Carpentaria Coast

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15 Carpentaria Coast

15.1 Introduction

This chapter examines water resources in the Carpentaria Coast region in 2011–12 and over recent decades. It starts with summary information on the status of water flows, stores and use. This is followed by descriptive information for the region, including the physiographic characteristics, soil types, population, land use and climate.

Spatial and temporal patterns in landscape water flows are presented, followed by an examination of the surface water and groundwater resources to finish the chapter. The data sources and methods used in developing the diagrams and maps are listed in the Technical Supplement.

15.2 Key information

Table 15.1 gives an overview of the key components of the data and information in this chapter.

Table 15.1 Key information on water flows and stores in the Carpentaria Coast region

Landscape water flows			
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911—2012 record
Rainfall	992 mm	+31%	9th— above average
Evapo-transpiration	775 mm	+30%	10th—very much above average
Landscape water yield	237 mm	+54%	9th—above average

Streamflow (at selected gauges)		
	Annual total flow:	Predominantly average flow, above average flow in some headwater rivers
	Salinity:	Annual median electrical conductivity below 1,000 µS/cm
	Flooding:	Minor to moderate floods in most gauges, major floods in some gauges in the southern and western rivers

Surface water storage (comprising about 24% of the region's total capacity of all major storages)							
	Total accessible capacity	30 June 2012		30 June 2011		Change	
		accessible volume	% of total capacity	accessible volume	% of total capacity	accessible volume	% of total capacity
	99 GL	92 GL	93%	93 GL	94%	-1 GL	-1%

Groundwater (in selected aquifers)		
	Salinity:	Non-saline groundwater (<3000 mg/L) throughout the region with some coastal areas of saline groundwater (≥3000 mg/L), due to seawater intrusion

15.3 Description of the region

The Carpentaria Coast region covers approximately 647,000 km^2. To the west is Arnhem Land and Groote Eylandt, the largest island in the Gulf of Carpentaria. To the east is the Cape York Peninsula.

The landscape is generally flat and low-lying, comprised of floodplains, much of which drain into the gulf. Subsections 15.3.1–15.3.4 provide more information on the topography and soils cover.

Approximately 66,500 people permanently reside in the Carpentaria Coast region. This accounts for less than 0.29% of the nation's total population (Australian Bureau of Statistics [ABS] 2011b). Over one quarter of the region's population is Indigenous.

In addition to its major population centre of Mount Isa, the region has a number of remote and regional towns that are shown in Figure 15.1. These include the regional centres of Cloncurry, Normanton, Doomadgee and Kowanyama. Further discussion of the region's population distribution can be found in subsection 15.3.6.

Grazing is the dominant land use. There are large areas of nature conservation, Indigenous land use and some forestry. Irrigated agriculture only exists on a very local scale, supported by water from two major storages. There is extensive mining activity in the region.

The climate is hot and humid mostly in the wet season. The dry season runs from about May–October and the monsoonal wet season from November–April. Subsections 15.3.7 and 15.3.8 provide more information on the rainfall patterns and deficits across the region.

The rivers are very large by Australian standards and carry approximately a quarter of the continent's total yearly streamflow. Most rivers, however, flow mainly during the wet season. Therefore, perennial rivers and perennial springs in the region are important sources of water.

The hydrogeology of the region is dominated by the sediments of the Great Artesian Basin, fractured and karstic rock in some areas, and some outcropping basement rock. A more detailed description of the rivers and groundwater status in the region is given in section 15.5.

River delta on the Gulf of Carpentaria between Weipa and Pormpuraaw, Queensland | Dr Linda Sands

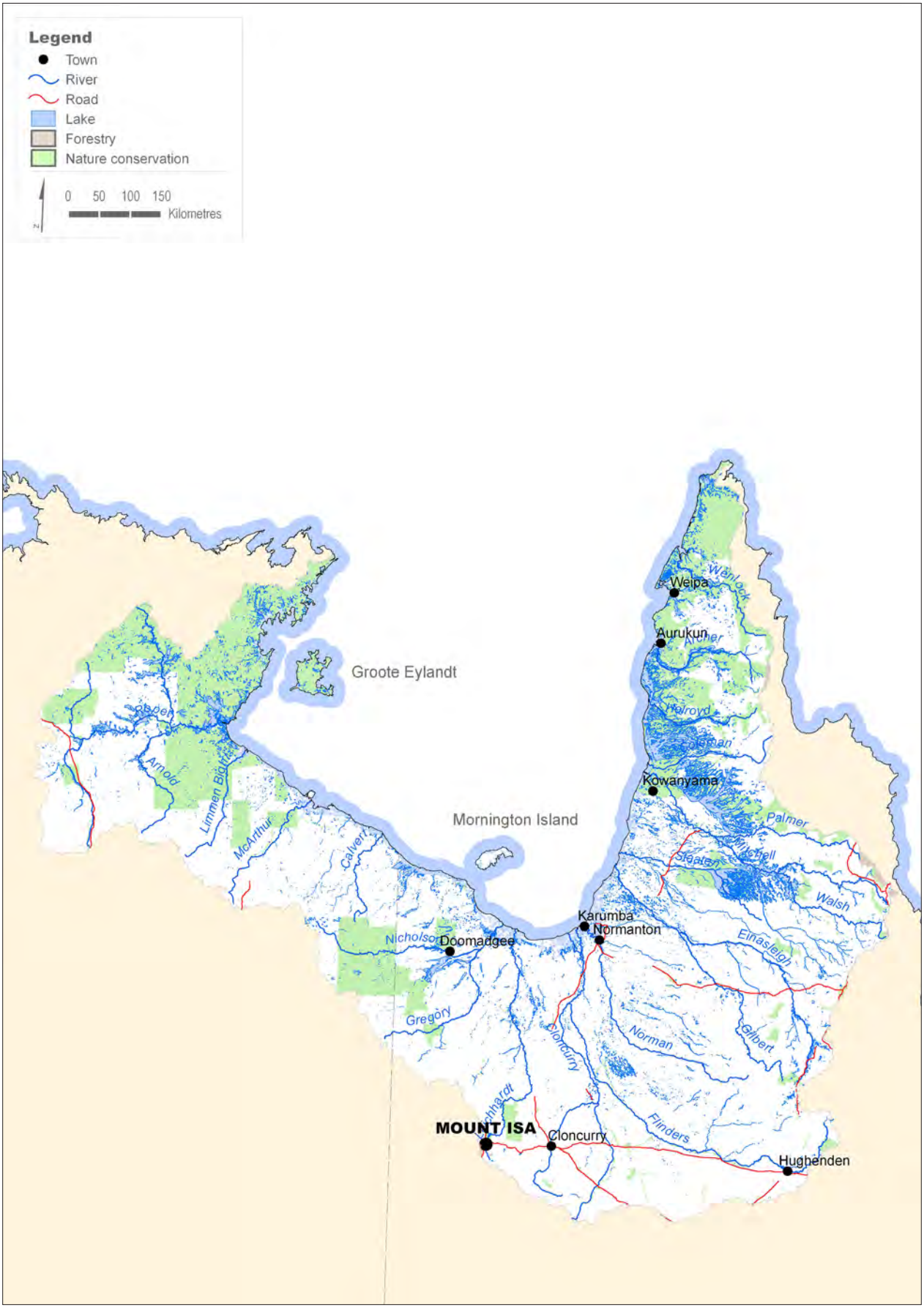

Figure 15.1 Major rivers and urban centres in the Carpentaria Coast region

15.3.1 Physiographic characteristics

The physiographic map in Figure 15.2 indicates areas with similar landform evolutionary histories (Pain et al. 2011). These can be related back to similar geology and climatic impacts which define the extent of erosion processes. The areas have distinct physical characteristics that can influence hydrological processes.

The Carpentaria Coast region has three such dominant physiographic provinces, namely:

- Carpentaria Fall (26%): ridges and hills with plains along much of the coast; ranges and lowlands on folded metamorphic rocks and granites in the east;
- Carpentaria Lowlands (37%): clay and sandy plains and plateaus of sandstone or bauxite in some areas; and
- Peninsular Uplands (13%): sandstone plateaus and hilly country on acid igneous and metamorphic rocks.

The remaining four provinces occupy 24% of the region.

- Barkly–Tanami Plains (7%): alluvial valleys;
- Central Lowlands (7%): undulating clay plains;
- North Australian Plateaus (6%): ranges of folded metamorphic rocks; and
- Burdekin Uplands (4%): partly sandstone plateau and some young basaltic plateaus; ranges predominantly of granite and metamorphic rocks.

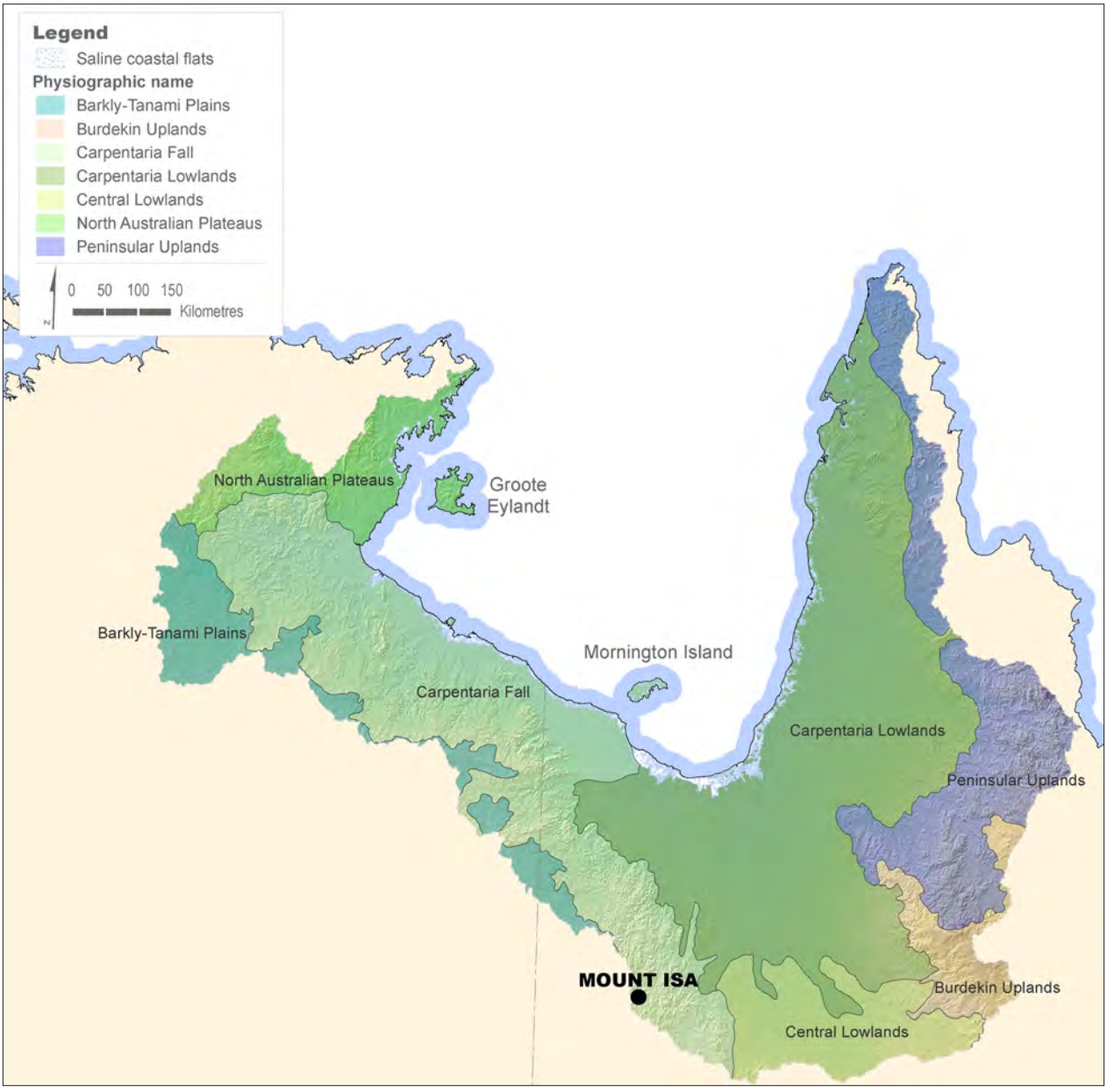

Figure 15.2 Physiographic provinces of the Carpentaria Coast region

15.3.2 Elevation

Figure 15.3 presents ground surface elevations in the Carprentaria Coast region. Information was obtained from the Geoscience Australia website (www.ga.gov.au/topographic-mapping/digital-elevation-data.html).

The eastern border of the region is formed by the crest of the northern part of the Great Dividing Range. The highest peaks in the area exceed 1,200 m above sea level. They are located where the region's border almost reaches the Coral Sea (Figure 15.3).

In the western part of the region, rivers originate from the mainland plateau and from the Arnhem Land Plateau in the north.

The central low-lying area (Gulf Plains) is crossed by the Flinders River and its tributaries. The Flinders River originates in the southeast of the region and is the longest river in Queensland.

Besides the Gulf Plains, the Gulf of Carpentaria coastline is a wide band of low-lying plains. The rivers in this area often form large floodplains in the wet season.

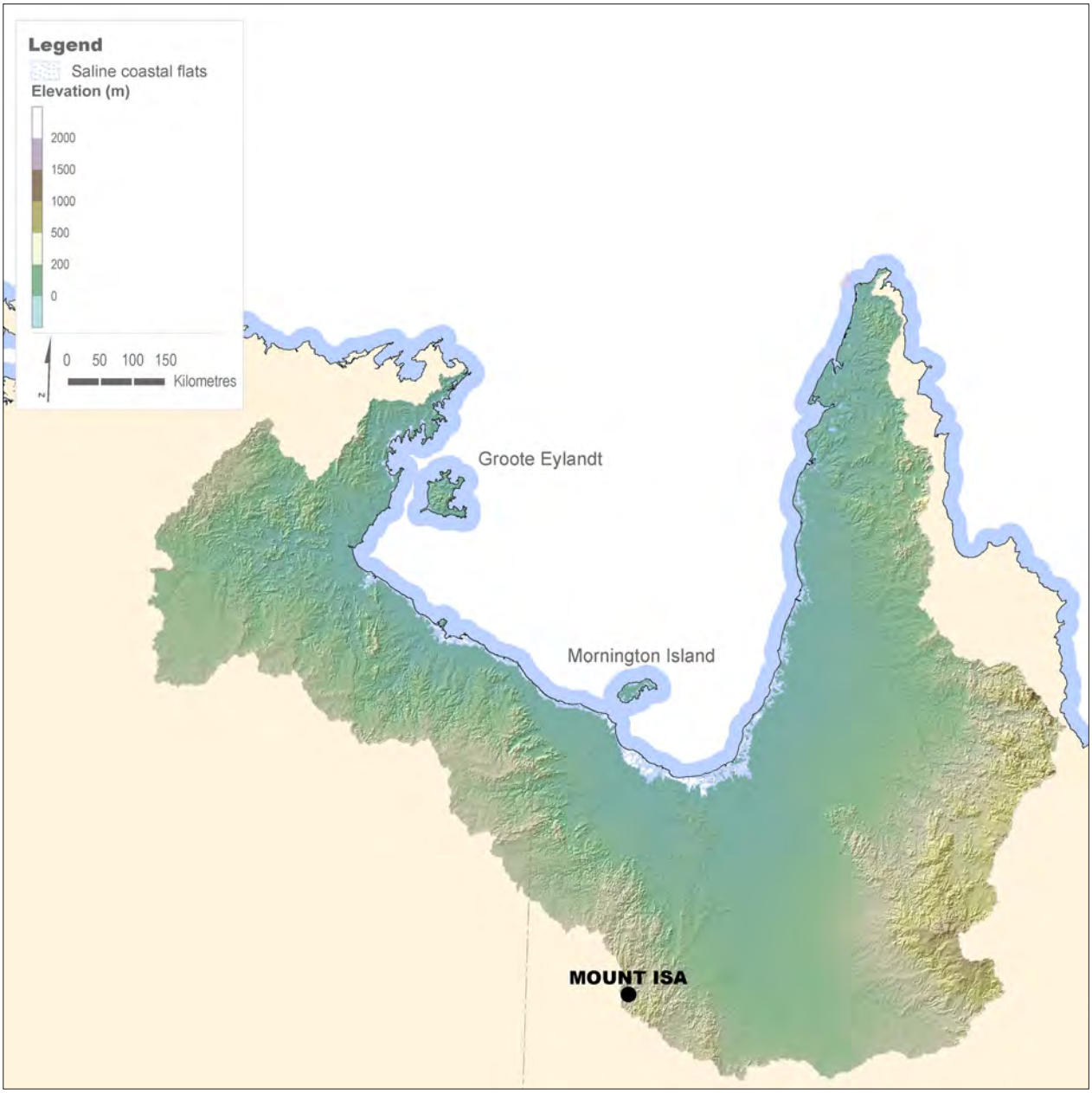

Figure 15.3 Land surface elevations in the Carpentaria Coast region

15.3.3 Slopes

Table 15.2 summarises the proportions of slope classes for the region while Figure 15.4 shows the spatial distribution of the surface slopes. Areas with steep slopes provide higher run-off generating potential than flat areas. The Carpentaria Coast region has few areas with steep slopes. The slopes were derived from the elevation information used in the previous section.

Table 15.2 Proportions of slope classes for the region

Slope class (%)	0–0.5	0.5–1	1–5	> 5
Proportion of region (%)	49.5	16.5	28.1	5.9

The steep slopes in Figure 15.4 particularly highlight the ranges and tableland escarpments west of Cairns. These are areas of high rainfall, and run-off generated in this area makes the Mitchell River one of the highest discharging rivers in Australia. Due to the high variation in rainfall during the year, the river has a seasonal flow pattern.

Due to the flatness of the central plain in the region (Gulf Plains), the rivers that cross it meander over vast areas. The streambeds of the Fitzroy River and its tributaries cover large areas.

In the hills north of Mount Isa, the valleys with their steep slopes have made it suitable for dam construction. Two major dams have been constructed here, forming Lake Moondarra and Lake Julius. These storages provide water for the local irrigation areas and fresh water for the town of Mount Isa.

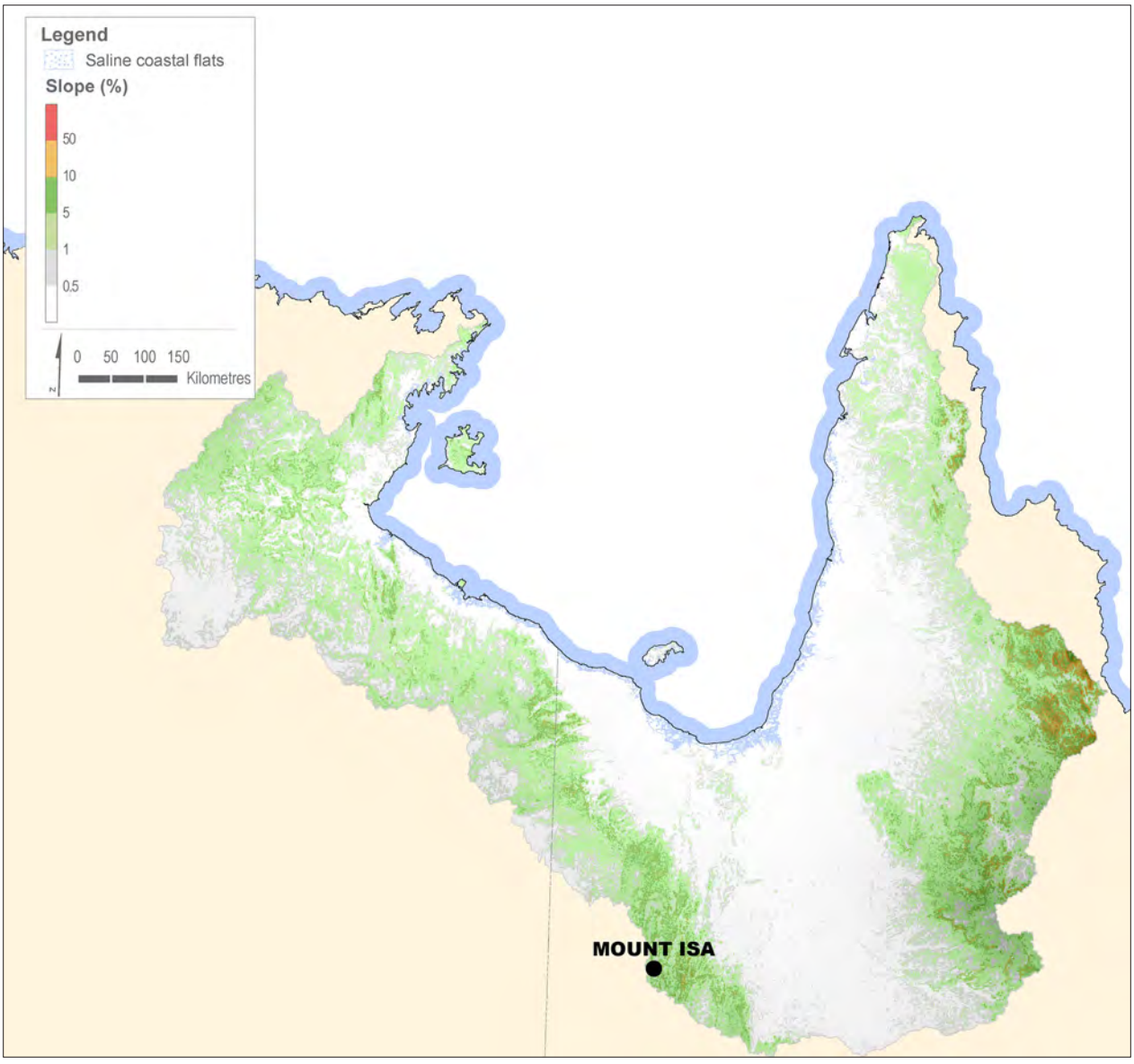

Figure 15.4 Surface slopes in the Carpentaria Coast region

15.3.4 Soil types

Soils play an important role in the hydrological cycle by distributing water that reaches the ground. Water can be transported to rivers and lakes via the soil surface as run-off or enter the soil and provide water for plant growth as well as contributing to groundwater recharge.

The nature of these hydrological pathways and the suitability of the soils for agricultural purposes are influenced by soil types and their characteristics. Soil type information was obtained from the Australian Soil Resource Information System website (www.asris.csiro.au).

About 89% of the Carpentaria Coast region consists of five soil types, namely tenosols, kandosols, vertosols, rudosols and hydrosols (Figure 15.5 and Figure 15.6). The majority of these soils are used for pastures and to some extent for nature conservation.

Tenosols as well as kandosols are widely spread across the region. Rudosols are more common in the western half of the region. Rudosols as well as tenosols are characterised by having weak and minimal development. They show no or little change in texture and colour and are often shallow in depth. Tenosols and rudosols are low in chemical fertility and in water-holding capacity and thus their agricultural potential is low.

Kandosols are structureless soils which are often very deep, up to three metres or more, but have neither a strong texture contrast nor carbonate throughout their profile. They have a low to moderate agricultural potential with moderate water-holding capacity, are mostly well drained and have moderate chemical fertility.

Vertosols are dominant in the central part of this region. They are clay rich soils with tendencies for soil cracks when dry, and swelling during wetting. They are highly fertile and have a large water-holding capacity. They, however, require a large amount of water before becoming available to plants.

Hydrosols are most common along the narrow coastal plains of the region, and to a greater extent along the east coast. These soils are seasonally wet due to high seasonal rainfall, and are thus saturated for two to three months and can also be influenced by tidal changes.

Other soil types with small area coverage in the region are chromosols, sodosols, ferrosols and dermosols (1–4%).

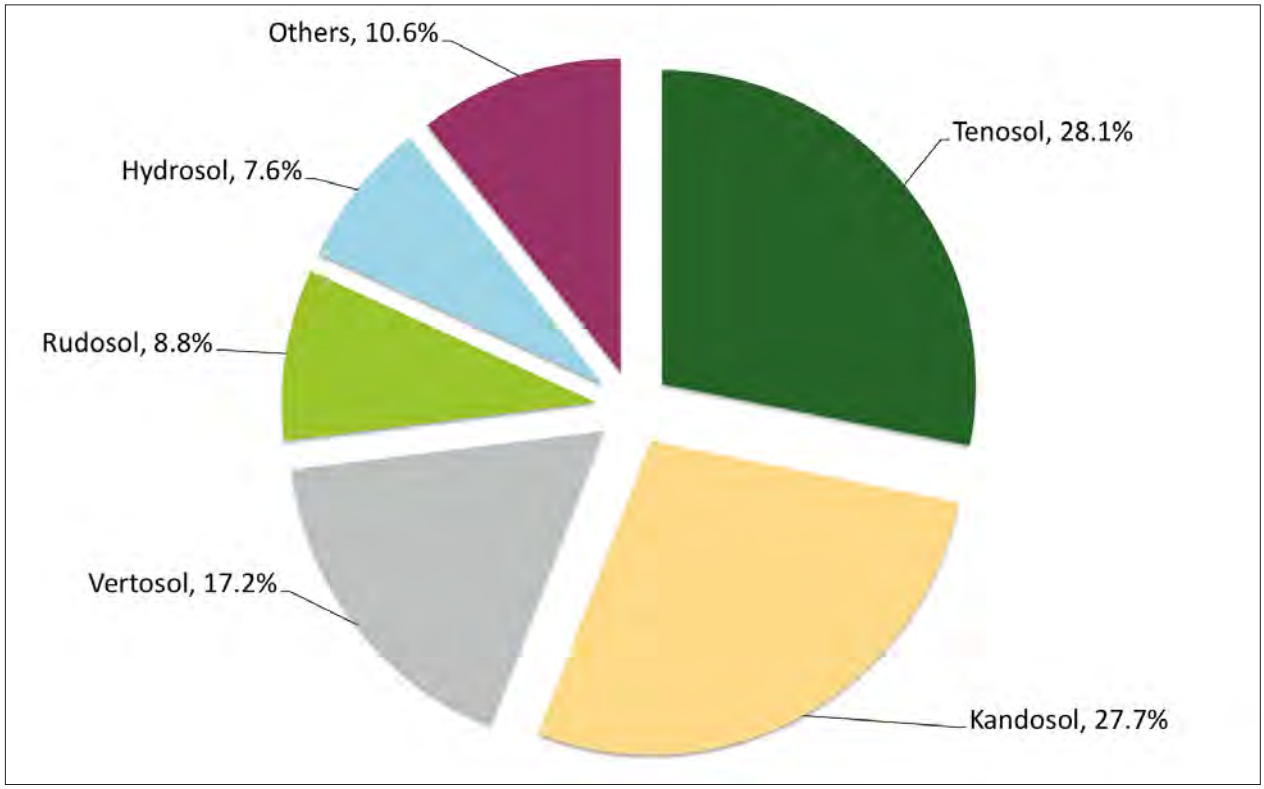

Figure 15.5 Soil types in the Carpentaria Coast region

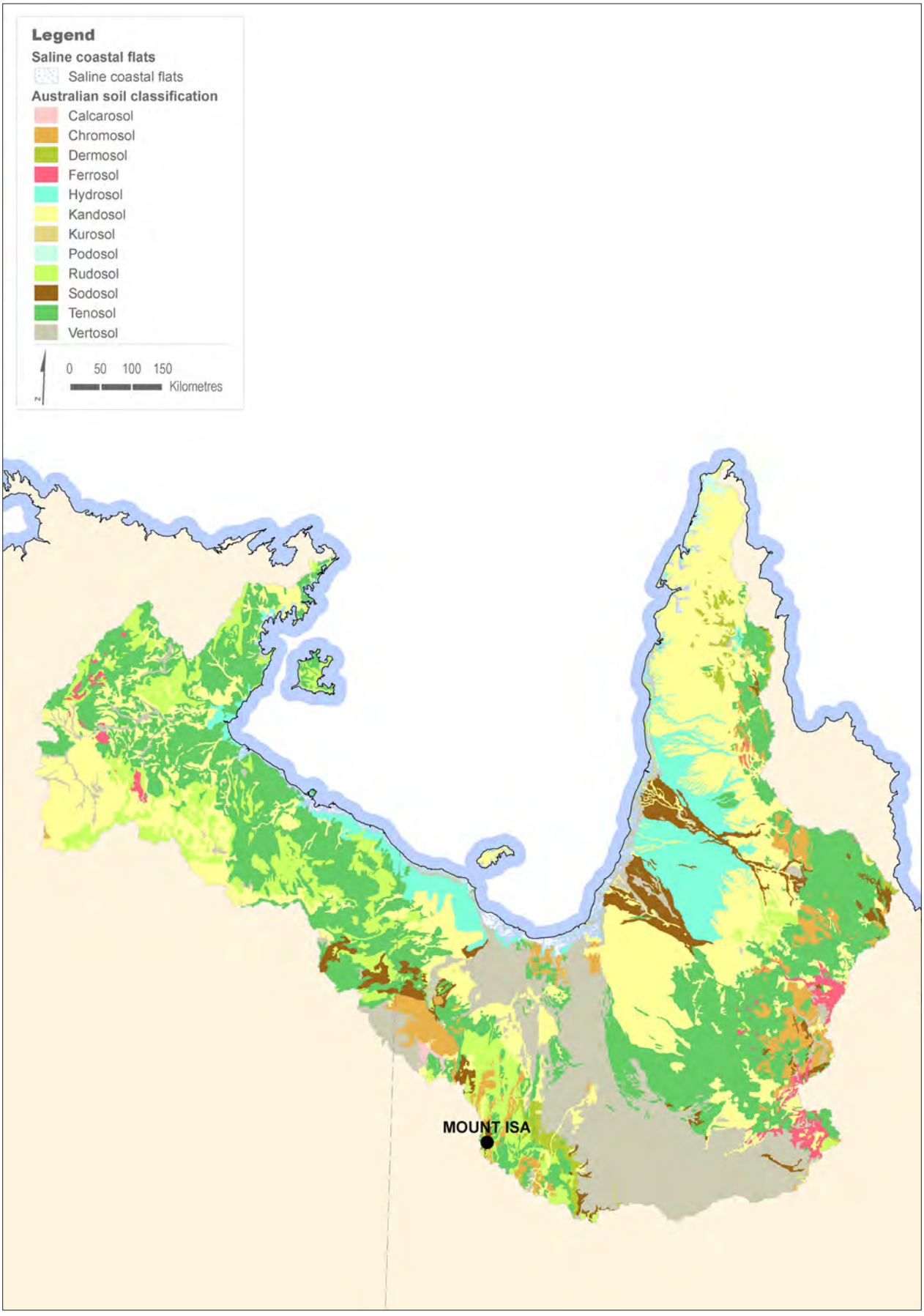

Figure 15.6 Soil type distribution in the Carpentaria Coast region

15.3.5 Land use

Figure 15.7 and Figure 15.8 present land use information in the Carpentaria Coast region (data from data.daff.gov.au/anrdl/metadata_files/pa_luav4g9abl07811a00.xml).

The region is predominantly covered by pasture with large areas also designated for nature conservation Cropping, either irrigated or dryland, occupies a very small portion of the region. Most income is generated by mining. Irrigated agriculture around Mount Isa only exists on a very local scale, supported by water from the storages of the Julius and Moondarra dams.

The Mareeba–Dimbulah Irrigation Area on the Atherton Tableland in the far east of the region is the region's only main irrigation area. Irrigation of sugarcane and horticultural crops occurs with water taken from Lake Tinaroo on the Barron River in the North East Coast region.

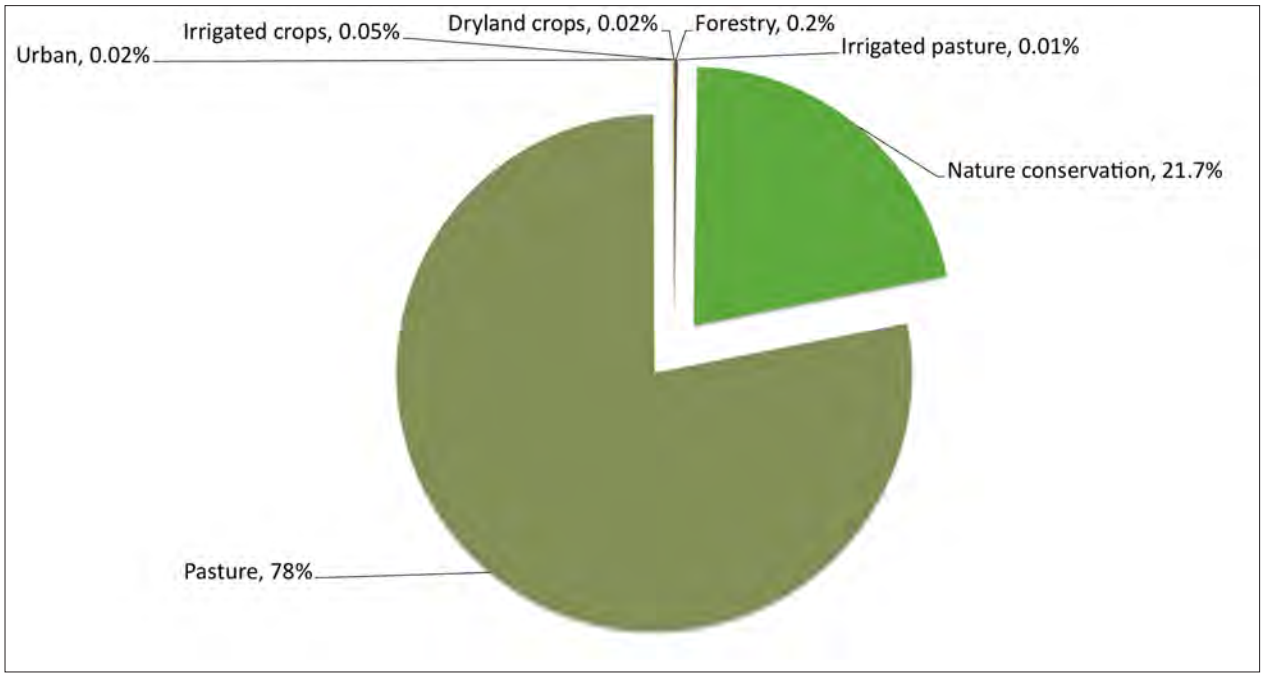

Figure 15.7 Land use in the Carpentaria Coast region

Julius Dam, Leichhardt River | Bureau of Meteorology

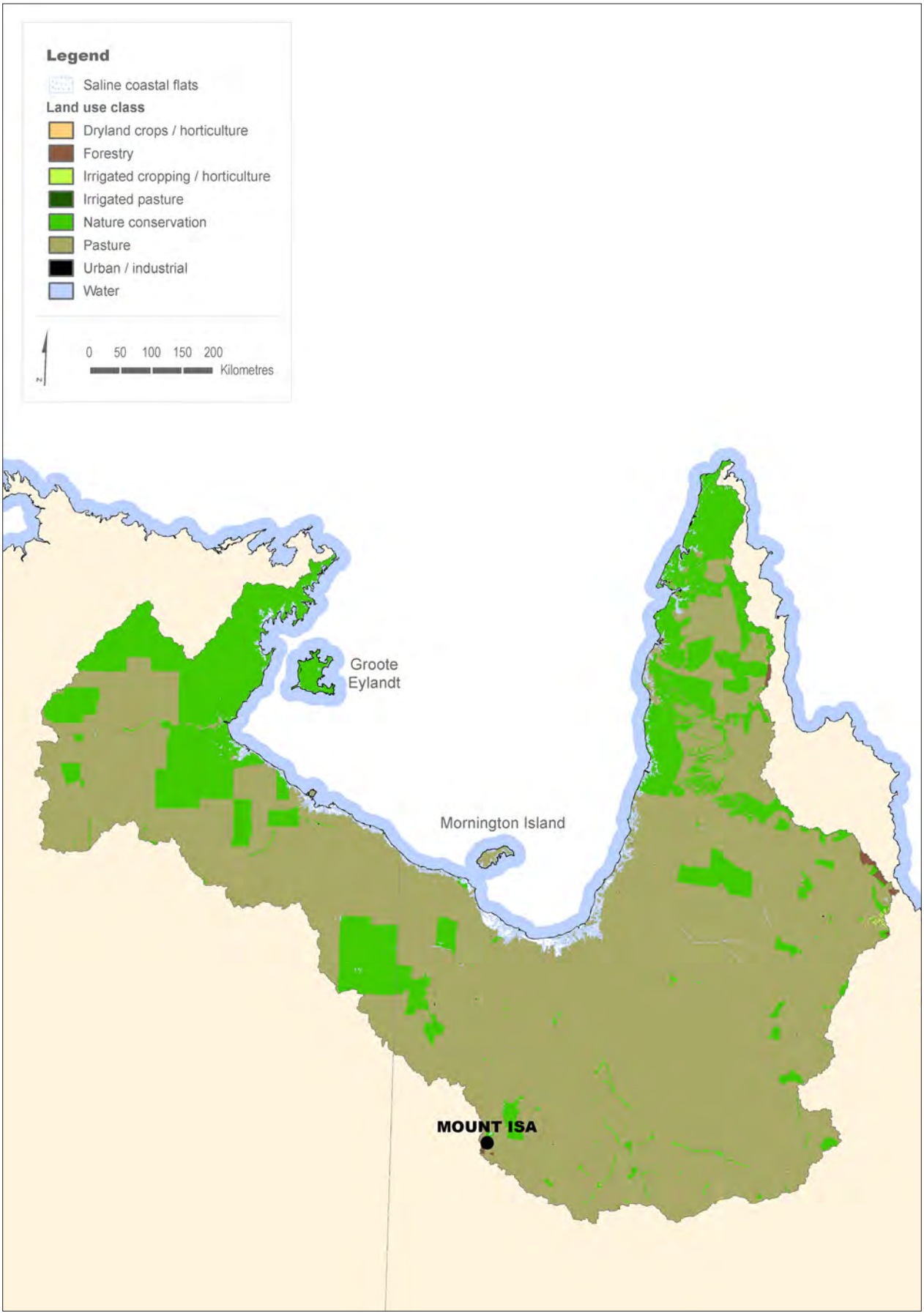

Figure 15.8 Land use distribution in the Carpentaria Coast region

15.3.6 Population distribution

Given its size and the number of people permanently residing in the Carpentaria Coast region, the population densities are very low and in many parts approach zero. This is clearly illustrated in Figure 15.9 (ABS 2011b).

The mining town of Mount Isa, in the central south of the region, is the major population centre and accounts for just under half of the region's population.

Whilst Mount Isa is located inland, the majority of regional communities are scattered along the coastal fringe of the Gulf of Carpentaria and include a number of remote Indigenous communities.

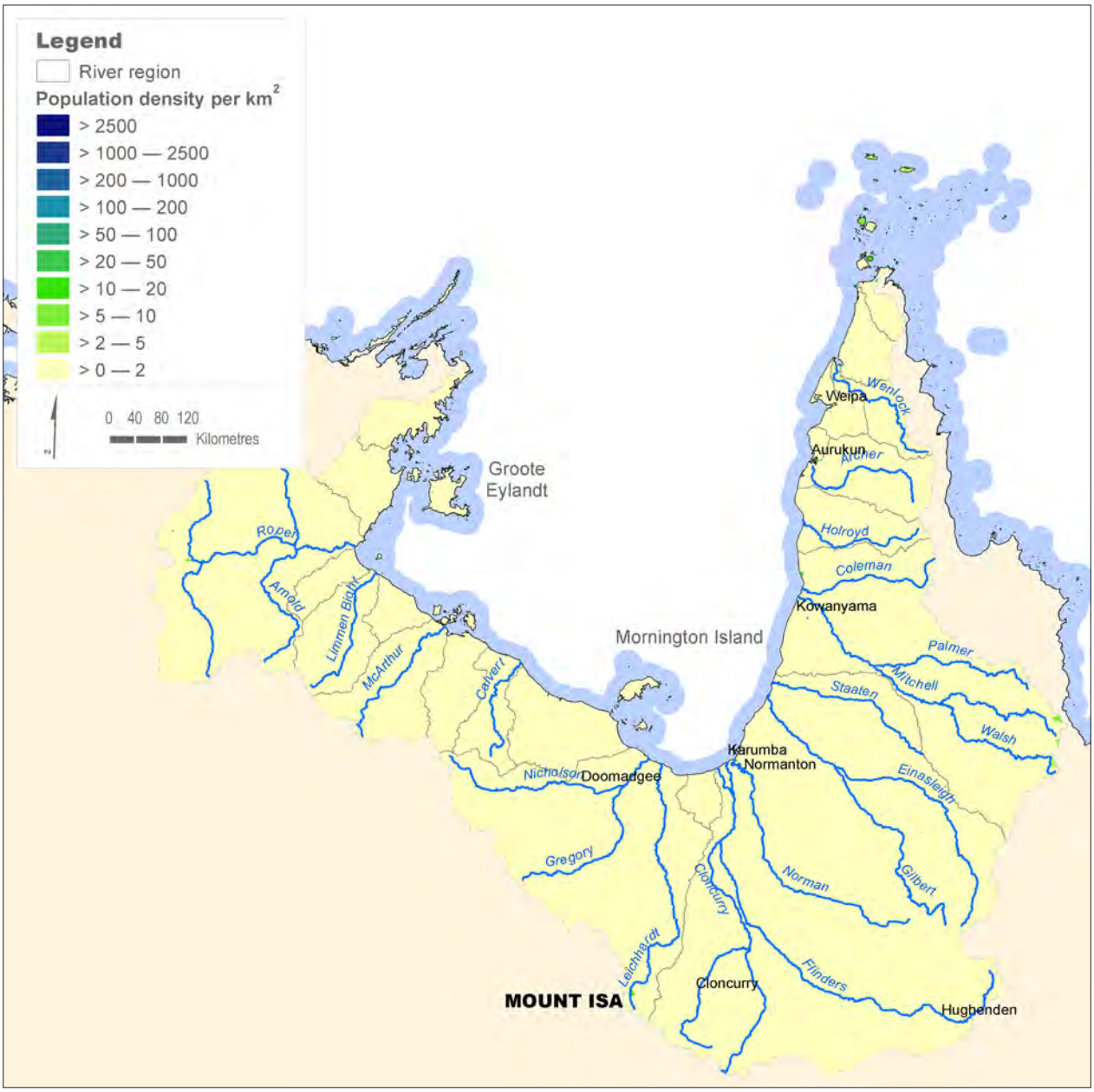

Figure 15.9 Population density and distribution in the Carpentaria Coast

15.3.7 Rainfall zones

The climate is hot and humid with two distinct seasons per year. The dry season runs from about May–September and the monsoonal wet season from October–April. The majority of rainfall occurs in a three-month period. Median rainfall exceeds 350 mm throughout (Figure 15.10).

The tropical northeast of the region, Cape York, receives most rainfall, with median rainfall exceeding 1,200 mm per annum.

Along the Gulf of Carpentaria coast the median rainfall normally reaches levels between 650 and 1,200 mm.

The southern part of the region has a much drier rainfall pattern gradually reaching median values lower than 350 mm in the far south of the region.

For more information on this and other climate classifications, visit the Bureau of Meteorology's (the Bureau's) climate website: www.bom.gov.au/jsp/ncc/climate_averages/climate-classifications/index.jsp

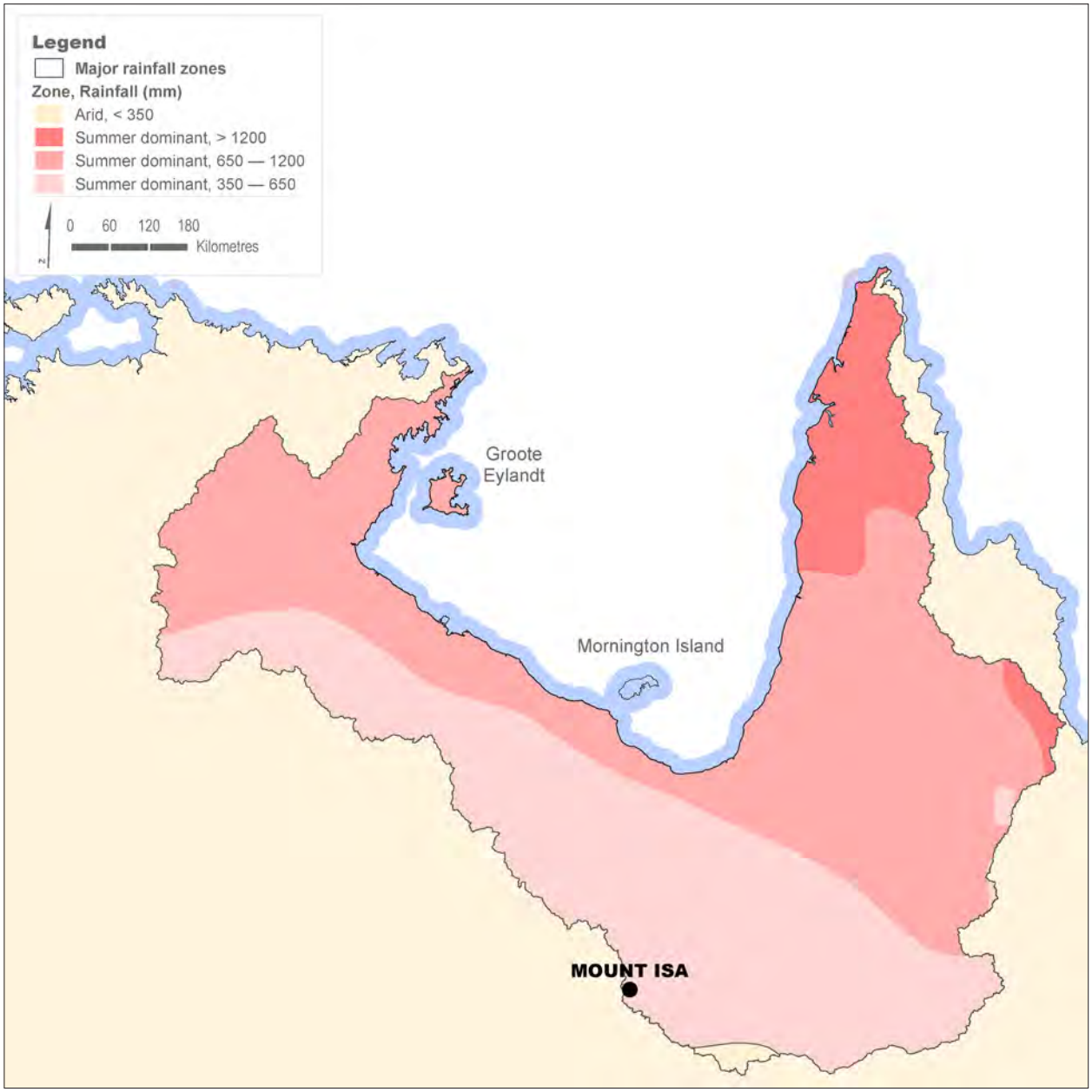

Figure 15.10 Rainfall zones in the Carpentaria Coast region

15.3.8 Rainfall deficit

The rainfall minus potential evapotranspiration indicator gives a general impression of which parts of the region moisture deficits are likely to occur over the period of a year. The Carpentaria Coast region is one of extremes in relation to this indicator (Figure 15.11).

Large deficits can be expected in most parts of the inland areas.

Along the coast, some areas experience less distinct deficits. The abundance of water in the headlands of the Mitchell River in the far east of the region is only of minor importance to streamflow in this river.

For more information on the rainfall and evapotranspiration data, see the Bureau's maps of average conditions: www.bom.gov.au/climate/averages/maps.shtml

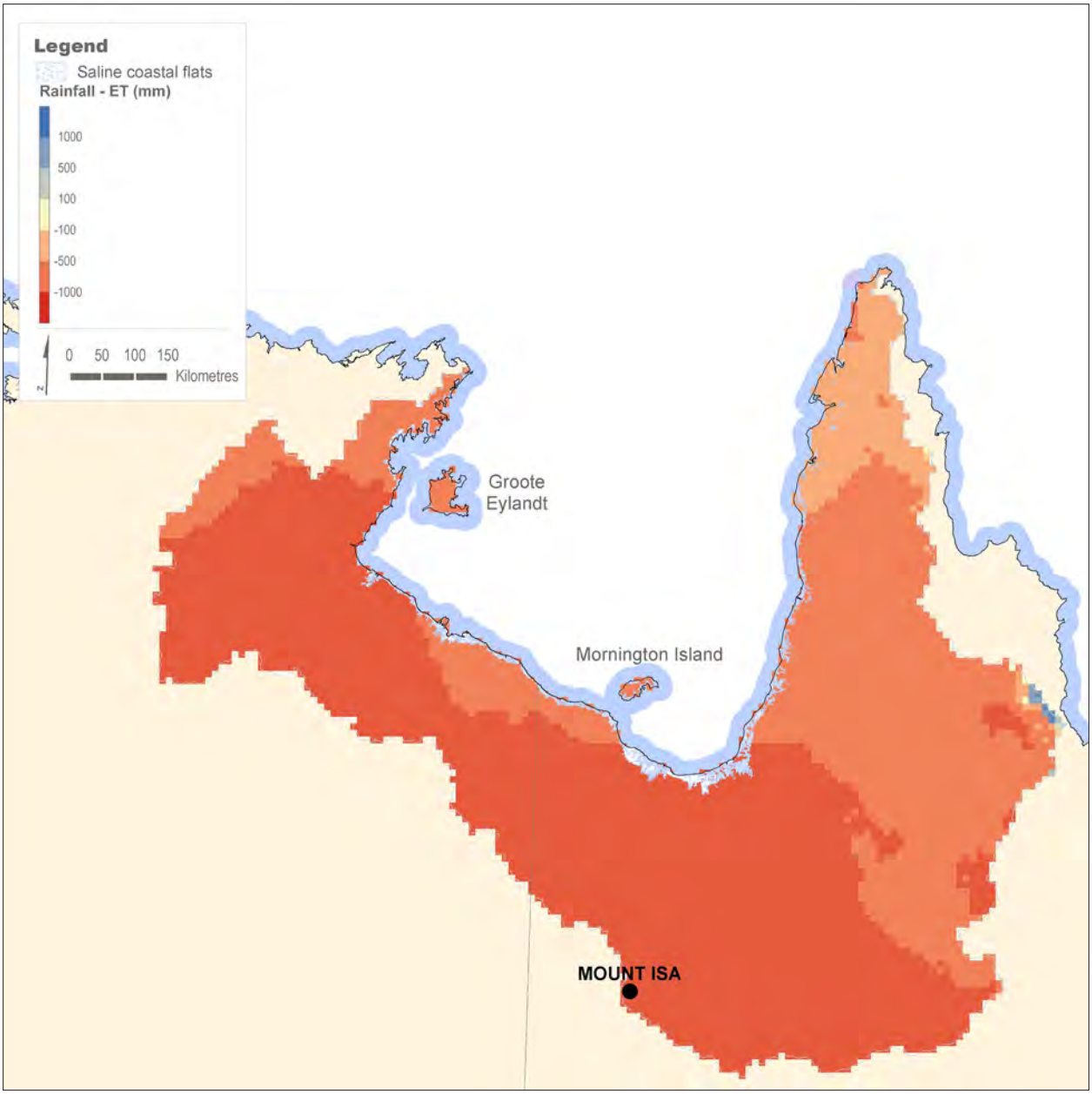

Figure 15.11 Rainfall deficit distribution for the Carpentaria Coast region

15.4 Landscape water flows

This section presents analyses of the spatial and temporal variation of landscape water flows (rainfall, evapotranspiration and landscape water yield) across the Carpentaria Coast region in 2011–12. National rainfall grids were generated using data from a network of persistent, high-quality rainfall stations managed by the Bureau. Evapotranspiration and landscape water yields were derived using the landscape water balance component of the Australian Water Resources Assessment System (Van Dijk 2010). These methods and associated output uncertainties are discussed in the Introduction and addressed in more detail in the Technical Supplement.

Figure 15.12 shows that the region has a highly seasonal rainfall pattern with distinct wet and dry seasons. Evapotranspiration in the dry season always exceeds rainfall. After the wet season, the soils normally contain plenty of moisture that is available for evapotranspiration. The monthly landscape water yield history for the region shows a stable pattern of very low yield in the dry season.

It gradually increases during the wet season and subsides afterwards.

The 2011–12 year was a relatively wet year, especially during November–December 2011, when rainfall was consistently higher than the historic median. Additionally, an active monsoon in the north of the region contributed to particularly high rainfall totals for the month of March 2012.

With wet soil conditions present at the start of the year, evapotranspiration was high for the first six months of 2011–12. With the exception of January and February 2012, evapotranspiration rates remained above the 75th percentile for the rest of the year. Evapotranspiration in June 2012 was the second highest on record (1911–2012) for this month.

The landscape water yield for 2011–12 closely followed the rainfall pattern, with the March landscape water yield being fourth highest on record. The only exception is the month of February, when rainfall was below average, but high soil moisture levels, due to the wet spring, maintained a relatively high landscape water yield.

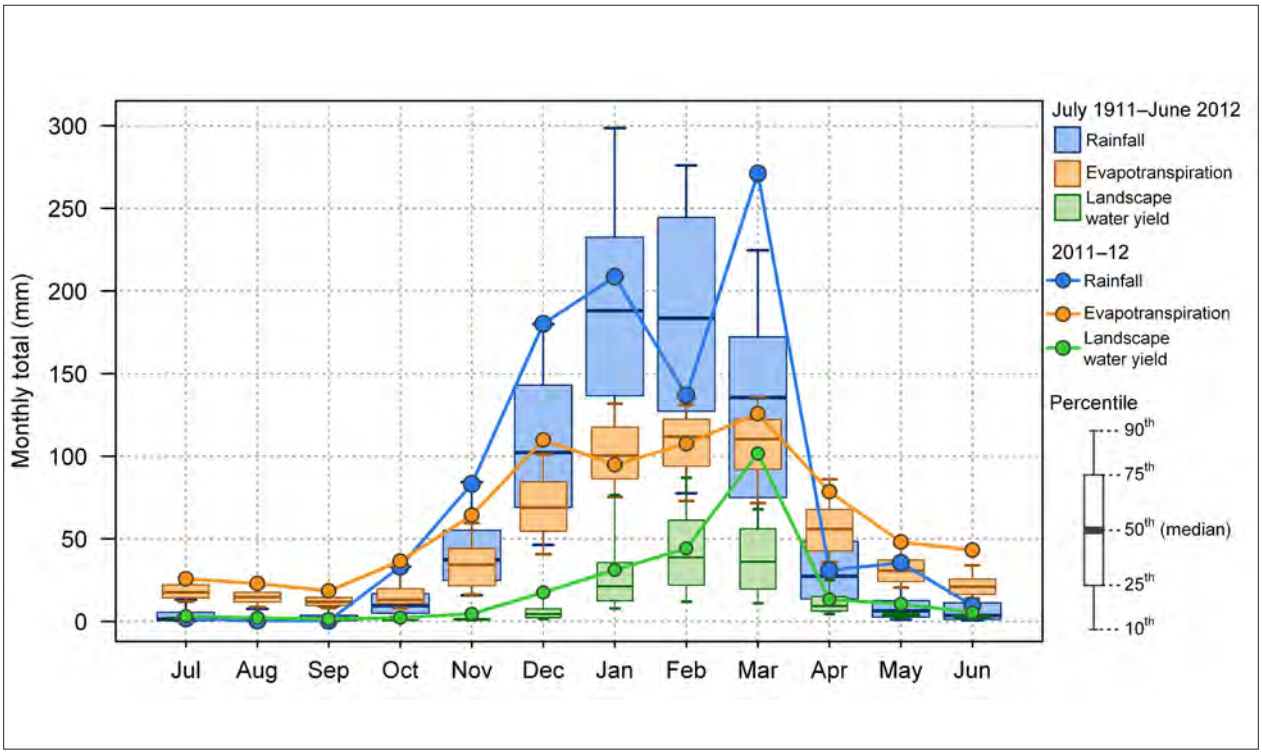

Figure 15.12 Landscape water flows in 2011–12 compared with the long-term record (July 1911–June 2012) for the Carpentaria Coast region

15.4.1 Rainfall

Rainfall for the Carpentaria Coast region for 2011–12 is estimated to be 992 mm. This is 31% above the region's long-term average (July 1911–June 2012) of 755 mm. Figure 15.13a shows that the highest rainfall occurred along the eastern coastal areas of the Gulf of Carpentaria with annual totals exceeding 1,800 mm in 2011–12. The western and southern parts of the region had rainfall mostly ranging between 600 and 900 mm.

Rainfall deciles for 2011–12 show average to very much above average rainfall (Figure 15.13b). The high rainfall in the Cape York area only resulted in a very much above average decile ranking in parts of the area. The southern part of the region was also relatively wet. In the far northwest and the far east, rainfall was average. In the Mitchell River basin, rainfall was below historic average.

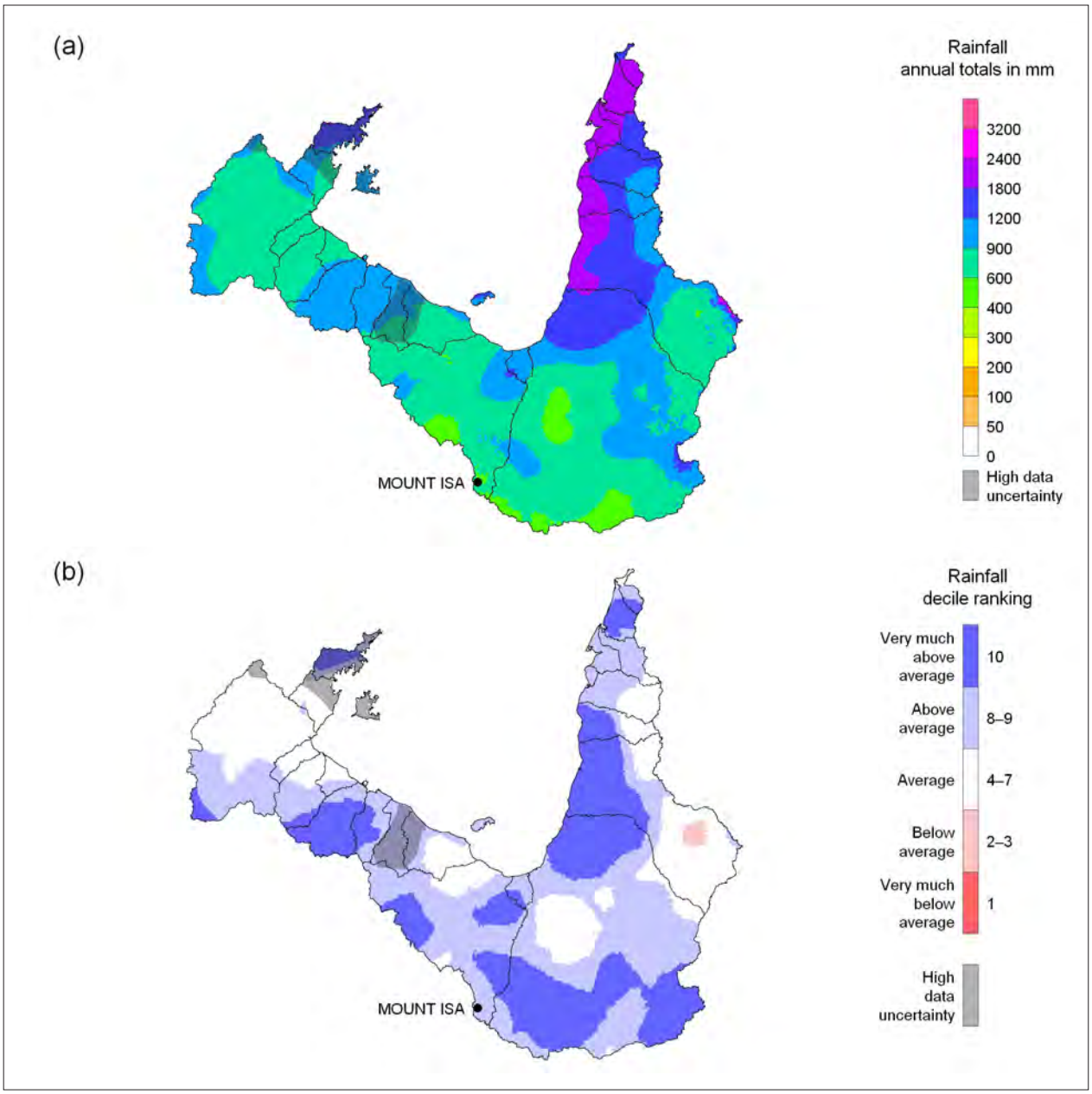

Figure 15.13 Spatial distribution of (a) annual rainfall in 2011–12, and (b) their decile rankings over the 1911–2012 period for the Carpentaria Coast region

Rainfall variability in the recent past

Figure 15.14a shows annual rainfall for the region from July 1980 onwards. Over this 32-year period the annual average was 833 mm, varying from 506 mm (1987–88) to 1,388 mm (2010–11). Temporal variability and seasonal patterns since 1980 are presented in Figure 15.14b.

The graphs indicate that the annual variation in rainfall is based on the variation in rainfall in the wet season (November–April) only. The difference between rainfall in the winter and summer periods, as in Figure 15.14b, is indicative for a region that is completely dependent on the annually returning monsoon to deliver rainfall.

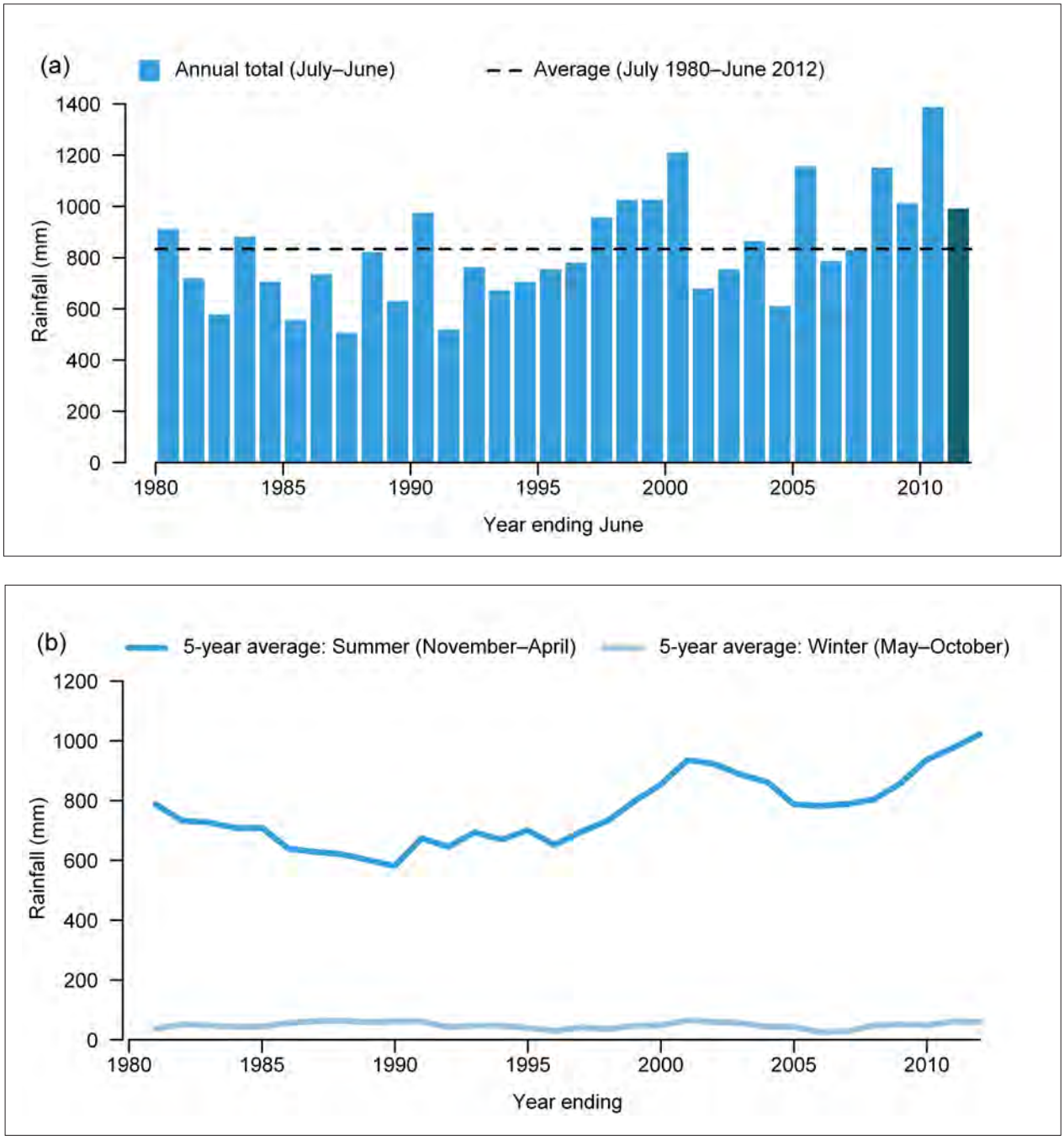

Figure 15.14 Time-series of (a) annual rainfall, and (b) five-year retrospective moving averages for the wet summer (November–April) and dry winter (May–October) periods for the Carpentaria Coast region

Recent trends in rainfall

Figure 15.15a presents the spatial distribution of the trends in annual rainfall for July 1980–June 2012. These are derived from linear regression analyses on the time-series of each model grid cell.

The statistical significance of the trends is provided in Figure 15.15b.

Figure 15.15a shows that since 1980 a strong increase in rainfall has occurred in large parts of the region. These trends are strongly significant in most of the region (Figure 15.15b). The local area of decreasing rainfall in the northeast is remarkable, but not statistically significant.

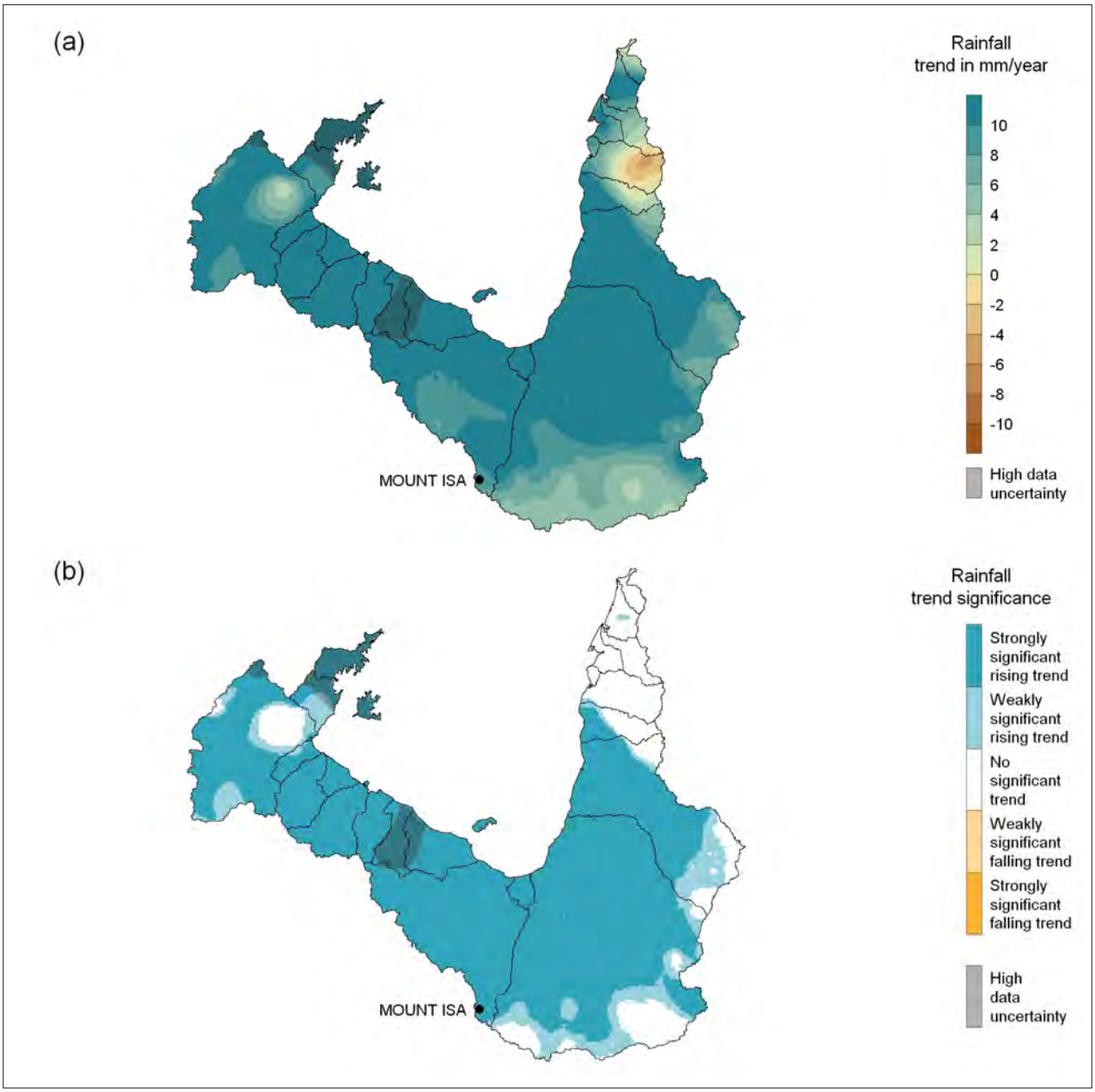

Figure 15.15 Spatial distribution of (a) trends in annual rainfall from 1980– 2012, and (b) their statistical significance at 90% (weak) and 95% (strong) confidence levels for the Carpentaria Coast region

15.4.2 Evapotranspiration

Modelled annual evapotranspiration for the Carpentaria Coast region for 2011–12 is estimated to be 775 mm. This is 30% above the region's long-term (July 1911–June 2012) average of 598 mm. The spatial distribution of annual evapotranspiration in 2011–12 (Figure 15.16a) is similar to that of rainfall (Figure 15.13a), but lower in magnitude.

Evapotranspiration deciles for 2011–12 indicate above average or very much above average totals across most of the region (Figure 15.16b). The exceptions are the northern part of Cape York and in the upstream part of the Mitchell River basin. The very much above average evapotranspiration along much of the southwest is largely the result of the high soil moisture availability starting in the previous wet year 2010–11.

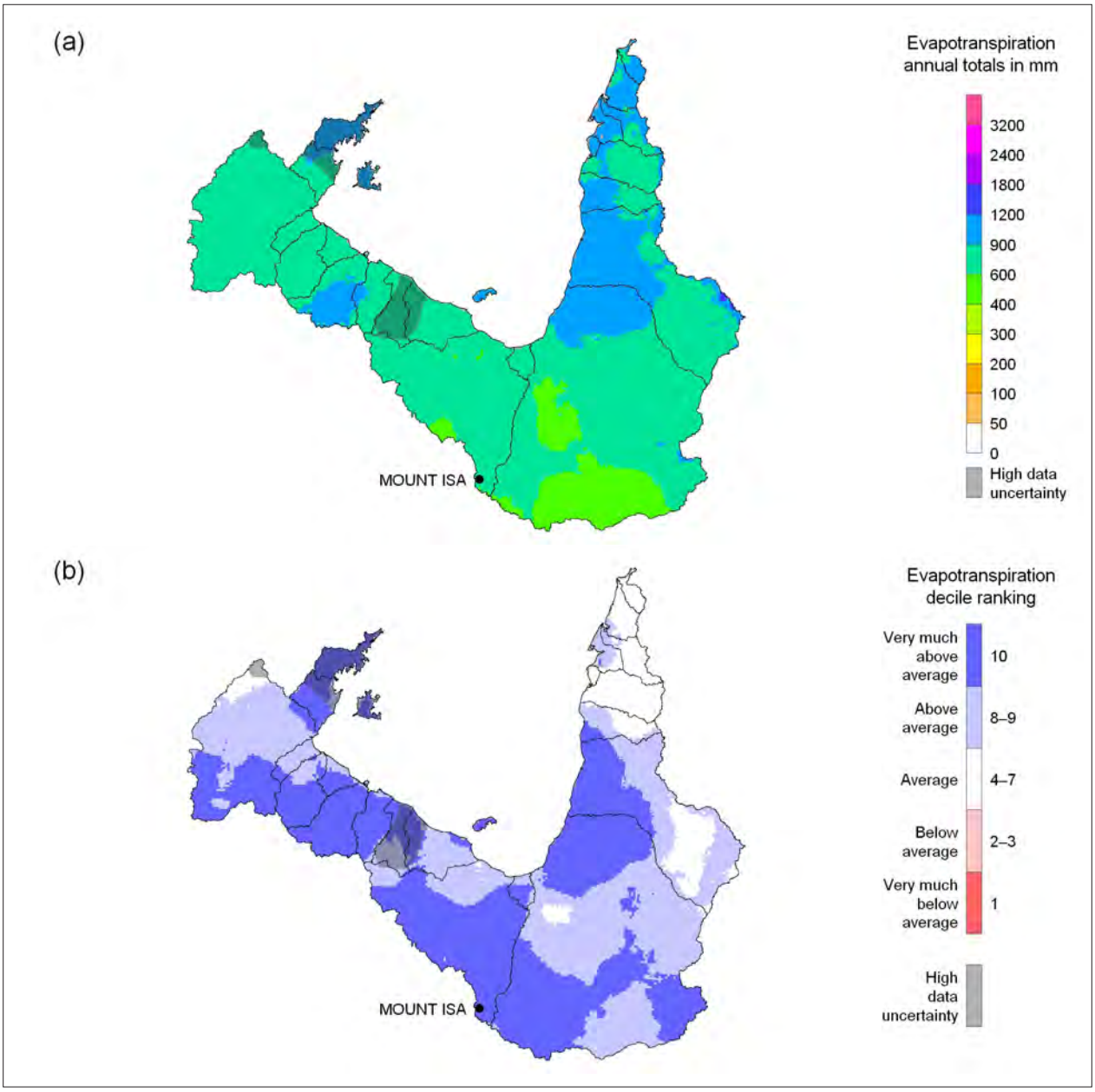

Figure 15.16 Spatial distribution of (a) modelled annual evapotranspiration in 2011–12, and (b) their decile rankings over the 1911–2012 period for the Carpentaria Coast region

Evapotranspiration variability in the recent past

Figure 15.17a shows annual evapotranspiration for the region from July 1980 onwards. Over this 32-year period the annual evapotranspiration average was 634 mm, varying from 479 mm (1987–88) to 935 mm (2010–11). Temporal variability and seasonal patterns since 1980 are presented in Figure 15.17b.

Evapotranspiration in the wet season is much higher than in the dry season. This is due to the higher rainfall amounts and therefore water availability during the wet season. During the dry season, evapotranspiration is substantially higher than the rainfall for this season (Figure 15.14b).

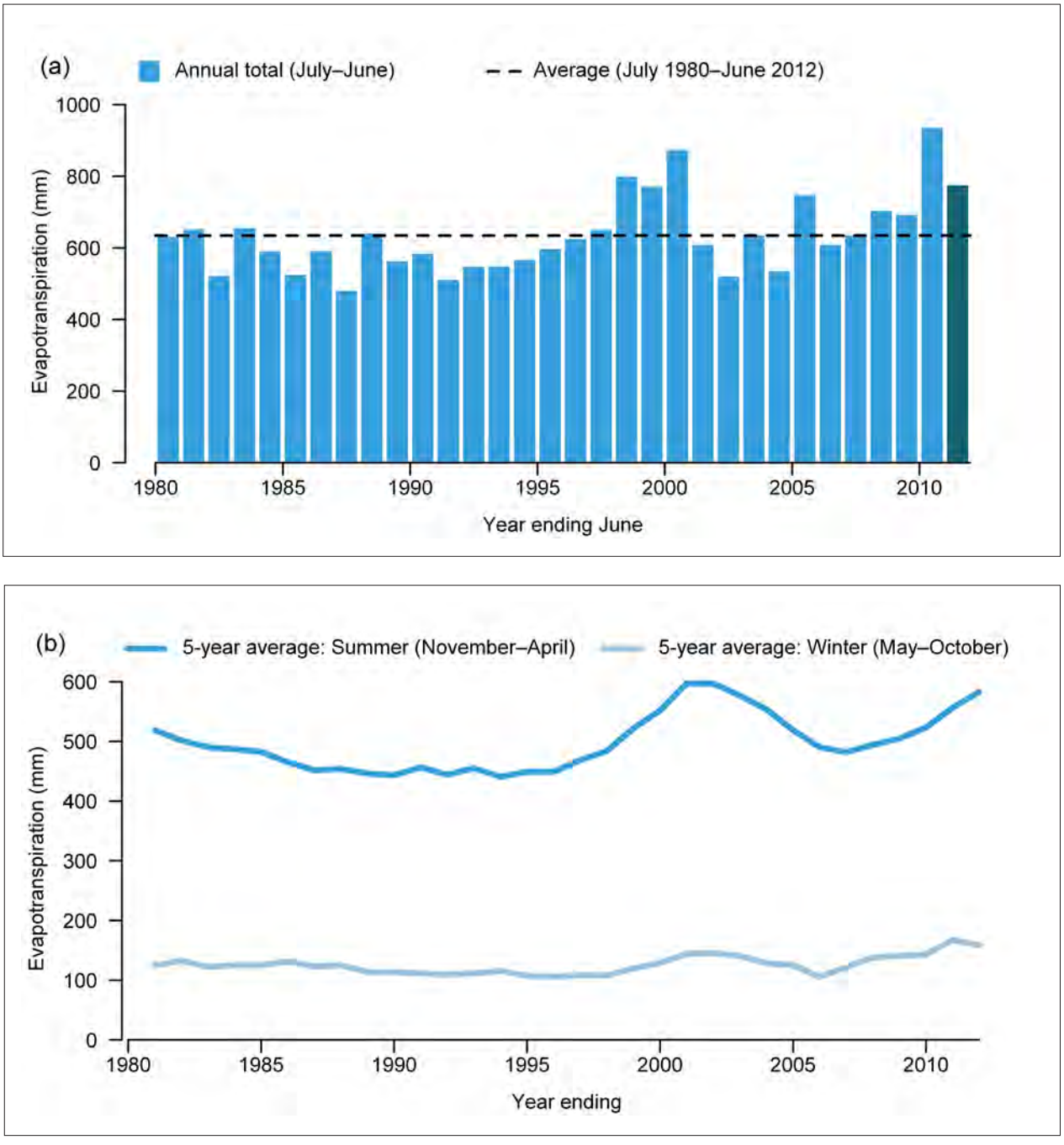

Figure 15.17 Time-series of (a) annual evapotranspiration, and (b) five-year retrospective moving averages for the wet summer (November–April) and dry winter (May–October) period for the Carpentaria Coast region

Recent trends in evapotranspiration

Figure 15.18a presents the spatial distribution of the trends in modelled annual evapotranspiration for 1980–2012. These are derived from linear regression analyses on the time-series of each model grid cell. The statistical significance of the trends is provided in Figure 15.18b.

Figure 15.18a shows that since 1980 trends are rising in the most of the region except for the far northern part of Cape York.

As shown in Figure 15.18b, the trends are generally statistically significant throughout most of the region. The marginal and negative trends in the north are not statistically significant.

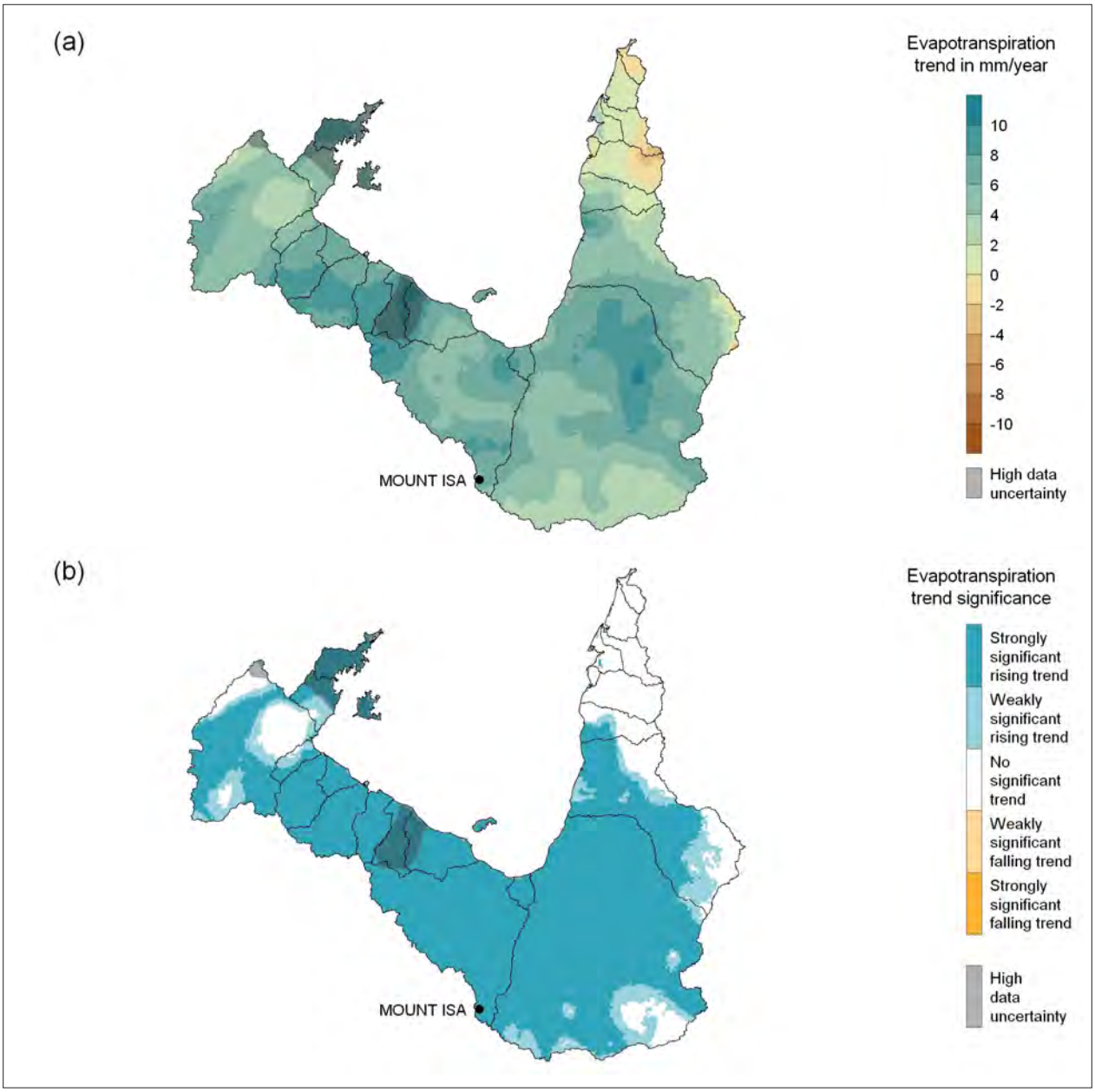

Figure 15.18 Spatial distribution of (a) trends in annual evapotranspiration from 1980–2012, and (b) their statistical significance at 90% (weak) and 95% (strong) confidence levels for the Carpentaria Coast region

15.4.3 Landscape water yield

Modelled landscape water yield for the Carpentaria Coast region for 2011–12 is estimated to be 237 mm. This is 54% above the region's long-term (July 1911–June 2012) average of 154 mm. Figure 15.19a shows the spatial distribution of landscape water yield for 2011–12, which is similar to the annual rainfall distribution (Figure 15.13a).

The highest landscape water yields in 2011–12 occurred in the northeast, locally exceeding 900 mm. For the south and west of the region, the landscape water yield generally did not exceed 200 mm over the year.

The decile-ranking map for 2011–12 (Figure 15.19b) shows that landscape water yield closely followed the patterns of rainfall deciles in Figure 15.13b.

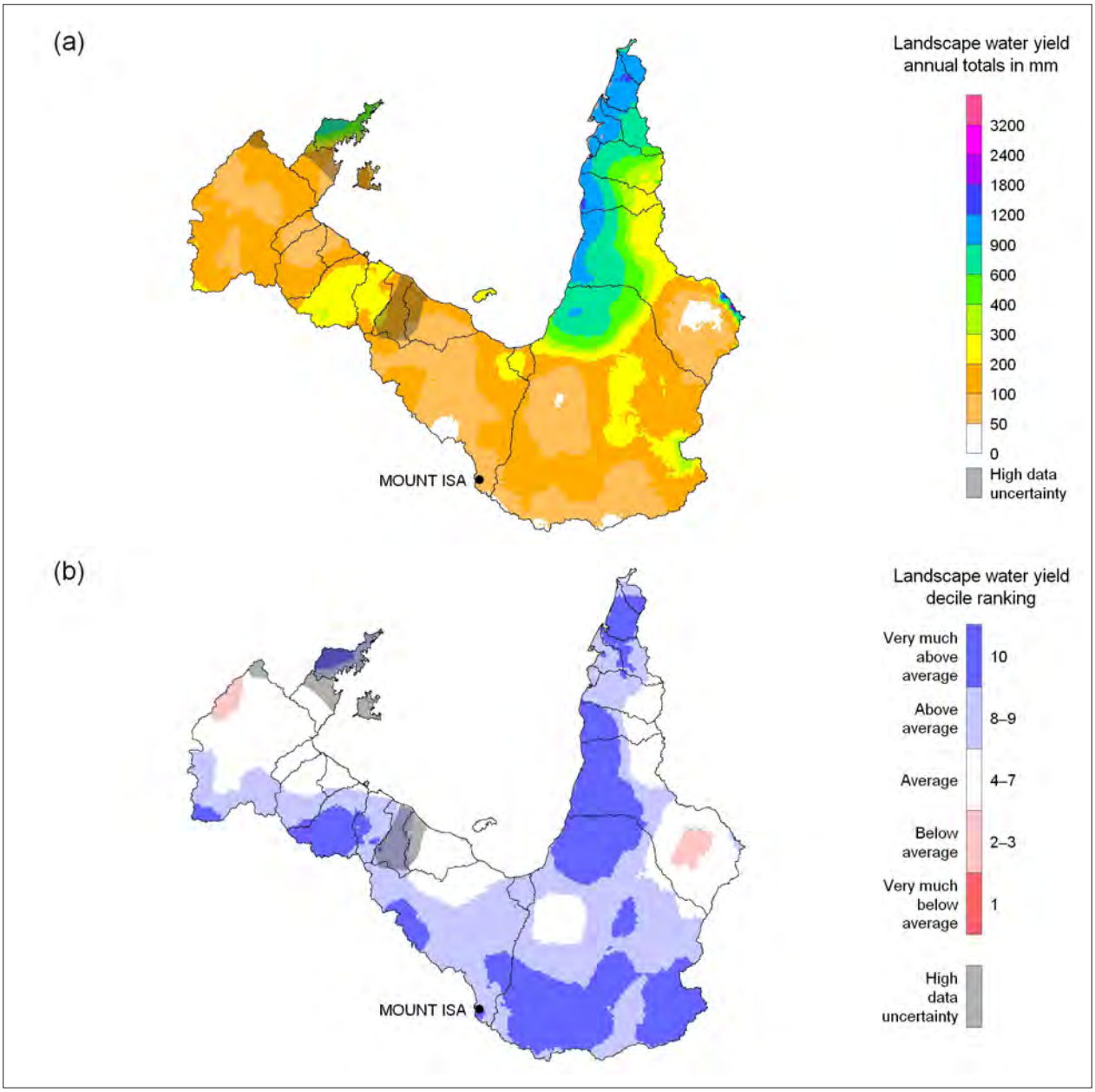

Figure 15.19 Spatial distribution of (a) modelled annual landscape water yield in 2011–12, and (b) their decile rankings over the 1911–2012 period for the Carpentaria Coast region

Landscape water yield variability in the recent past

Figure 15.20a shows annual landscape water yield for the Carpentaria Coast region from July 1980 onwards. Over this 32-year period, annual landscape water yield was 194 mm, varying from 50 mm (1982–83) to 437 mm (2010–11). Temporal variability and seasonal patterns since 1980 are presented in Figure 15.20b.

Landscape water yields clearly shows a rising trend in annual and wet season totals. In particular the last five years have seen consistently high landscape water yields.

Dry season landscape water yield is particularly low and has had minimal contribution to the annual total landscape water yield.

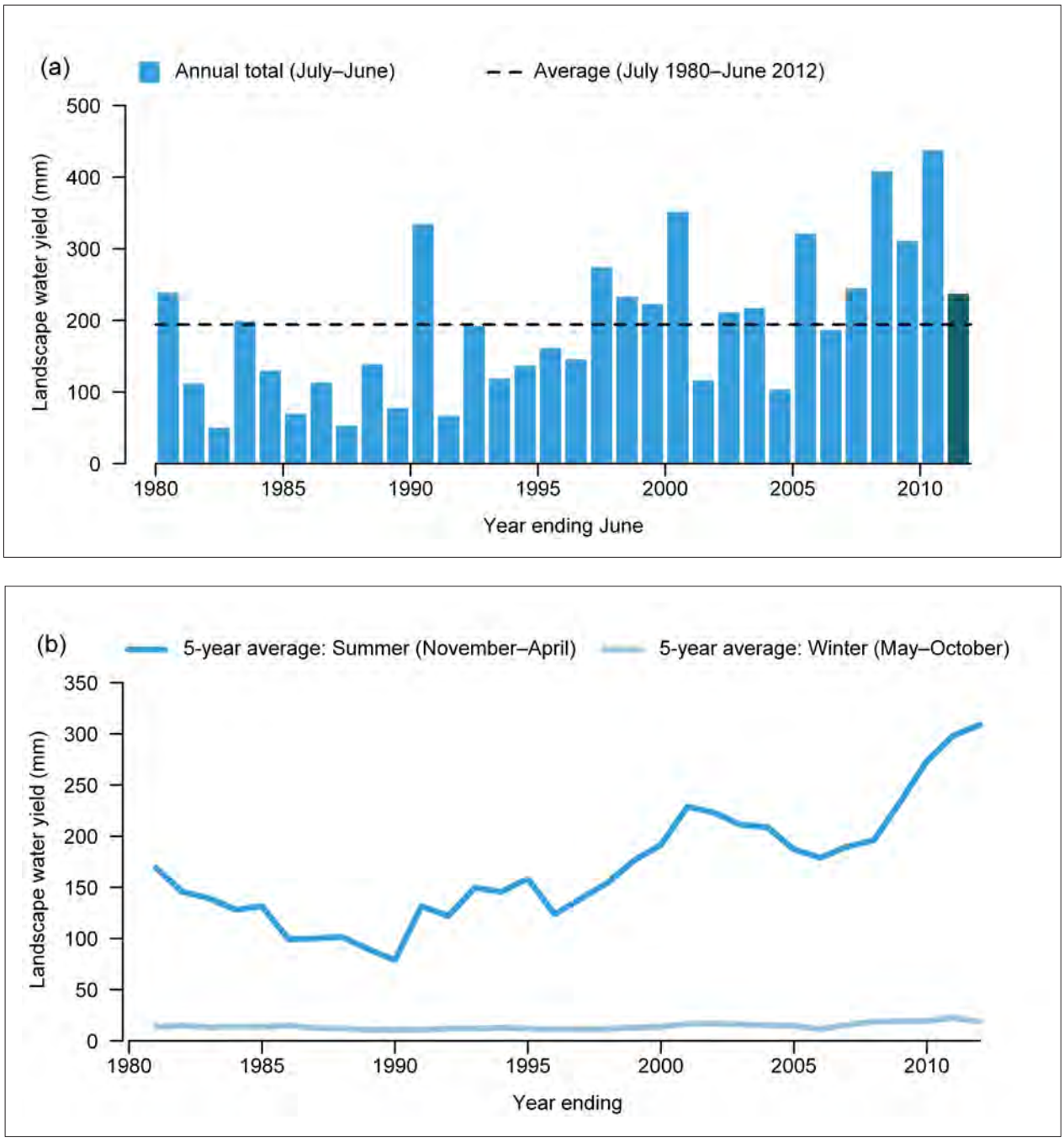

Figure 15.20 Time-series of (a) annual landscape water yield, and (b) five-year retrospective moving averages for the wet summer (November–April) and dry winter (May–October) periods for the Carpentaria Coast region

Recent trends in landscape water yield

Figure 15.21a shows the spatial distribution of the trends in modelled annual landscape water yield for 1980–2012. These are derived from linear regression analyses on the time-series of each model grid cell. The statistical significance of the trends is provided in Figure 15.21b.

Figure 15.21a shows that since 1980 strong rising trends occur along the coastline of the Gulf of Carpentaria. Locally these trends exceed 14 mm/year.

Figure 15.21b shows that most of the rising trends are confirmed to be statistically significant. As already noted in the graphs of Figure 15.20, the trends are very obvious, especially with the period of very high landscape water yield for the last five years.

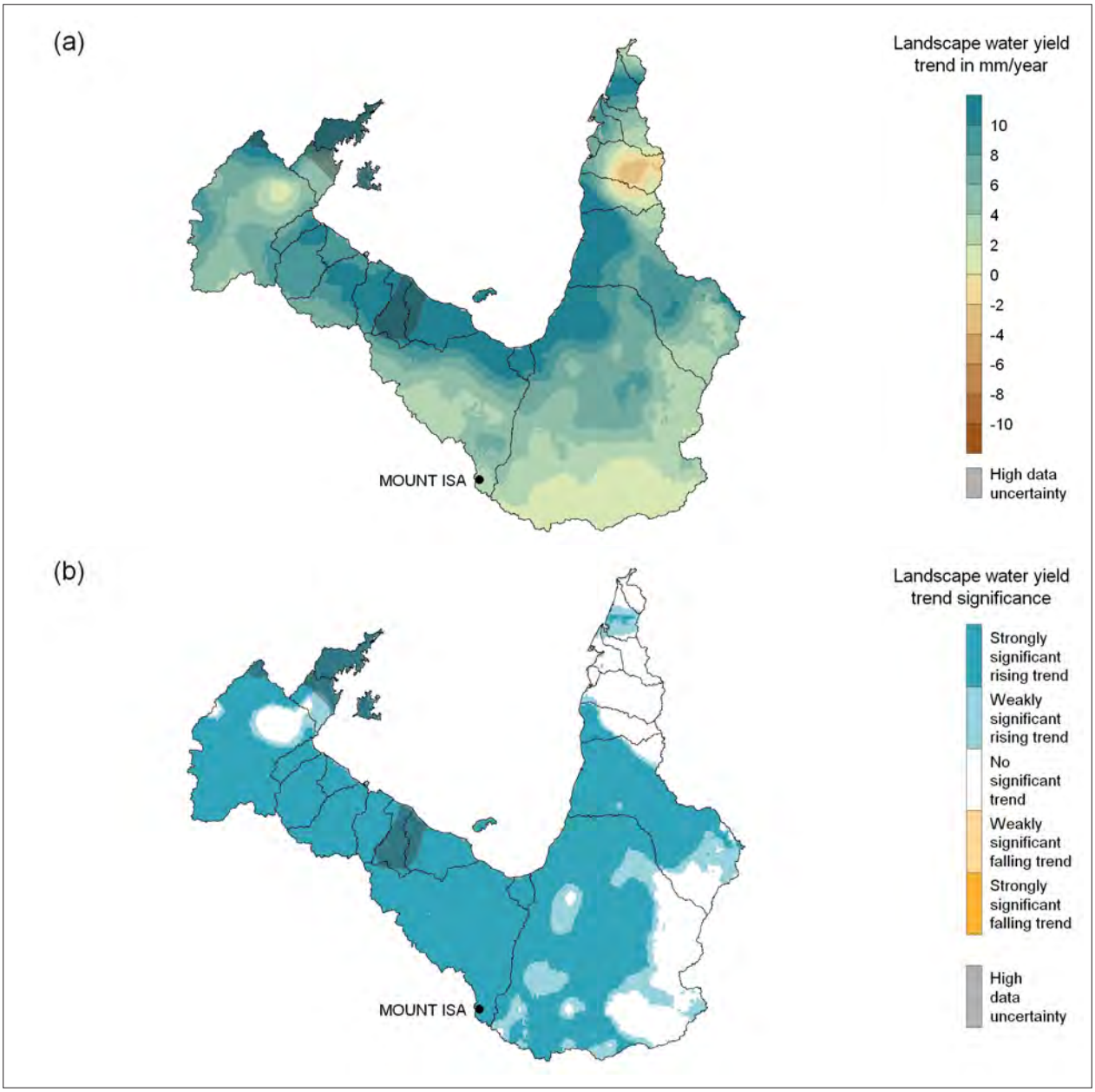

Figure 15.21 Spatial distribution of (a) trends in annual landscape water yield from 1980–2012, and (b) their statistical significance at 90% (weak) and 95% (strong) confidence levels for the Carpentaria Coast region

15.5 Surface water and groundwater

This section examines surface water and groundwater resources in the Carpentaria Coast region in 2011–12. Rivers, wetlands and storages are discussed to illustrate the state of the region's surface water resources. The region's watertable aquifers and salinity are described. No data was available at the Bureau in a suitable format for a detailed analysis on individual aquifers.

15.5.1 Rivers

There are 23 river basins in the Carpentaria coast region, varying in size from 1,000 to 231,000 km^2 (Figure 15.22). The four major basins in the region are the Flinders–Norman, Roper, Nicholson–Leichhardt, and Mitchell–Coleman. Much of the Carpentaria Coast region drains into the Gulf of Carpentaria and comprises floodplains.

The rivers, however, are very large by Australian standards and carry approximately a quarter of the continent's total yearly streamflow.

The main rivers flowing north to the Gulf of Carpentaria are the Mitchell, Flinders, Gilbert, Roper and Leichhardt. These rivers are generally braided and seasonally intermittent. A few exceptions like the Roper and the Gregory are perennial. The Gilbert, Mitchell, Flinders and Leichhardt rivers are typical of seasonal rivers and their discharge can vary greatly depending on the intensity of the monsoon. The Leichhardt River flows north from the Mount Isa district towards the Gulf of Carpentaria, east of Burketown, and the Flinders River rises in the Great Dividing Range, 110 km northeast of Hughenden and flows into the gulf west of Karumba. Most rivers, however, flow only during the wet season. Therefore, all perennial rivers and perennial springs are important sources of water.

Boodjamulla (Lawn Hill) National Park | Wilderness Challenge Pty Ltd

Figure 15.22 Rivers and catchments in the Carpentaria Coast region

15.5.2 Streamflow volumes

Figure 15.23 presents an analysis of river flows at 16 monitoring sites in the Carpentaria Coast region during 2011–12 relative to annual flows for the July 1980–July 2012 period. Sites with relatively long records across seven geographically representative rivers were selected (see Technical Supplement). The annual river flows for 2011–12 are colour-coded according to the decile rank at each site over the 1980–2012 period.

The flows generally reflect the mostly average to above average modelled landscape water yield results shown in Figure 15.19b.

Above average flows were observed at five sites located on rivers in the southeast and McArthur River in the southwest of the region. Five further sites, mainly located on the rivers in the central east, the Roper River in the west and the Gregory River in the southwest, recorded average flows.

Of the 16 monitoring sites across the region there were only two locations where below average flows were recorded. These were located on the Waterhouse River in the west and Walsh River in the central east of the region.

Flow deciles in the wet season (November 2011–April 2012) were very similar to total annual flows for 2011–12 as shown in Figure 15.23. There are few monitoring sites that did not show this pattern, such as on the Roper River in the west of the region which had relatively low flows in the wet season.

15.5.3 Streamflow salinity

Figure 15.24 presents an analysis of streamflow salinity for 2011–12 at seven monitoring sites throughout the Carpentaria Coast region. The monitoring sites with at least a five-year data record were selected for analysis. The results are presented as electrical conductivity (EC, µS/cm at 25 °C). This is a commonly used surrogate for the measurement of water salinity in Australia. Standard EC levels for different applications, such as for drinking water or types of irrigation, are provided in the Technical Supplement. The median annual EC values are shown as coloured circles. The size of the circle depicts the variability in annual EC, shown as the coefficient of variation (CV), being the standard deviation divided by the mean.

The median EC values for most of the monitoring sites in the main rivers fall in the range 0–1,000 µS/cm, which is suitable for most irrigation uses. Of the seven monitoring sites, 43% had median EC values below 500 µS/cm and 57% were between 500–1,000 µS/cm. A little higher salinity occurs in the river basins in the south of the region.

The salinity CV is the expected variability of a measurement of EC, relative to the mean EC. The CV in EC is typically related to the variability of the flow at the monitoring sites. The CV is relatively low for the most of the monitoring sites in the region except Dugald River in the south of the region. Of the seven monitoring sites, 43% had a CV below 20%; 43% of the sites had a CV between 20% and 60%; and the CV was above 60% at one of the seven monitoring sites. This was on the Dugald River in the south of the region.

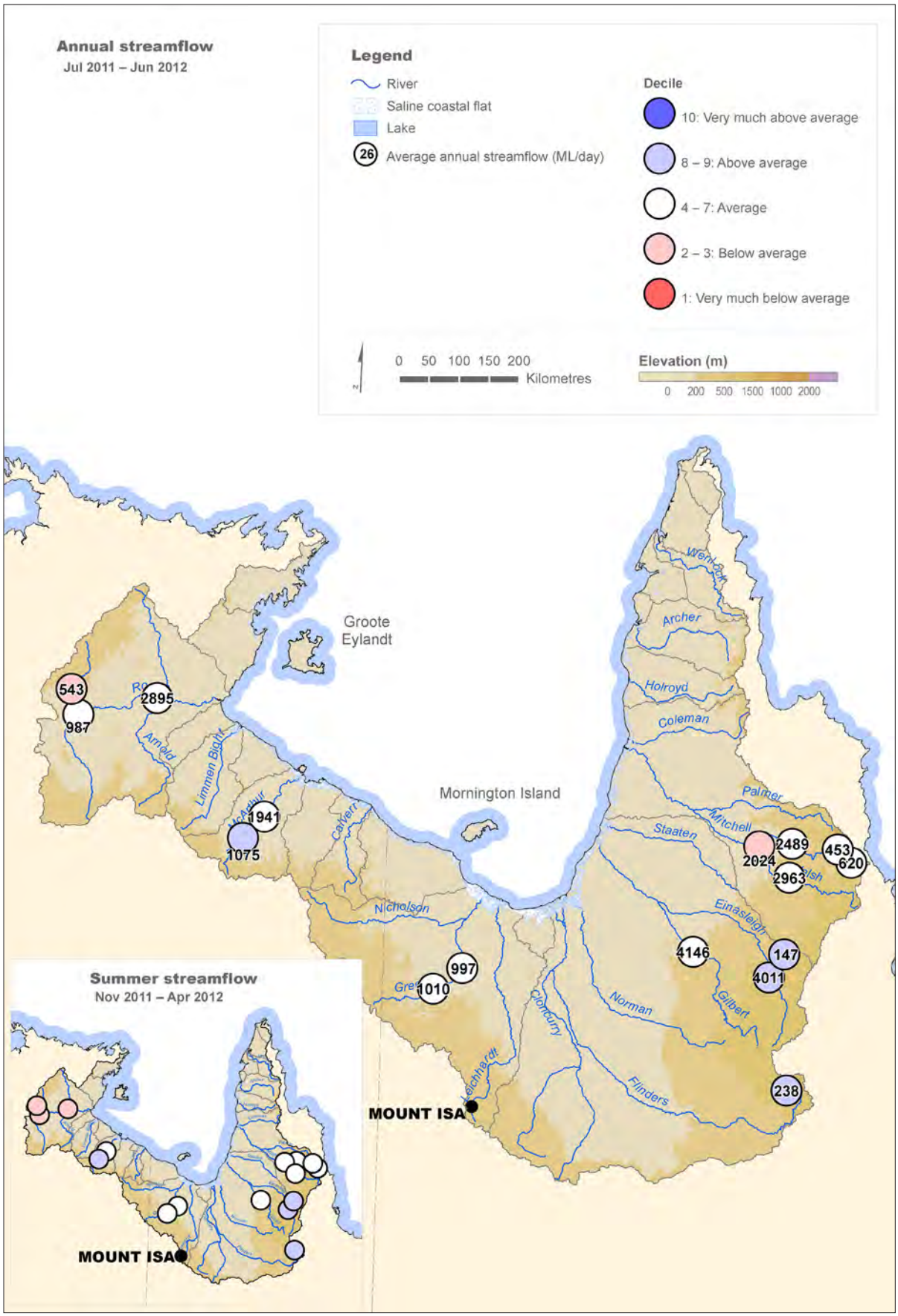

Figure 15.23 Average annual and wet season (November 2011–April 2012) flow volumes of selected monitoring sites for 2011–12 and their decile rankings over the 1980–2012 period in the Carpentaria Coast region

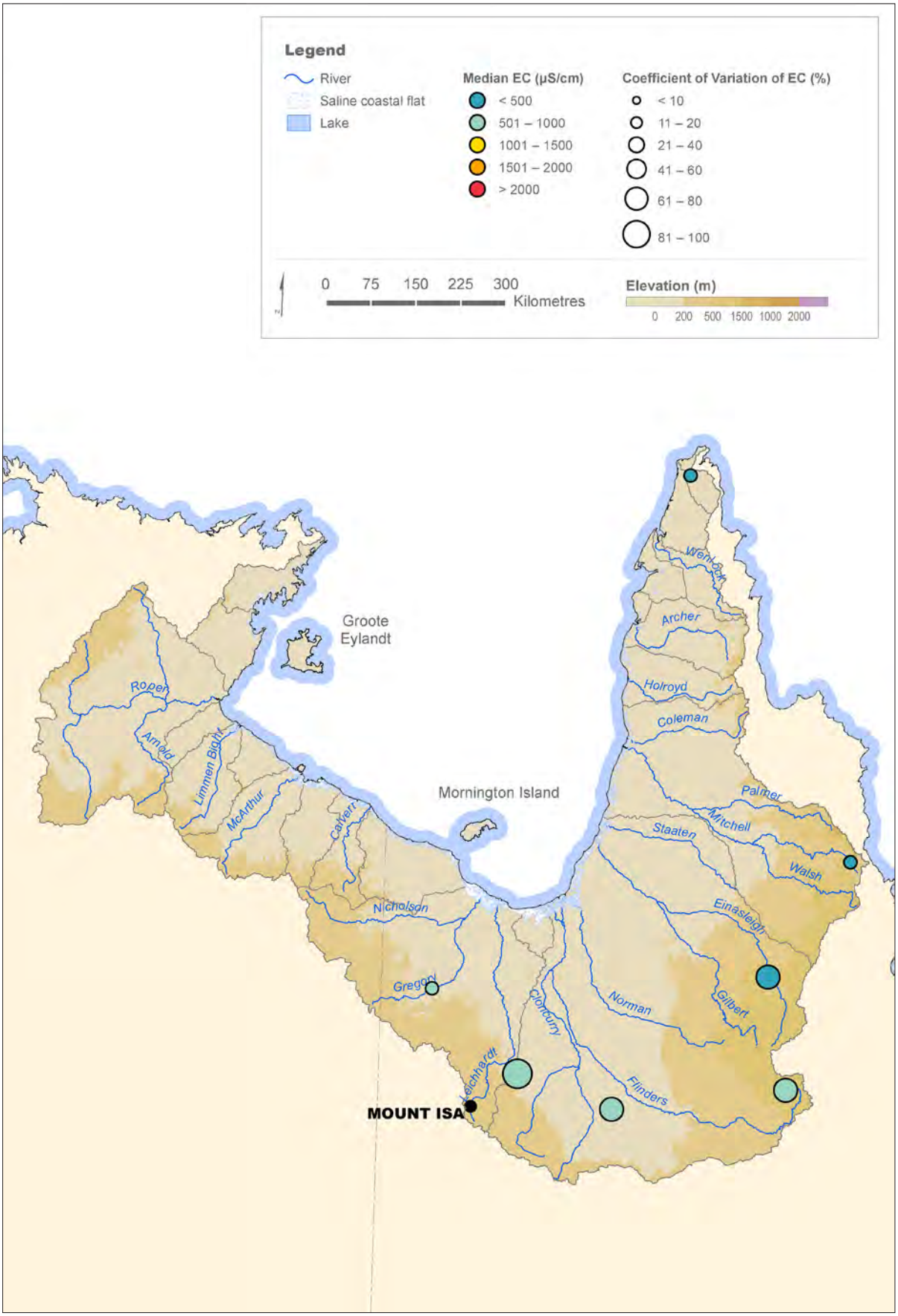

Figure 15.24 Salinity as electrical conductivity and its associated coefficient of variation for 2011–12 in the Carpentaria Coast region

15.5.4 Flooding

Figure 15.25 gives an overview of the locations where the Bureau is assesses flood levels in the Carpentaria Coast region through the Northern Territory Government as part of its flood forecasting service. These levels are further specified in the Technical Supplement.

There were major floods in the region, mostly during the January–March 2012 period, that were associated with an active monsoon over northern Australia and the Gulf of Carpentaria.

In the last week of December 2011 the monsoon was very active over the eastern half of Northern Australia. In late January 2012 a low formed over western Cape York Peninsula and moved into the southeast Gulf of Carpentaria. Major floods occurred in the Cloncurry River with other moderate floods in the Leichhardt River and minor floods further west in the Gregory River.

In mid to late February 2012 a low pressure system produced heavy rainfalls across most of the Gulf Country and resulted in major floods over vast part of the region from the Einasleigh River in the east to the Gregory River in the west.

In early March 2012 moderate to heavy rainfall affected the north tropical coast and central coast and major floods occurred in northeast rivers such as Mitchell with minor flooding in other eastern rivers such as the Gilbert and Einasleigh.

One major flood occurred during April 2012 in upper Flinders. The heavy rainfalls subsided in the region and no flooding occurred afterwards.

15.5.5 Storage systems

One storage, Lake Julius, is reported in the Carpentaria Coast region by the Bureau's water storage information. The Bureau's water storage website includes information on approximately 24% of the region's publicly owned storage capacity (as at August 2012). Storages not reported include Lake Moondarra and Lake Mitchell. Lake Julius provides water to Mount Isa and surrounding mines.

The location of Lake Julius is shown in Figure 15.26. The storage normally fills up over the wet season and slowly drops in level over the dry season. In June 2012, Lake Julius was filled to 93% of its storage capacity. The lowest storage level was 80% of its storage capacity.

Further information on the past and present volumes of the storage systems and the individual storages can be found on the Bureau's water storage website: water.bom.gov.au/waterstorage/awris/

15.5.6 Wetlands

There are no Ramsar-listed internationally important wetlands in the Carpentaria Coast region, but there are a large number of wetlands of national importance mentioned (Figure 15.27). More information about the wetlands in the region can be found in the *Australian Directory of Important Wetlands* (www.environment.gov.au/water/topics/wetlands/database/diwa.html).

The wetlands consist mainly of widespread tidal flats in the estuaries of most rivers. These estuaries are flooded with fresh water during the wet season peak flows, and provide large habitats for water birds to feed and breed.

No detailed assessment on the inflows of selected wetlands has been performed for this region.

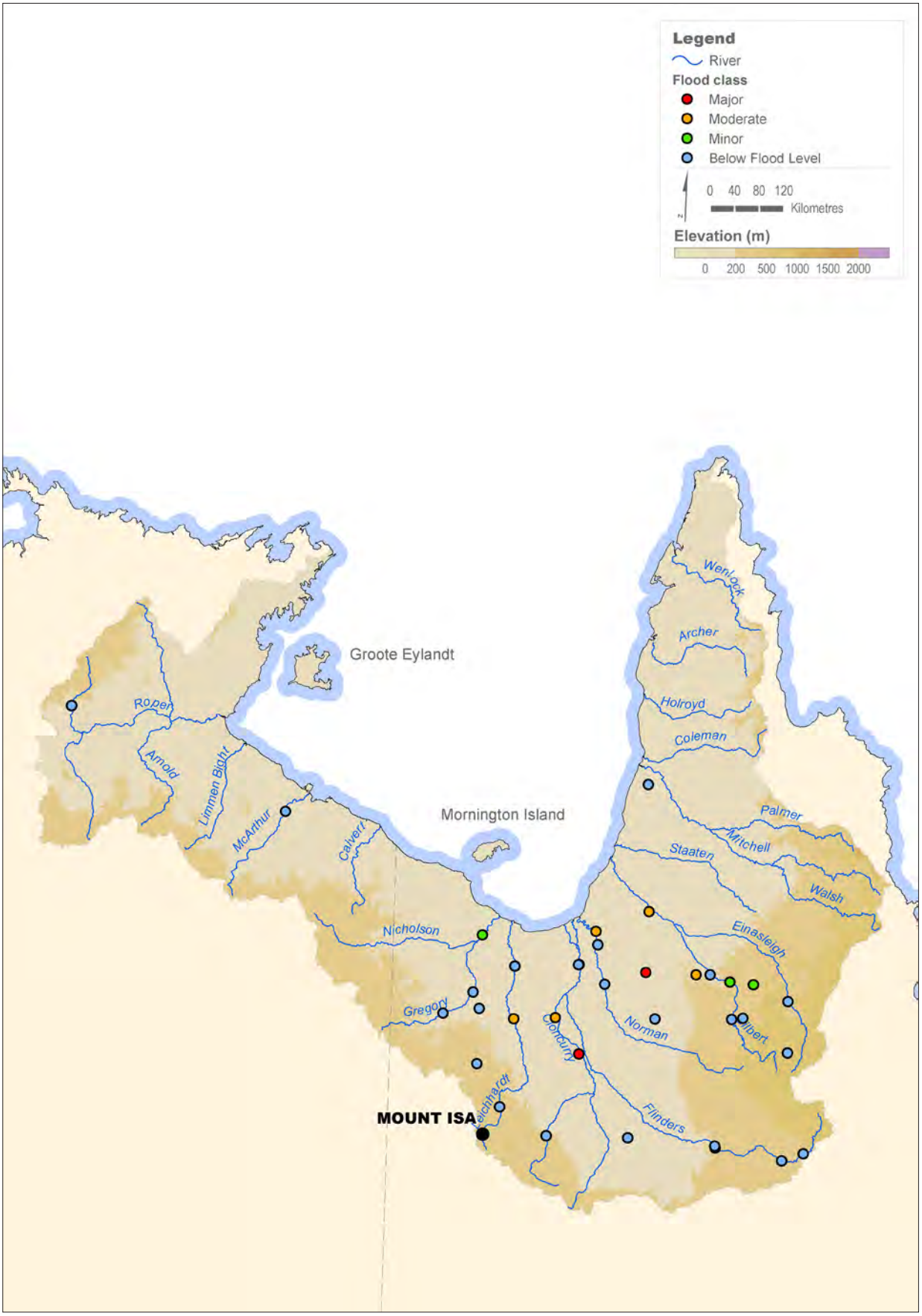

Figure 15.25 Flood occurrence in 2011–12 for the Carpentaria Coast region

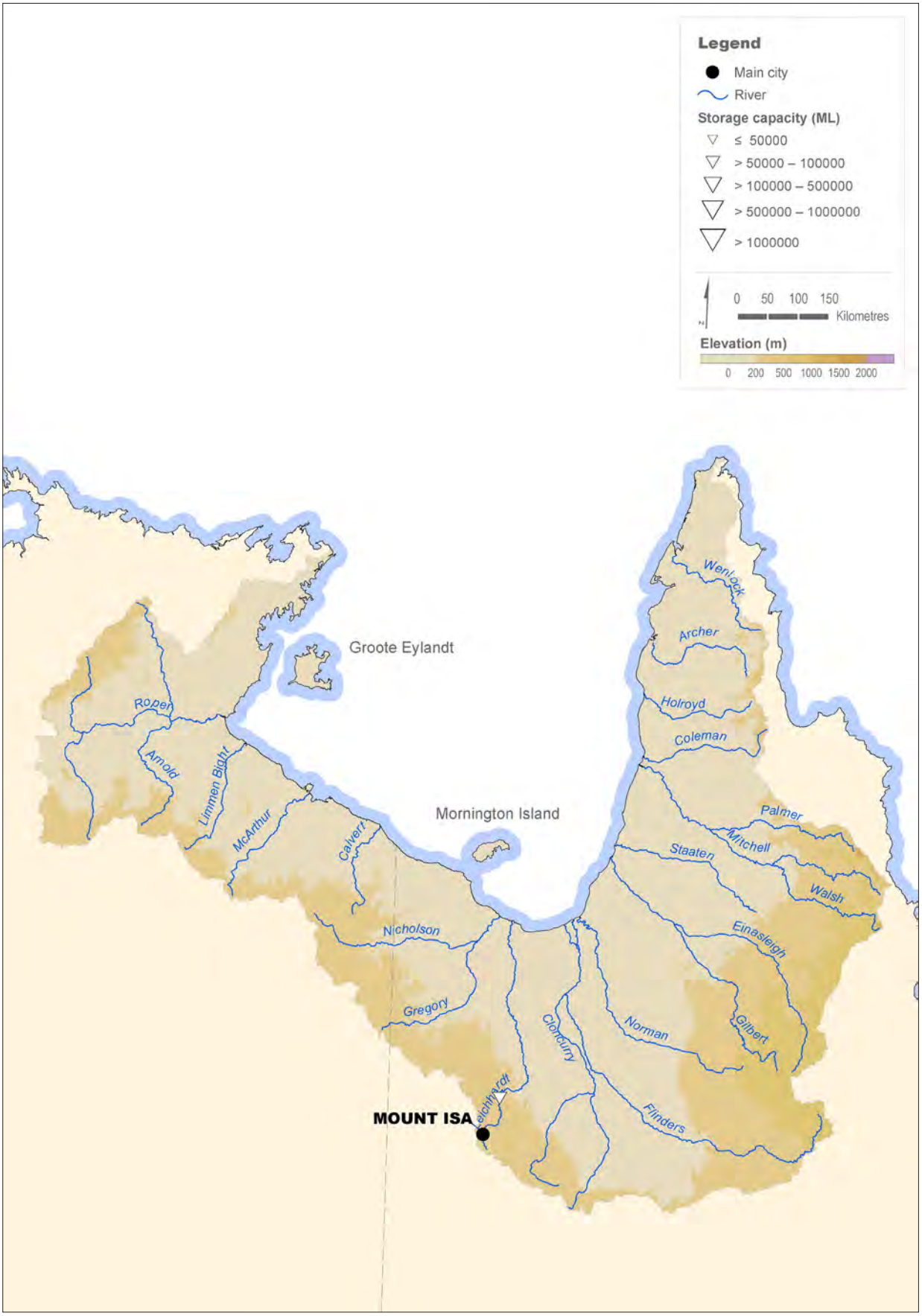

Figure 15.26 Storage systems in the Carpentaria Coast region (information extracted from the Bureau's water storage website in August 2012)

Figure 15.27 Location of important wetlands in the Carpentaria Coast region

15.5.7 Hydrogeology

The hydrogeology of the region is dominated by the sediments of the Great Artesian Basin, fractured and karstic rock in some areas, and some outcropping basement rock (Figure 15.28).

Groundwater systems that provide more potential for extraction are labelled as:

- Fractured and Karstic Rocks; and
- Mesozoic GAB (porous media—consolidated).

The Great Artesian Basin is one of Australia's largest and most significant groundwater basins with porous sandstone aquifers from the Triassic, Jurassic and Cretaceous periods. There is a substantial amount of extraction of groundwater from this large resource for stock and domestic purposes.

Fractured and karstic rock occurs in the Roper catchment (in the region's west) and the Mount Isa area in the south. In the hard rock of the basement, substantial groundwater flow only occurs in rock fractures and this type of groundwater system typically offers restricted low volume groundwater resources.

15.5.8 Water table salinity

Figure 15.29 shows the classification of watertable aquifers as fresh (total dissolved solids [TDS] < 3,000 mg/L) or saline (TDS ≥ 3,000 mg/L) water according to watertable salinity. As shown in this figure there is a large area of no data represented in grey; however, where the data exists groundwater is mainly fresh.

Although the water quality of shallow aquifers is generally good, the seasonal variability of rainfall, and consequently the level of the watertable, reduces the reliability of the yield.

15.5.9 Groundwater management units

The groundwater management units within the region are key features that control the extraction of groundwater through planning mechanisms. Figure 15.30 shows that the major groundwater management unit within the Northern Territory contains the fractured and karstic rocks aquifers of the Daly Roper area. In Queensland the major groundwater management units are the Great Artesian Basin, the Cook, and the Mount Isa.

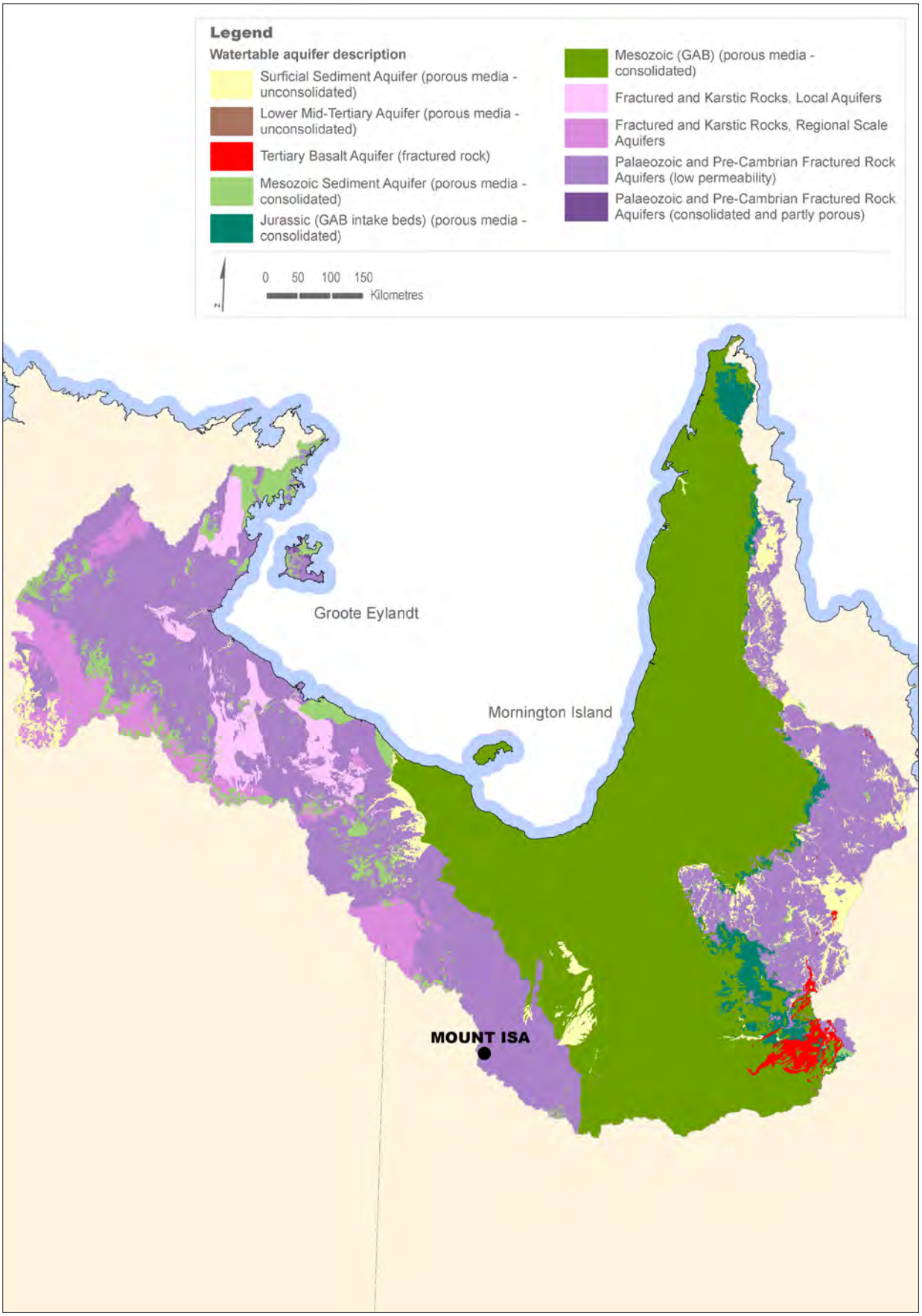

Figure 15.28 Watertable aquifers in the Carpentaria Coast region; data extracted from the Groundwater Cartography of the Australian Hydrological Geospatial Fabric (Bureau of Meteorology 2012)

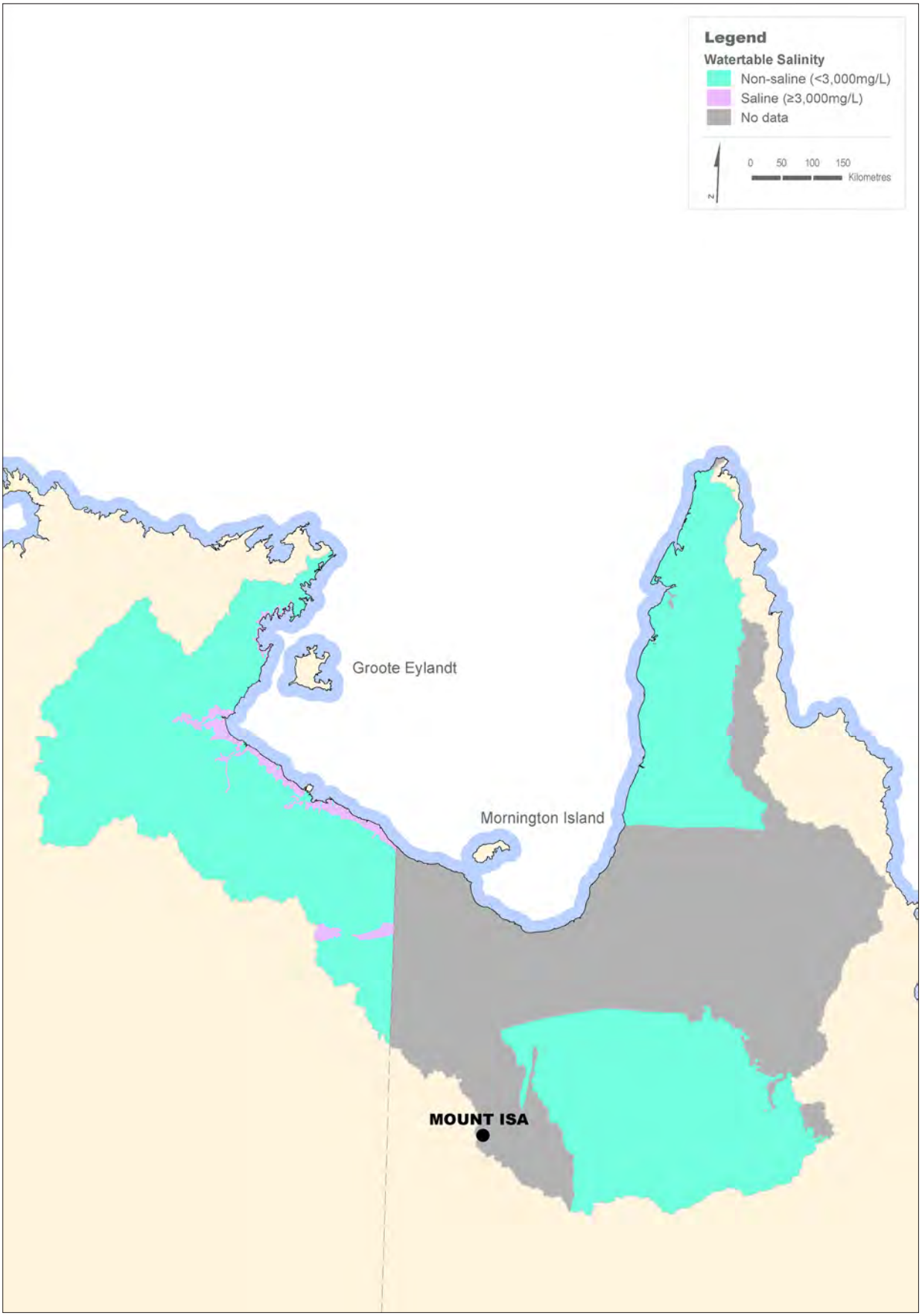

Figure 15.29 Watertable salinity classes in the Carpentaria Coast region; data extracted from the Groundwater Cartography of the Australian Hydrological Geospatial Fabric (Bureau of Meteorology 2012)

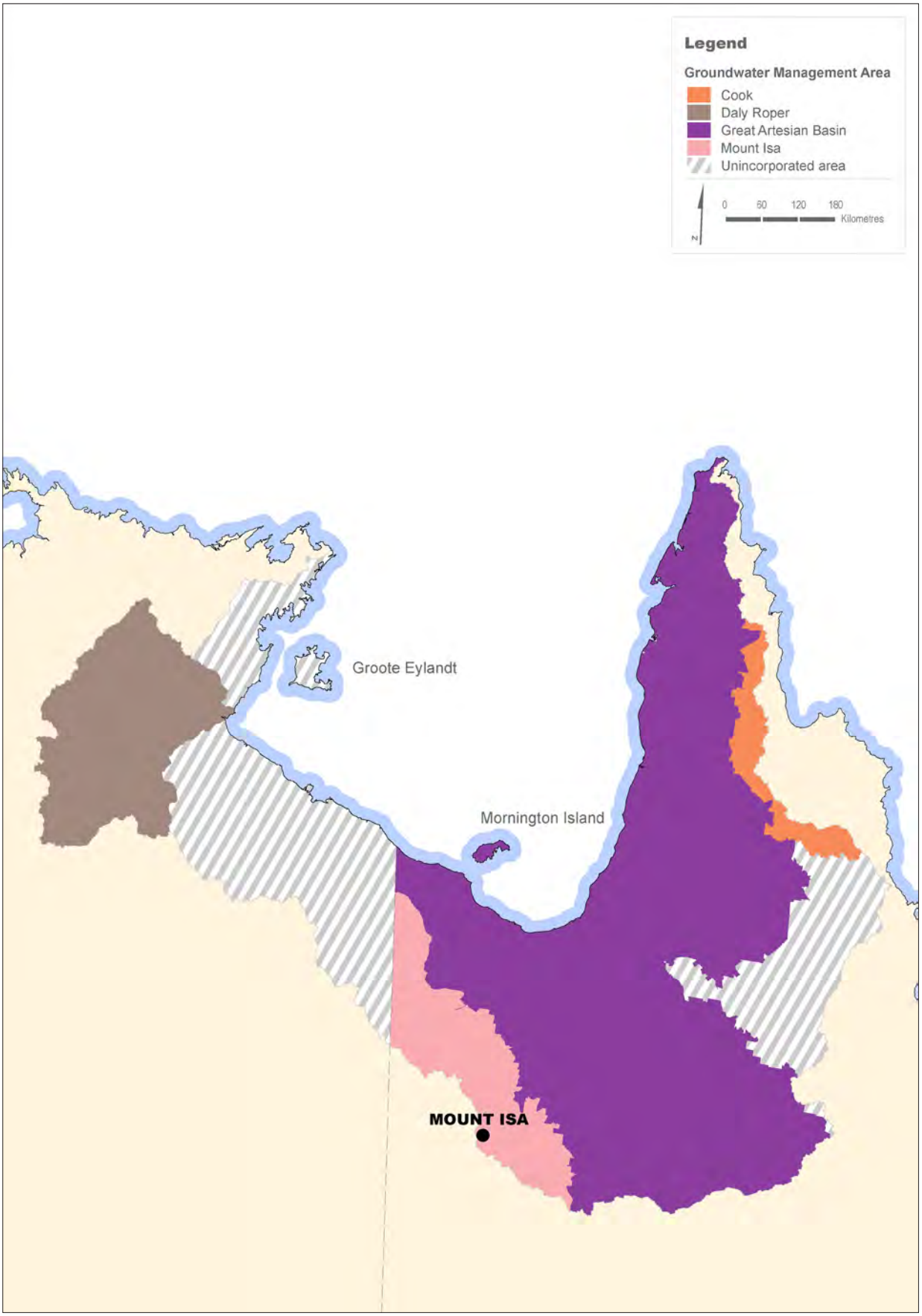

Figure 15.30 Groundwater management units in the Carpentaria Coast region; data extracted from the National Groundwater Information System (Bureau of Meteorology 2013)