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Australian Water Resources Assessment 2012

Summary Report

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1. Introduction

1.1 What is the Australian Water Resources Assessment?

Australian Water Resource Assessments are regular reports on the availability, quality and use of the nation's water resources. They use the best available water data, models and analyses to describe the state of the nation's water resources at a point in time and in the context of the long-term record.

Under the Commonwealth *Water Act 2007*, the Bureau of Meteorology (the Bureau) is responsible for compiling and delivering comprehensive water information across Australia. This includes conducting timely, rigorous and independent assessments of the status of Australia's water resources and patterns of use of those resources.

Accordingly, the Assessment aims to:

- monitor the hydrological state of rivers, storages, wetlands and aquifers and publish hydrometric statistics for key sites;
- highlight patterns, trends and variability in water availability, quality and use at city, regional and national scales over time-scales of months to decades; and
- provide analyses of varying complexity, predominantly in the form of readily interpretable maps, graphs and tables.

The reports are intended to assist assessment of the impact and sustainability of current water management practices and inform the design of water resource plans, supporting the goals of the National Water Initiative.

Collectively, the Australian Water Resources Assessments are focused on consistency in reporting over time at key sites and highlighting patterns, variability and trends. They are designed to be transparent about the source and quality of data presented and about the modelling, methods and analysis techniques used.

Each biennial assessment includes a National Overview, 13 regional assessments (as shown in Figure 1.1) and a Technical Supplement that presents information on the analytical methods used and their scientific peer review.

The Assessments for the years 2009–2010 (the 2010 Assessment) and 2011–12 (the 2012 Assessment) are available on the Bureau's website: www.bom.gov.au/water/awra/index.shtml

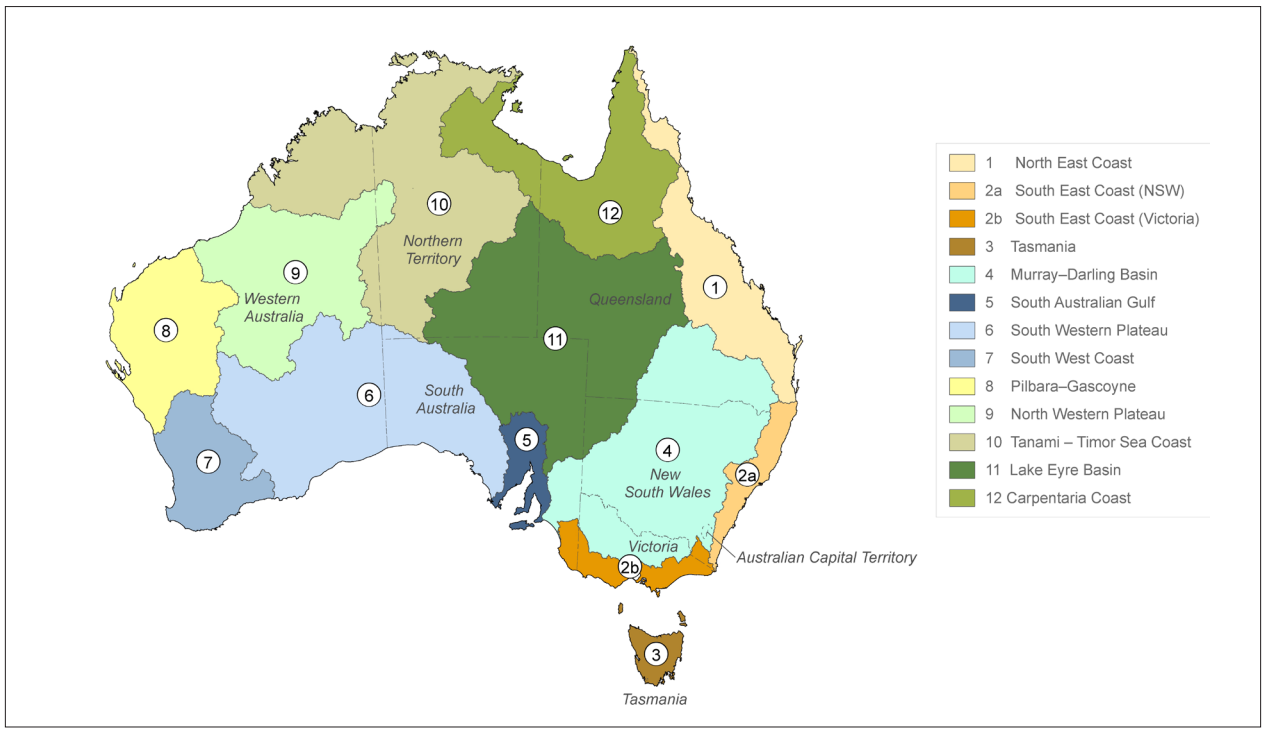


Figure 1.1 Australian Water Resources Assessment 2012 reporting regions

1.2 What information is included in the 2012 Assessment?

The National Overview provides a national scale assessment of climate and water flows and stores in Australian landscapes from July 2011–June 2012. The chapter also examines some important drivers of climatic conditions and their impact on rainfall and evapotranspiration over the year. Information on nationally significant weather and water events is also presented.

The regional assessment chapters provide information for each region on:

- impacts of climatic conditions on water resources for 2011–12 and over the preceding three decades;
- recent anomalies and trends in the hydrological characteristics of rivers and aquifers at selected monitoring sites; and
- water availability for, and use by, selected major cities and irrigation areas.

The depth of analysis and information presented in this assessment is limited by the availability of data. It is expected that Australian Water Resources Assessment reporting will expand and improve significantly over time as the Bureau's water resources information systems develop.

1.3 How was the 2012 Assessment prepared?

The 2012 Assessment has used a nationally consistent landscape water balance model, the Australian Water Resources Assessment System (AWRA-System), to generate estimates of landscape water flows and stores and to describe and interpret the state of the nation's water resources across the country.

The landscape water component of the AWRA-System, referred to as AWRA-L, is a distributed model that was run nationally on a 0.05° grid (approximately 5 km x 5 km) and at a daily time-step.

Figure 1.2 presents a schematic representation of the components (inputs, stores, flows and outputs) of the AWRA-L model.

Differing from the 2010 Assessment, which used the combined outputs of the WaterDyn and AWRA-L models, only the latter model, with an improved calibration, has been used in the 2012 Assessment. This has resulted in a more satisfactory and consistent representation of the landscape water flows.

Similar to the 2010 Assessment, trend values for rainfall, evapotranspiration and landscape water yield were determined to show how these water balance terms have changed in different regions of Australia over time.

Monitoring data from around the country are included in the 2012 Assessment to support the model results and to give information on other water resources components, including water storage, supply and use. An extended set of reference sites (from that used for the 2010 Assessment) informed the analyses of trends and variability in water availability, supply, and urban and agricultural use over the 2011–12 year and the past decades.

Groundwater levels were analysed for aquifers associated with the major groundwater management units in regions where data was available at the Bureau in a suitable form for access and analysis.

Site-based information about streamflow salinity, land use, population, soil types, physiographic regions, rainfall zones and rainfall deficits have also been added to the 2012 Assessment.

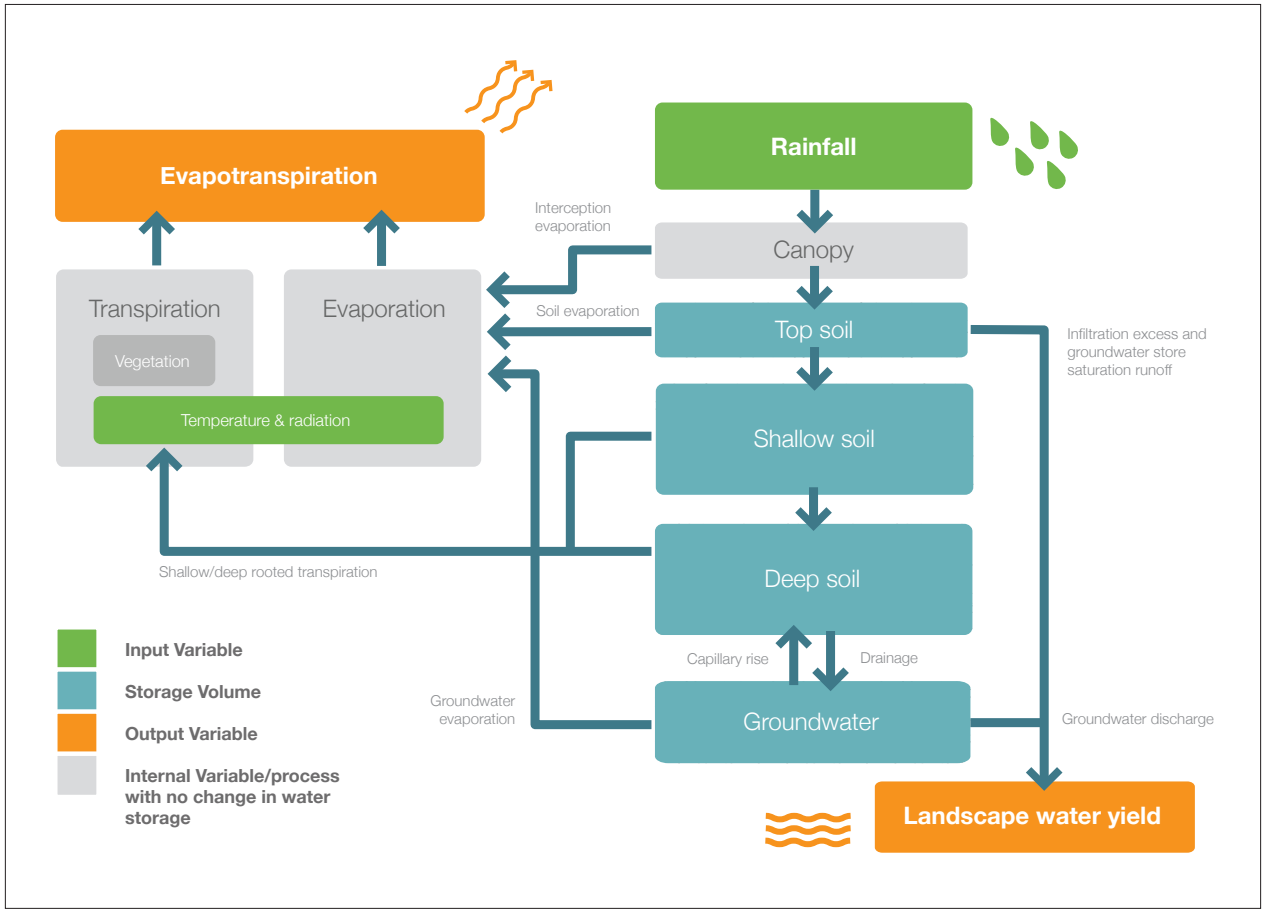


Figure 1.2 Schematic representation of inputs, outputs, flows and stores in the landscape water balance model used in the 2012 Assessment

1.4 Quality control and review: who was involved?

A detailed review process was developed and implemented to ensure that the 2012 Assessment provides accurate and relevant information. Chapters of the report were initially reviewed by various experts from within the Environment and Research division of the Bureau. The report was then sent to non-Bureau water domain and regional experts for further review.

Comments and suggestions were received from water domain and regional experts from 17 external organisations. Technical expertise, especially with regard to updating modelling of national landscape water flows, was provided through the Water Information Research and Development Alliance (WIRADA) between the Bureau and CSIRO.

1.5 Further information

Further information about the Bureau's Australian Water Resources Assessment is available at: www.bom.gov.au/water/awra/index.shtml or via email: awra@bom.gov.au

2. National Overview

2.1 Key findings

The Australian climatic condition in 2011–12 (defined in this report as from 1 July 2011–30 June 2012) was characterised by a moderately strong La Niña event. This followed the very strong La Niña event of 2010–11, which decayed to neutral conditions by the beginning of the 2011–12 year. During July–September 2011, average to below average rainfall was recorded over much of the country. A La Niña developed in spring 2011 with markedly above average rainfall across most of the country. The La Niña event was declared over in late March 2012 and, after Australia's third wettest March on record, below average rainfall was seen over large areas of the country for the remainder of 2011–12.

For more information on the drivers of Australian climatic conditions in 2011–12 see: www.bom.gov.au/climate/annual_sum/annsum.shtml

The key information table summarises the water outcomes of the climatic conditions for Australia over 2011-12 (Table 2.1).

Highlights of 2011–12

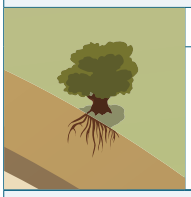
- Total annual rainfall was 33% above the long-term 1911–2012 average; evapotranspiration was 30% above the long-term average; and landscape water yield was 57% above the long-term average.
- Wet soil moisture conditions prevailed throughout most of the country except for the South West Coast region where soils were dry and remained far below long-term average levels.
- The substantially higher landscape water yield contributed to above average streamflow in large parts of the country, causing the total water stored in major reservoirs to increase from 75% at the end of 2010–11 to 83% of their total accessible capacity on 30 June 2012. The increase is largely due to storage volume increases in the Tasmania and Murray–Darling Basin regions.
- Rising trends in groundwater levels were present in most of the selected aquifers within the North East Coast, South East Coast (Victoria) and Murray–Darling Basin regions, reflecting the higher recharge to groundwater.
- Urban water consumption in 2011–12 remained consistent with that of the previous year for Australia's State and Territory capitals. Total urban water use in 2011–12 was 1,530 GL, a rise of just 1% from 1,513 GL in 2010–11.

Table 2.1 Key information on water flows, stores and use in Australia

Landscape water flows

	Australian average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	567 mm	+33%	10th—very much above average
Evapo-transpiration	483 mm	+30%	10th—very much above average
Landscape water yield	83 mm	+57%	10th—very much above average

Mean annual soil moisture (decile ranking with respect to the 1911–2012 record averaged over Australia)

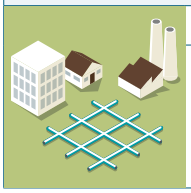


2011–12	2010–11
10th—very much above average	10th—very much above average

Surface water storage (comprising about 94% of Australia's total surface water storage capacity)

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
79,700 GL	66,300 GL	83%	60,100 GL	75%	+6,200 GL	+8%

Urban water use (for all State and Territory capitals, excluding Hobart due to data unavailability)



Total use in 2011–12	Total use in 2010–11	Change
1,530 GL	1,513 GL	17 GL (+1%)

2.2 Landscape water flows

The modelled landscape water flow components are presented in Figure 1.2.

Table 2.2 gives an overview of the region totals and rankings for three water balance components (rainfall, evapotranspiration and landscape water yield) of 2011–12 in comparison to the 1911–2012 record. Figure 2.2 also shows the decile ranking and spatial distribution of these components.

Although average rainfall for 2011–12 was above the long-term record and large areas of the country such as the Murray–Darling Basin received very much above average rainfall, other parts such as Wimmera Mallee, Limestone Coast in South Australia and the Barwon Coast in south-western Victoria received little rainfall. Rainfall in other regions such as Tasmania was average.

Evapotranspiration for the year was very much above average across most inland areas. The coastal areas along the west and south coast and the north east coast had low evapotranspiration. These included the western part of the South East Coast (Victoria) region and the southwestern tip of Western Australia. In Tasmania, evapotranspiration was close to average.

Landscape water yield for the year was above the national long-term average in most parts of the country including the Murray–Darling Basin. In southwest Western Australia, landscape water yield was low. Other parts, including much of Tasmania and the South Australian Gulf, received largely average landscape water yield.

Table 2.2 Average rainfall, evapotranspiration and landscape water yield as well as its percentile ranking in 2011–12 by region, with highest (blue) and lowest (red) values shown

Region	Region average in 2011–12 (mm)			Percentile ranking with respect to the 1911–2012 record		
	Rainfall	Evapo-transpiration	Landscape water yield	Rainfall	Evapo-transpiration	Landscape water yield
North East Coast	1,041	814	223	84	87	83
South East Coast (NSW)	1,265	**919**	352	87	89	92
South East Coast (Victoria)	842	648	180	88	**64**	**97**
Tasmania	**1,396**	769	**632**	**62**	72	54
Murray–Darling Basin	651	559	65	**95**	93	**97**
South Australian Gulf	331	306	9	74	70	53
South Western Plateau	**256**	**268**	**6**	89	94	92
South West Coast	499	455	28	77	86	**32**
Pilbara–Gascoyne	338	341	19	82	89	91
North Western Plateau	319	291	26	91	92	90
Tanami – Timor Sea Coast	754	646	142	90	94	87
Lake Eyre Basin	337	327	25	88	93	93
Carpentaria Coast	992	775	237	89	**95**	87

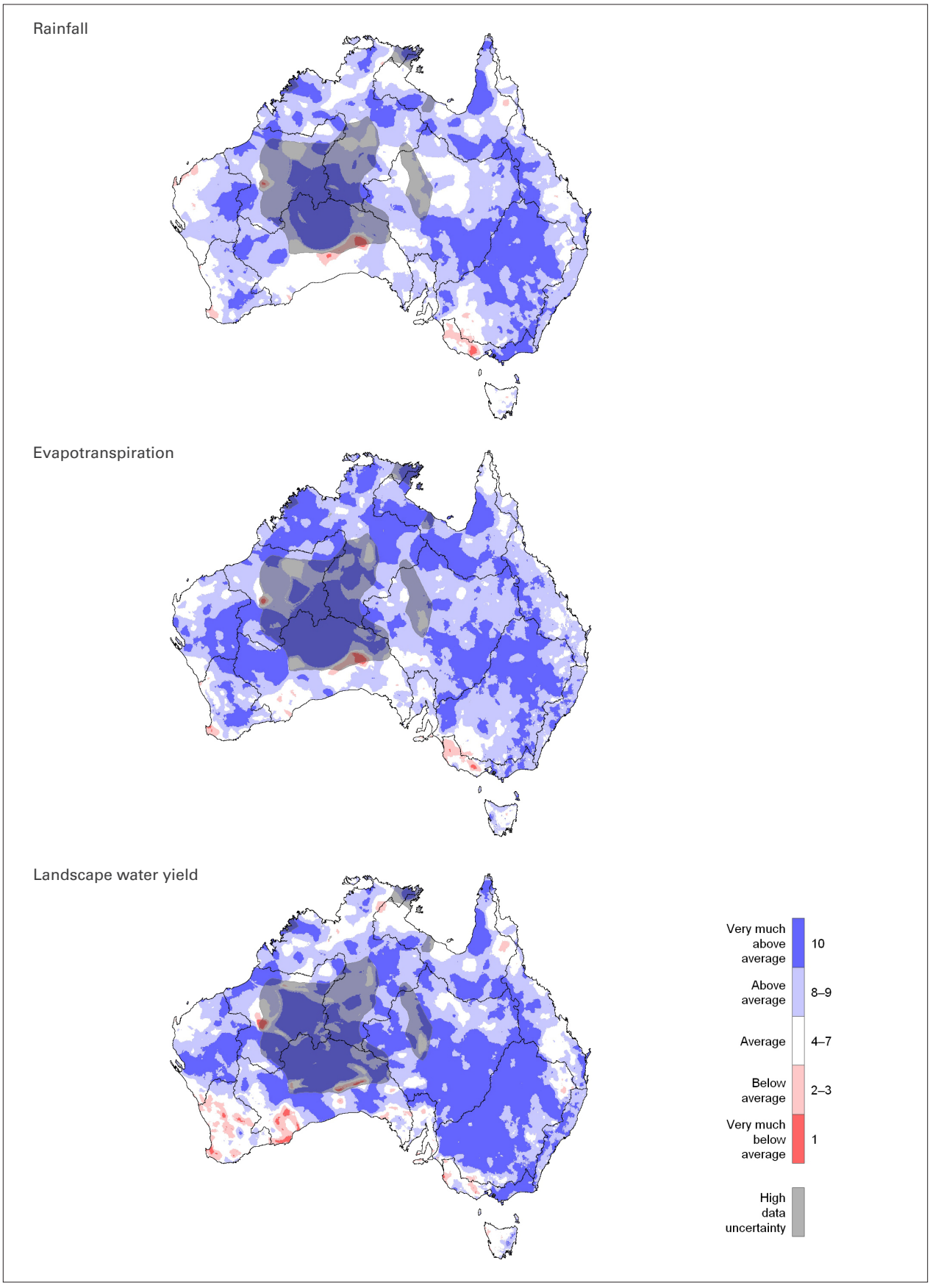


Figure 2.1 Maps of water flow decile ranking of 2011–12 annual totals with respect to the 1911–2012 record

2.3 Soil moisture store

The modelled soil moisture volumes are a simplified conceptual representation of soil water storage and, as they are not verified against local soil moisture measurements, they are presented in relative terms only.

In 2011–12, soil moisture volumes were very much above average in most regions of the country, the exception being the South West Coast region. Very low soil moisture volumes were experienced in this region at the start of the year. Even the relatively high rainfall during the year could not lift the overall soil moisture to average levels. The large areas of very much above average soil moisture volumes, such as in the southeast of the country, include important agricultural areas which benefitted from the higher water reserves in the soil profile.

A comparison of Figure 2.2 with Figure 2.1 shows the similarity of the spatial distribution of the landscape water yield and that of the soil moisture content. This relationship can be explained by the way the model estimates landscape water yield. Both rainfall infiltration excess, that is, rainfall that is not infiltrating into the soil, and percolation of infiltrated water to groundwater discharge depend on soil moisture. They both generate landscape water yield. Groundwater lavels also become higher with high soil moisture levels. As a result, a higher landscape water yield is generated.

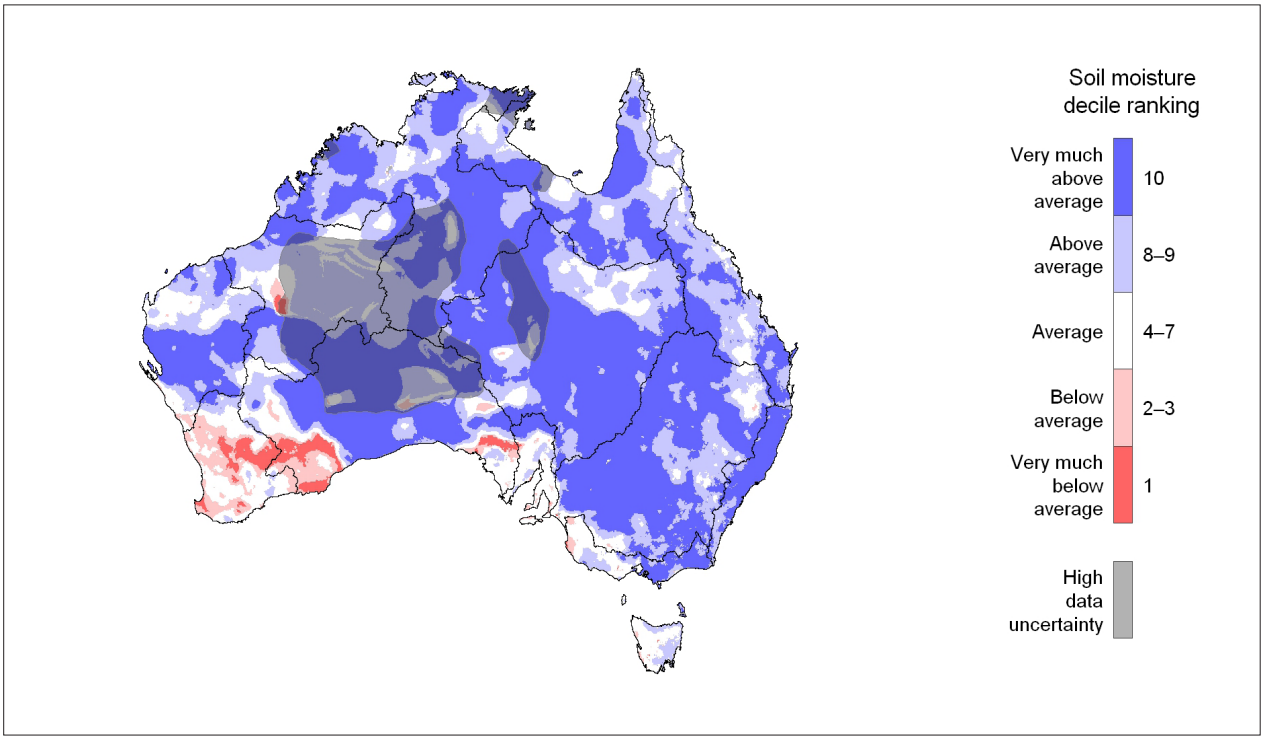


Figure 2.2 Decile rankings of modelled annual average soil moisture for 2011–12 with respect to the 1911–2012 record

2.4 Groundwater levels

National coverage of groundwater availability in all major groundwater management units cannot be presented in this report due to the limited amount of quality-controlled data available in a suitable form at this time. For example, nationally-significant groundwater systems have not been assessed in Western Australia, the Northern Territory and Tasmania. Additionally, no analysis has been attempted for aquifers of the Great Artesian Basin.

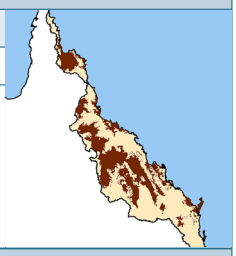
The status of groundwater levels is evaluated in a number of aquifers in four regions where data were available. These are aquifers in the North East Coast, South East Coast (Victoria), Murray–Darling Basin and South Australian Gulf regions.

The trends in groundwater levels within large aquifers are categorised as decreasing, increasing, stable or variable for each 20 km x 20 km grid (for the Murray–Darling Basin and South East Coast [Victoria] regions), and for each 5 km x 5 km grid (for intermediate to local flow systems within smaller aquifers in the North East Coast and South Australian Gulf regions).

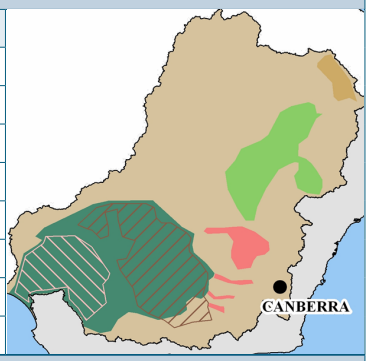
The results are summarised in Table 2.4. The trends are driven by a combination of effects including one or more of the following: rainfall, land use, and extracted groundwater volume. In particular, the higher than average rainfall has contributed to rising trends in groundwater levels. For more details, see the full reports available from the Bureau's website: www.bom.gov.au/water/awra/

Table 2.4 Groundwater level trends for the 2007–2012 period

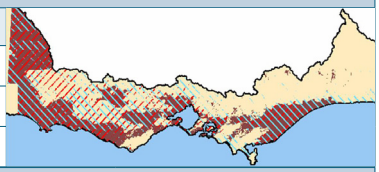
North East Coast	
Region aquifers	**Trend**
Alluvial and Tertiary basalts	rising ↗



Murray–Darling Basin	
Region aquifers	**Trend**
Condamine alluvial	rising ↗
Condamine basalts	rising ↗
Narrabri and Gunnedah	stable or rising →↗
Cowra and Lachlan	rising ↗
Shepparton	no prevalent trend
Calivil	declining ↘
Murray Group	stable →
Renmark	no prevalent trend



South East Coast (Victoria)	
Region aquifers	**Trend**
Quarternary and upper Tertiary	rising ↗
Upper middle and lower middle Tertiary	stable or rising →↗
Lower Tertiary	no prevalent trend



South Australian Gulf	
Region aquifers	**Trend**
Adelaide Plains watertable	rising ↗
Tertiary aquifer (T1)	declining ↘
Tertiary aquifer (T2)	rising ↗
McLaren Vale watertable	stable →
Port Willunga	stable or declining →↘
Maslin Sands	no prevalent trend

2.5 Surface water storage

As shown in Table 2.5, the total volume of water stored in major public water storages in Australia at the end of 2011–12 was at 83% of their total accessible capacity. This represents an 8% increase on the previous year.

Most regions had a rise in their storage volumes during 2011–12. Storage volumes in the eastern regions, which had not reached full supply capacity in the previous years, increased substantially. The highest relative increase in storage volume occurred in the South East Coast (NSW) region, where the Warragamba storage reached full supply capacity and spilled on several occasions during the year. Warragamba storage accounts for more than 50% of the total storage capacity in the region. Even in the South West Coast region where the landscape water yield for the year was average, the volume of water in surface storage increased from 22% of accessible volume to 32%. Only in the South Australian Gulf and the Pilbara–Gascoyne regions did the surface water storage decrease noticeably by 41%.

Table 2.5 Difference in surface water storage at 30 June for consecutive years by region

Region	Accessible volume in storage (GL)			% of total accessible capacity		
	30 June 2011	30 June 2012	Difference	30 June 2011	30 June 2012	Difference
North East Coast	9,135	9,301	+166	96	98	+2
South East Coast (NSW)	3,049	3,658	+609	79	95	+16
South East Coast (Victoria)	1,078	1,346	+268	57	71	+14
Tasmania	13,576	15,672	+2,096	61	71	+10
Murray–Darling Basin	22,006	25,230	+3,224	73	84	+11
South Australian Gulf	135	96	–39	69	49	–20
South Western Plateau[1]	—	—	—	—	—	—
South West Coast	210	309	+99	22	32	+10
Pilbara–Gascoyne	62	36	–26	98	57	–41
North Western Plateau[2]	—	—	—	—	—	—
Tanami – Timor Sea Coast	10,710	10,549	–161	100	98	–2
Lake Eyre Basin[3]	—	—	—	—	—	—
Carpentaria Coast	93	92	–1	94	93	–1
Total Australia	**60,054**	**66,289**	**+6,235**	**75**	**83**	**+8**

[1–3] No major public storages exist in the South Western Plateau, North Western Plateau, and Lake Eyre Basin regions.

2.6 Water use

2.6.1 Urban water use

Figure 2.3 presents average water consumption per property for the nation along with that of a number of major cities. The national water consumption is based on data from the 44 water utilities across the nation that are included in the National Performance Report 2011–12.

Water conservation and demand management have resulted in a reduction in the nation's urban water consumption over the past six years. Significantly above average rainfalls in many parts of Australia over the past two years has seen increased water storage levels and an easing of water restrictions across much of the country. The exception is southwest Western Australia, including Perth, which continued to experience low rainfall.

Capital city urban water consumption continued to fall with the exception of the southeast where above average rainfalls and increased water storage volumes has seen a shift in consumer behaviour and a rise in urban water consumption. While continuing its downward trend, Perth remains the highest urban user of water on a per property basis.

On a volumetric basis, total urban water supplied to capital cities saw a marginal increase in 2011–12, with the volume supplied rising by just over 1.4% from 2010–11; however, on a per property basis total urban water supplied remained unchanged across all capital cities.

In 2011–12 residential water use accounted nationally for 63% of the total volume supplied to urban areas. Commercial, municipal and industrial uses comprised 25% and the remaining 12% was attributed to uses categorised as 'other' (National Water Commission, 2013).

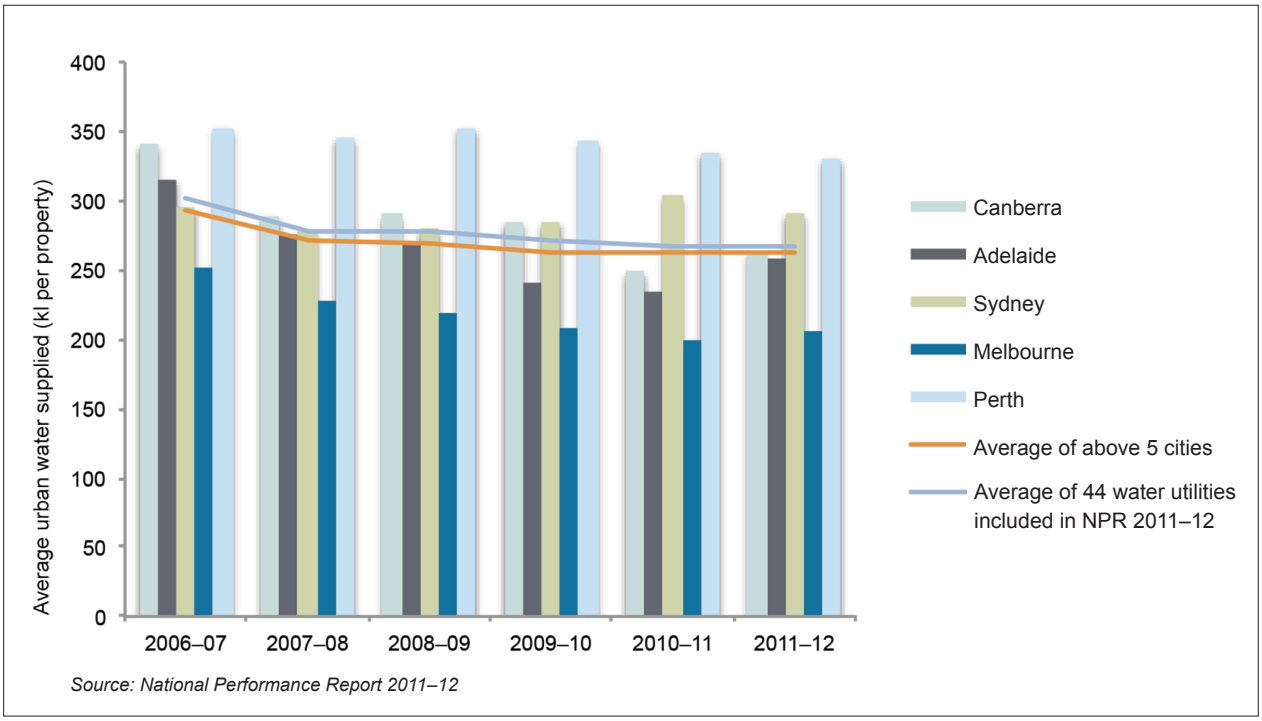


Figure 2.3 Total urban water supplied per property from 2006–07 to 2011–12 (Brisbane, Darwin and Hobart have been excluded from the individual and capital city analysis due to data unavailability)

2.6.2 Agricultural water use

Average agricultural water use in Australia between 2005–06 and 2010–11 was 8,232 GL (Australian Bureau of Statistics [ABS] 2011a), 90% of which (7,400 GL) was used for irrigation of crops and pasture.

Figure 2.4 compares water use for irrigation in the Murray–Darling Basin between 2005–06 and 2011–12 with that for the rest of Australia. The water use in the Murray–Darling Basin decreased from 2005–06 to 2009–10 and it increased since; however, it did not reach the same level as in 2005–06.

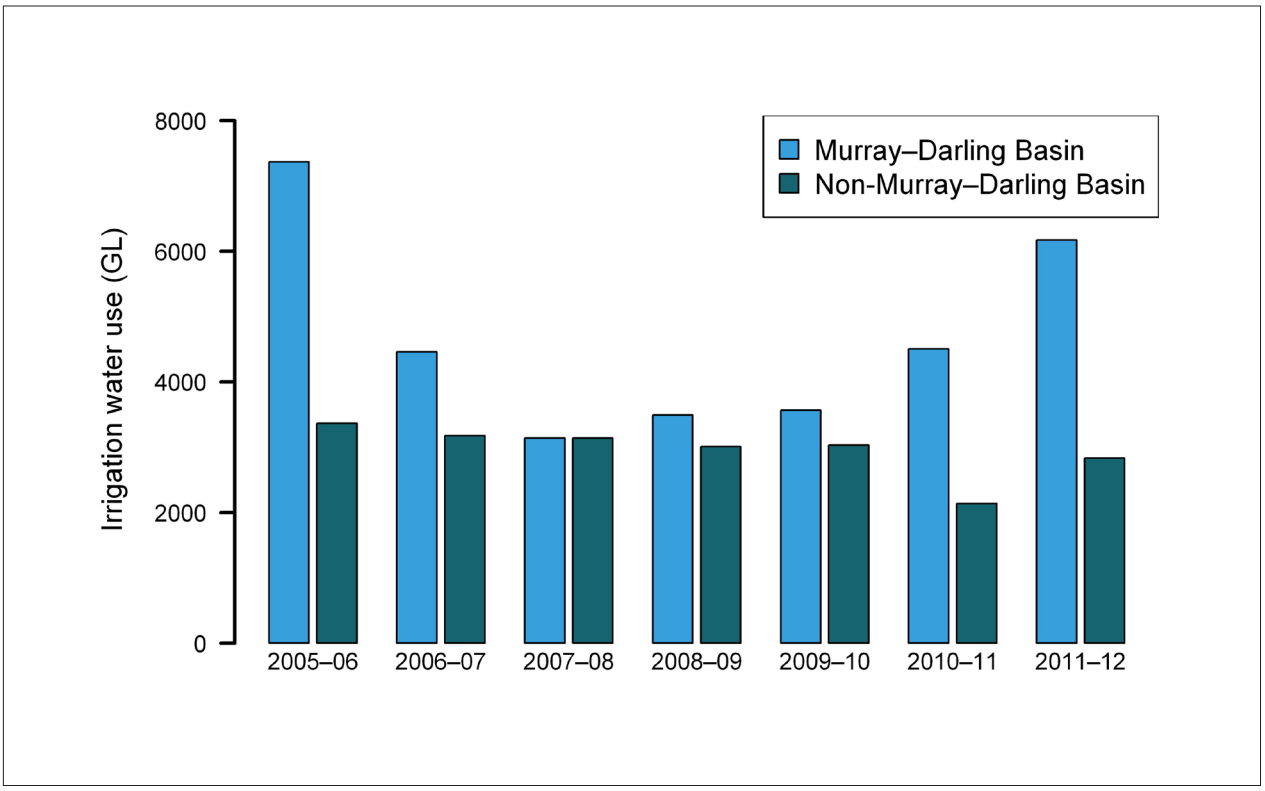


Figure 2.4 Irrigation water use between 2005–06 and 2011–12

3. North East Coast

3.1 Regional overview

The North East Coast region is a 451,000 km² area in Queensland surrounded by the Great Dividing Range in the west, the Coral Sea in the east and Torres Strait in the north, and by the Queensland–New South Wales border in the south. The region covers river basins that vary in size from 257–143,000 km². The largest river basins are the Burdekin River basin and the Fitzroy River basin.

The region includes high altitudes associated with coastal ranges and tablelands and a retreating escarpment as well as coastal alluvial plains. With a population in excess of 4 million people, the region is home to just over 19% of all Australians and 92% of all Queensland residents. The largest population centres are Brisbane, the Gold Coast and the Sunshine Coast in the southeast.

The region's climate is subtropical to tropical with hot, wet summers and cooler, dry winters. The monsoonal summer rainfall is more reliable in the north than in the south.

Rainfall and evapotranspiration for the region were both above their long-term record. The overall storage volumes in the region were near their full capacity with an increase of 2% over the 2011–12 year.

The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 3.1).

3.2 Recent trends in landscape water yield

Landscape water yield for the North East Coast region for 2011–12 was 42% above the region's long-term (July 1911–June 2012) average. Highest values were observed along the mid-north and south coast (Figure 3.1a).

The decile-ranking map for 2011–12 (Figure 3.1b) shows average to above average landscape water yields. Above average water yields are found across much of the inland, in particular along the western border, as well as along the southern coast.

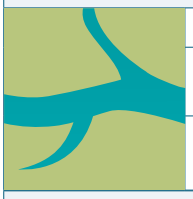
An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using moving averages in Figure 3.2. The figure shows that landscape water yield is consistently higher during the summer period compared to the winter period. The summer averages also exhibit a greater interannual and cyclical variability.

Table 3.1 Key information on water flows, stores and use in the North East Coast region

Landscape water flows

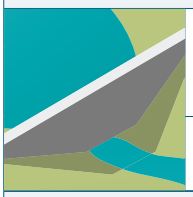
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	1,041 mm	+22%	9th—above average
Evapo-transpiration	814 mm	+18%	9th—above average
Landscape water yield	223 mm	+42%	9th—above average

Streamflow (at selected gauges)



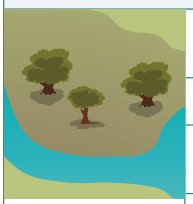
Annual total flow:	Predominantly average to above average flow throughout the region
Salinity:	Annual median electrical conductivity predominantly below 1,000 µS/cm throughout the region
Flooding:	Major floods in many parts of the region

Surface water storage (comprising about 92% of the region's total capacity of all major storages)



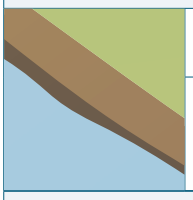
Total accessible capacity	30 June 2012		30 June 2011		Change	
	accessible volume	% of total capacity	accessible volume	% of total capacity	accessible volume	% of total capacity
9,516 GL	9,301 GL	98%	9,135 GL	96%	+166 GL	+2%

Wetlands inflow patterns (for selected wetlands)



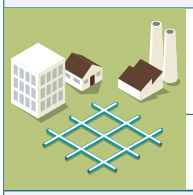
Bowling Green Bay:	Average flows throughout the year, but very much above average flows in March
Fitzroy River floodplain:	Very much above average flows during February and March 2012
Great Sandy Strait:	Very much above average flows over the January to March 2012 period
Moreton Bay:	Very much above average flows in January and March 2012

Groundwater (in selected aquifers)



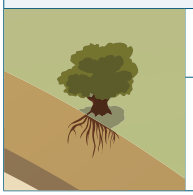
Levels:	Predominantly rising trends in the selected watertable aquifers over the 2007–08 to 2011–12 period
Salinity:	Scattered areas of saline groundwater (≥3,000 mg/L) throughout the region

Urban water use (Brisbane and Gold Coast)



Total use in 2011–12	Total use in 2010–11	Change	Restrictions
176 GL	180 GL	–4 GL (–2%)	Permanent Water Conservation Measures

Annual mean soil moisture (model estimates)



Spatial patterns:	Predominantly above average annual mean soil moisture with large inland areas of very much above average soil moisture
Temporal patterns in regional average:	Above average to very much above average soil moisture throughout the year

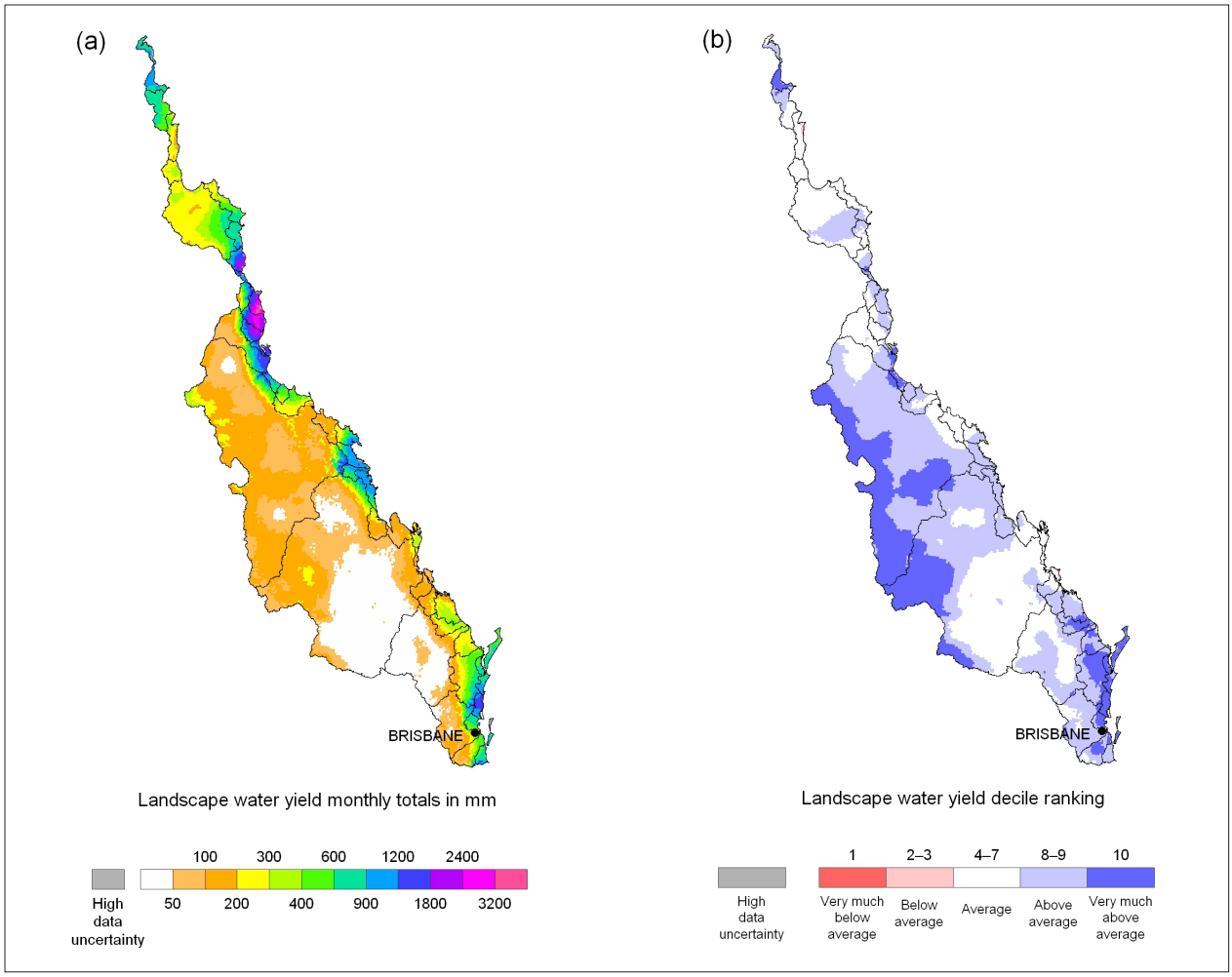


Figure 3.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2012 period for the North East Coast region

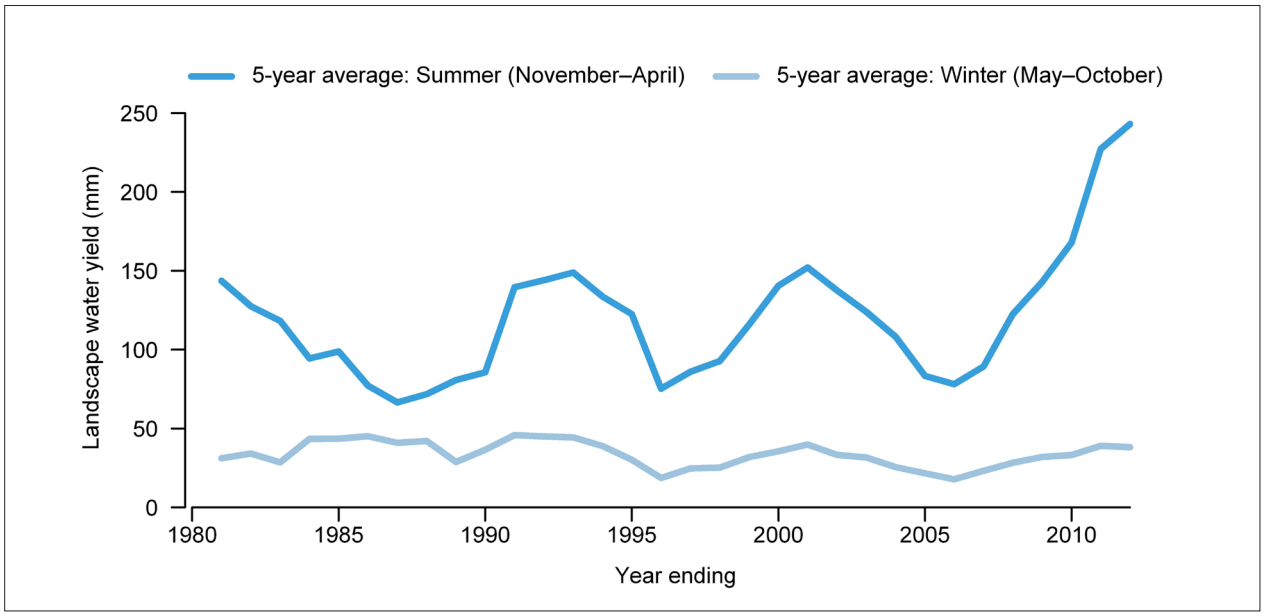


Figure 3.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the North East Coast region

4. South East Coast (NSW)

4.1 Regional overview

The South East Coast (NSW) region covers all of coastal New South Wales, and has a total area of 129,500 km². The region is defined by the Great Dividing Range to the west and the coast to the east. The northern boundary is defined as the New South Wales–Queensland border and the southern boundary reflects the dividing line between the Towamba and East Gippsland river basins.

The region has a warm temperate climate with a moderate and generally reliable rainfall due to the presence of the Great Dividing Range.

The region has a population of over 6 million, just under one-third of Australia's total population and includes Australia's largest city, Sydney.

Both rainfall and evapotranspiration were above the long-term average for 2011–12. The landscape water yield was 84% above average.

The above average rainfall in the region during 2011–12 favoured wet conditions in the soils, which ranked as very much above the long-term average for most areas indicating favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 4.1).

4.2 Recent trends in landscape water yield

Landscape water yield in 2011–12 was highest in areas adjacent to the coast, locally exceeding 900 mm. The landscape water yield was substantially lower inland, with some areas not exceeding 50 mm, especially in the Hunter Valley (Figure 4.1a).

Landscape water yield deciles for 2011–12, shown in Figure 4.1b, indicate above average landscape water yields throughout the region. Some areas recorded very much above average landscape water yield, often reflecting the patterns of rainfall deciles.

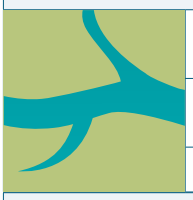
An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) is presented using moving averages in Figure 4.2. The graph shows a distinct interannual and cyclical variability driven by the region's rainfall dynamics. It also indicates that landscape water yield is equally distributed between the summer and winter periods. This is a result of higher landscape water yields in the south in winter and in the north in the summer period.

Table 4.1 Key information on water flows, stores and use in the South East Coast (NSW) region

Landscape water flows

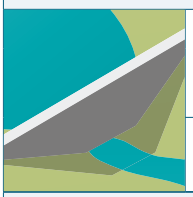
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	1,265 mm	+25%	9th—above average
Evapo-transpiration	919 mm	+12%	9th—above average
Landscape water yield	352 mm	+84%	10th—very much above average

Streamflow (at selected gauges)



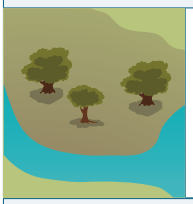
Annual totals:	Above average flow throughout the region, locally very much above average
Salinity:	Annual median electrical conductivity predominantly below 1,000 µS/cm (Hunter River basin only)
Flooding:	Minor to moderate flooding in many rivers, locally major flooding in the north

Surface water storage (comprising about 83% of the region's total capacity of all major storages)



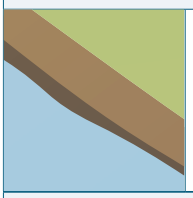
Total accessible capacity	30 June 2012		30 June 2011		Change	
	accessible volume	% of total capacity	accessible volume	% of total capacity	accessible volume	% of total capacity
3,853 GL	3,658 GL	95%	3,049 GL	79%	+609 GL	+16%

Wetlands inflow patterns (for selected wetlands)



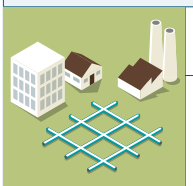
Hunter Estuary wetlands:	Above average flows throughout the year, with particularly high flows in November, February and March

Groundwater (in selected aquifers)



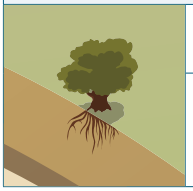
Salinity:	Scattered areas of saline groundwater (≥3,000 mg/L), particularly in coastal aquifers

Urban water use (Sydney)



Total use in 2011–12	Total use in 2010–11	Change	Restrictions
528 GL	544 GL	–16 GL (–3%)	Water Wise Rules

Annual mean soil moisture (model estimates)



Spatial patterns:	Very much above average soil moisture levels in the centre and north of the region, above average in the south
Temporal patterns in regional average:	Above average to very much above average regional average soil moisture throughout the year

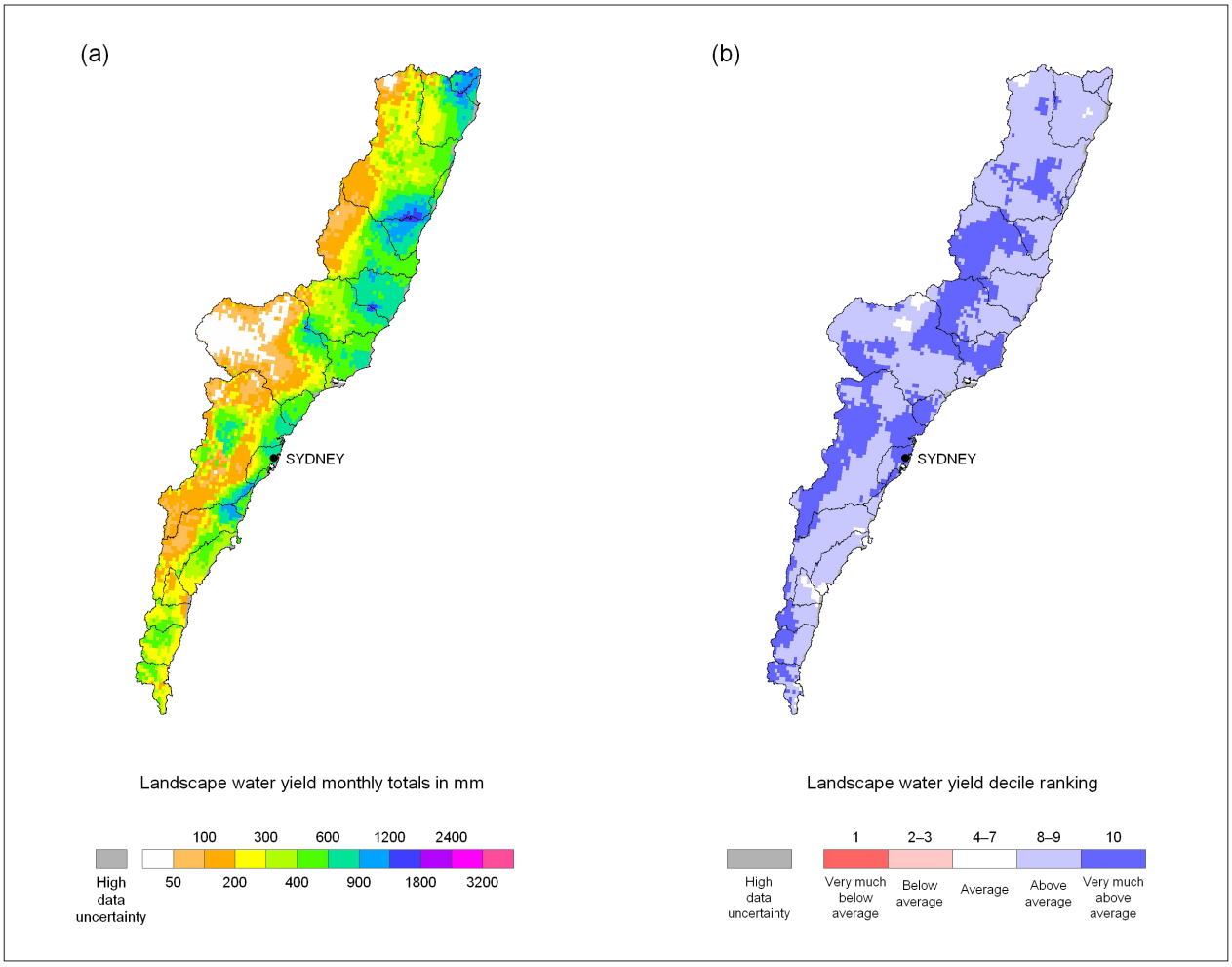


Figure 4.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2012 period for the South East Coast (NSW) region

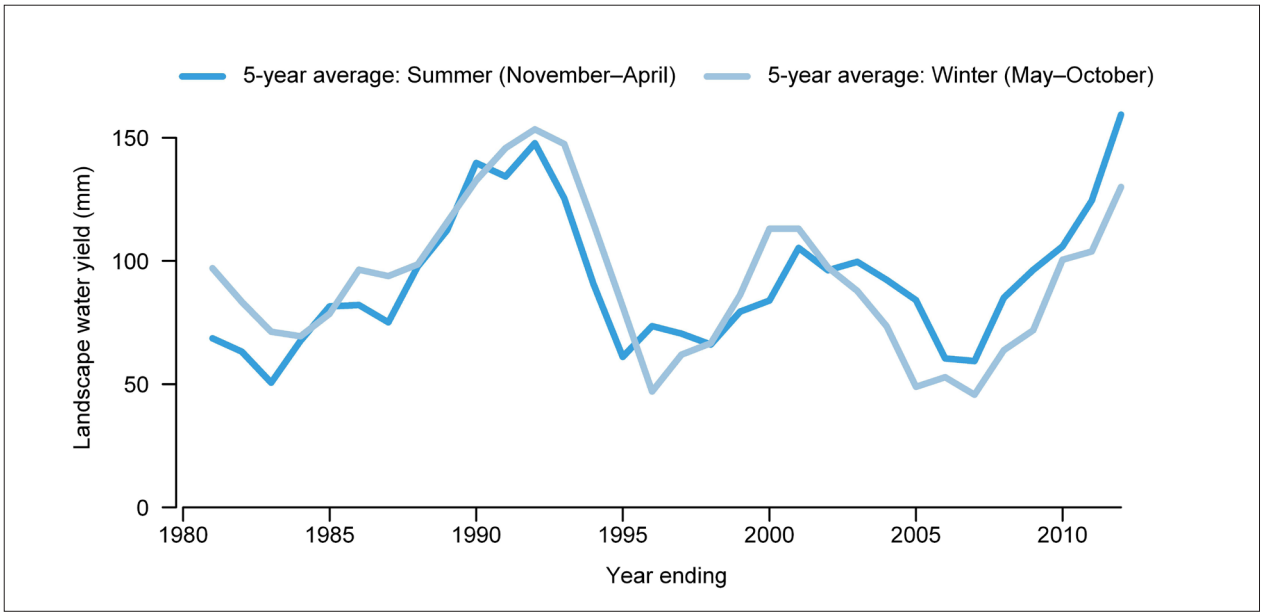


Figure 4.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the South East Coast (NSW) region

5. South East Coast (Victoria)

5.1 Regional overview

The South East Coast (Victoria) region covers approximately 134,600 km² of land area in southern Victoria, bordered in the south by the Victorian and South Australian coastlines. It is set between the Great Dividing Range in the north, the eastern boundaries of the East Gippsland and Snowy River basins in the east and Mount Gambier and the Millicent coast of South Australia in the west.

The region has a population in excess of 4.8 million people, almost one-quarter of Australia's total population.

The climate of the region is affected by a seasonal movement of the major atmospheric systems in Australia which brings warm temperate conditions, and merges with a moderate Mediterranean climate in the south.

All of the landscape water flows were highly variable in 2011–12. Rainfall was very much above average in March and June 2012, but fell below median rainfall for six months of the year.

Evapotranspiration was higher than the long-term average and varied similarly to rainfall.

Landscape water yield was very much above average in seven months of the year, with March and June 2012 being the highest values compared with other months.

Soil moisture was very much above average in the east of the region. The soil moisture availability over the whole region dropped to average during the spring and summer months while evapotranspiration rose during this period.

The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 5.1).

5.2 Recent trends in landscape water yield

Figure 5.1a shows the spatial distribution of landscape water yield for 2011–12. In the eastern highlands of the region, the landscape water yield is higher than the rainfall.

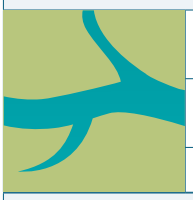
The decile-ranking map (Figure 5.1b) shows very much above average landscape water yields in the east. To the west, a more variable pattern is observed, with relatively higher decile rankings throughout, in comparison to the rainfall deciles in this part of the region.

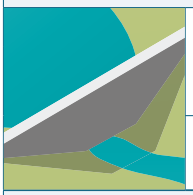
An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using moving averages in Figure 5.2.

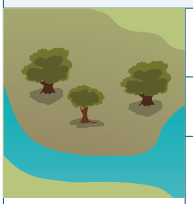
Regionally, landscape water yield is consistently higher during the winter period, although the last 15 years have seen lower than average landscape water yields in winter.

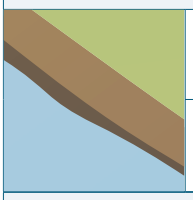
Table 5.1 Key information on water flows, stores and use in the South East Coast (Victoria) region

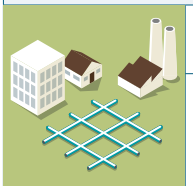
Landscape water flows			
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	842 mm	+14%	9th—above average
Evapo-transpiration	648 mm	+3%	7th—average
Landscape water yield	180 mm	+68%	10th—very much above average

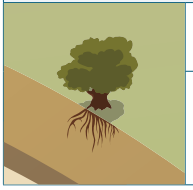
Streamflow (at selected gauges)		
	Annual total flow:	Very much above average flow in the eastern half of the region, predominantly average in the western rivers
	Salinity:	Annual median electrical conductivity below 1000 µS/cm in the few gauges in the east and many rivers in the west with higher than 2000 µS/cm
	Flooding:	Major flooding in the eastern rivers in June 2012

Surface water storage (comprising about 73% 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
	1,907 GL	1,346 GL	71%	1,078 GL	57%	+268 GL	+14%

Wetlands inflow patterns (for selected wetlands)		
	Western District Lakes:	Below average flows, particularly in the wet season (August to October)
	Gippsland Lakes:	Very much above average flows for much of the year
	Reedy Lake–Lake Connewarre:	Predominantly average flows, with high flows in June 2012

Groundwater (in selected aquifers)		
	Levels:	Variable groundwater levels in the various aquifers throughout the region
	Salinity:	Large areas of saline groundwater (≥3,000 mg/L), particularly in the eastern aquifers

Urban water use (Melbourne)				
	Total use in 2011–12	Total use in 2010–11	Change	Restrictions
	361 GL	343 GL	+18 GL (+5%)	Eased to Stage 1

Annual mean soil moisture (model estimates)		
	Spatial patterns:	Above average soil moisture levels in the east, predominantly average in the west
	Temporal patterns in regional average:	Above average in July 2011, dropping to average between October 2011 and February 2012, then returning to above average in March 2012

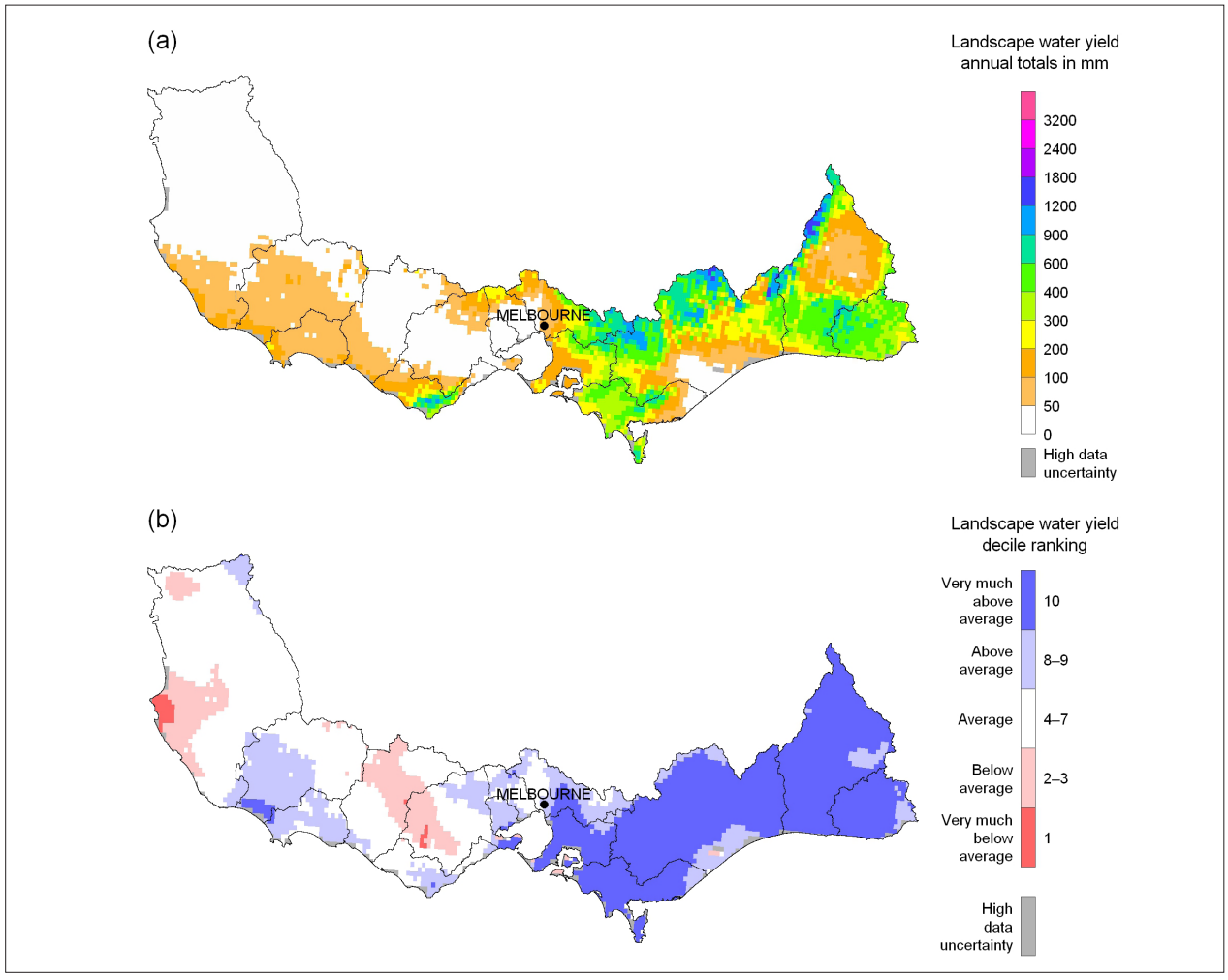


Figure 5.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2012 period for the South East Coast (Victoria) region

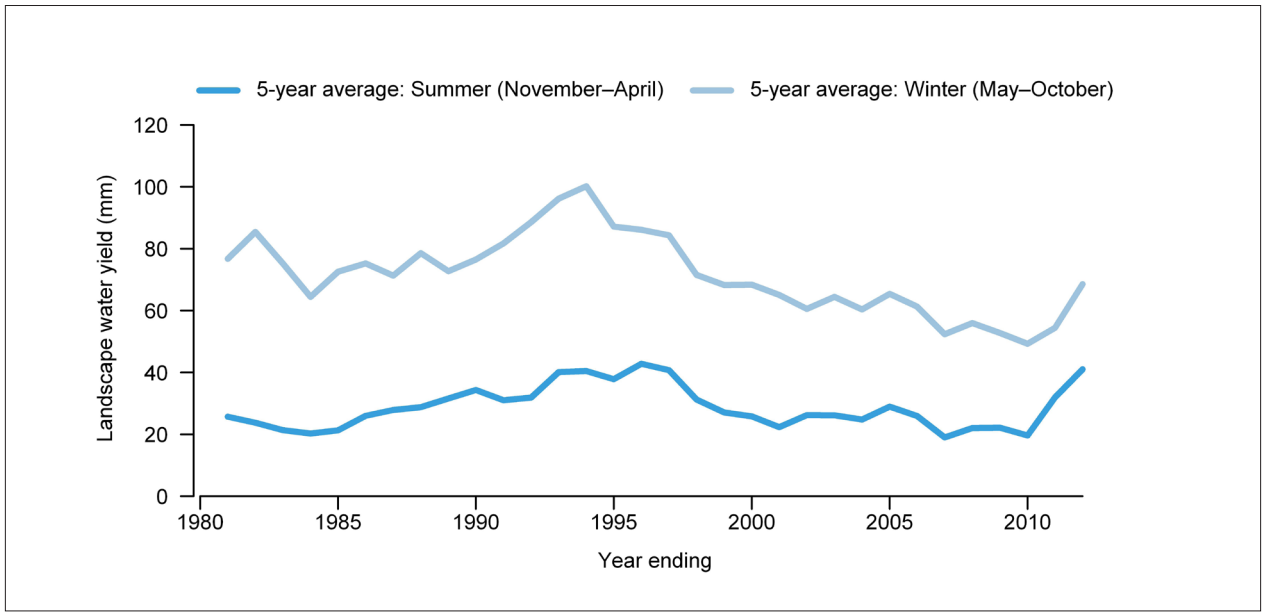


Figure 5.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the South East Coast (Victoria) region

6. Tasmania

6.1 Regional overview

The island of Tasmania is the smallest of Australia's States with a total land size of approximately 68,000 km^2. Though it is less than 1% of Australia's surface area, the region contains about 12% of Australia's freshwater resources. Bass Strait is the water separating Tasmania from mainland Australia.

Tasmania has a cool temperate climate with high rainfall in the western highlands and low rainfall in the lowlands and east.

The state-based region of Tasmania has a population of just under 0.5 million people. Major population centres include the State's capital, Hobart, as well as the cities of Launceston, Devonport and Burnie.

The 2011–12 year was average with no dry or wet periods identifiable for consecutive months.

Evapotranspiration deciles for 2011–12 indicate above average or average totals across most of the region.

Landscape water yield for the Tasmania region was just above the region's long-term average.

Soil moisture levels were average and below average during the year. The region experienced much drier conditions in the west compared with the eastern areas.

The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 6.1).

6.2 Recent trends in landscape water yield

The highest landscape water yields in 2011–12 are observed along the west coast. In contrast, some inland areas had annual landscape water yield totals below 50 mm (Figure 6.1a).

The decile-ranking map for 2011–12, shows mostly above average landscape water yields to the east, average landscape water yields in the centre and western part of the region and some areas of below average landscape water yield on the west coast (Figure 6.1b).

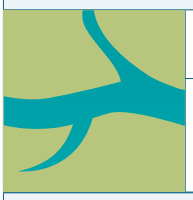
An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using moving averages in Figure 6.2. Landscape water yield is generally high in winter due to the combination of higher rainfall and the lower evapotranspiration producing more saturated soils. No significant cyclic pattern is observed in both the summer and winter graphs.

Table 6.1 Key information on water flows, stores and use in the Tasmania region

Landscape water flows

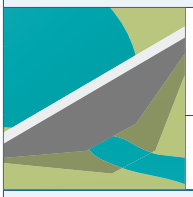
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	1,396 mm	+2%	7th—average
Evapo-transpiration	769 mm	+3%	8th—above average
Landscape water yield	632 mm	+1%	6th—average

Streamflow (at selected gauges)



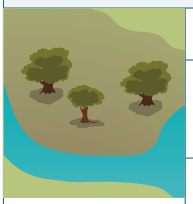
Annual total flow:	Predominantly average flow in the northern and southern rivers, mostly above average flow in the central east of the region
Flooding:	Moderate to major floods in the central east of the region

Surface water storage (comprising about 86% of the region's total capacity of all major storages)



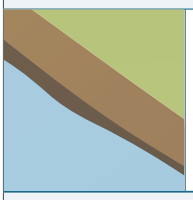
Total accessible capacity	30 June 2012		30 June 2011		Change	
	accessible volume	% of total capacity	accessible volume	% of total capacity	accessible volume	% of total capacity
22,141 GL	15,672 GL	71%	13,576 GL	61%	+2,096 GL	+10%

Wetlands inflow patterns (for selected wetlands)



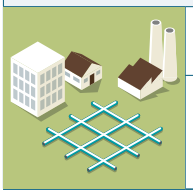
Lower Ringarooma River:	Average flows, but above average flow in August 2011
Apsley Marshes:	Very much above average flows in August 2011 and above average in May and June 2012, generally average to below average flows in the other months
Moulting Lagoon:	Very much above average flows in August 2011 and above average in May and June 2012, generally average flows in the other months

Groundwater (in selected aquifers)



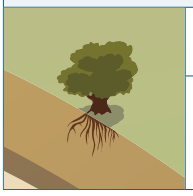
Salinity:	Non-saline groundwater (<3,000 mg/L) in most aquifers, locally some small areas with saline (≥3,000 mg/L) groundwater in the east

Urban water use (Hobart)



Total sourced in 2011–12	Total sourced in 2010–11	Change	Restrictions
40 GL	42 GL	–2 GL (–4%)	No restrictions

Annual mean soil moisture (model estimates)



Spatial patterns:	Predominantly average with large areas of below average in the southwest and above average soil moisture mainly in the southeast
Temporal patterns in regional average:	Above average soil moisture at the start of the year, gradually dropping to below average in January and returning to above average by June 2012

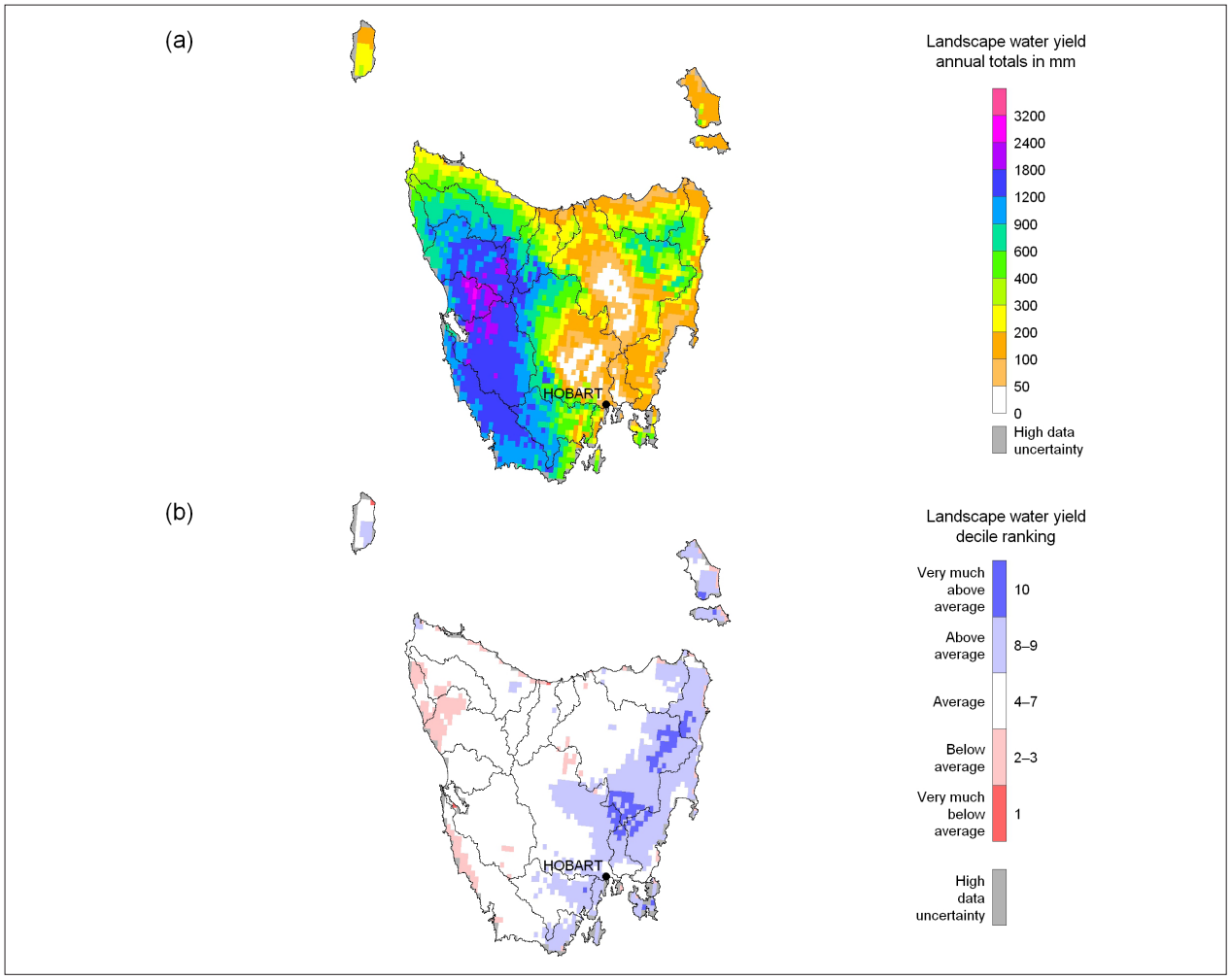


Figure 6.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2010 period for theTasmania region

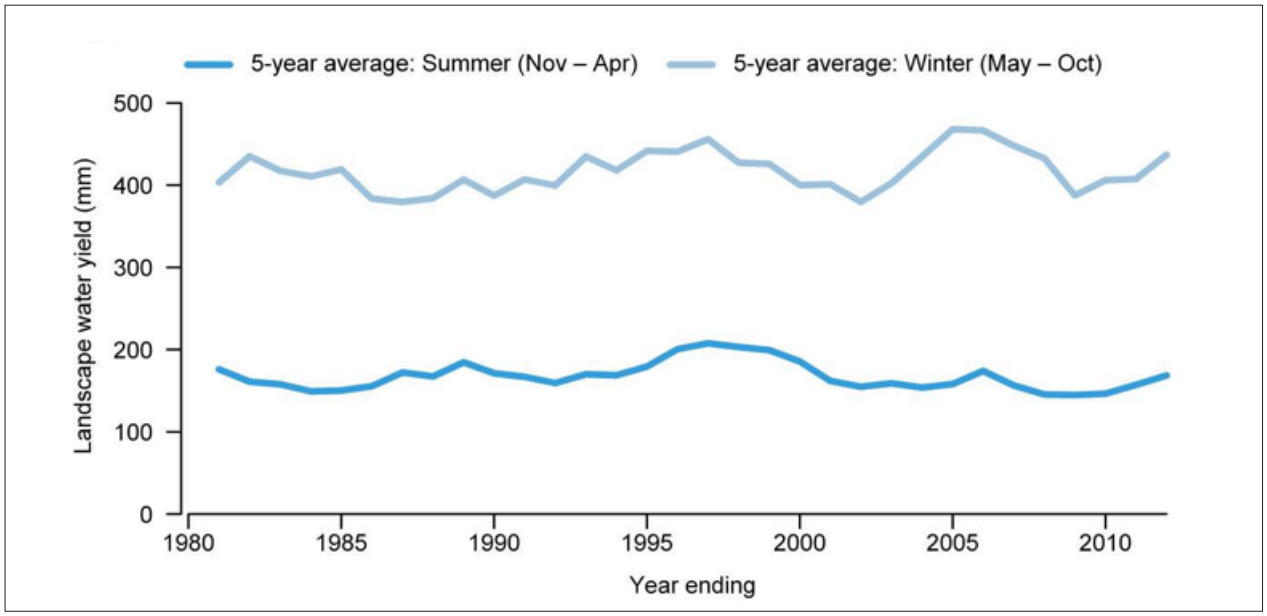


Figure 6.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for theTasmania region

7. Murray–Darling Basin

7.1 Regional overview

The Murray–Darling Basin region covers more than 1 million km^2, one-seventh of mainland Australia, including parts of Queensland, New South Wales, Victoria and South Australia, and all of the Australian Capital Territory. The region is bounded in the south and east by the Great Dividing Range. In the northwest and southwest, the boundaries are much less distinct.

The region has a large range of climatic conditions and natural environments, from the rainforests of the cool and humid eastern uplands, the temperate Mallee country of the southeast, the subtropical areas of the northeast, to the hot, dry semi-arid and arid lands of the far western plains.

The region also includes the three longest rivers in Australia: the River Murray, Murrumbidgee River and Darling River.

The region has a population of over 2 million people, or approximately 10% of Australia's total population. The major population centre is Canberra/Queanbeyan. Other major towns are mostly located in the southeast of the region.

All three landscape water flows were above the long-term (1911–2012) average.

The 2011–12 year started with four months of mostly average rainfall which were followed by five very much above average wet months. For the remaining three months of the year rainfall was close to average.

Evapotranspiration in 2011–12 was generally consistent with rainfall, with high values for November 2011– March 2012.

The landscape water yield for 2011–12, relative to long-term values, was above average for November–January and very much above average high for February–March.

Soil moisture for the majority of the Murray–Darling Basin region was above or very much above average during 2011–12. The prevalent wet conditions in the soil provided favourable farming opportunities in the region and reduced the requirement for irrigation.

The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 7.1).

7.2 Recent trends in landscape water yield

The highest landscape water yields were generated in the mountainous southeast of the region (Figure 7.1a). The decile-ranking map shows very much above average landscape water yields for 72% of the region. However, the largest proportion of the region remained below 50 mm of annual landscape water yield (Figure 7.1b).

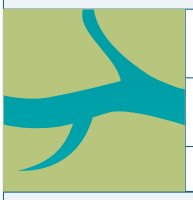
An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) is presented using moving averages in Figure 7.2. The graph shows that landscape water yield in winter is historically higher than in summer; however, the last two years saw some high intensity summer rainfall that generated higher landscape water yields throughout the whole region. It resulted in summer landscape water yields that exceeded those of winter.

Table 7.1 Key information on water flows, stores and use in the Murray–Darling Basin region

Landscape water flows

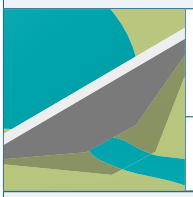
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	651 mm	+40%	10th—very much above average
Evapo-transpiration	559 mm	+29%	10th—very much above average
Landscape water yield	65 mm	+110%	10th—very much above average

Streamflow (at selected gauges)



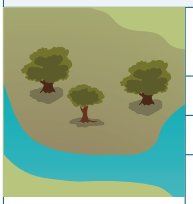
Annual total flow:	Predominantly above average flow throughout the region and numerous stream gauges in the upper Darling River with very much above average flow
Salinity:	Annual median electrical conductivity predominantly below 1,000 µS/cm throughout the region
Flooding:	Major floods in the upper Darling River and in the Lachlan and Murrumbidgee rivers

Surface water storage (comprising about 88% of the region's total capacity of all major storages)



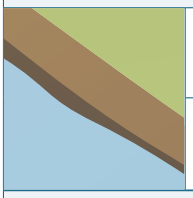
Total accessible capacity	30 June 2012		30 June 2011		Change	
	accessible volume	% of total capacity	accessible volume	% of total capacity	accessible volume	% of total capacity
30,192 GL	25,230 GL	84%	22,006 GL	73%	+3,224 GL	+9%

Wetlands inflow patterns (for selected wetlands)



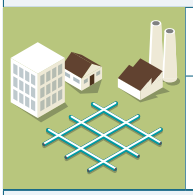
Currawinya Lakes and Paroo River wetlands:	Very much above average flows in the normally wettest month of February and above average flows in December and March
Gwydir wetlands:	Very much above average flows in November, December and February
Macquarie Marshes:	Very much above average flows in March and April
Barmah–Millewa Forest:	Very much above average flows in March, above average flows in July and August

Groundwater (in selected aquifers)



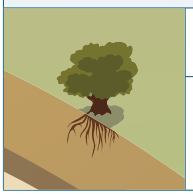
Levels:	Predominantly rising groundwater levels in the northern aquifers, variable to stable groundwater level trends in the southern aquifers
Salinity:	Non-saline groundwater (< 3,000 mg/L) in most aquifers in the uphill areas, mostly saline (≥3,000 mg/L) in the downhill basin aquifers

Urban water use (Canberra)



Total sourced in 2011–12	Total sourced in 2010–11	Change	Restrictions
44 GL	41 GL	+3 GL (+7%)	Permanent Water Conservation Measures

Annual mean soil moisture (model estimates)



Spatial patterns:	Predominantly very much above average throughout the region, with some areas of above average in the south and east of the region
Temporal patterns in regional average:	Consistently very much above average during the year

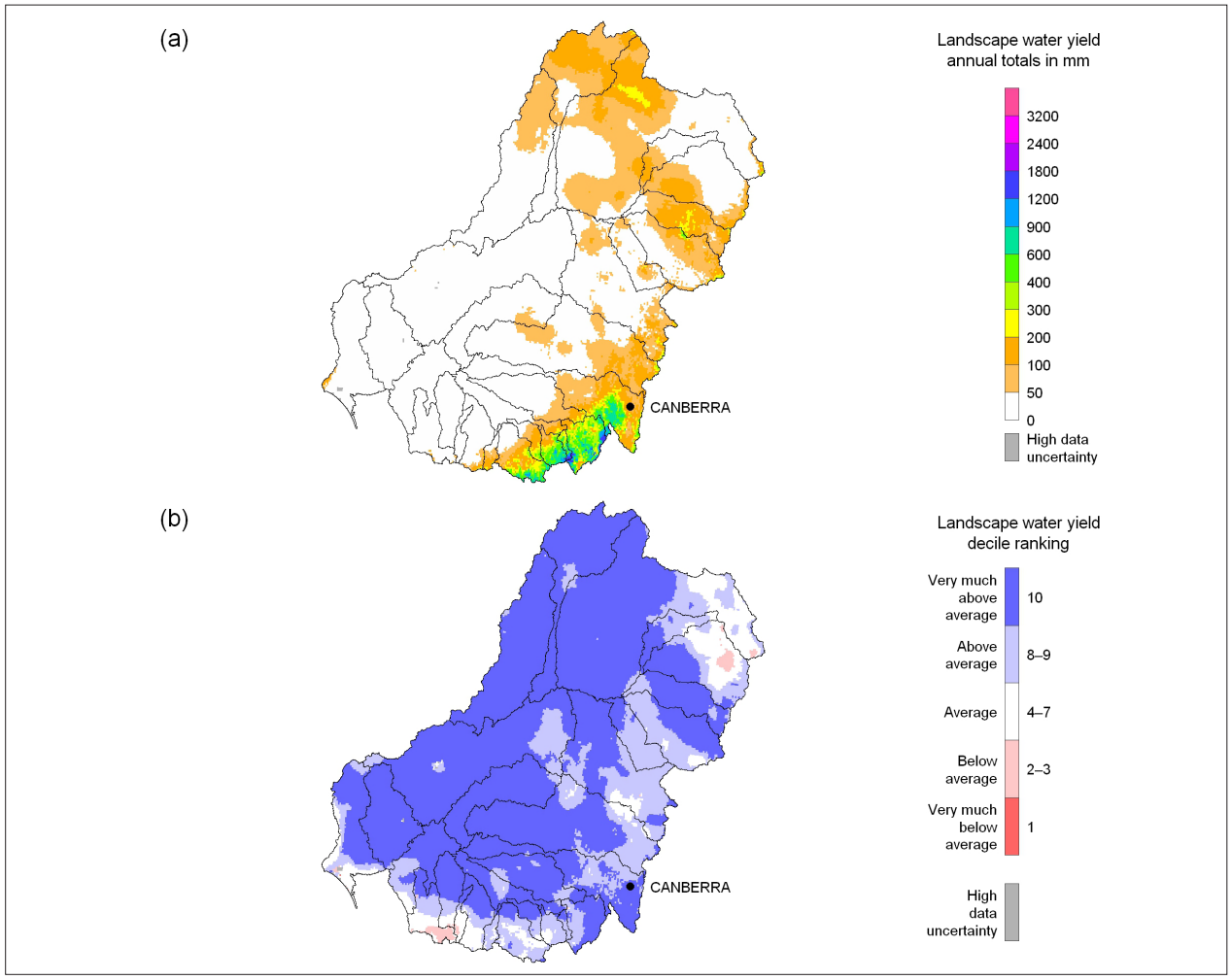


Figure 7.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2010 period for the Murray–Darling Basin region

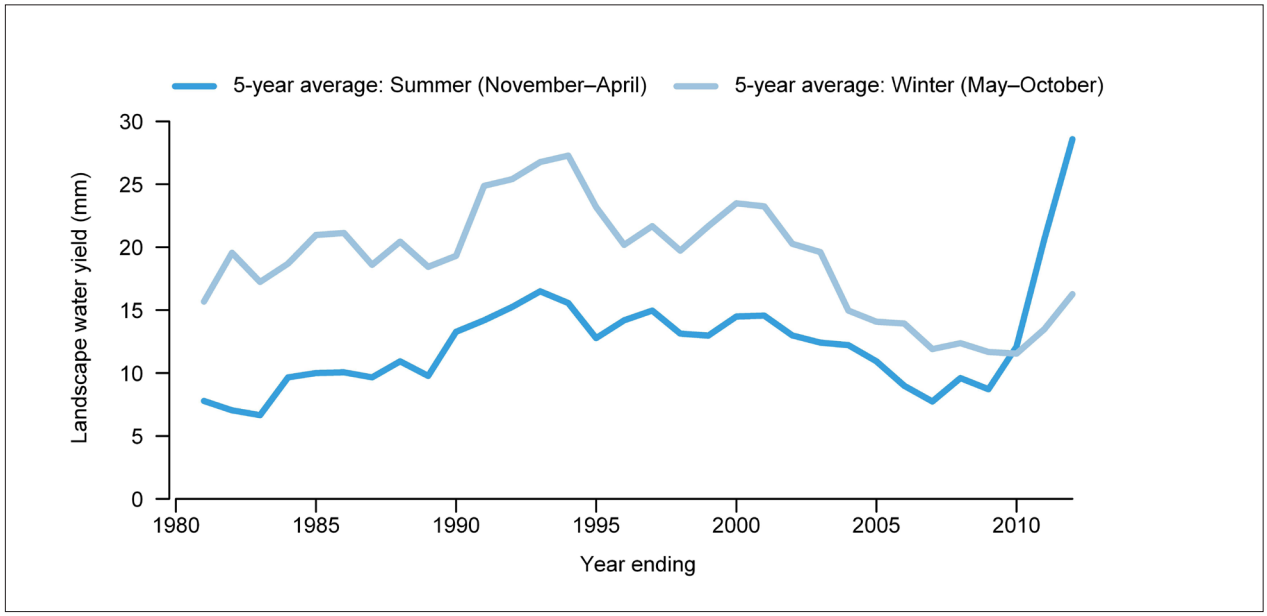


Figure 7.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Murray–Darling Basin region

8. South Australian Gulf

8.1 Regional overview

The South Australian Gulf region extends over 117,700 km^2 of South Australia, surrounding the Gulf of St Vincent and Spencer Gulf, stretching inland 300 km to the north of Spencer Gulf. The region is bounded by the western slopes of the Mount Lofty and the Flinders Ranges bordering the Murray–Darling Basin region to the east, the Lake Eyre Basin region to the north and the South Western Plateau region to the west, and includes Kangaroo Island in the south.

The South Australian Gulf region has a population in excess of 1.4 million, or just over 6% of the Country's total population. Major population centres in the region include Adelaide, Victor Harbour, Port Pirie, Port Augusta, Whyalla and Port Lincoln.

The region has a Mediterranean climate in the southeast varying to a semi-arid climate to the north. Rainfall mainly occurs in winter; spring and summer rainfall can be substantial, although highly variable.

The 2011–12 year was a generally average year in regards to landscape water flows. Rainfall only exceeded the 90th percentile in the normally driest month of March, when evapotranspiration was also very high. Evapotranspiration for March was third highest on record for the 1911–2012 period. Landscape water yield was a little below the long-term average.

The soil moisture content was mainly at average levels. Some irrigated lands of the southern region experienced below to very much below average soil moisture conditions.

The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 8.1).

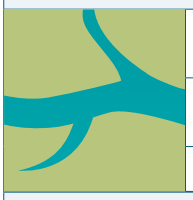
8.2 Recent trends in landscape water yield

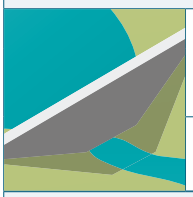
Landscape water yield was generally very low during the 2011–12 year and only in the south and including Kangaroo Island did some areas have landscape water yields exceeding 50 mm (Figure 8.1a); however in relative terms, the decile-ranking map for the year shows the far north of the region had very much above average yield (Figure 8.1b).

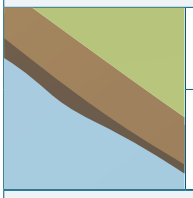
An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using moving averages in Figure 8.2 using time-series and moving averages. The graph shows that the historic landscape water yield of the region has a weak cyclic pattern that is dominant in the winter.

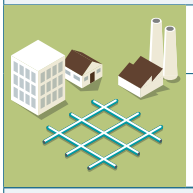
Table 8.1 Key information on water flows, stores and use in the South Australian Gulf region

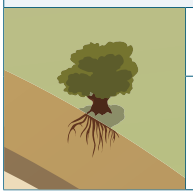
Landscape water flows			
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	331 mm	+10%	8th—above average
Evapo-transpiration	306 mm	+7%	8th—above average
Landscape water yield	9 mm	–10%	6th—average

Streamflow (at selected gauges)		
	Annual total flow:	Highly variable pattern of high and low flow in the river gauges in the south eastern rivers
	Salinity:	Annual median electrical conductivity predominantly above 1,000 µS/cm in gauges in the south eastern rivers and on Kangaroo Island
	Flooding:	No major flooding in the monitoring gauges surrounding Adelaide

Surface water storage (comprising about 74% 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
	197 GL	96 GL	49%	135 GL	69%	–39 GL	–20%

Groundwater (in selected aquifers)		
	Levels:	Variable trends in the different aquifers, predominantly falling in middle aquifers and rising in deeper aquifers
	Salinity:	Saline groundwater (≥3,000 mg/L) throughout most of the region with non-saline (<3,000 mg/L) areas around Adelaide and in the Flinders Ranges

Urban water use (Adelaide)				
	Total sourced in 2011–12	Total sourced in 2010–11	Change	Restrictions
	138 GL	125 GL	+13 GL (+10%)	Water Wise Measures

Annual mean soil moisture (model estimates)		
	Spatial patterns:	Predominantly average annual mean soil moisture and very much above average soil moisture in the far north
	Temporal patterns in regional average:	Average to above average soil moisture throughout the year

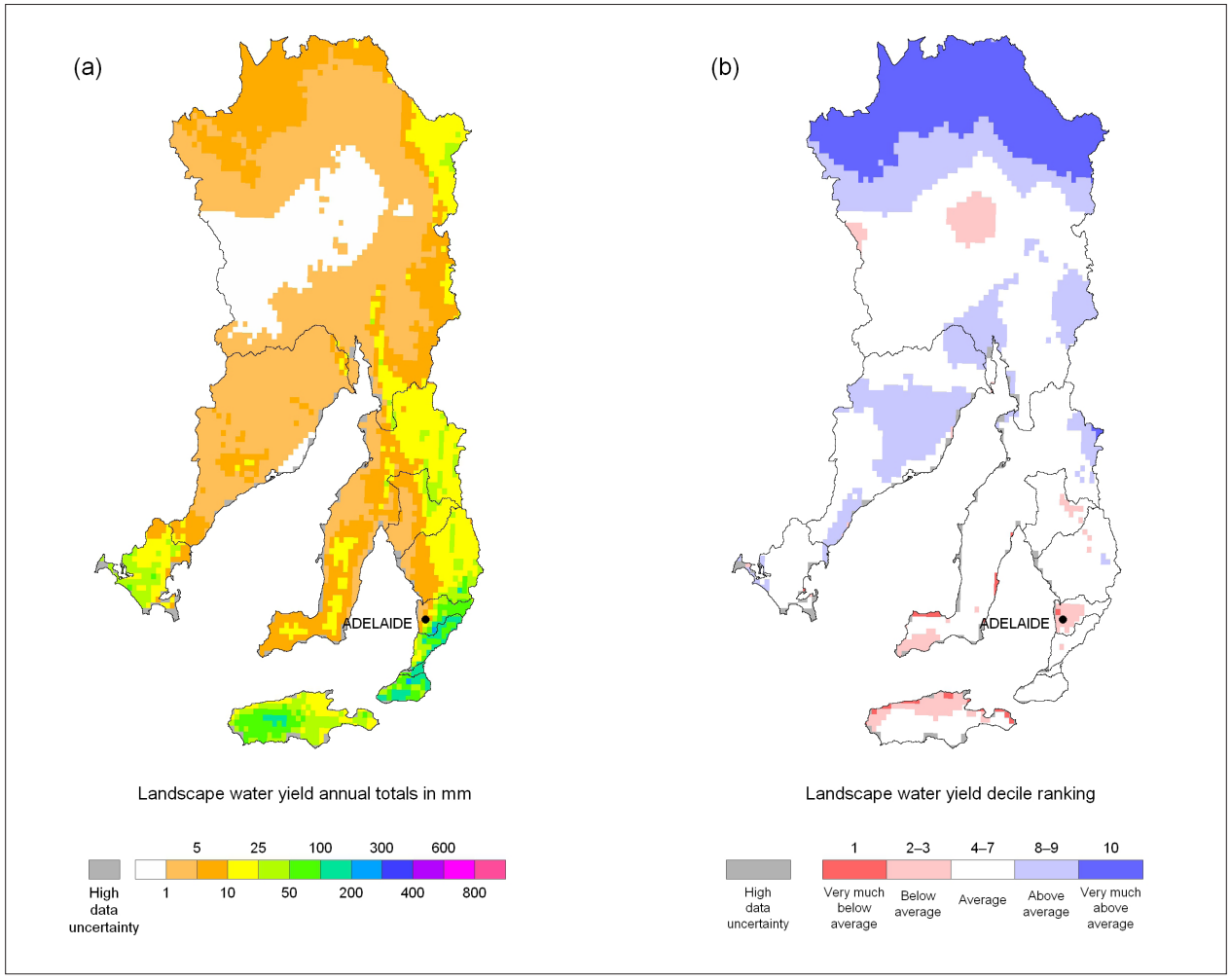


Figure 8.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2010 period for the South Australian Gulf region

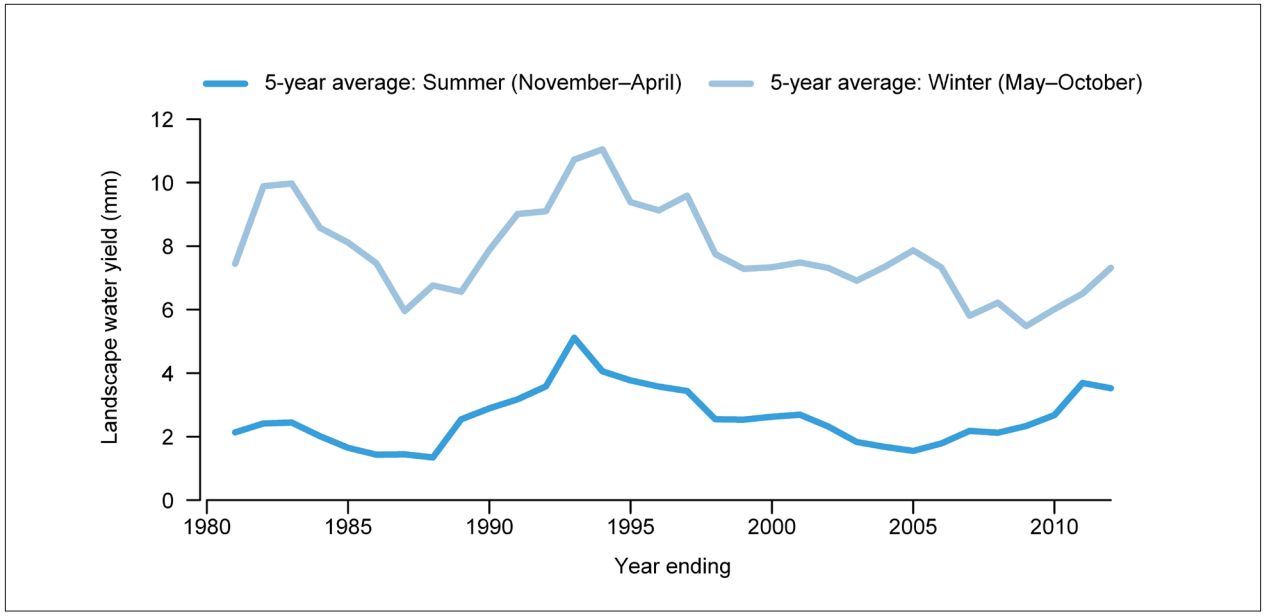


Figure 8.2 Time-series of five-year moving averages for summer (November–April) and winter (May–October) landscape water yield for the South Australian Gulf region

9. South Western Plateau

9.1 Regional overview

The South Western Plateau region covers 1,093,000 km^2 of mostly sandy or stony desert within Western Australia, South Australia and the Northern Territory. The region borders the South Australian Gulf region to the east, Lake Eyre Basin region to the northeast, Tanami – Timor Sea Coast and North Western Plateau regions to the north, and the Pilbara–Gascoyne and South West Coast regions to the west. The Southern Ocean is the southern boundary of the region.

The South Western Plateau region has a population of just under 72,400 people that accounts for just over 0.30% of the nation's total population. Major population centres in the region include Kalgoorlie–Boulder, Esperance, Ceduna, Coolgardie, Kambalda West and Streaky Bay.

Rainfall, evapotranspiration and landscape water yield in 2011–12 were all above average across most parts of the region. The latter had a very low magnitude.

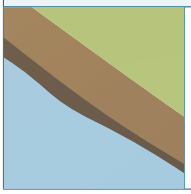
The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 9.1).

9.2 Recent trends in landscape water yield

Landscape water yield for the South Western Plateau region for 2011–12 was 6 mm. The spatial distribution of landscape water yield for 2011–12 was similar to the annual rainfall distribution with the majority of the region generating between 1–5 mm (Figure 9.1a). The decile-ranking map for 2011–12 shows above average to very much above average landscape water yields in most parts of the region. Some below average landscape water yield occurred in the southwest of the region (Figure 9.1b).

An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using moving averages in Figure 9.2. Landscape water yield is usually higher during the summer period compared to the winter period. There is an increase in the gap between the two seasons since 1997. There is also an increase in the gap between the two seasons after 1997. This follows the temporal patterns in rainfall in the region.

Table 9.1 Key information on landscape water flows and groundwater quality in the South Western Plateau region

Landscape water flows			
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	256 mm	+45%	9th—above average
Evapo-transpiration	268 mm	+55%	10th—very much above average
Landscape water yield	6 mm	+100%	10th—very much above average
Groundwater (in selected aquifers)			
	Salinity:	Saline groundwater (≥3000 mg/L) in the south of the region and scattered areas of saline groundwater mainly surrounding (dry) river beds and lakes in the north	

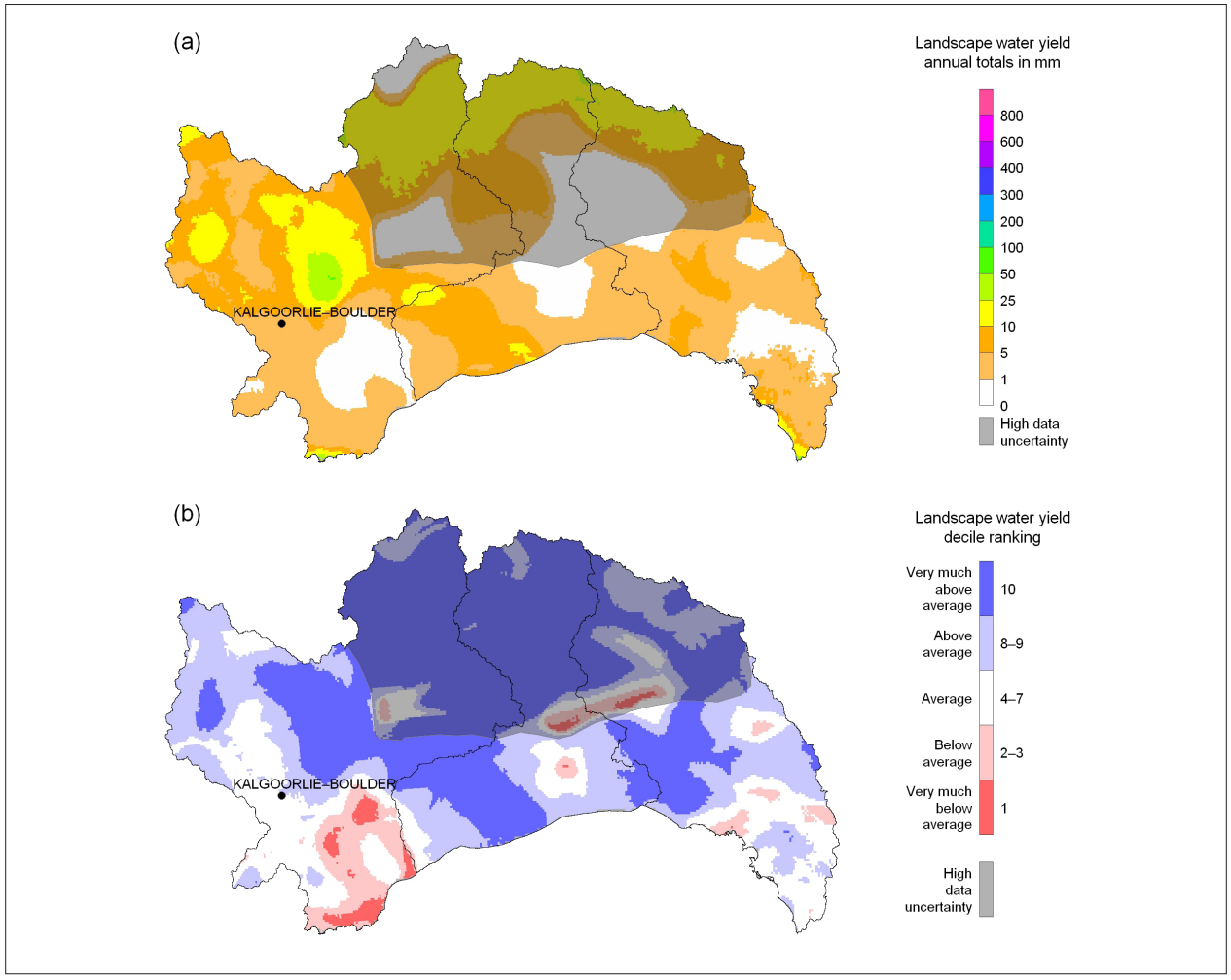


Figure 9.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2010 period for the South Western Plateau region

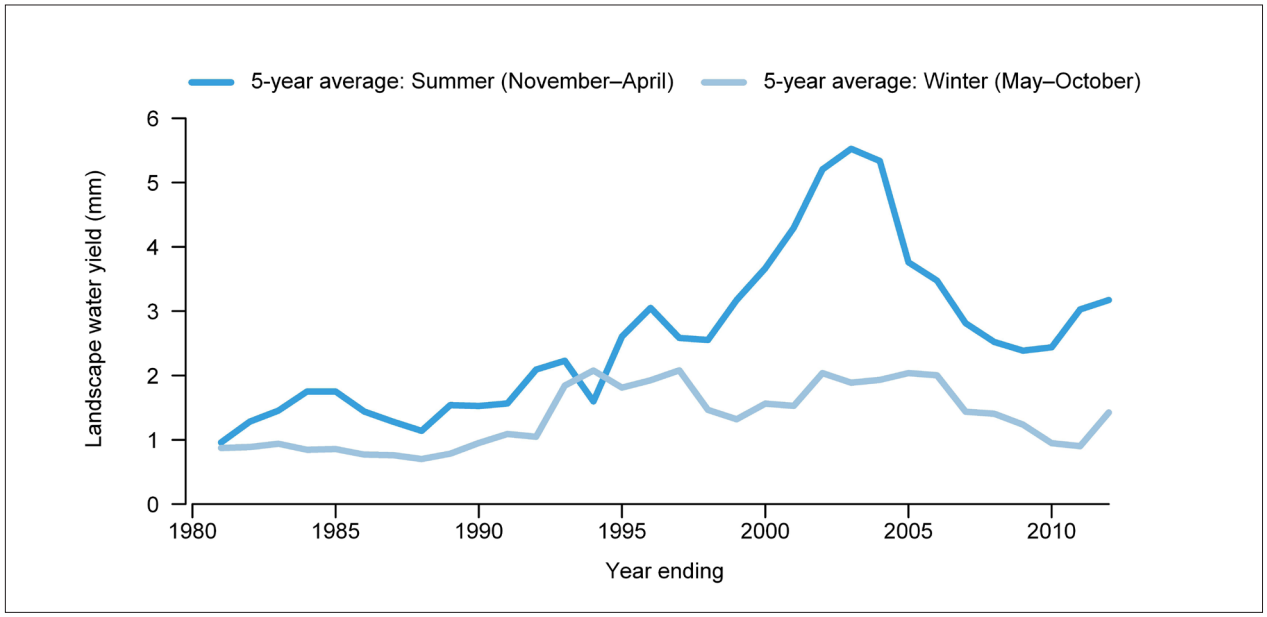


Figure 9.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the South Western Plateau region

10. South West Coast

10.1 Regional overview

The South West Coast region covers approximately 326,000 km² of land. It is bounded to the west by the Indian Ocean and to the south by the Great Australian Bight. The northern boundary is the Pilbara–Gascoyne region and the eastern boundary is the South Western Plateau region.

The region has a temperate climate with warm, dry summers and cool winters. Most rainfall occurs in the west along the Darling Scarp. The Stirling Range receives occasional snowfall. Further inland, the rainfall is more reduced.

The region has a population of just over 2 million people, which accounts for just over 9% of the nation's total population. The major population centres in the region include Perth, Mandurah, Bunbury and Albany.

The 2011–12 year was a relatively wet year, with some very much above average high rainfall between October and December. Above average rainfall and evapotranspiration occurred for most of the region over the course of the year; however, landscape water yield was mostly average to below average for larger areas along the coast as well as further inland.

A large portion of the region had below average to very much below average soil moisture conditions throughout the whole year.

The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 10.1).

10.2 Recent trends in landscape water yield

Figure 10.1a shows the landscape water yield for the South West Coast region for 2011–12 from east to west. In particular, the southeast areas of the region received the highest yield during the year; however, when considered historically, the overall landscape water yield was below the region's long-term average. The decile map shows mostly average to below average landscape water yields for large areas along the coast as well as further inland (Figure 10.1b).

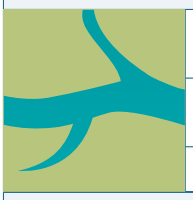
An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using moving averages in Figure 10.2. Landscape water yield is consistently higher during winter and particularly low during summer. The falling trend in winter landscape water yield since 2001 is consistent with that of rainfall and evapotranspiration.

Table 10.1 Key information on water flows, stores and use in the South West Coast region

Landscape water flows

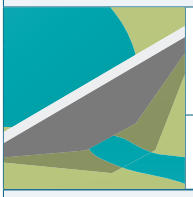
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	499 mm	+14%	8th—above average
Evapo-transpiration	455 mm	+15%	10th—very much above average
Landscape water yield	28 mm	-24%	4th—average

Streamflow (at selected gauges)



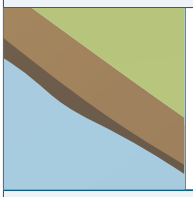
Annual total flow:	Between average and very much below average flow throughout the region
Salinity:	Annual median electrical conductivity predominantly above 2,000 µS/cm inland and less saline in the coastal rivers in the west
Flooding:	Sporadic minor and moderate flooding in the southwest river basins

Surface water storage (comprising about 92% of the region's total capacity of all major storages)



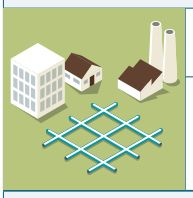
Total accessible capacity	30 June 2012		30 June 2011		Change	
	accessible volume	% of total capacity	accessible volume	% of total capacity	accessible volume	% of total capacity
951 GL	309 GL	32%	210 GL	22%	+99 GL	+10%

Groundwater (in selected aquifers)



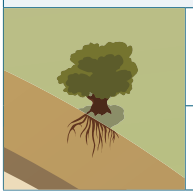
Salinity:	Non-saline groundwater (<3000 mg/L) only along the southwest coastline and in scattered areas in the north

Urban water use (Perth)



Total sourced in 2011–12	Total sourced in 2010–11	Change	Restrictions
248 GL	247 GL	+1 GL	Eased to Stage 5 in September, back to Stage 7 in June

Annual mean soil moisture (model estimates)



Spatial patterns:	Predominantly average to below average annual mean soil moisture with large areas of very much below average soil moisture to the east and in the southwest
Temporal patterns in regional average:	Below average soil moisture throughout the year, only reaching average levels in summer

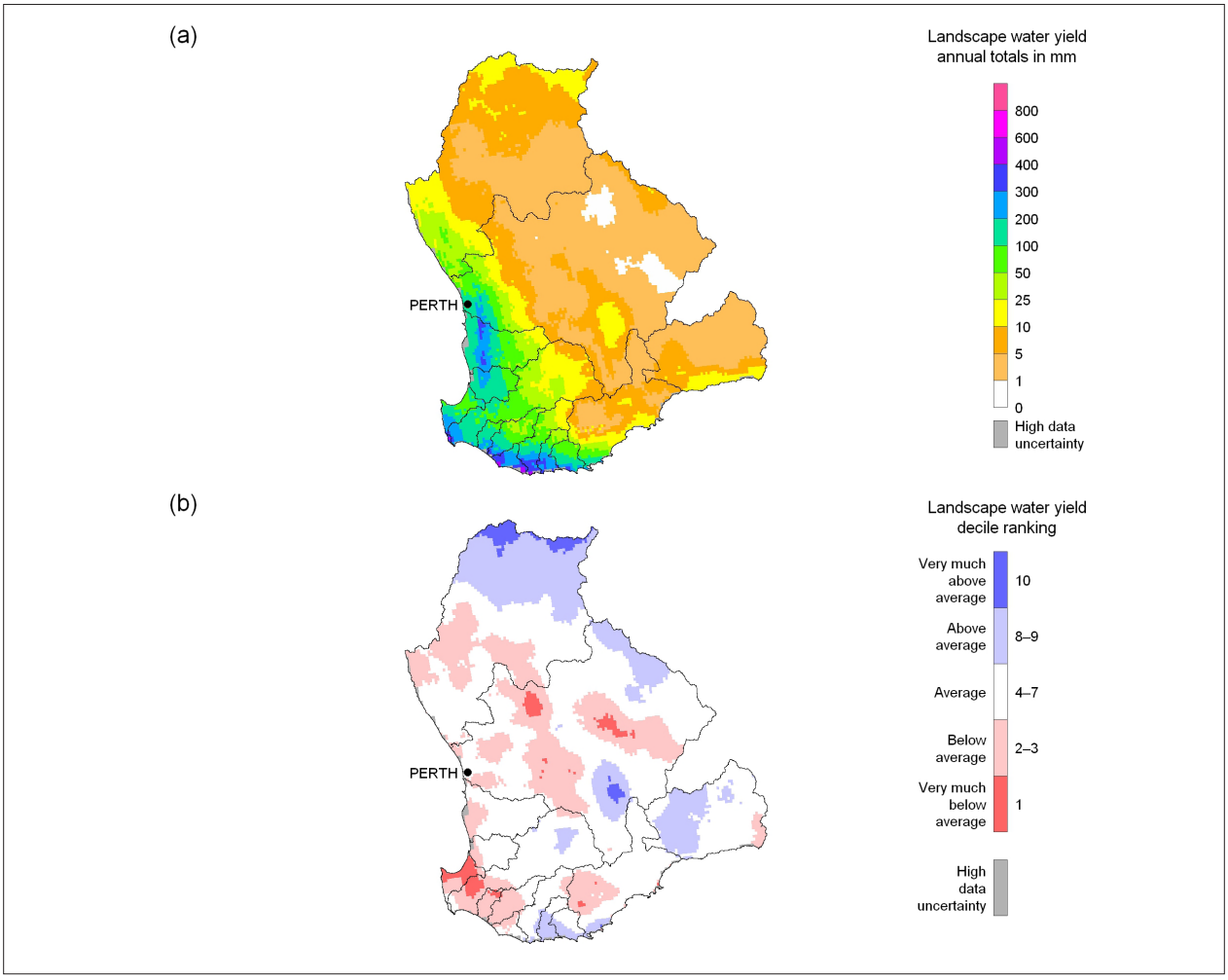


Figure 10.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2010 period for the South West Coast region

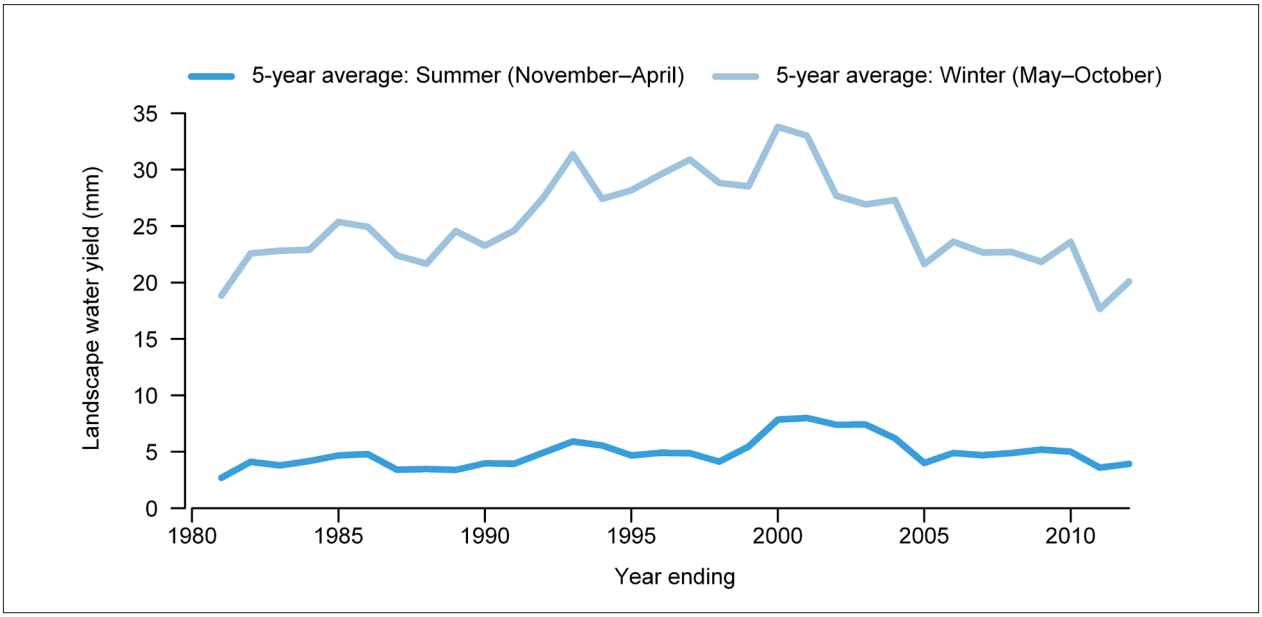


Figure 10.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the South West Coast region

11. Pilbara–Gascoyne

11.1 Regional overview

The Pilbara–Gascoyne region covers about 478,000 km² of land area in the central western corner of Western Australia. It comprises a long coastal section and a dry inland section bordered by the North Western Plateau and South Western Plateau regions in the east and the South West Coast region in the south.

The region has an arid subtropical climate, with a temperate Mediterranean climate predominantly occurring in the south. Rainfall is generally low and variable. Irregular monsoonal rain occurs in the north.

The Pilbara–Gascoyne region has a population of approximately 117,400 people, which is 0.5% of the nation's total population. Major population centres include the city of Geraldton as well as the regional centres of Karratha, Port Hedland (including South Hedland) and Carnarvon.

Rainfall, evapotranspiration and landscape water yield for the Pilbara–Gascoyne region for 2011–12 were all above the region's long-term average.

The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 11.1).

11.2 Recent trends in landscape water yield

The highest landscape water yields in 2011–12 were observed in the northeast of the region (Figure 11.1a). where tropical cyclone *Heidi* occurred in January 2012.

The decile-ranking map for 2011–12 shows largely average to above average landscape water yields. Very much above average water yields are found across much of the Gascoyne area (Figure 11.1b).

An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using moving averages in Figure 11.2. The data show landscape water yield increased five-fold for the five-year retrospective moving average between 2000 and 2004 and remained significantly higher for the subsequent period. This was as a result of a marked increase in summer rainfall after 1997 in the region that had a major impact on landscape water yield.

Table 11.1 Key information on water flows, stores and use in the Pilbara–Gascoyne region

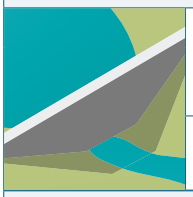
Landscape water flows

	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	338 mm	+29%	9th—above average
Evapo-transpiration	341 mm	+36%	9th—above average
Landscape water yield	19 mm	+73%	10th—very much above average

Streamflow (at selected gauges)

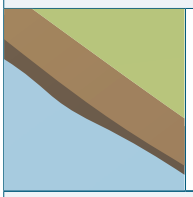
Flooding:	Minor flooding limited to two gauges in the far northern rivers in single gauges in the midstream part of the Gascoyne and Ashburton rivers

Surface water storage (comprising all of the region's major surface water storages)



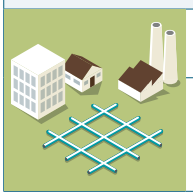
Total accessible capacity	30 June 2012		30 June 2011		Change	
	accessible volume	% of total capacity	accessible volume	% of total capacity	accessible volume	% of total capacity
63 GL	36 GL	57%	62 GL	98%	-26 GL	-41%

Groundwater (in selected aquifers)



Salinity:	Large areas of saline groundwater (≥3000 mg/L) along the coast and in alluvial aquifers surrounding major river beds

Urban water use (Geraldton)



Total sourced in 2011–12	Total sourced in 2010–11	Change	Restrictions
7.8 GL	8.1 GL	–0.3 GL (-4%)	Permanent Water Conservation Measures

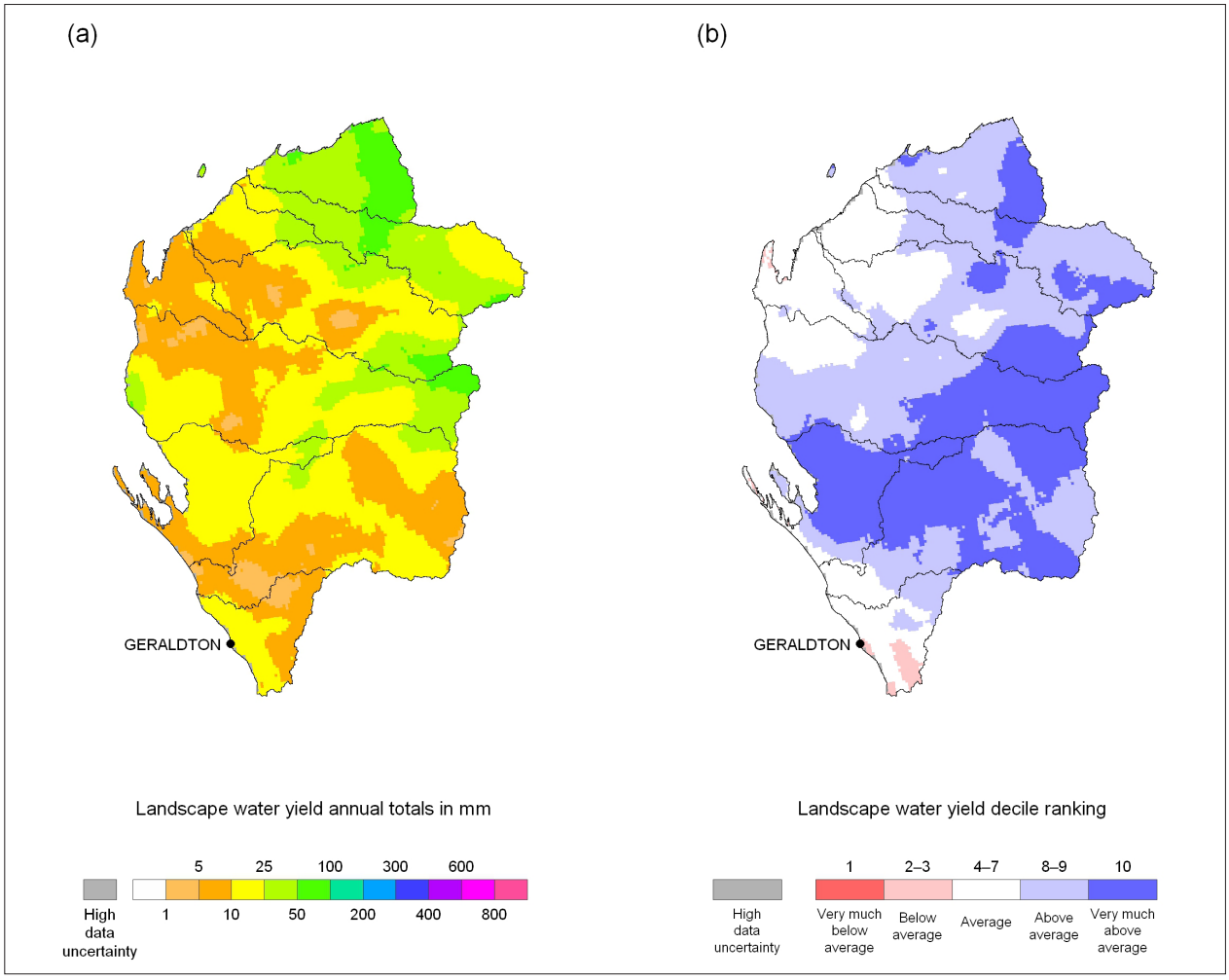


Figure 11.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2010 period for the Pilbara–Gascoyne region

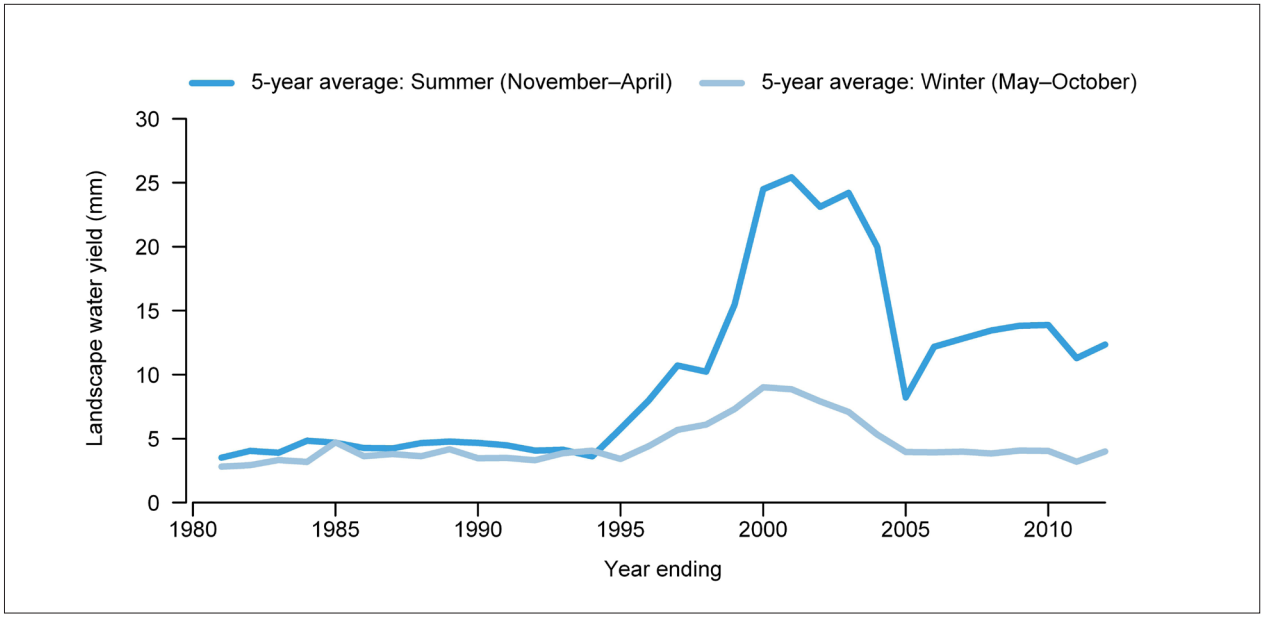


Figure 11.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Pilbara–Gascoyne region

12. North Western Plateau

12.1 Regional overview

The North Western Plateau region is located in northwest Australia and includes major parts of the Great Sandy and Gibson deserts. The region covers 716,000 km² of land area and only has some limited surface water resources present in the northern and eastern parts of the region. The climate is arid and is affected by erratic monsoonal rainfall in summer, particularly in the north.

With a population of approximately 13,100 people the North Western Plateau is home to less than 0.1% of the nation's total population.

The 2011–12 year was a relatively wet year; rainfall, evapotranspiration and landscape water yield for the region for 2011–12 were all above the region's long-term average.

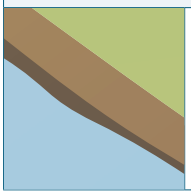
The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 12.1).

12.2 Recent trends in landscape water yield

Figure 12.1a shows the spatial distribution of the landscape water yield. The decile-ranking map for 2011–12 (Figure 12.1b) shows above average to very much above average landscape water yields for majority of the region.

An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using retrospective moving averages in Figure 12.2. Landscape water yield is higher for the summer period than for the winter. The temporal variability closely resembles the variability in rainfall.

Table 12.1 Key information on landscape water flows and groundwater quality in the North Western Plateau region

Landscape water flows			
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	319 mm	+65%	10th—very much above average
Evapo-transpiration	291 mm	+61%	10th—very much above average
Landscape water yield	26 mm	+136%	10th—very much above average
Streamflow (at selected gauges)			
	Flooding:	Major flooding in the De Grey River basin	
Groundwater (in selected aquifers)			
	Salinity:	Scattered areas of saline groundwater (≥3000 mg/L) mainly surrounding (dry) riverbeds and lakes	

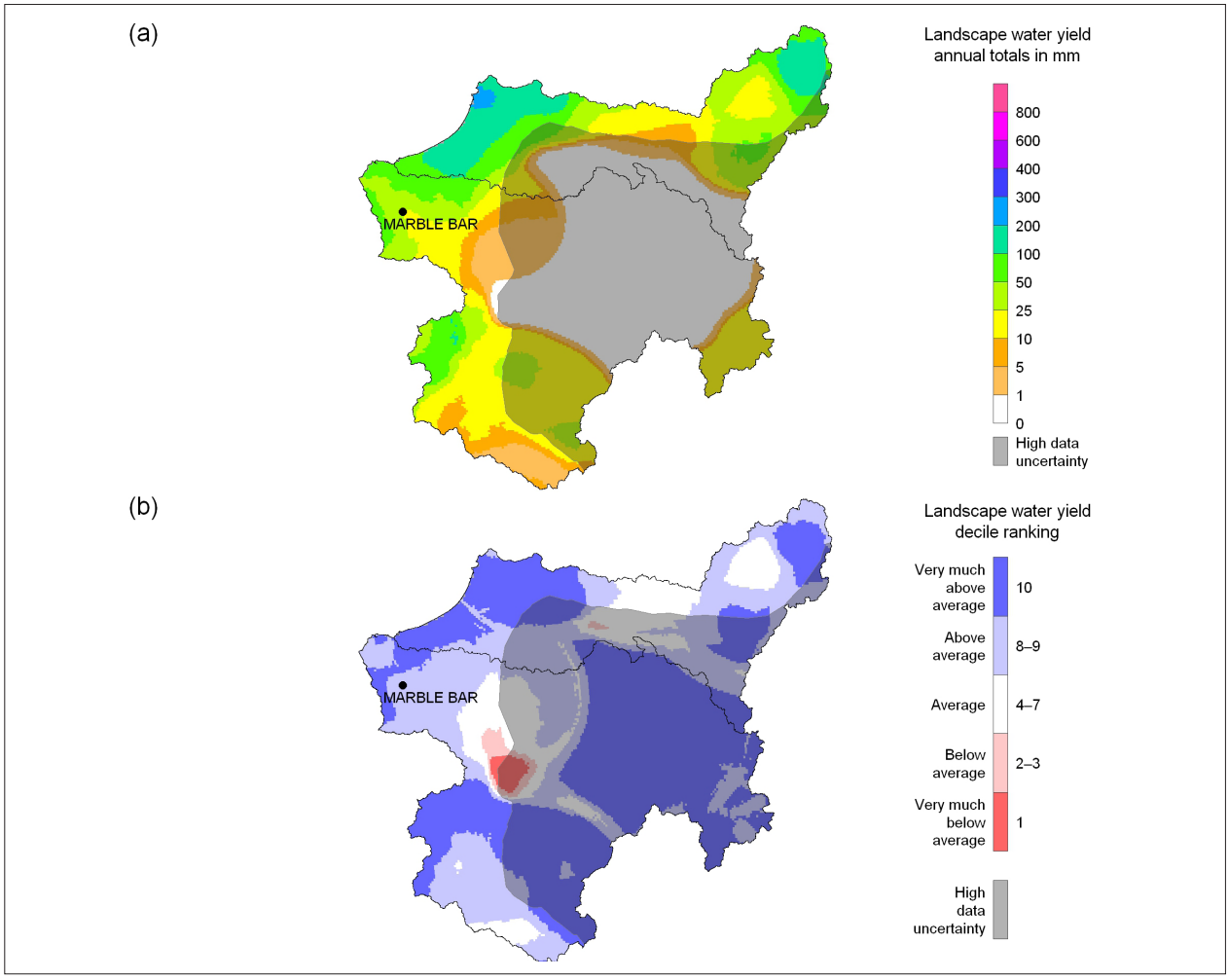


Figure 12.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2010 period for the North Western Plateau region

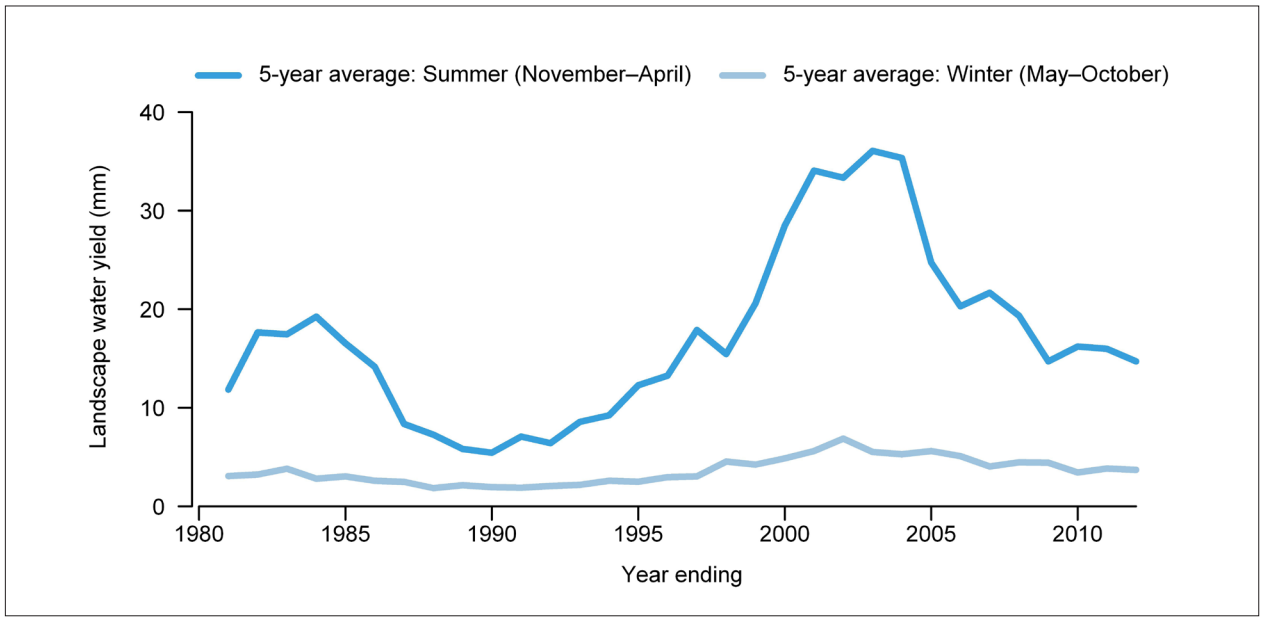


Figure 12.2 Time-series of five-year retrospective moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the North Western Plateau region

13. Tanami – Timor Sea Coast

13.1 Regional overview

The Tanami – Timor Sea Coast region extends over a large area of northern Australia covering much of the Northern Territory and the north of Western Australia. The region is approximately 1,162,000 km² and includes the Ord, Darwin, Daly, Victoria and Fitzroy river basins. The region extends across distinctive climatic zones and is dominated by a humid tropical climate to the north and a very dry arid climate to the south.

With a population of approximately 201,500 the region is home to 0.9% of the nation's total population. Darwin, Palmerston, Broome, Katherine and Kununurra are the region's major population centres in the region.

The 2011–12 year was a wet year in the Tanami – Timor Sea Coast region. The annual rainfall, evapotranspiration and landscape water yield were all above average. The highest rainfall occurred in the tropical north.

Soil moisture conditions during 2011–12 were above average in many parts of the landscape due to above average rainfall from October through to December 2011–12. The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 13.1).

13.2 Recent trends in landscape water yield

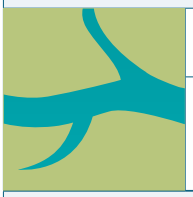
The highest landscape water yields in 2011–12 were in some areas along the coast, locally exceeding 600 mm (Figure 13.1a). The decile-ranking map for 2011–12 shows average to above average landscape water yields (Figure 13.1b).

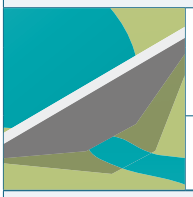
An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using retrospective moving averages in Figure 13.2.

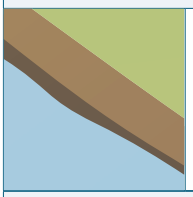
Landscape water yield in 2010–11 was very much above average high, but even without this exceptional year the general trend in regional average annual and summer landscape water yield shows a rising trend since 1990. In the first half of the reference period, only two years reached total annual landscape water yields that were above the period average, albeit only marginally.

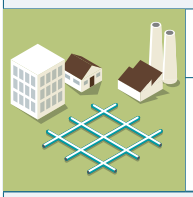
Table 13.1 Key information on water flows, stores and use in the Tanami – Timor Sea Coast region

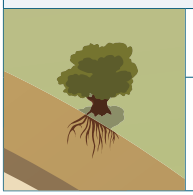
Landscape water flows			
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	754 mm	+35%	9th—above average
Evapo-transpiration	646 mm	+40%	10th—very much above average
Landscape water yield	142 mm	+53%	9th—above average

Streamflow (at selected gauges)		
	Annual total flow:	Predominantly average to above average flow in river basins in the central north
	Flooding:	Localised minor to moderate flooding in the northern half of the region

Surface water storage (comprising about 96% 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
	10,733 GL	10,549 GL	98%	10,710 GL	100%	-161 GL	-2%

Groundwater (in selected aquifers)		
	Salinity:	Non-saline groundwater (<3000 mg/L) throughout the region

Urban water use (Darwin)				
	Total sourced in 2011–12	Total sourced in 2010–11	Change	Restrictions
	35.5 GL	32.3 GL	+3.2 GL (+10%)	No restrictions

Annual mean soil moisture (model estimates)		
	Spatial patterns:	Predominantly above average to very much above average annual mean soil moisture
	Temporal patterns in regional average:	Very much above average soil moisture throughout most of the year, above average in the wet season

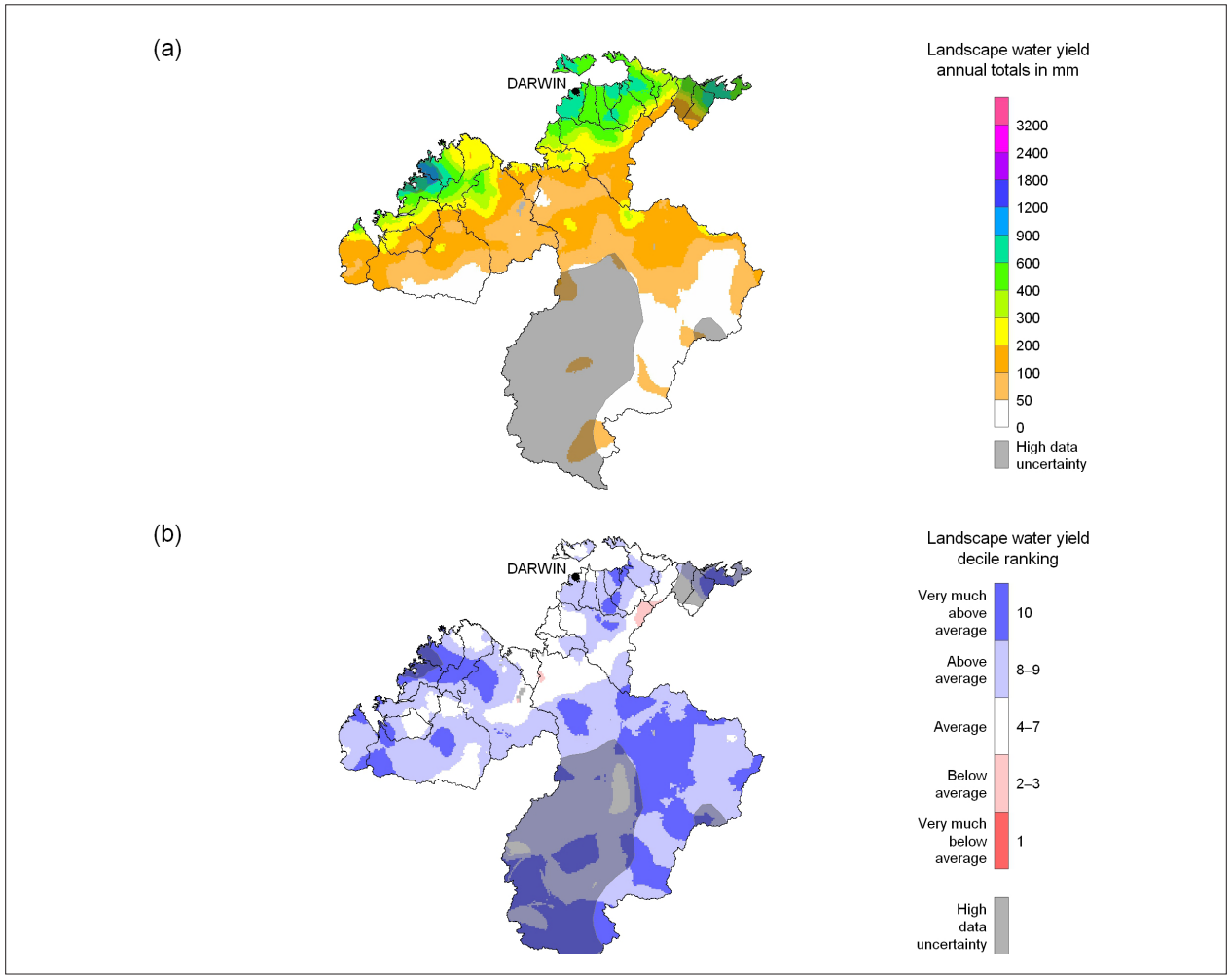


Figure 13.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2010 period for the Tanami – Timor Sea Coast region

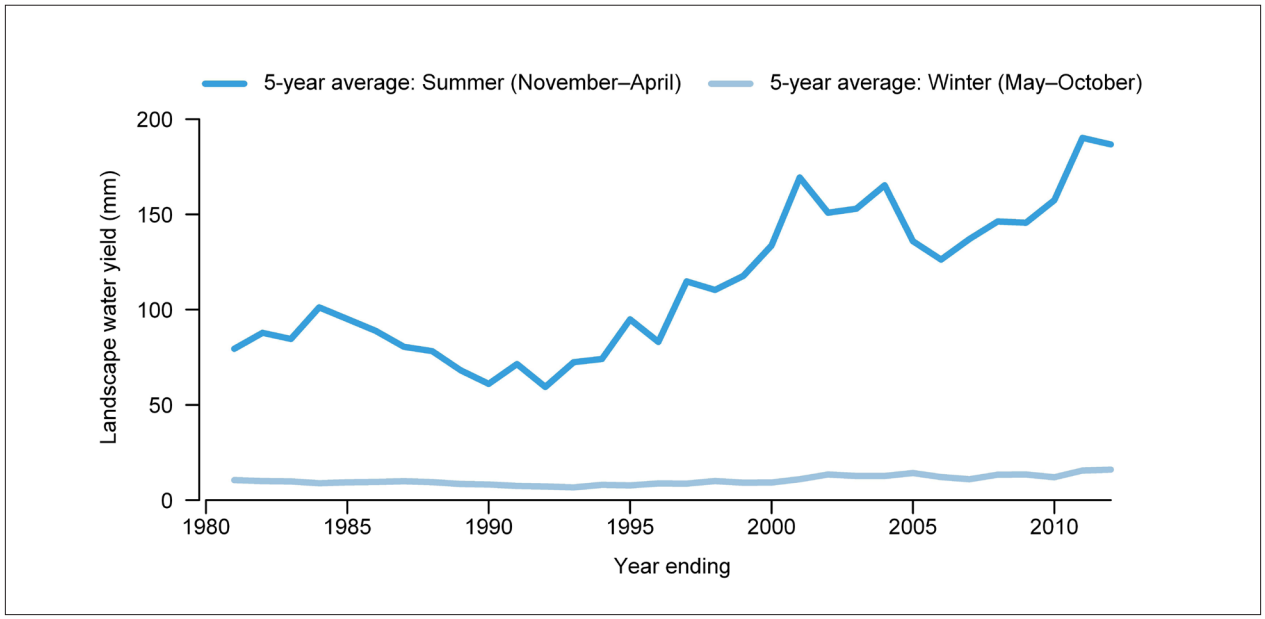


Figure 13.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Tanami – Timor Sea Coast region

14. Lake Eyre Basin

14.1 Regional overview

The Lake Eyre Basin region covers approximately 1.2 million km² of arid and semi-arid central Australia. It represents 17% of the continent and stretches, north to south, from just below Mount Isa in Queensland to Marree in South Australia. From west to east, it extends from Alice Springs in the Northern Territory to Longreach and Blackall in central Queensland.

The region's climate is generally quite arid, with rainfall much below potential evaporation. The region is driest in the northeast, but this area does receive some monsoonal rain. Though this is highly variable, it can supply large amounts of water, in particular into the upper reaches of the Diamantina and Georgina rivers.

With a population of approximately 58,700, the Lake Eyre Basin accounts for less than 0.25% of the nation's total population. Alice Springs is the major population centre along with a number of remote and regional centres including Coober Pedy, Birdsville, Winton, Longreach and Peterbourough.

Average rainfall for the Lake Eyre Basin region for 2011–12 was 337 mm. The highest rainfall occurred in the northeast with annual totals exceeding 600 mm. Rainfall, evapotranspiration and landscape water yield were all above region's long-term average.

The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 14.1).

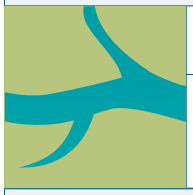
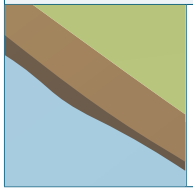
14.2 Recent trends in landscape water yield

Landscape water yield is highly variable in the Lake Eyre Basin region (Figure 14.1a). The variability in annual and summer landscape water yield is related to ENSO variability.

The decile-ranking map for 2011–12 (Figure 14.1b) shows above average to very much above average landscape water yields, particularly in the central and southern areas of the region. The decile rankings of landscape water yield are substantially higher than those of rainfall due to the higher initial soil moisture levels, caused by the strong wet season in 2010–11.

An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using retrospective moving averages in Figure 14.2. The variability in landscape water yield of the summer period is directly related to rainfall.

Table 14.1 Key information on water flows and groundwater quality in the Lake Eyre Basin region

Landscape water flows			
	Region average	Difference from 1911–2012 long-term annual mean	Decile ranking with respect to the 1911–2012 record
Rainfall	337 mm	+42%	9th—above average
Evapo-transpiration	327 mm	+45%	10th—very much above average
Landscape water yield	25 mm	+150%	10th—very much above average
Streamflow (at selected gauges)			
	Annual total flow:	Above average flow in three gauges in the east. Average flows on one of the gauges in the centre	
	Flooding:	Major floods in the upstream part of the Cooper Creek basin, decreasing in severity downstream and some flooding in the Diamantina and Bulloo rivers	
Groundwater (in selected aquifers)			
	Salinity:	Mostly non-saline (<3000 mg/L) groundwater in the north and saline (≥3000 mg/L) in the south	

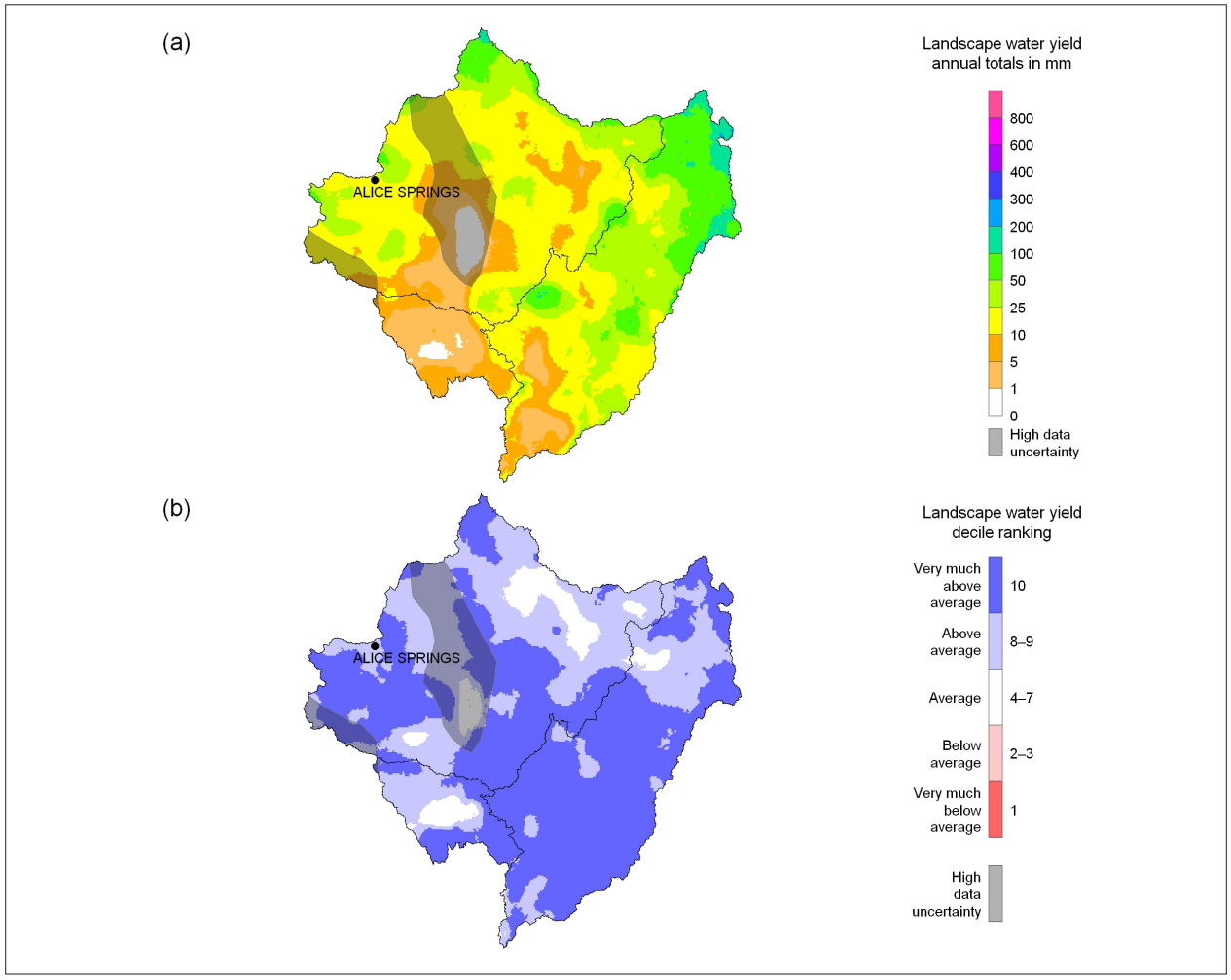


Figure 14.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2010 period for the Carpentaria Coast region Lake Eyre Basin region

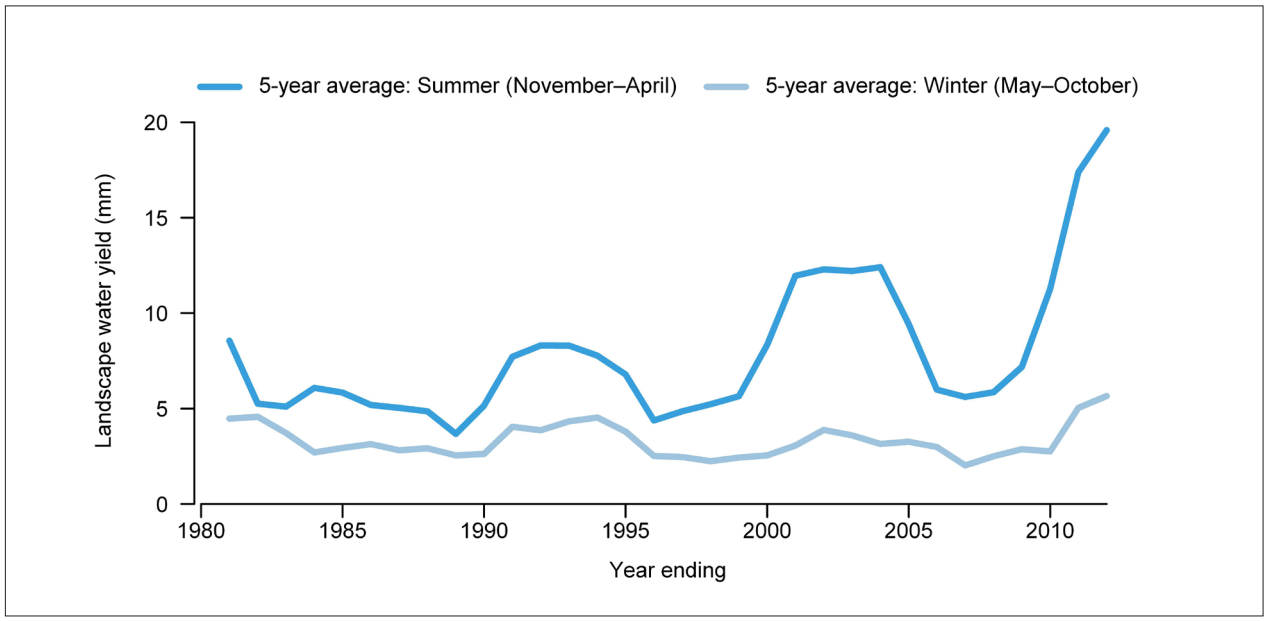


Figure 14.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Lake Eyre Basin region

15. Carpentaria Coast

15.1 Regional overview

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 climate is hot and humid mostly in the wet season. The dry season runs from about May to October and the monsoonal wet season from November to April.

Approximately 66,500 people permanently reside in the Carpentaria Coast region. This accounts for less than 0.29% of the nation's total population. Mount Isa is a major population centre of the region. Over 25% of the region's population is Indigenous.

The 2011–12 year was a relatively wet year especially during November–December 2011. An active monsoon in the north of the region contributed to particularly high rainfall totals in March 2012.

In addition to rainfall, evapotranspiration and landscape water yield were both above the region's long-term averages.

The key information table highlights the water flows, stores and use for the region for 2011–12 (Table 15.1).

15.2 Recent trends in landscape water yield

The spatial distribution of landscape water yield for 2011–12 indicates the highest landscape water yields occurred in the northeast, locally exceeding 900 mm. In the south and west of the region, the landscape water yield did not generally exceed 200 mm over the year (Figure 15.1a).

In addition to rainfall, evapotranspiration and landscape water yield were both above long-term averages for the region.

The decile-ranking map for 2011–12 shows variability of the landscape water yield over the region that closely followed the patterns of rainfall deciles. The southern part of the region had very much above average landscape water yield. In contrast, in the Mitchell River basin on the east, landscape water yield was below long-term average (Figure 15.1b).

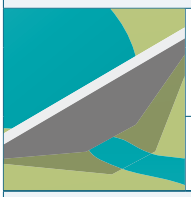
An indication of trends and variability in the seasonal landscape water yield over the 32-year period (July 1980–June 2012) for summer (November–April) and winter (May–October) are presented using retrospective moving averages in Figure 15.2.

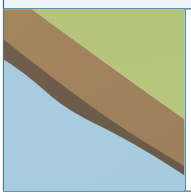
Landscape water yield shows a rising trend in the wet season. In particular the last five years have seen consistently high landscape water yields.

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

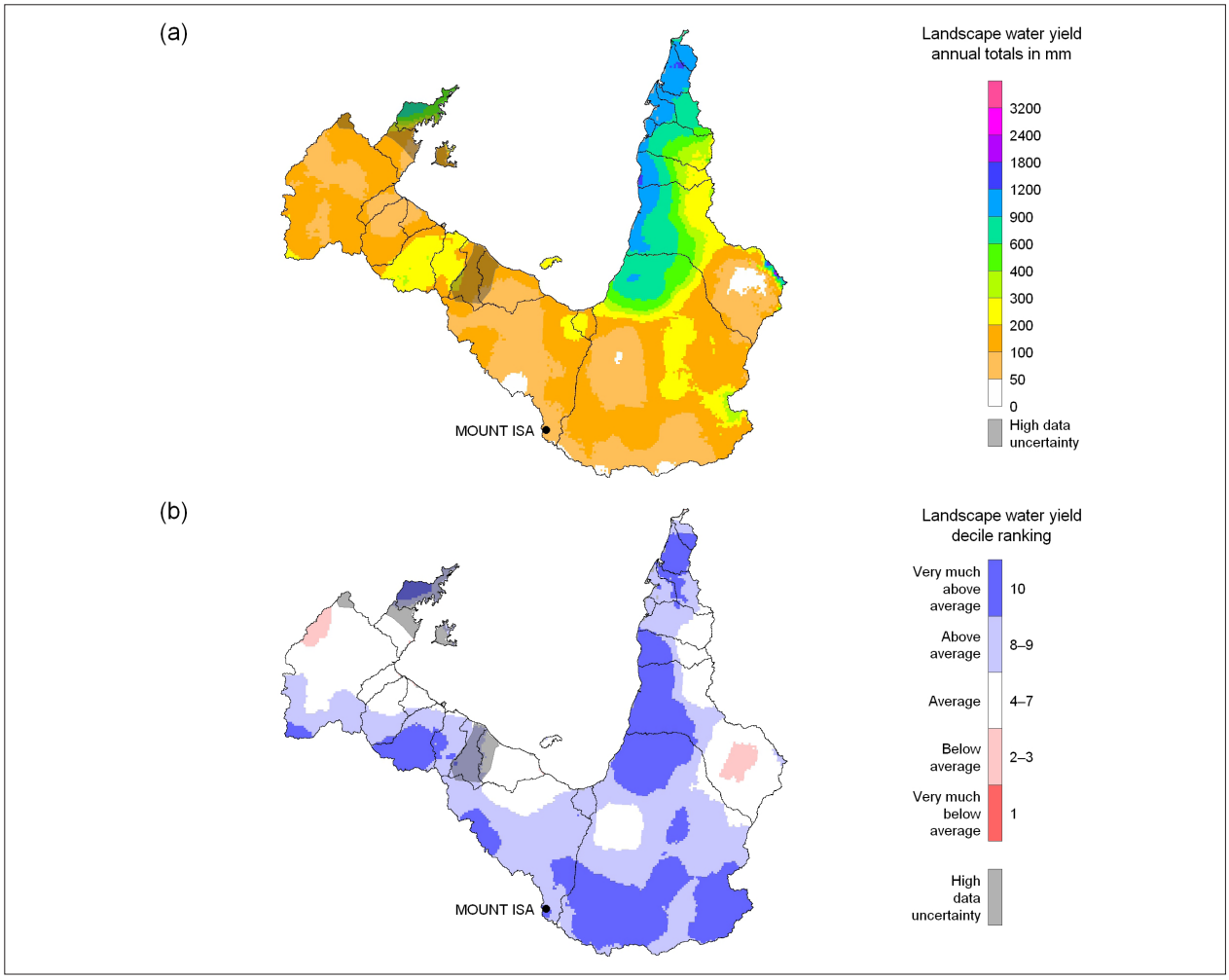


Figure 15.1 (a) Maps of modelled annual landscape water yield totals in 2011–12, and (b) their decile rankings over the 1911–2010 period for the Carpentaria Coast region

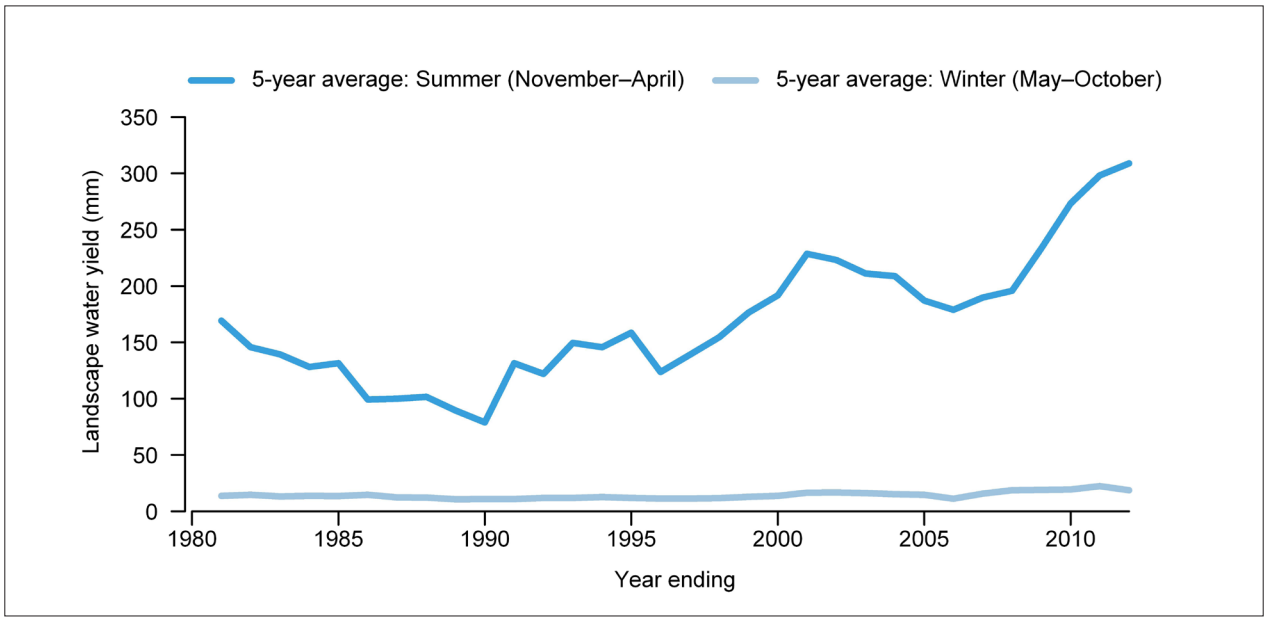


Figure 15.2 Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Carpentaria Coast region

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Australian Bureau of Statistics 2011a, *Water use on Australian farms, 2010–11,* www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4618.02010–11?OpenDocument

National Water Commission (NWC) 2013, *National Performance Report 2011–12: Urban water utilities,* NWC, Canberra, www.nwc.gov.au/publications?result_24055_result_page=2

Through the *Water Act 2007*, the Australian Government has given the Bureau of Meteorology responsibility for compiling and delivering comprehensive water information across Australia.

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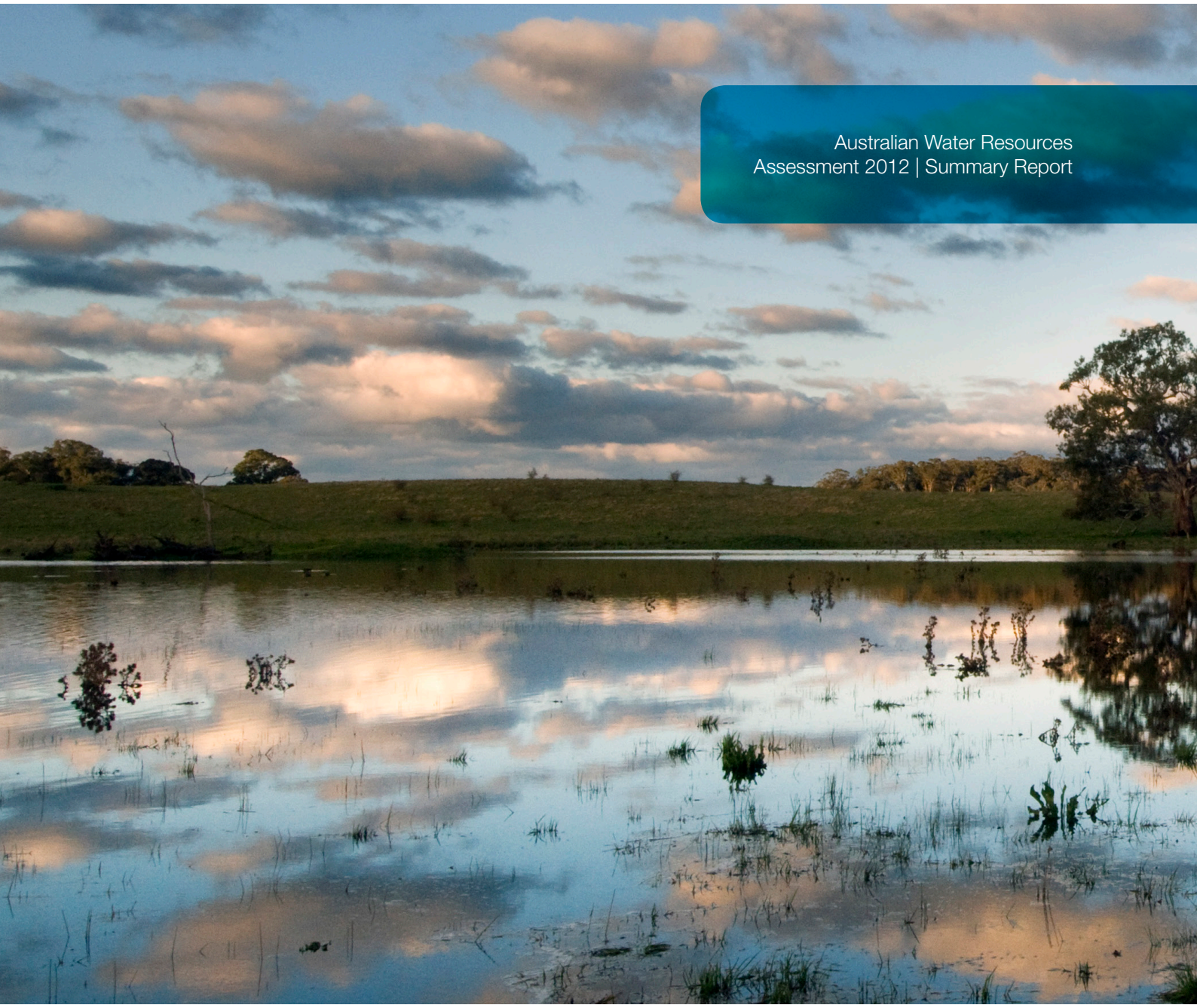
Send an email request to waterinfo@bom.gov.au



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