in technology result in continuous upgrading of many minerals' *economic documented reserves*.

Information on mineral and energy resources of Northern Australia can be accessed directly through the online *Atlas of Australia's Mineral Resources, Mines and Processing Centres*.¹⁸ The atlas has a web-based geographic information system format and shows the spatial location of resources, mines and respective production/processing centres across Australia. Information contained in this section was largely sources from the *Australia's identified mineral resources, 2008*, by Geoscience Australia, which is also available online.¹⁹

In addition to the deposits of iron ore, coal, oil and gas, which are subject to exports in large tonnage via sea ports, Northern Australia has a number of metal ore deposits, such as copper, bauxite, lead, zinc, manganese and nickel. Apart from these 'high tonnage' minerals, there are numerous deposits of other minerals and energy products mined in Northern Australia, such as uranium, gold, silver, tin, et cetera. Some of the minerals are mined jointly in various quantities from the same ore body, for example, copper, gold and uranium in the Darwin-East Arnhem Region of the Northern Territory, while others are found in a geographic proximity to others, such as iron ore and manganese in the Pilbara Region of Western Australia.

Western Australia's Pilbara Region dominates the Australian iron ore mining industry, accounting for 97 per cent of total production. The Pilbara Region produces about 85 per cent of Australia's total identified resources and 92 per cent of its extraction.

The following maps illustrate the geographic location of selected minerals which can be found in the previously mentioned *Atlas of Australia's Mineral Resources, Mines and Processing Centre*.

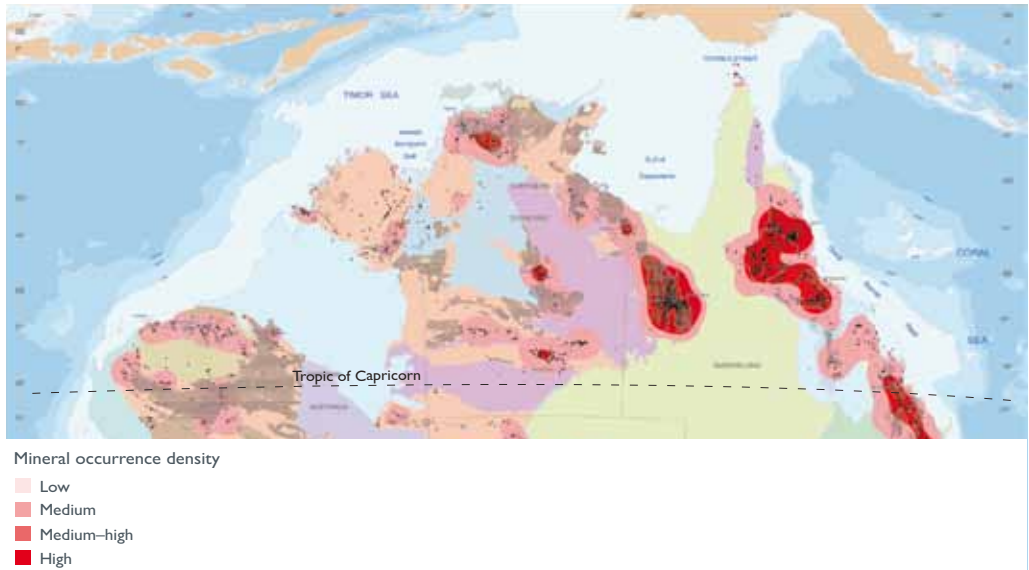
Copper

Copper ore deposits are being mined in a number of regions of northern Queensland, around Mt Isa and in eastern northern Queensland, and in the Darwin-East Arnhem Region (Ranger project). Queensland has the second largest *economic documented reserves* (EDR) with 12 per cent of the national total. Copper is also mined in other mining operations across Northern Australia either as a dedicated operation or as part of wider mining projects in the Katherine-Lower Top End and Barkly-Central NT in the Northern Territory (see Map 8.5.1). The map also illustrates the potential copper reserves which are present in nearly all regions of Northern Australia.

18. The Atlas can be accessed from this website: www.australianminesatlas.gov.au.

19. Publication available http://www.ga.gov.au/image_cache/GA12717.pdf.

Map 8.5.1 Northern Australia—copper deposits, occurrence and potential



Source: Geoscience Australia.

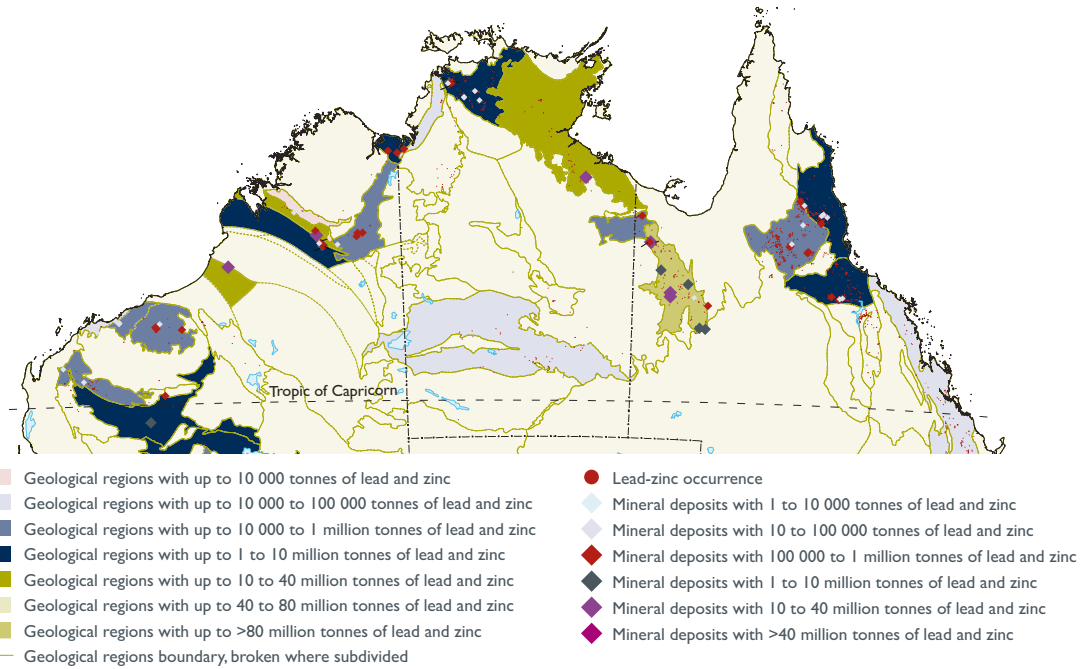
Lead and zinc

Lead and zinc are being mined in the Mt Isa area of Queensland but prospective reserves in Northern Australia are numerous across north-eastern Queensland, the Darwin-East Arnhem Region in Northern Territory, the Pilbara and Kimberley regions of Western Australia (see Map 8.5.2).

Manganese

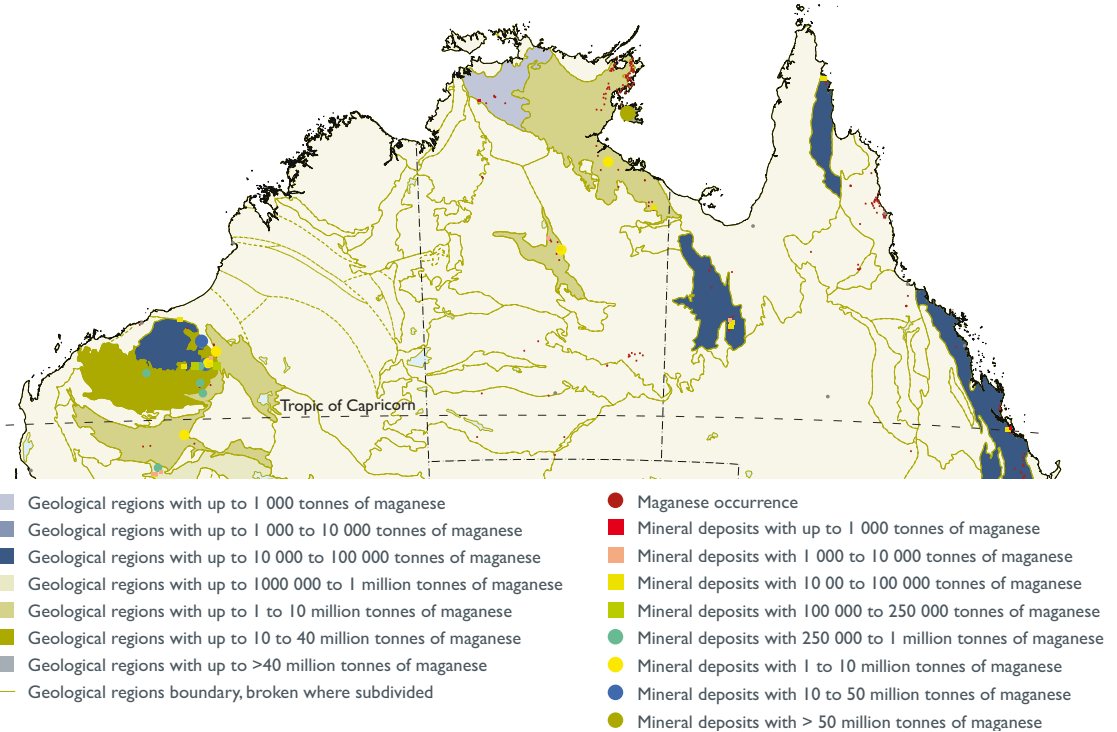
Manganese ores are mined in the Kimberley Region of Western Australia and are also documented to occur in smaller quantities in the Darwin-East Arnhem and Katherine-Lower Top End regions of Northern Territory, as well as in the North West and Far North regions of Queensland (see Map 8.5.3).

Map 8.5.2 Northern Australia—lead and zinc resources



Source: Geoscience Australia.

Map 8.5.3 Northern Australia—manganese resources

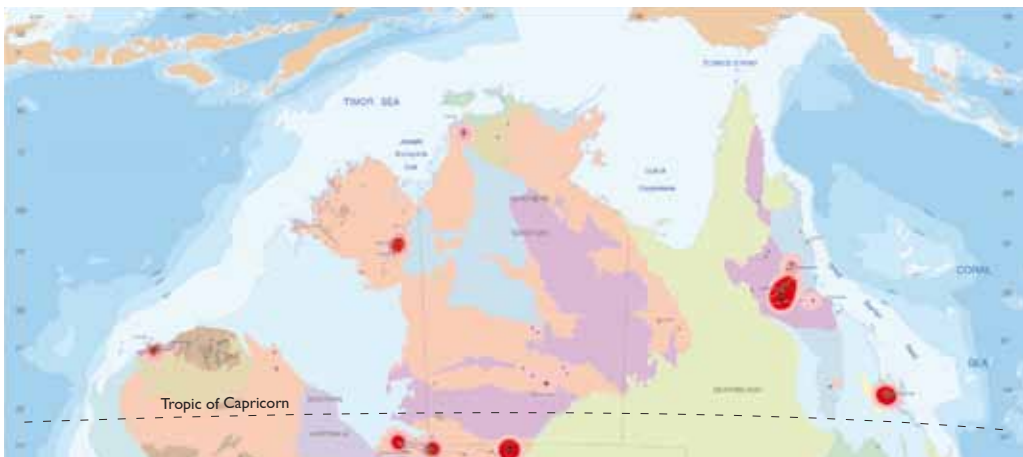


Source: Geoscience Australia

Nickel

Nickel deposits are documented in a number of regions of Northern Australia, such as the Pilbara and Kimberly regions in Western Australia, the Darwin-East Arnhem and Barkly-Central NT in the Northern Territory (see Map 8.5.4). Substantial nickel deposits are located in the Northern Region of Queensland.

Map 8.5.4 Northern Australia—nickel deposits, occurrences and potential



Mineral occurrence density

- Low
- Medium
- Medium-high
- High

Source: Geoscience Australia.

Gold

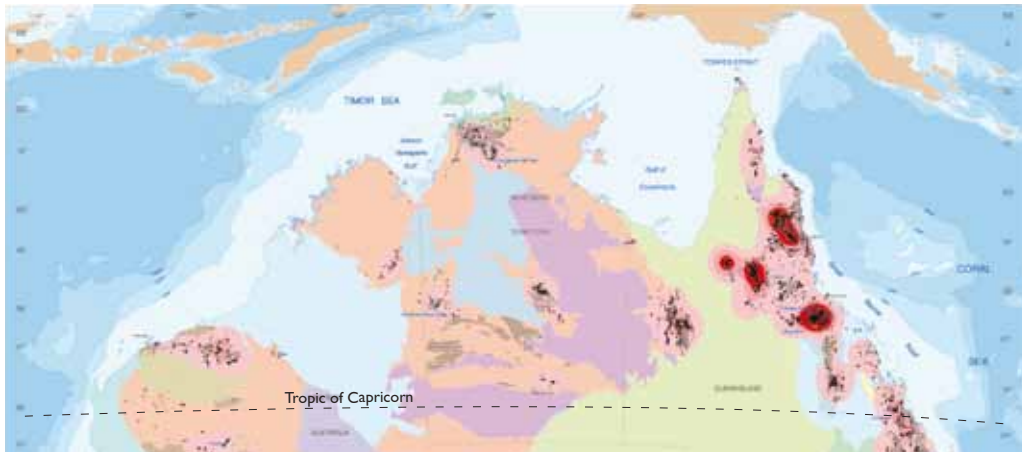
Australia's gold resources occur and are mined in all states and the Northern Territory. The largest documented deposits of gold are in the northern part of the Great Dividing Range of Queensland. Smaller sites occur in many regions of Northern Australia, as illustrated on Map 8.5.5. Gold's *economic demonstrated resources* have increased steadily since 1975 with much of the increase attributed to the improvement in ore processing by introduction of the carbon-based technology which allowed for processing of low-grade ore deposits.

Diamonds

Australia ranks as the world's fourth largest producer of diamond by weight after Russia, Botswana and Congo. As a producer of gem/near gem diamond, Australia is the fourth largest after Russia, Botswana and Canada, and is the third largest producer of industrial grade diamonds after Congo and Russia.

Australia's diamond production is almost entirely from Rio Tinto Ltd's Argyle mine in the Kimberley Region of Western Australia. Other diamond resources are being developed and mined in the Ellendale mine in the western part of the Kimberley region (see Map 8.5.6). North Australian Diamonds Ltd is evaluating a potential mining project which could produce 400 000 carats per year and is located in Merlin, (eastern part of the Darwin-East Arnhem Region).

Map 8.5.5 Northern Australia—gold deposits, occurrences and potential

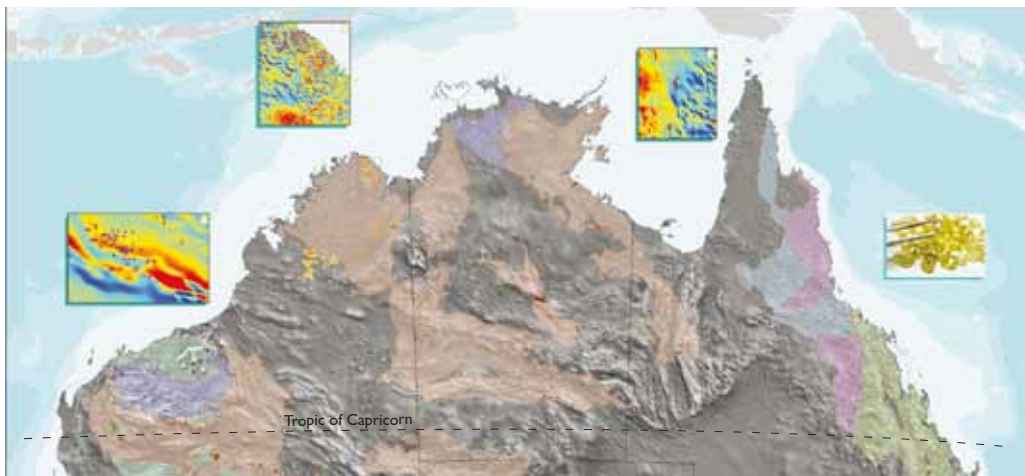


Mineral occurrence density

- Low
- Medium
- Medium-high
- High

Source: Geoscience Australia.

Map 8.5.6 Northern Australia—diamond deposits, kimberlites, and related rocks



Total Magnetic Intensity

- High (nT)
- Low (nT)

Note: nT—nanotesla.

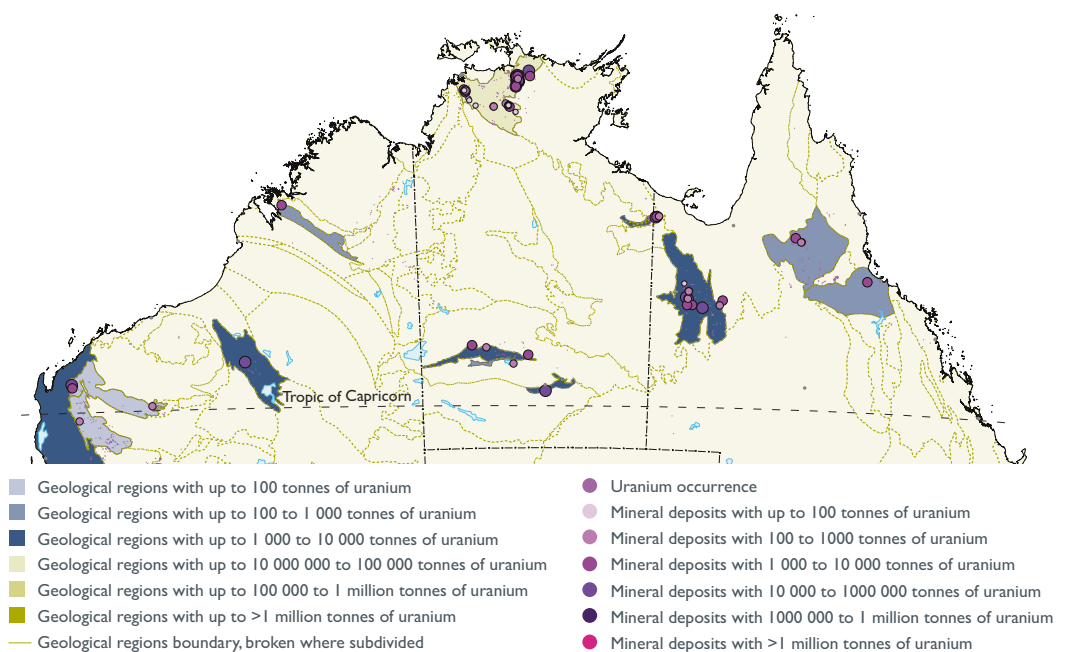
Source: Geoscience Australia.

Uranium

Australia's *economic demonstrated resources* at December 2007 were estimated to be 983 000 tonnes of U_3O_8 , which represented an increase of 38 per cent over the estimates for December 2006. This was due mainly to a large increase in resource estimates for the Olympic Dam deposit (South Australia) but resources also increased at *Ranger 3* deposit in the Darwin-East Arnhem Region in the Northern Territory. This fast deposit development took place mostly in Northern Australia. Among the main exploration areas (in terms of expenditure) in developing uranium resources during 2007 were the Northern Territory—the Alligator Rivers region and Western Arnhem Land, Rum Jungle area and Ngalia Basin and in Queensland—the Mt Isa area.

Northern Territory's uranium resources represented 13 per cent of Australia's total resources. Approximately 95 per cent of Australia's total uranium resources in *economic demonstrated reserves* are within the following six deposits: Olympic Dam, which is the world's largest uranium deposit in South Australia; Ranger, Jabiluka, Koongarra in the Alligator Rivers region in the Northern Territory; and Kintyre and Yeelirrie, which are located in southern Western Australia.

Map 8.5.7 Northern Australia—uranium resources



Source: Geoscience Australia.

Coal

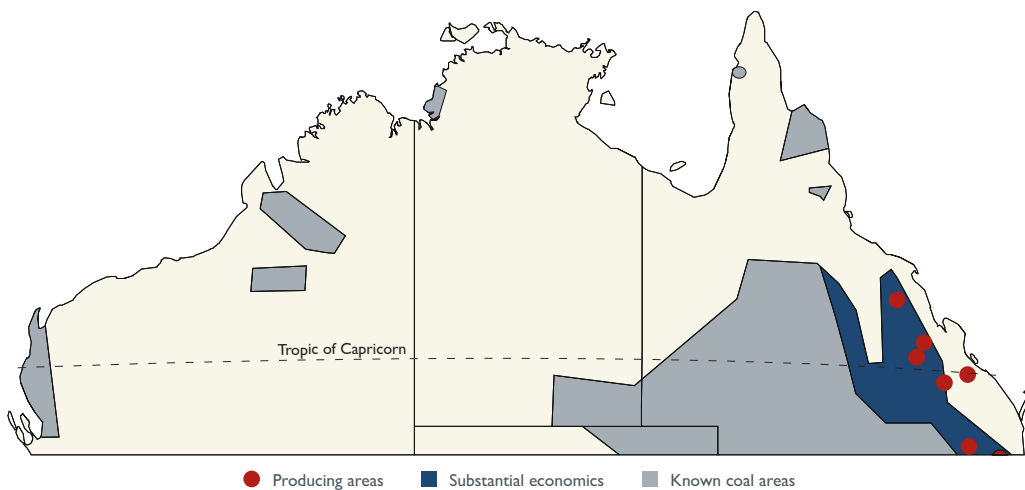
Coal is a widespread resource available across Australia. In Northern Australia, coal is abundant in the Mackay and Far North regions of Queensland. The Bowen Galilee Basins in particular are being further developed to provide thermal and coking coal for exports and local industries. The map below illustrates the *known coal areas, substantial economic and producing area* (see Map 8.5.8). Currently, the *economic*

resources, which are closer to port facilities or local markets are being exploited and further developed, although new coal fields are being added to coal resources.

For example, Waratah Coal was granted two coal exploration leases in the Laura Basin, in the Far North Region of Queensland, in December, 2007. The Laura Basin is situated on the eastern side of Cape York Peninsula. Within the Laura Basin, known coking coal resources have been identified at Bathurst Range in the Bathurst Seam. Resource tonnage is in excess of 50 million tonnes and the seam thickness greater than 1.5 metres (Waratah Coal, 2007).

Similar potential for future coal resource expansion exists in a number of regions, as the *known coal areas* exist in the Pilbara and Kimberley regions of Western Australia, the Darwin-East Arnhem Region of the Northern Territory and the North Western region of Queensland.

Map 8.5.8 Northern Australia—black coal resources



Source: Australian Coal Association (2009).

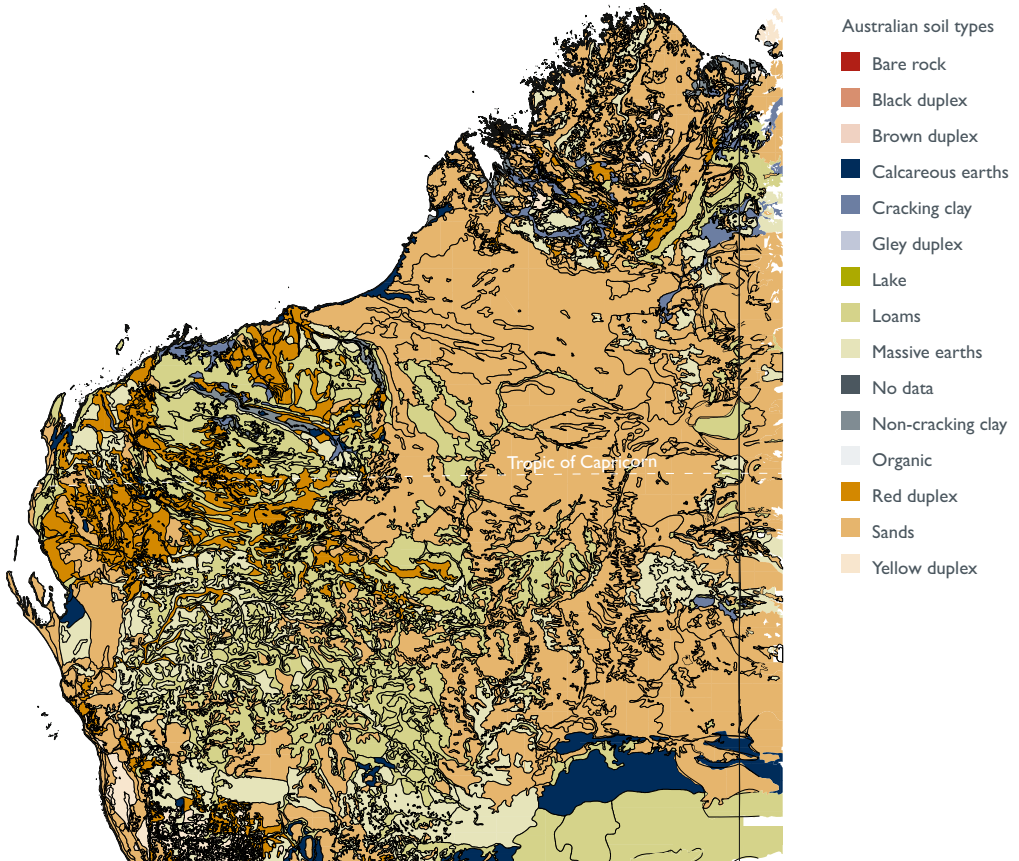
8.6 Soil characteristics

This section discusses soil characteristics across Northern Australia, with reference to soil types, organic carbon levels, soil pH levels and plant available water capacity. These are some of the indicators which can be used by land users and policymakers in assessing the productive capacity of different tracts of land.

Maps 8.6.1 to 8.6.3 provide a basic overview of soil types across Northern Australia. With reference to the North of Western Australia, Pindan red loam makes up the basis of most soils throughout the western Pilbara. The loams of Karratha, Dampier, Roebourne, Wickham and Point Samson have a gravelly texture, with stone making up a significant component of the soil (Water Corporation, no date available). Sand, sandy loam and rocky stony soils are more common inland (Water Corporation, no data available). In semi-tropical to arid climates across the region, agricultural use of land (where possible) is based largely on rangeland pastoralism across large tracts of grazing country.

In about one-third of the Kimberley Region, shallow soils and rock outcrops dominate, making these areas generally unsuitable for agriculture. Deep red or brown sandy soils occupy approximately one-quarter of the region, and support some pastoral rangelands grazing, as well as some irrigated cropping. Cracking clays are more limited, but are important for grazing and irrigated agriculture (Kimberley Development Commission, no date available).

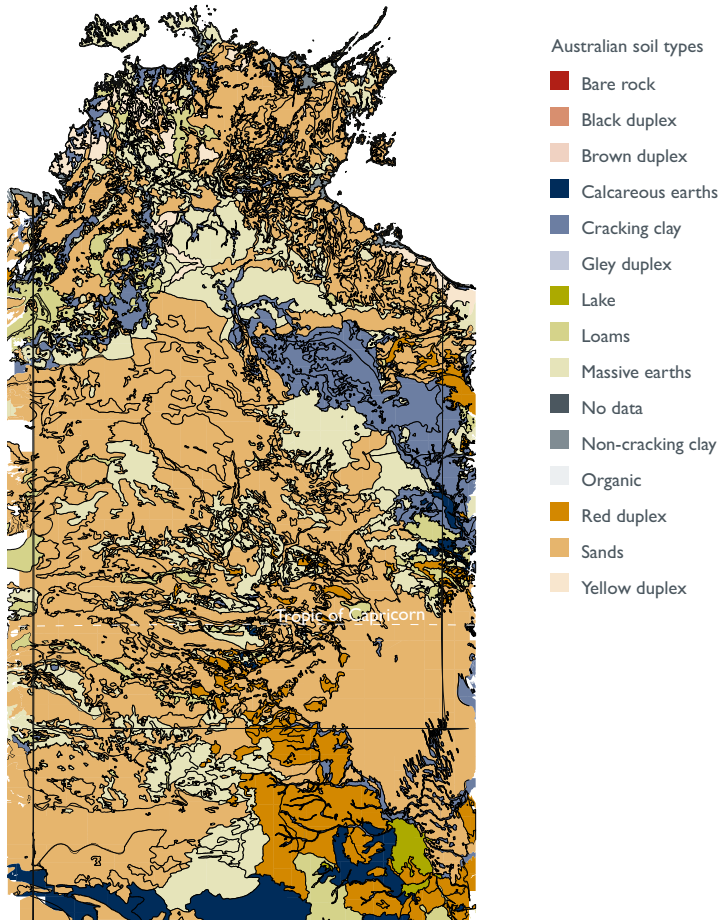
Map 8.6.1 Northern Australia— northern Western Australia soil types



Source: BRS (2009).

With respect to the Northern Territory, the soil pattern is complex without large areas of uniform soil types. According to O’Gara (2007 p.13), ‘Most soils are highly erodible, difficult to manage under conventional cultivation and have relatively poor natural fertility and low water holding capabilities. Soil types range from massive red, yellow and grey earths to shallow ironstone gravels ... shallow stony and sandy soils [are] interspersed with massive red and yellow earths throughout the Top End ... Surface textures range from sands to clay loams ... Black and brown cracking clay soils ... are common on the seasonally flooded coastal areas ...’

Map 8.6.2 Northern Australia—Northern Territory soil types



Source: BRS (2009).

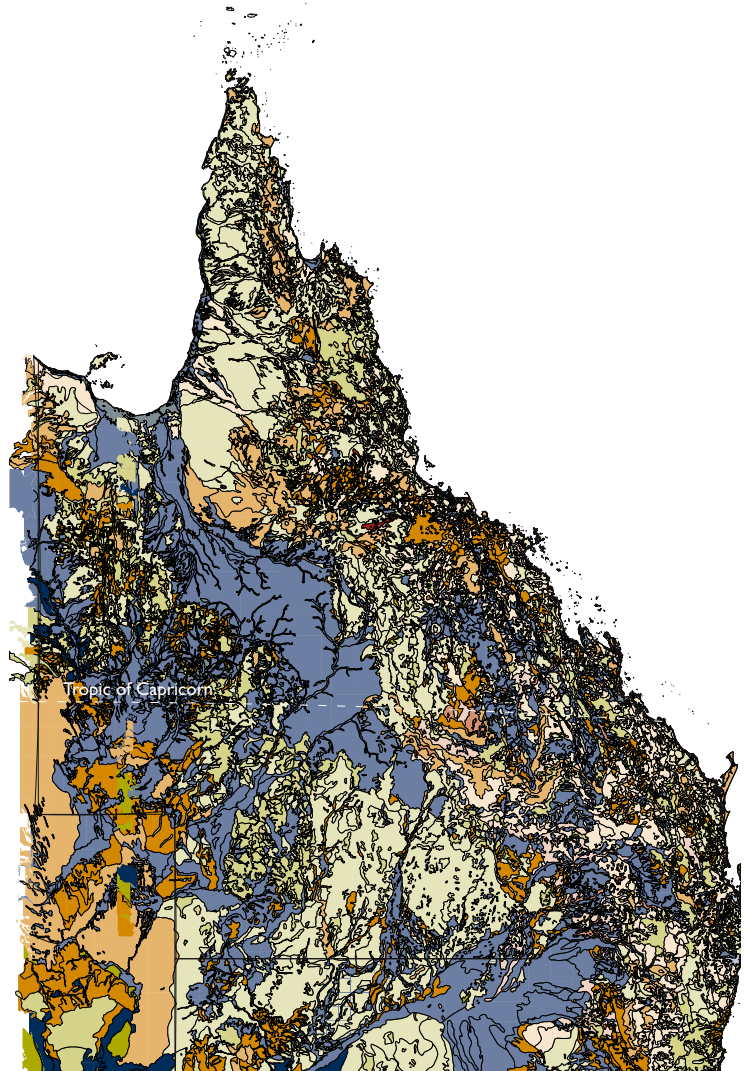
In the semi-arid and tropical regions of northern Queensland, red, yellow and grey Kandosols feature strongly²⁰ (McKenzie, Jacquier et al 2004 p.68). These soil types (particularly red and yellow) have relatively high plant water availability and are well-drained. Red Kandosols are suitable for uses such as sugar cane cropping and beef grazing, for example. The other Kandosols are associated more typically with rangelands grazing (Department of the Environment, Water, Heritage and the Arts 2007).

20. Kandosols include soils with weak or massive subsoil structure. For further information see (Department of the Environment, Water, Heritage and the Arts 2007). They are displayed on the map in this publication under the catch all category ‘massive earths’.

Map 8.6.3 Northern Australia—northern Queensland soil types

Australian soil types

- Bare rock
- Black duplex
- Brown duplex
- Calcareous earths
- Cracking clay
- Gley duplex
- Lake
- Loams
- Massive earths
- No data
- Non-cracking clay
- Organic
- Red duplex
- Sands
- Yellow duplex



Source: BRS (2009).

The Australian Soil Resource Information System (ASRIS) database²¹ includes descriptions of soils and landscapes across the whole of Australia, as well as more detailed soil profile information on soil thickness, water storage, permeability, salinity, fertility and erodibility for selected sites across the country. Readers seeking more detailed soil information may also contact the National Committee on Soil and Terrain. This committee is made up of a range of Federal, state and territory agencies which provide information to a central data collection point through the Australian Collaborative Land Evaluation Program. Relevant contact details and information about the agencies involved can be found online at <http://www.clw.csiro.au/aclep/Collaborators.htm>.

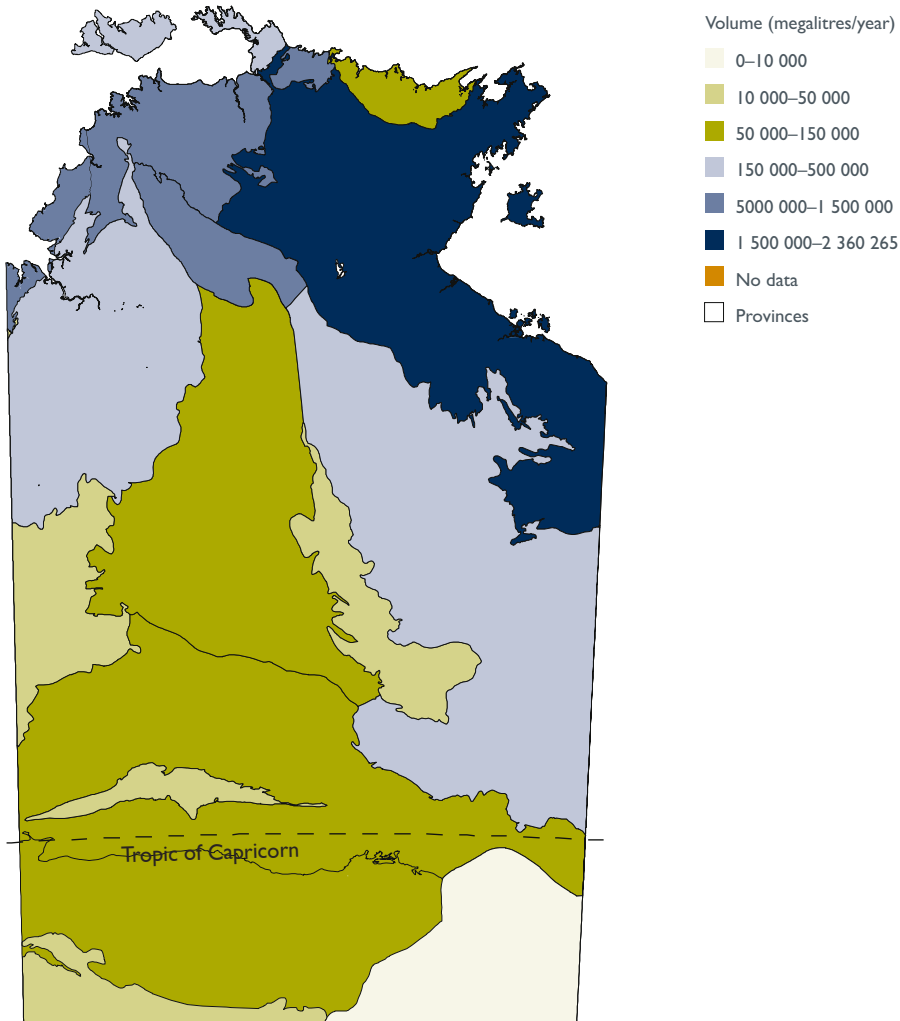
21. For more detailed information about soils and landscapes across Australia, readers may consult online at <http://www.asris.csiro.au/about.html>.

Groundwater

Groundwater refers to water which is stored underground in rock fractures or pores. Maps 8.7.1 to 8.7.3 show that groundwater capacity varies considerably over the Northern Australian region.

For example, Map 8.7.1 and 8.7.3 show that across much of the Northern Territory's interior and the northern Kimberley in Western Australia, groundwater basins have a sustainable yield of less than 500 gigalitres per year. Meanwhile, in Map 8.7.1 it can be seen that much of the Arnhem and Gulf coastal area of the Northern Territory (part of the Darwin-East Arnhem Region) have underground reserves which can produce a sustainable yield of between 2000 and 2500 gigalitres per year, the highest in Northern Australia.

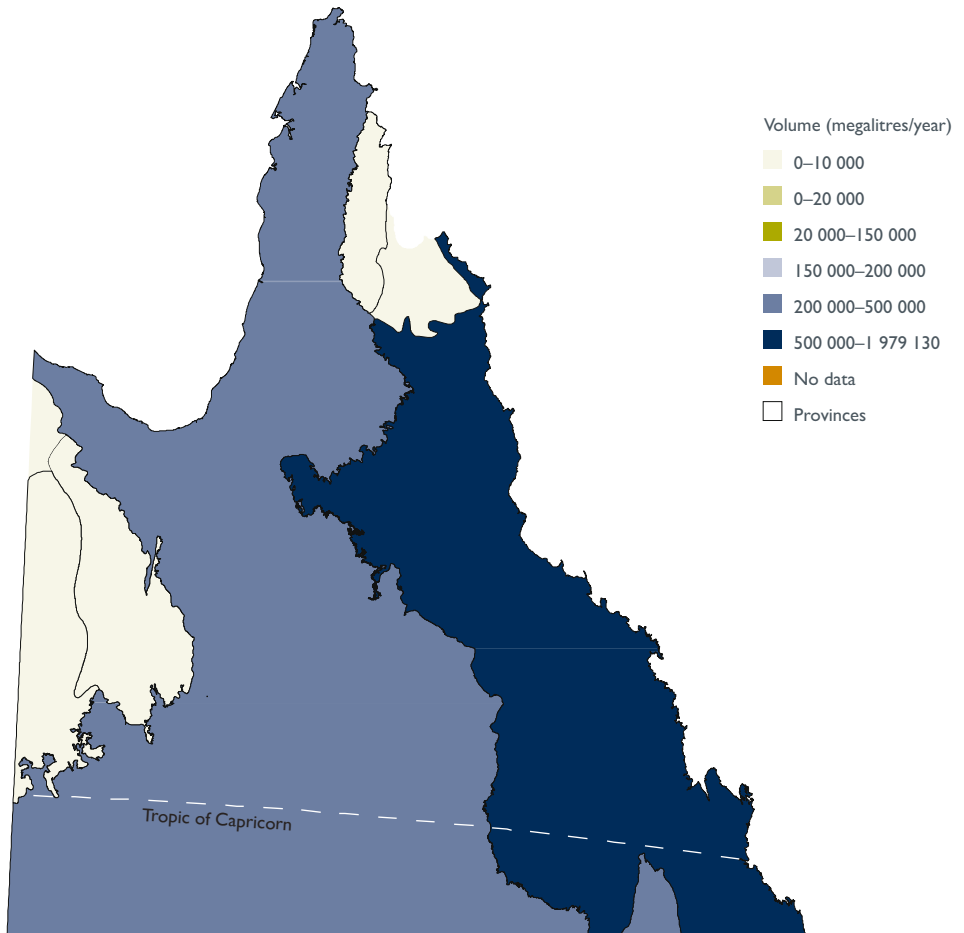
Map 8.7.1 Sustainable yield of groundwater provinces, Northern Territory



Source: Land and Water Australia (2001).

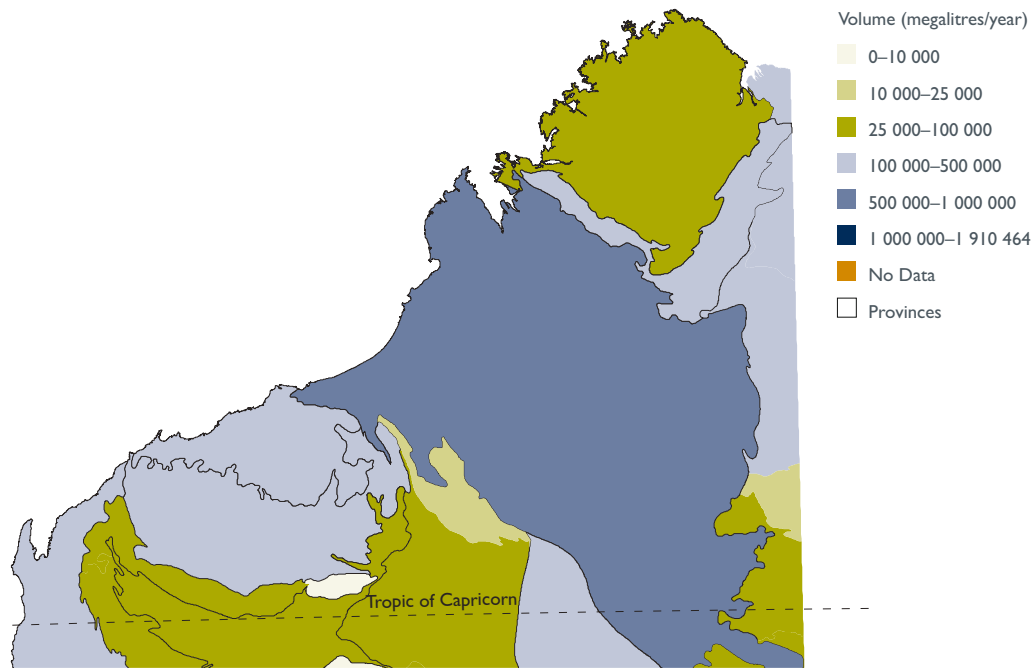
In Map 8.7.2, it can be seen that the Great Artesian Basin stretches across much of Queensland (particularly the North West and Far North regions within Northern Australia), with a sustainable yield of between 200 000 and 500 000 megalitres of water per year. This is one of the largest artesian groundwater basins in the world. It underlies approximately one-fifth of Australia, covers a total area of over 1 711 000 square kilometres and it has an estimated total water storage of 64 900 million megalitres.

Map 8.7.2 Sustainable yield of groundwater provinces, Queensland



Source: Land and Water Australia (2001).

Map 8.7.3 Sustainable yield of groundwater provinces, Western Australia



Source: Land and Water Australia (2001).

Water supplies from groundwater resources have been developed to meet urban, rural domestic, pastoral, irrigated agriculture, mining, construction and aquaculture demands (Australian State of the Environment Committee 2006). Many rural and urban areas within Northern Australia rely heavily on groundwater to meet their water supply needs.

Across Australia, there has been a large increase in the levels of groundwater usage between 1983–84 and 1996–97. This is particularly the case in Western Australia and the Northern Territory (see Table 8.7.1).

As information on ground water within the Northern Australia subregions considered by this compendium was not available, data tables and maps have been provided which show the ground water levels and allocated usage for the three states/territories within Northern Australia: Western Australia, Queensland and the Northern Territory.

Table 8.7.1 Groundwater usage, 1983–84 to 1996–96

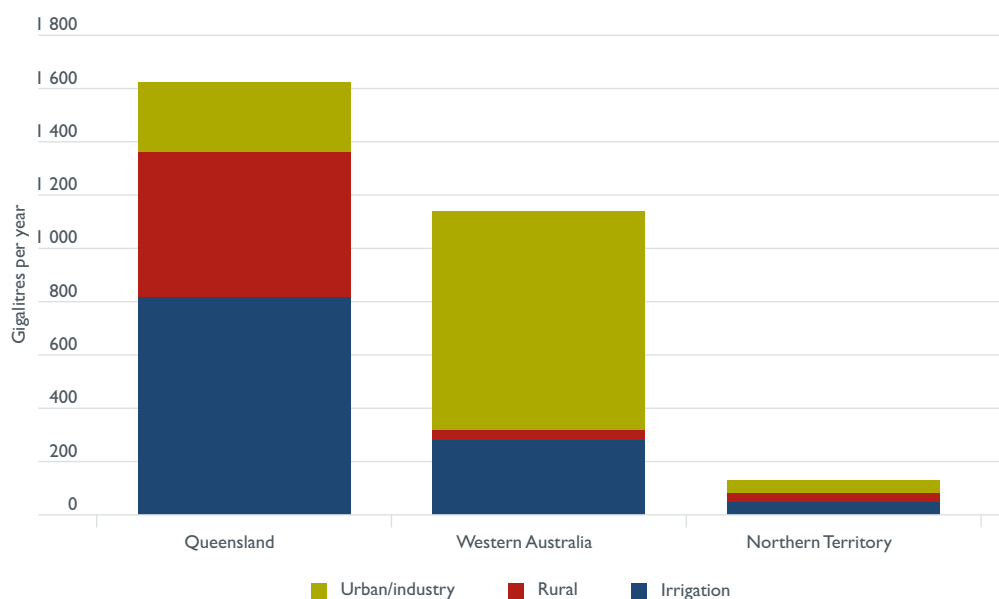
Province	Use in 1983–84 (gigalitres per year)	Use in 1996–97 (gigalitres per year)	Per cent change
Queensland	1 121	1 622	45
Western Australia	373	1 138	205
Northern Territory	65	128	97
Australia	2 634	4 962	88

Source: Australia State of the Environment Committee (2006).

As discussed in Chapter 9, irrigated agriculture, mining, and forestry and fishing are large industries within Northern Australia. Due to the reliance of these industries on water, and the increased levels of usage which have been observed over the past decades, there is growing pressure to exploit additional groundwater and river systems within Northern Australia (Australian State of the Environment Committee 2006).

Figure 8.7.1 shows that the highest user of groundwater in Queensland during 1996–97 was irrigated agriculture, while industries (such as mining and manufacturing) used a substantial proportion of Western Australia’s groundwater during the same period. Groundwater use within the Northern Territory was balanced between irrigation, rural, and urban/industry during 1996–97.

Figure 8.7.1 Groundwater usage, by state, 1996–97



Source: Australian Government (2007).

Additional maps which show the volume of groundwater allocated for use, either within or external to a surface water management area, is available in the background information.

Within the north of the northern Northern Territory, the highest levels of groundwater usage are within the Darwin-East Arnhem Region. The more southern parts of the Barkly-Central NT Region, in and around Alice Springs, also have higher levels of groundwater usage. The Darwin and Katherine population centres use both groundwater and surface water supplies. In contrast, Tennant Creek and Alice Springs are entirely reliant on groundwater supplies, as are the majority of smaller communities within the Northern Territory.

At the regional level, most of the groundwater is used by the pastoral industry (23.5 gigalitres per year), with mines across the region such as the Nabalco bauxite mine also using on groundwater (17 gigalitres per year).²² Irrigated agriculture and

22. http://www.anra.gov.au/topics/water/allocation/nt/index.html#gw_alloc.

horticulture, which mainly feature in the Darwin and Katherine regions, also use a large amount of groundwater (47 gigalitres per year).²³

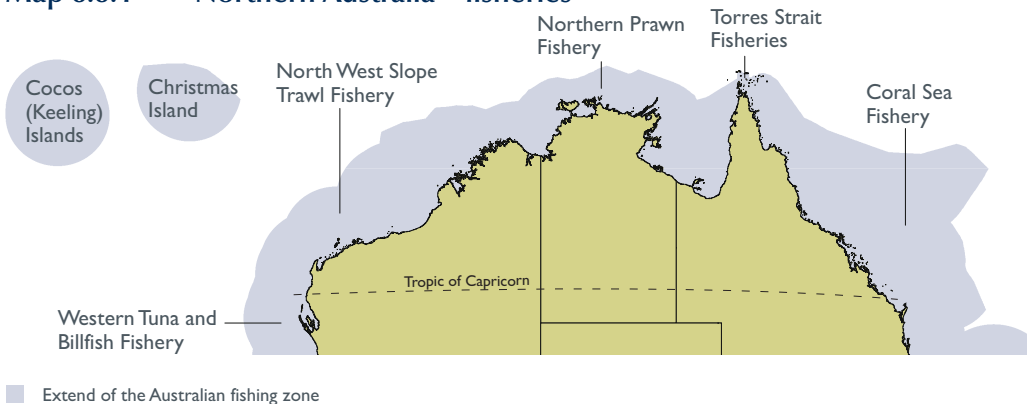
8.8 Fisheries

Due to the importance of the fishing industry and the pressures currently being placed on the natural marine environment, the fisheries of Australia have been placed under strict management, both at the state and national level. Each fishery incorporates measures such as catch limits, size limits, target catches and seasonality to ensure the sustainable harvest of the fisheries.

Fisheries are open to two classes of fishing: commercial and recreational. Commercial fishing is important as a source of food for both domestic and foreign consumption, while recreational fishing is important as a source of tourism revenue for the regions where this is allowed.

At the national level, the Australian Fisheries Management Authority (AFMA) is responsible for the efficient and sustainable management of the Commonwealth fish resources. Generally, they manage fisheries from three nautical miles to 200 nautical miles (or national economic boundaries) of ocean, but on negotiation with the states can manage up to the shore line. State authorities control the fisheries situated within three nautical miles of the coast.²⁴

Map 8.8.1 Northern Australia—fisheries



Source: AFMA (2008).

AFMA manages more than twenty fisheries, nine of which include waters off Northern Australia. Of these nine, only four fisheries are exclusively associated with Northern Australia.

The fisheries which are situated off the coast of Northern Australia are:

- Torres Strait Fisheries
- Coral Sea Fishery

23. http://www.anra.gov.au/topics/water/allocation/nt/index.html#gw_alloc.

24. All data on the fisheries administered by the AFMA comes from their website <http://www.afma.gov.au/fisheries/default.htm>.

- Western Deepwater Fishery (a small area of its most northern part)
- Northern Prawn Fishery
- North West Slope Fishery
- Eastern and Western Tuna, Skipjack and Billfish fisheries (which cover the whole of the Australian coast).

Coral Sea Fishery

The Coral Sea Fishery is a relatively small fishery which lies off the coast of Queensland, encompassing approximately 17 000 square kilometres. A diverse set of marine life are allowed to be fished, including sea cucumber, shark and large varieties of finfish. In 2006–07, the approximate landed weight from the Coral Sea Fishery was 192.2 tonnes (plus aquarium fish) with an estimated value of \$1.34 million.

Northern Prawn Fishery

Situated off the northern coast of Australia, the Northern Prawn Fishery stretches from Cape York in Queensland to Cape Londonderry in Western Australia. The Northern Prawn Fishery produces nine commercial species of prawns as well as squid, scallops, scampi and bugs.

To manage this fishery, the AFMA operates a number of controls so that the fishery is not over fished. These controls include and are not limited to seasonal closure, localised permanent closures and limited entry.

In 2006–07, production from this fishery was estimated at \$64 million, which is down from the 2000–01 peak estimate of \$164 million. In 2006–07, 2647 tonnes of banana prawns and 1834 tonnes of tiger prawns were produced.

North West Slope Trawl Fishery

The North West Slope Trawl Fishery is situated off the northern Western Australia coast, extending from 114°E to approximately 125°E. The fishery mostly targets crustaceans such as deepwater prawns and scampi. Many operators fish both the Northern Prawn Fishery and the North West Slope Trawl Fishery, though the fishery is somewhat seasonal, based on the seasonal operation of the Northern Prawn Fishery.

In 2003–04 (latest year available), the fishery produced an estimated 61.6 tonnes with an estimated value of \$A1.149 million, mostly for domestic consumption.

Western Deepwater Trawl Fishery

The majority of the Western Deepwater Trawl Fishery is not situated off the coast of 'northern Australia', though its most northern part can be considered part of Northern Australia. This fishery produces numerous different types of fish, primarily finfish. In the northern section the fish tend to be more tropical in nature, such as tropical snapper.

The Western Deepwater Trawl Fishery is not heavily fished with a total haul of 109.5 tonnes valued at approximately \$979 600 in 2003–04. The market for the produce of the fishery is mainly domestic.

The above figures are for the whole of the Australian fishery and not for Northern Australia parts alone, as the data was not able to be divided into our northern Australia classifications.

Eastern and Western Tuna, Skipjack and Billfish fisheries

These fisheries cover the whole of the Australian Fishing Zone, with the only difference in coverage being in the Torres Strait area. Fishing of these fish also occurs on the high seas, outside of the Australian Fishing Zone. These fisheries have an east/west divide for the ease of management. The main markets for the production of the Tuna and Billfish Fisheries are Japan, America and domestically, while the majority of the production of the Skipjack Fisheries are supplied to the Port Lincoln cannery.

The Eastern Tuna and Billfish Fishery's main port in Northern Australia is Cairns. A total of 5217 tonnes was produced from this fishery at a value of \$A26.8 million in 2006–07.

The Western Tuna and Billfish Fishery produced 925 tonnes (including 446 tonnes of skipjack tuna) in 2005–06 at a value of \$A3.2 million. Due to the depressed price of skipjack, Australian production values have in the ten years to June 2007 ranged from \$A0 to \$A8.1 million.

These figures are for the whole of these fisheries and not for Northern Australia alone, as the data was not able to be divided into our Northern Australia classifications.

Torres Strait Fisheries

The Protected Zone Joint Authority (PZJA)²⁵ (a joint operation of the Australian Government, the Queensland Government and the Torres Strait Regional Authority) manages and is responsible for the 10 separate fisheries located in the Torres Strait Protected Zone (TSPZ). The purpose of these fisheries is to acknowledge and protect the traditional culture and livelihoods of the inhabitants of the Torres Strait. Within these fisheries, the traditional inhabitants have the right of free movement and can fish for their traditional catch, in a traditional manner. For instance, in the Pearl Shell Fishery, licences are limited to the Indigenous population, and the only method of harvest allowed is diving and hand collection.

The largest (in geographical size) fishery is the Turtle and Dugong Fishery, where Torres Strait Islanders are allowed to fish for turtles and dugong using their traditional methods. All of the other fisheries are geographical subsets of the Turtle and Dugong fishery. Detailed maps of the other Torres Strait fisheries can be found at <http://www.pzja.gov.au/resources/maps.htm>. Some of the other fisheries of the Torres Strait are for rock lobster, barramundi, beche-de-mer (sea cucumber) and crab.

The total catch for the Torres Strait Fisheries was 1835 tonnes at an approximate value of \$23.5 million in 2006–07. The majority of this (1171 tonnes and \$11.3 million) came from harvesting prawns. In 2000–01, 619 (± 134) dugongs and 1619 (± 574) turtles were reported as caught.

25. <http://www.pzja.gov.au/>.

Western Australia State Fisheries

The Western Australian Department of Fisheries oversees the fisheries along the Western Australian coast which are within three nautical miles of the shore. The Department breaks up its coast into four offshore and two inland bioregions. Each region contains numerous fisheries based on geographical location and target catch. Of interest to Northern Australia are the North Coast Bioregion and the most northern part of the Gascoyne Coast Bioregion.

The North Coast Bioregion contains twelve individual fisheries, four dedicated to prawns, five dedicated to fish (and shark) of different species, and one each for oysters, crabs and beche-de-mer.

The estimated total catch for these fisheries was 4007 tonnes and 600 654 oysters for the 2007 reporting period (Western Australian Department of Fisheries 2008). The approximate value for this catch has not been made available yet.

The Gascoyne Bioregion contains six bioregions, only one of which is applicable to Northern Australia. The Exmouth Gulf Prawn Fishery, as its name suggests, is situated in the water east of Exmouth and targets four species of prawns. The fishery approximated production was 790 tonnes in the 2007 reporting period.

In terms of value of production, the Pearl Oysters Fishery is the most important of the Western Australia state fisheries. In the 2006 reporting period, the oyster production contributed over 80 per cent of the total production value for the year. This fishery is the last remaining wild stock pearl fishery in the world.

The second largest (by tonnage) fishery is the Pilbara Fish Trawl Fishery, which produces various species of snapper, emperor and cod. The Pilbara Fish Trawl Fishery produced an estimated 1704 tonnes in 2007. In 2006, this fishery produced 2222 tonnes at an estimated value of \$A10.5 million.

Recreational fishing is low in the North West Bioregion, with most of the recreational fishing occurring in the Blue Swimmer Crab (25 per cent of the commercial catch) and Mackerel Fisheries (around 45 per cent of the commercial catch with a small catch in the Pilbara Fish Trawl Fishery (between 2 and 10 percent) and the Kimberley Gillnet and Barramundi Managed Fishery (under 2 per cent).

Also situated in the Gascoyne Bioregion is the Ningaloo reef, an important natural attraction for the tourism industry, acting as a main attraction for tourists.

Northern Territory Fisheries

The Northern Territory Department of Regional Development, Primary Industry, Fisheries and Resources is responsible for the fisheries of the Northern Territory. The Northern Territory has 11 operating wild catch fisheries.

The value of the wild catch of the Northern Territory fisheries was estimated at \$A28.2 million in 2006, with the highest values coming from barramundi (\$A5.3 million), mud crab (\$A4.7 million) and shark (\$A4.3 million) (Department of Primary Industry, Fisheries and Mines 2007).

Due to the diverse nature of the marine life off the Northern Territory coast from the tropical nature of the waters, the Territory has a dedicated aquarium fishery for the sole purpose of harvesting marine life for the purpose of display. This fishery produced over 37 500 individual fish in 2006.

Indigenous fishing is also an important part of the Northern Territory fisheries. In 2000–01, 91 per cent of the Indigenous population of communities along the northern coast went fishing, with an average of 12 days fishing each in that year. The most important species for the Indigenous population (in number of organisms) were mussels, mud crabs and mullet.

Recreational fishing in the Northern Territory is estimated at the value of \$A35 million, which is from the value of equipment such as rods, reel and boats, spent by the people of the Northern Territory each year, with approximately 25 per cent coming from tourists from outside of the Northern Territory.

Queensland State Fisheries

The Queensland Department of Primary Industry and Fisheries is the authority which manages the states fisheries. Twenty-one fisheries were in operation in 2006, eighteen of which have an influence on Northern Australia. Most of the Queensland fisheries cover the whole of the Queensland coastline; only four fisheries are located solely in the waters off Northern Queensland.²⁶ These four fisheries are:

- East Coast Tropical Rock Lobster Fishery
- Gulf of Carpentaria Developmental Finfish Trawl
- Gulf of Carpentaria Inshore Finfish Fishery
- Gulf of Carpentaria Line Fishery.

Together these four fisheries produced 3037 tonnes with a combined estimated value of \$A25.7 million. The largest fishery is the Gulf of Carpentaria Inshore Finfish Fishery with 1929 tonnes of fish harvest, with an approximate value of \$A12.8 million in 2006.

These fisheries are also important as a source of indigenous fishing. There was an indigenous harvest of 13 000 individual lobsters from the East Coast Tropical Rock Lobster Fishery and a combined 262 000 individual fish were harvested from the Development Finfish Trawl and the Line Fishery.

As well as these fisheries, the fisheries of the Torres Strait are important to the coastal fishing of Queensland—but the majority of these are reserved for Torres Strait Islanders to fish in their traditional ways.

Recreational fishing is not large in these fisheries, with only 101 tonnes harvested in the Inshore Finfish Fishery and 44 tonnes in the Line Fishery.

The natural marine resources off the Queensland coast, includes the Great Barrier Reef. Considered one of the natural wonders of the world, it serves as a major tourist attraction for Queensland, bringing numerous tourists to the region each year, as indicated by the high aviation travel to and from Cairns and Townsville (see Chapter 6).

26. Each fishery has its own report and there is no amalgamated report to reference.

The following table (Table 8.8.1) summarises the total catch at the fishery level (only for those fisheries which are solely located in Northern Australia), the whole of Western Australia, Queensland and the Northern Territory, and for Australia as a whole. However, the numbers contained in this table provide an illustration of magnitude of tonnages caught and their respective location.

Table 8.8.1 Northern Australia—fisheries catch in tonnes and value, 2006–07

<i>Fishery</i>	<i>Catch (tonnes)</i>	<i>Commercial GVP (thousands of dollars)</i>	<i>Year</i>
Onslow Prawn	4	na ²	2007
Nickol Bay Prawn	44	na ²	2007
Broome Prawn	72	na ²	2007
Kimberley Prawn	271	na ²	2007
Kimberly Gillnet and Barramundi	26	na ²	2007
Northern Demersal Scalefish	908	na ²	2007
Pilbara fish trawl	1 704	na ²	2007
Pilbara demersal trap and line	460 (trap) 102 (line)	na ²	2007
Mackerel	324	na ²	2007
Northern Shark	na ¹	na ¹	2007
Pearl Oyster	600 658 individual	na ²	2007
beche-de-mer	92.2	na ²	2007
Exmouth Gulf Prawn	790	na ²	2007
Western Australia state total	26 826	351 500	2006/07
GOC Developmental Finfish	613	2 500	2006
GOC Inshore FinFish	1 929	12 800	2006
GOC Line	307	1 600	2006
Tropical Rock Lobster	188	7 800	2006
Queensland state total	24 003	201 100	2006/07
Aquarium	1 778 kg rock, 66 413 individuals rock, coral crustaceans and fish	na ³	2006
Barramundi	1 019	5 200	2006
Coastal Line	236	670	2006
Coastal Net	47.7	190	2006
Demersal	223	1 320	2006
Development	na ⁴	na ⁴	2006
Finfish Trawl	866.2	na ⁴	2006
Mud Crab	266	4 730	2006
Offshore Net and Line	1 292	4 340	2006
Spanish Mackerel	409	2 490	2006
Timor Reef	726	4 080	2006
Trepang	169.8	na ⁴	2006
Northern Territory total	5 717	28 900	2006/07
Torres Strait Fisheries	1 311	23 449	2006/07
Coral Sea Fishery	192.2	13 800	2006/07
Northern Trawl Prawn Fishery	5 131	63 700	2006/07
North West Region Slope Fishery	61.6	1 150	2003/04
Australia Wildcatch total	185 925	1 429 000	2006/07

Note: State and national totals and Commonwealth fisheries data sourced from ABARE, state fisheries data sources from relevant states.

1. Closed to fishing in 2007.
2. Not disclosed in report.
3. Not reported in 2006.
4. Deemed confidential due to small number of operators.

Sources: ABARE (2008); Northern Territory Department of Primary Industry, Fisheries and Mines (2007); Western Australia Department of Fisheries (2008); Queensland Primary Industries and Fisheries (2007).

Data relating to natural resources available in the online compendium

Tables

8.1 Land use

- Northern Australia—selected land use, by region, 2001
- Pilbara Region—land use, by region, 2001
- Kimberley Region—land use, by region, 2001
- Darwin-East Arnhem Region—land use, by region, 2001
- Katherine-Lower Top End Region—land use, by region, 2001
- Barkly-Central NT Region—land use, by region, 2001
- Mackay Region—land use, by region, 2001
- Northern Region—land use, by region, 2001
- Far North Region—land use, by region, 2001
- North West Region—land use, by region, 2001
- Longreach Region—land use, by region, 2001.

8.4 Cyclone activity

- Northern Australia—cyclones, by SLA, January 1970 and 30 June 2007.

Maps

8.7 Groundwater usage

- Western Australia—allocated groundwater, 1996–97
- Queensland—allocated groundwater, 1996–97
- Northern Territory—allocated groundwater, 1996–97.