Australian Water Resources Assessment 2010

Summary Report

Australian Government
Bureau of Meteorology

Published by the Bureau of Meteorology
GPO Box 1289, Melbourne VIC 3001
Tel: (03) 9669 4000
Fax: (03) 9669 4699
Email: awra@bom.gov.au
Website: www.bom.gov.au

The full report and other information about the Australian Water Resources Assessment 2010 are available at: www.bom.gov.au/water/awra/2010

The Bureau of Meteorology welcomes feedback on this report.

Find out more about the Bureau of Meteorology's Water Information role at: www.bom.gov.au/water

ISBN: 978 0 642 70620 1

Cover image: Lake Eildon, Victoria. Photograph courtesy of Alison Pouliot.

Contents

Foreword

The Commonwealth *Water Act 2007* charges the Bureau of Meteorology with ‘providing regular reports on the status of Australia’s water resources and patterns of usage of those resources’. The Australian Water Resources Assessment 2010 is the first in a regular series of such reports.

This report presents data and information on the extent and magnitude of Australia’s water resources in 2009–10 in the context of the long-term record. It updates earlier assessments of Australia’s water resources, the most recent of which was produced for the 2004–05 year by the National Water Commission, as a baseline for the National Water Initiative of 2004.

The Australian Water Resources Assessment 2010 includes comprehensive information on the nation’s surface water resources and more limited information on its groundwater resources. Information is presented in the form of maps, graphs and tables with an accompanying narrative.

The body of the report consists of a national overview and 13 regional chapters, with the regions based on the new drainage division boundaries derived from the Australian Hydrological Geospatial Fabric. A Technical supplement provides additional detail on the data selection, analysis and water balance modelling techniques used in preparing this report and the level of peer review and acceptance they have received.

I hope that this report assists all Australians, but particularly policy-makers and planners, to understand the current state of the nation’s water resources and to gauge the impact of past and present water management practices. Your feedback on the report’s use will help us ensure that future reports achieve this aim.

The Bureau of Meteorology is currently building its water resources information systems. As these systems develop, more data and different data types will become available for inclusion in our assessments and a richer understanding of the nation’s water resources will be possible.

I would like to thank all those who have assisted us in the preparation of this report including the State and Territory water agencies that operate the vital water monitoring networks across our country, our water science collaborators in CSIRO in particular those within the Water Information Research and Development Alliance between the Bureau of Meteorology and CSIRO, and the many many reviewers of report drafts – your diligence and expertise has greatly enhanced the quality of this report.

Finally I would like to acknowledge the dedication and professionalism of the Bureau of Meteorology staff who have brought this landmark report to publication. Well-done!

Dr Rob Vertessy
Acting Director of Meteorology
November 2011

1. Introduction

1.1 What are Australian Water Resources Assessments?

Under the Commonwealth *Water Act 2007*, the Bureau of Meteorology (the Bureau) has responsibility 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.

National water resources assessments were undertaken by various Australian Government agencies and partners at irregular intervals over the past 50 years, each with a slightly different purpose and approach. The last Australian water resources assessment, Australian Water Resources 2005, was published by the National Water Commission in 2007 as a baseline for measuring the success of reforms under the National Water Initiative.

Since then, the Bureau and water agencies around the country have delivered a range of standardised water data and information products. Through strategic water research and development investments, new water resources assessment capabilities have been developed.

The Bureau's Australian Water Resources Assessments report on the state of the nation's water resources and aim 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 regional and national scales over time-scales of months to decades
- 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.

In contrast to previous Australian water resources assessments, the Bureau's reports are focused on consistency in reporting over time at key sites, highlighting patterns, variability and trends.

Australian Water Resources Assessment reports will be:

- freely available
- nationally consistent
- informative at regional and national scales
- scientifically robust
- transparent about the source and quality of data presented and about the modelling and analysis techniques used
- unbiased in the presentation of data and information.

The Bureau's Australian Water Resources Assessments will be conducted and published regularly from 2011.

1.2 What information is included in the 2010 Assessment?

The Australian Water Resources Assessment 2010 comprises a National overview, 13 regional assessments and a Technical supplement that presents information on the analytical methods used and their scientific peer review.

The National overview provides a national scale assessment of climate and water flows and stores in Australian landscapes in 2009–10 (July 2009 to June 2010). The chapter also examines important climate drivers and their impact on rainfall and evapotranspiration over the year. Information on nationally significant weather and water events experienced in 2009–10 is also presented.

The regional assessments provide analyses of water resources in 13 contiguous regions across the Australian continent (Figure 1-1). These regions are based on the new drainage division boundaries derived from the Australian Hydrological Geospatial Fabric.

Information for each region includes:

- impacts of climatic conditions on water resources for 2009–10 and over the preceding 30 years, including seasonal effects
- recent anomalies and trends in the hydrological characteristics of rivers and aquifers at selected monitoring sites
- 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 data available at the time of its preparation. 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.

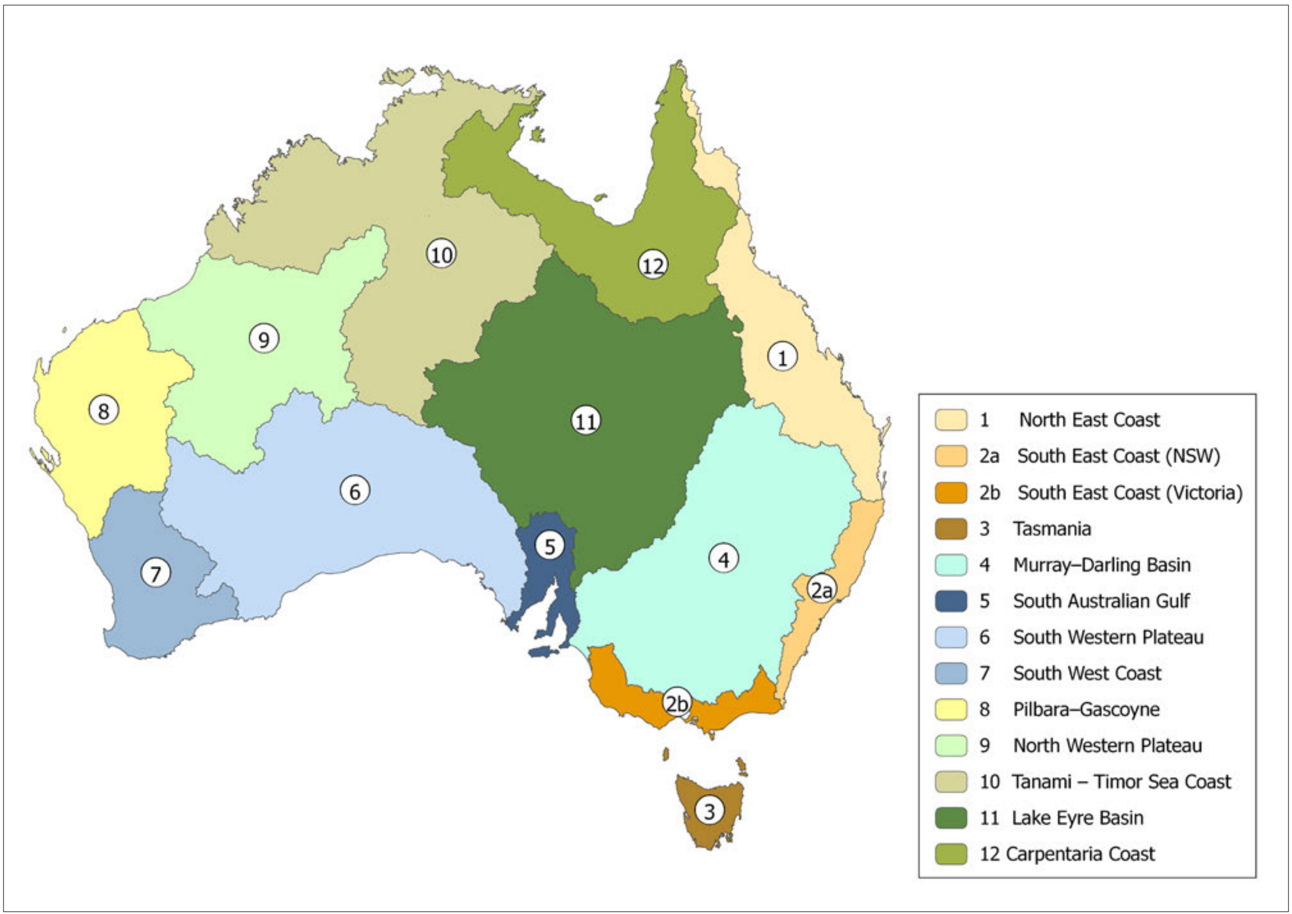


Figure 1-1. Australian Water Resources Assessment 2010 reporting regions

1.3 How was the 2010 Assessment prepared?

The Australian Water Resources Assessment 2010 uses the best available water data, models and analyses, underpinned by a water balance framework, to describe and interpret the state of the nation's water resources.

Two landscape water balance models were run nationally on a 0.05 degree grid (approximately 5 x 5 km) to generate estimates of landscape water flows and stores across the country. A schematic representation of the components of these models is shown in Figure 1-2 below.

Trends in the key input and output variables (rainfall, evapotranspiration and landscape water yield) were calculated to show how these water balance terms have changed in different Australian regions over time.

Monitoring site data from around the country were included in the assessment to support the model results and to give information on other water resources components, such as water storage and use. Reference sites were identified to help present trends and variability in water availability and use around the country over the past 12 months and the past three decades.

Groundwater levels and groundwater salinities were analysed for aquifers associated with major groundwater management units in some regions. National coverage of groundwater status in all major groundwater management units was not possible in this report due to the limited amount of quality-controlled data available in a suitable form at Bureau.

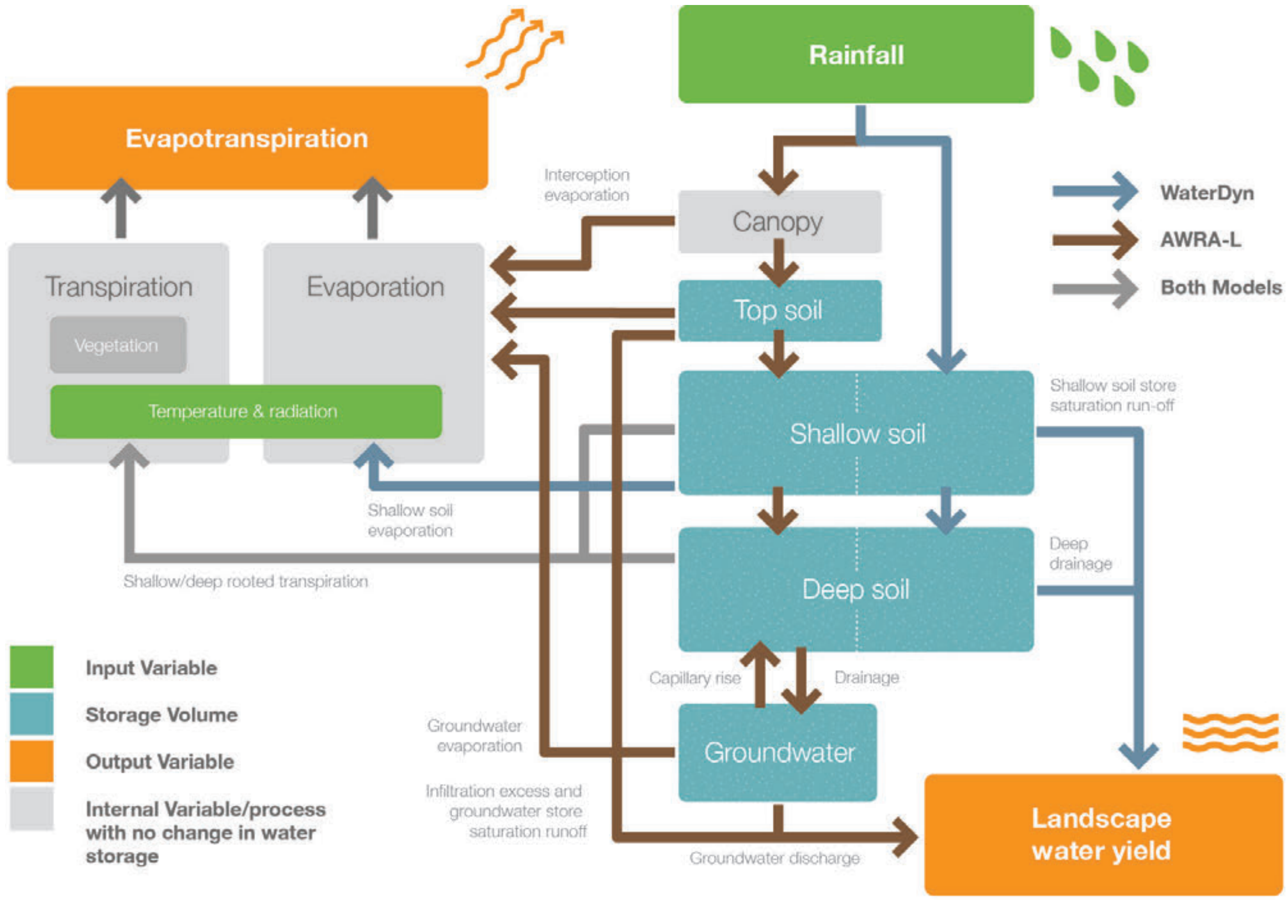


Figure 1-2. Schematic representation of inputs, outputs, flows and stores in the two landscape water balance models used in the 2010 Assessment

1.4 Quality control and review – who was involved?

A project Steering Committee within the Bureau of Meteorology provided oversight of the production, review and publication of Australian Water Resources Assessment 2010.

The implementation plan for producing the 2010 Assessment was developed in consultation with a number of organisations and was based on a review of existing jurisdictional water reporting products.

A scientific review group comprising non-Bureau water domain and regional experts reviewed the report iteratively as it was developed.

These reviewers were requested to examine the report with the aim of improving its quality and credibility by evaluating:

- the suitability of data employed
- the validity and robustness of the methods employed
- the appropriateness and presentation of figures and tables
- the extent to which information is accurate, clear, complete and unbiased
- whether information is presented within a proper context
- the clarity of interpretations, conclusions and findings
- the extent to which conclusions are unambiguous and supported by results
- whether any important issues or data were omitted
- the overall quality, style and presentation of the material.

In addition, CSIRO provided technical expertise throughout the report development process, specifically with regard to identifying appropriate report content and the modelling of landscape water flows. State and Territory water agencies and representatives of academia and professional services organisations provided water industry guidance. A general feedback group, comprising likely report users, was established to provide high level advice on both the content and utility of the Australian Water Resources Assessment 2010.

Overall, comments and suggestions were received from more than 25 organisational stakeholders in the scientific community, State and Territory water agencies and from the general feedback group.

A communication and adoption strategy developed by the Bureau of Meteorology requires the reporting process be reviewed subsequent to publication of this report. Comments and suggestions from stakeholders that were unable to be incorporated into this report will be considered as part of this review process for future water informations products and water resources assessments.

1.5 Further information

Further information about the Bureau of Meteorology's Australian Water Resources Assessments, is available on our website: www.bom.gov.au/water or via email: awra@bom.gov.au.

Information on the Bureau of Meteorology's Australian Hydrological Geospatial Fabric is available on our website: www.bom.gov.au/water or via email: ahgf@bom.gov.au.

2. National overview

2.1 Key findings

The Australian climatic condition in 2009–10 was characterised by an El Niño event in the Pacific Ocean, which broke down in early 2010 and was followed by a rapid switch to La Niña conditions[1]. The development of this significant La Niña event heralded the beginning of at least 12 months of very much above average rainfall in most parts of Australia. For more information see: www.bom.gov.au/climate/annual_sum/annsum.shtml.

It was relatively wet in the centre and north of the country from December 2009 onwards, resulting in above average evapotranspiration and landscape water yield for the year. Soil moisture stores increased for all of the North East Coast, Carpentaria Coast, Tanami – Timor Sea Coast, Lake Eyre Basin, Murray–Darling Basin and South Australian Gulf regions. However, total surface water storage in the Carpentaria Coast and Tanami – Timor Sea Coast regions decreased, which was largely due to significant releases in the few major storages in these regions.

In contrast to the centre and north of the country, 2009–10 was relatively dry in the west, particularly in the Pilbara–Gascoyne and South West Coast regions, where rainfall, evapotranspiration and landscape water yield were below average. This was also reflected in a decrease in soil moisture for these regions as well as for the North and South Western Plateau regions. Despite this, the total accessible volume of water held in surface water storages in the South West Coast region increased as a result of water restrictions and a number of significant coastal rainfall and run-off events in July, September and November 2009.

Rainfall conditions were around average in the South East Coast (Victoria), South Western Plateau, Tasmania and North Western Plateau regions.

Key information regarding the climatic conditions and water outcomes for Australia over 2009–10 is provided in Table 2-1. Some highlights were:

- Australian rainfall in 2009–10 was 13 per cent above the long-term (July 1911 to June 2010) average; evapotranspiration was four per cent above the long-term average and landscape water yield was 40 per cent above the long-term average.
- Deep soil moisture stores increased in the northeast and southeast of the country, but decreased in the west.
- The total water stored in major water storages in Australia increased from 46 per cent to 52 per cent of accessible volume, driven primarily by increases in the Murray–Darling Basin, Tasmania and North East Coast regions.
- Urban water use in the urban centres considered in this report decreased from 1,719 GL in 2005–06 to 1,497 GL in 2009–10. Residential water consumption accounted for 68 per cent of urban use in 2009–10.
- Annual agricultural irrigation water use in Australia in 2009–10 was approximately 6,600 GL, up one per cent on 2008–09.
- Widespread heavy rainfall was experienced in the Northern Territory and Queensland between 22 February and 3 March 2010 and caused significant flooding in the Lake Eyre Basin region, in the south of the North East Coast region and in the far north of the Murray–Darling Basin region.

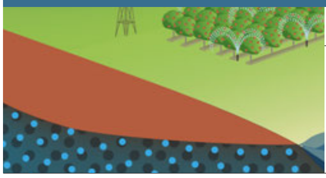
1. See www.bom.gov.au/climate/ for more information on climate drivers.

Table 2-1. Key information on the water flows, stores, use and climatic condition in Australia

Landscape water balance in 2009–10

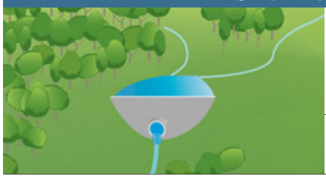
	Australian average	Difference from long-term mean	Rank (out of 99)*
Rainfall	536 mm	+13%	80
Evapotranspiration	415 mm	+4%	71
Landscape water yield	96 mm	+40%	86

Soil moisture in 2009–10



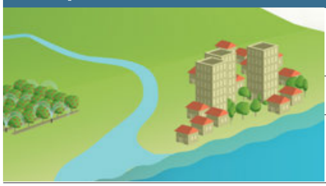
Regions that became drier	Regions that became wetter
North Western Plateau, Pilbara–Gascoyne, South West Coast, South Western Plateau, South East Coast (NSW) and Tasmania	Carpentaria Coast, Lake Eyre Basin, Murray–Darling Basin, North East Coast, South Australian Gulf, South East Coast (Victoria) and Tanami – Timor Sea Coast

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



Total accessible capacity	July 2009		June 2010		% Change
	Accessible volume	% of accessible capacity	Accessible volume	% of accessible capacity	
78,500 GL	36,000 GL	46%	40,500 GL	52%	+6%

Comparison of water use between 2008–09 and 2009–10



Urban water use		Agricultural irrigation water use (natural resource management regions)	
Volume	Change	Volume	Change
1,568 GL in 2008–09 1,497 GL in 2009–10	-4.5%	6,530 GL in 2008–09 6,600 GL in 2009–10	+1%

Drivers of climatic condition in 2009–10

El Niño-Southern Oscillation	Central and eastern equatorial Pacific Ocean was warm (El Niño conditions) until February 2010 then cooled to La Niña conditions by April 2010. As a result the Southern Oscillation Index was negative until March 2010 then strongly positive
Indian Ocean Dipole	Positive during 2009 and negative during 2010

Major rainfall events in 2009–10

Timing	Location	Characteristics
22 February – 3 March 2010	Northern Territory, Queensland and far northern New South Wales	Monsoon low triggered very widespread heavy rainfall: 28 February – wettest day on record for the Northern Territory, 2 March – wettest day on record for Queensland

Major flood events in 2009–10

Timing	Location	Characteristics
February– March 2010	Gulf of Carpentaria, Lake Eyre Basin, North East Coast, Murray–Darling Basin	Short but large flood peaks in the major tributaries of the Darling River, with an estimate of only 15% reaching Menindee Lakes in western New South Wales

*A rank of 1 indicates the lowest annual result on record, 99 the highest on record

2.2 Landscape water flows

The modelled landscape water flow components are introduced in Section 1.3.

Figure 2-1 shows the ranking and spatial distribution of three key landscape water flows (rainfall, evapotranspiration and landscape water yield) across Australia in 2009–10. Ranking is in deciles with respect to the 1911–2010 period. Table 2-2 summarises these landscape water flows by region.

Rainfall was higher than average throughout much of the country, with the Lake Eyre Basin and Carpentaria Coast regions receiving well above average rainfall. In contrast, conditions were relatively dry in parts of South East Coast (NSW) and the northeast of the Murray–Darling Basin regions. In Western Australia, the South West Coast and Pilbara–Gascoyne regions received well below average rainfall.

Evapotranspiration for the year was higher than average across most inland areas, especially in the Lake Eyre Basin. Below average levels of evapotranspiration occurred in west and southwest Western Australia (the South West Coast and Pilbara–Gascoyne regions) and parts of the North East Coast, South East Coast (NSW), Murray–Darling Basin and South East Coast (Victoria) regions.

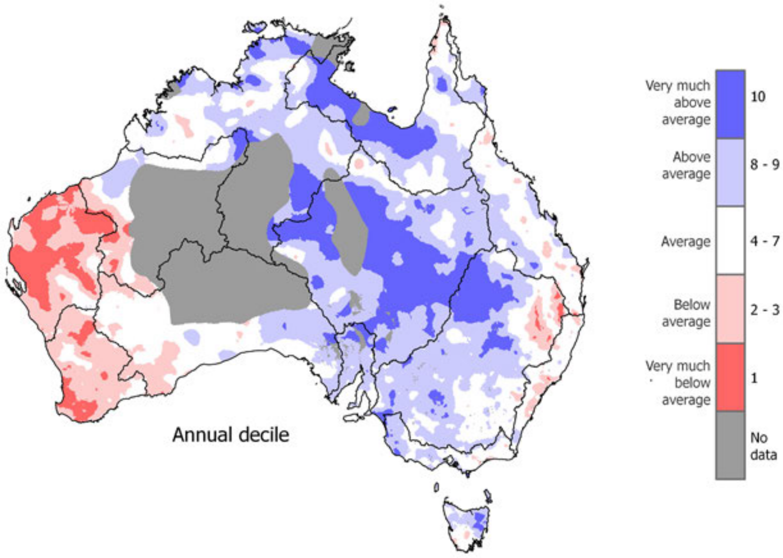
Landscape water yield for the year was above average in most parts of the country, including the majority of the Murray–Darling Basin region, with the exception of southwest Western Australia and coastal Victoria and New South Wales.

Table 2-2. Region average rainfall, evapotranspiration and landscape water yield in 2009–10 by region, with highest (blue) and lowest (red) values in each component (column) highlighted

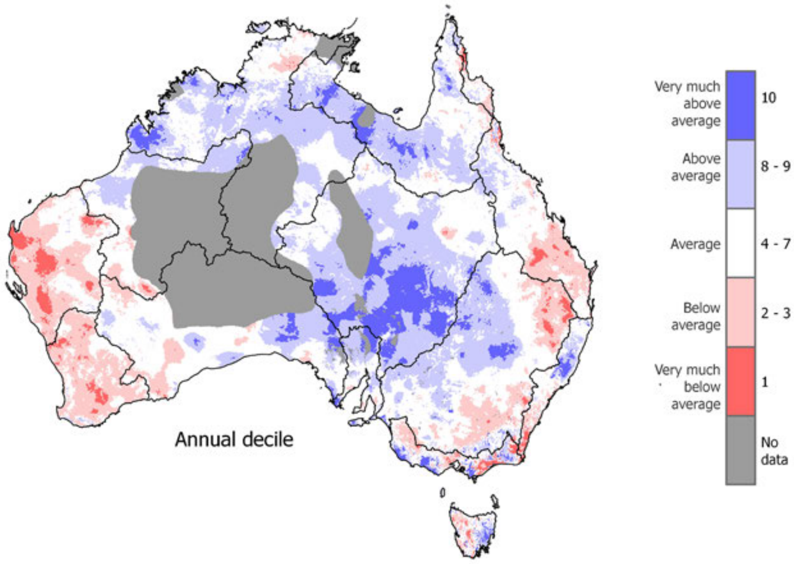
	Region average in 2009–10 (mm)			Rank (out of 99)*		
Region	Rainfall	Evapo-transpiration	Landscape water yield	Rainfall	Evapo-transpiration	Landscape water yield
North East Coast	866	675	172	64	42	73
South East Coast (NSW)	913	**840**	140	39	55	53
South East Coast (Victoria)	773	603	59	69	33	**11**
Tasmania	**1,481**	631	**769**	69	53	74
Murray–Darling Basin	533	428	45	81	55	78
South Australian Gulf	367	291	24	85	78	66
South Western Plateau	220	222	**6**	48	55	29
South West Coast	346	373	24	11	**15**	20
Pilbara–Gascoyne	**132**	**195**	9	**5**	19	12
North Western Plateau	311	297	48	52	65	76
Tanami – Timor Sea Coast	775	602	157	82	76	85
Lake Eyre Basin	387	220	74	**92**	81	**96**
Carpentaria Coast	976	679	268	89	**82**	94

*Indicates the lowest annual result on record, 99 the highest on record

Rainfall



Evapotranspiration



Landscape Water Yield

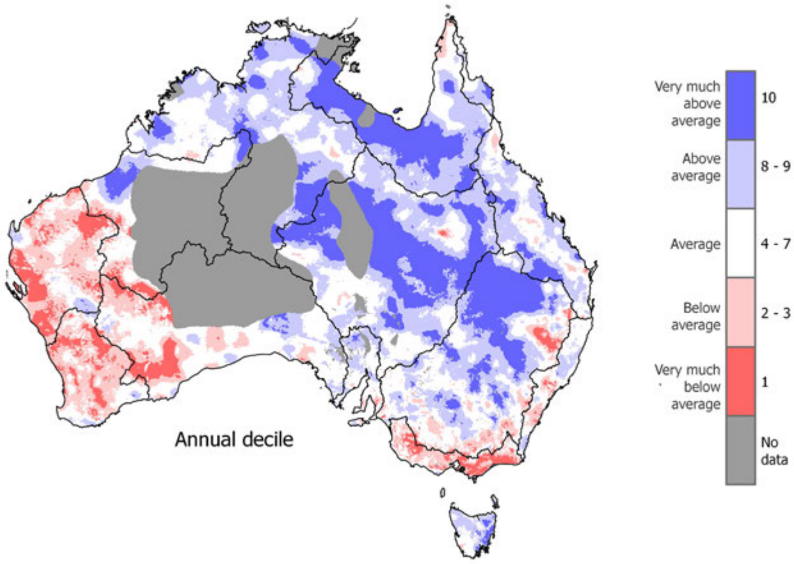


Figure 2-1. Maps of rainfall (top), evapotranspiration (middle) and landscape water yield (bottom) decile ranges for 2009–10 totals with respect to the 1911–2010 record

2.3 Soil moisture store

Deep soil moisture stores were modelled and estimated to have generally increased across the country in 2009–10. This indicated more favourable conditions for agriculture and drainage of soil moisture below the root zone and potentially groundwater recharge.

Figure 2-2 shows the modelled soil moisture in the deep soil layer at the beginning and end of the 2009–10 year.

Soil moisture conditions in 2009–10 are presented as decile ranges for the 1911–2010 period.

The most notable increases were in the Carpentaria Coast, North East Coast, Lake Eyre Basin and Murray–Darling Basin regions. The South Australian Gulf, South East Coast (Victoria) and Tanami – Timor Sea Coast regions also experienced increases in deep soil moisture storage.

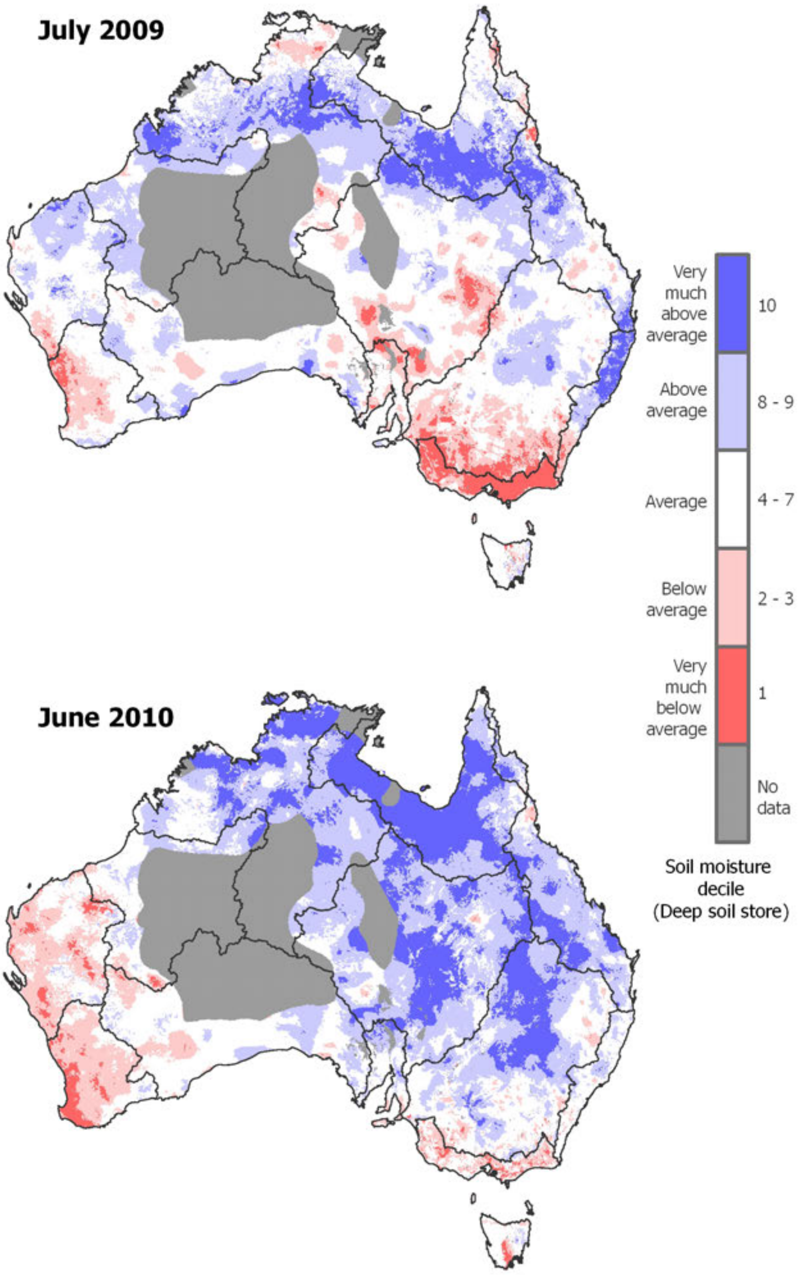


Figure 2-2. Modelled deep soil moisture store deciles for July 2009 and June 2010 with respect to the 1911–2010 record

2.4 Groundwater

National coverage of groundwater status in all major groundwater management units was not possible in this report due to the limited amount of quality-controlled data available in a suitable form.

The status of groundwater levels was evaluated in a number of aquifers in two regions where data were available. The data are presented in terms of linear trends for the period of 2005–10. The trends in groundwater levels in a subsystem are categorised for each 20 km grid square (Murray–Darling Basin) or 5 km grid square (South Australian Gulf).

The following categories are assigned when greater than or equal to 60 per cent of the bores in a grid square have a linear trend that is:

- lower than -0.1 m/year – decreasing
- between -0.1 m/year and 0.1 m/year – stable
- higher than 0.1 m/year – increasing
- has no dominant tendency – variable.

As indicated above, the analysis was constrained by the limited amount of quality controlled data accessible in a suitable form available to the Bureau. The results are summarised in the tables below.

Table 2-3. Groundwater status for aquifers in the Murray–Darling Basin region

Groundwater subsystem	Change in groundwater levels
Condamine	decreasing or variable
Narrabri and Gunnedah	decreasing or variable
Cowra and Lachlan	decreasing
Shepparton	decreasing
Calivil	decreasing
Murray Group	decreasing or stable
Renmark	decreasing

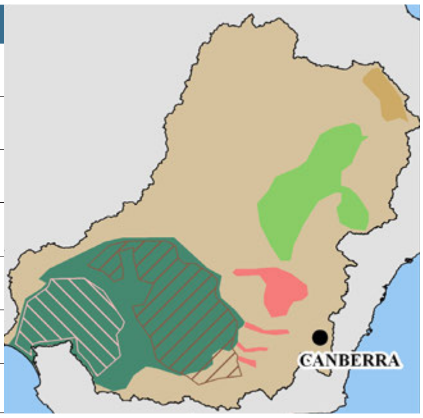


Table 2-4. Groundwater status for aquifers in the South Australian Gulf region

Groundwater subsystem	Change in groundwater levels
Adelaide Plains watertable aquifer (upper)	decreasing
Tertiary aquifer T1 (middle)	decreasing
Tertiary aquifer T2 (lower)	decreasing
McLaren Vale watertable (upper)	decreasing or stable
Port Willunga (middle)	decreasing
Maslin Sands (lower)	decreasing or stable

2.5 Surface water storage

The total volume of water stored in major public water storages in Australia at the end of 2009–10 was at 51.6 per cent of their total accessible capacity which represented a 5.9 per cent increase compared with the previous year. The changes in storage varied between regions as shown in Table 2-5. As a percentage of total capacity, the biggest increase in storage was in the Murray–Darling Basin region (+12.5 per cent) and the biggest decrease was in the Tanami – Timor Sea Coast region (-17.1 per cent). These two regions also had the biggest increase and decrease in storage respectively in terms of volume of water.

Table 2-5. Change in surface water storage over 2009–10 by region

Region	Volume in storage (GL)[2]			Per cent of total accessible capacity		
	1 July 2009	30 June 2010	Difference	1 July 2009	30 June 2010	Difference
North East Coast	6,573	7,615	+1,042	77.1	89.4	+12.3
South East Coast (NSW)	2,402	2,237	-165	65.3	60.8	-4.5
South East Coast (Victoria)	891	1,288	+397	12.8	18.6	+5.8
Tasmania	10,209	11,969	+1,760	46.1	54.1	+8.0
Murray–Darling Basin	5,057	8,200	+3,143	20.1	32.5	+12.4
South Australian Gulf	107	109	+2	54.3	55.3	+1.0
South West Coast	339	367	+28	35.3	38.3	+3.0
Tanami – Timor Sea Coast	10,398	8,571	-1,827	97.3	80.2	-17.1
Carpentaria Coast	94	92	-2	94.9	92.9	-2.0

2. Refers to the accessible volume of water held in those storages listed in the Bureau's water storage database (http://water.bom.gov.au/waterstorage/awris/index.html).

2.6 Water use

2.6.1 Urban water use

The past decade was characterised by low rainfall conditions in the south, east and west of the country that resulted in the implementation of water restrictions in most cities and towns. Water restrictions led to a reduction of total urban water consumption for the eight major urban centres considered in this report, from a total of approximately 1,719 GL in 2005–06 to 1,497 GL in 2009–10 (National Water Commission 2011a). In the residential sector however, consumption has increased from 2007–08 as a result of higher rainfall and expectation of water security projects being completed. In 2009–10 the residential consumption of the urban centres considered in this report increased by 3.2% compared to 2008–09 and accounted for approximately 68 per cent of use whilst commercial, municipal and industrial used 24 per cent.

2.6.2 Agricultural water use

Annual agricultural water use in Australia between 2005 and 2010 is summarised in Table 2-6. Average annual water use for agriculture over the period was 8,369 GL, with approximately 90 per cent (7,551 GL) used for irrigation. Water use for irrigation decreased by about 30 per cent after 2005–06 (see Figure 2-3) as a result of drought over the majority of Australia. The decline in irrigation water use was most prominent in the Murray–Darling Basin compared to the rest of Australia.

Table 2-6. Agricultural water use in Australia between 2005 and 2010 (Australian Bureau of Statistics 2007; 2008; 2009; 2010a; 2011)

Water use category	Total annual water use (GL)				
	2005–06	2006–07	2007–08	2008–09	2009–10
Irrigation*	10,737	7,636	6,285	6,501	6,596
Other agriculture^	951	885	704	785	763
Total agriculture	**11,688**	**8,521**	**6,989**	**7,286**	**7,359**

* Total volume applied

^ Including stock drinking, dairy and piggery cleaning

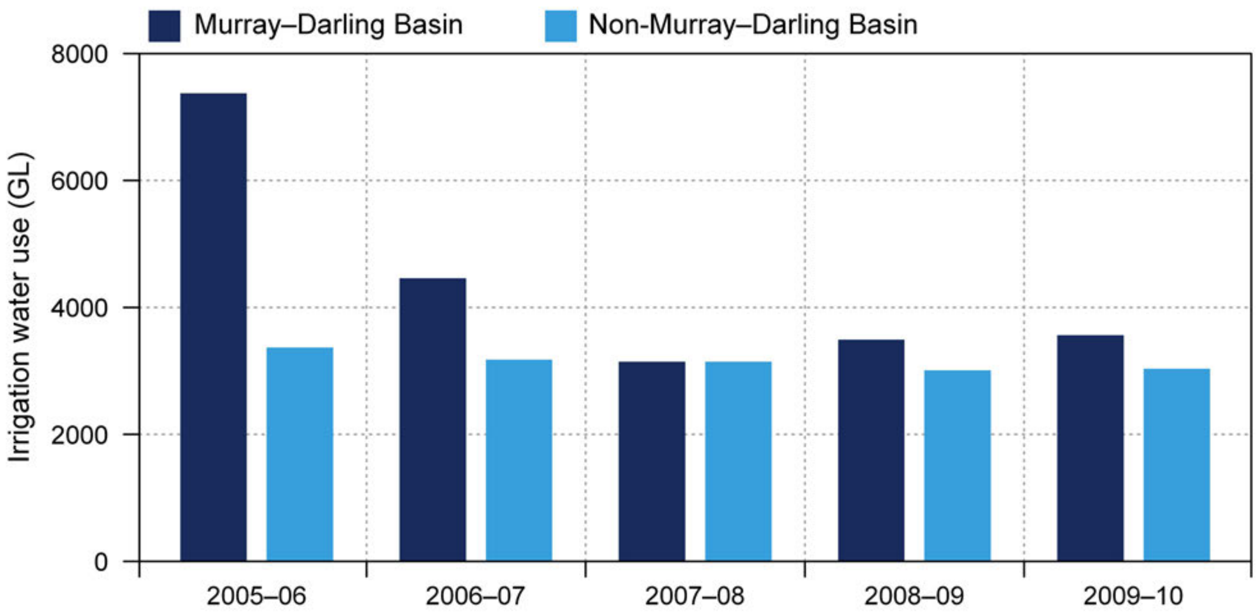


Figure 2-3. Changes in irrigation water use between 2005 and 2010

3. North East Coast

3.1 Regional overview

The North East Coast region is the long, narrow area of Queensland between the Great Dividing Range and the Coral Sea. It is bounded at the north by Torres Strait and in the south by the Queensland–New South Wales border. The region covers 451,000 km^2 of land area and includes some of the most topographically diverse terrain in Australia. 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 and winter rainfall is more reliable in the south.

The region has a population greater than 3.5 million. The largest population centres are Brisbane, the Gold Coast and the Sunshine Coast in the southeast.

Rainfall and evapotranspiration for the region were close to average for 2009–10. High summer rainfall resulted in large increases in water levels in major storages and also reduced irrigation water demand.

Increases in soil moisture levels during summer and autumn 2010 resulted in above average landscape water yield. Deep soil moisture stores are estimated to have generally increased across the region in 2009–10, indicating more favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Table 3-1 highlights the key water information for this region for 2009–10.

3.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 3-1. 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.

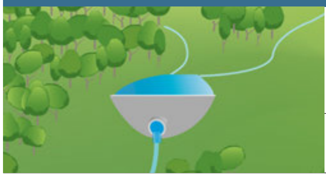
Landscape water yield for the North East Coast region for 2009–10 was above the region's long-term (July 1911 to June 2010) average. Highest values were observed along the eastern coast with a sharply decreasing gradient to the west of the region (Figure 3-2 [a]). Landscape water yield deciles for 2009–10, shown in Figure 3-2 (b), indicate above average yield values across much of the west, along the southern coast and in areas to the north of the region. Average and below average values are identified through the region's centre.

Table 3-1. Key information on water flows, stores and use in the North East Coast region

Landscape water balance

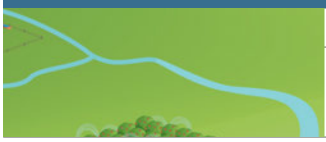
	During 2009–10			During the past 30 years	
	Region average	**Difference from long-term mean**	**Rank (out of 99)***	**Highest value (year)**	**Lowest value (year)**
Rainfall	866 mm	+5%	64	1,124 mm (1988–89)	533 mm (1992–93)
Evapotranspiration	675 mm	-3%	42	818 mm (1998–99)	515 mm (1994–95)
Landscape water yield	172 mm	+25%	73	317 mm (1990–91)	51 mm (1986–87)

Surface water storage (comprising approximately 83% of the region's total surface water storage)



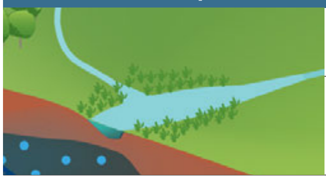
Total accessible capacity	July 2009		June 2010		% Change
	Accessible volume	**% of accessible capacity**	**Accessible volume**	**% of accessible capacity**	
8,520 GL	6,573 GL	77.1%	7,615 GL	89.4%	+12.3%

Measured streamflow in 2009–10



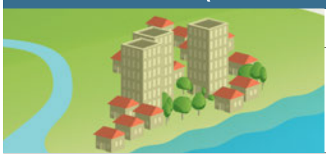
Northern rivers	Central north rivers	Central south rivers	Southern rivers
Average to above average	Average to above average	Above average to very much above average	Predominantly average

Wetlands inflow patterns in 2009–10



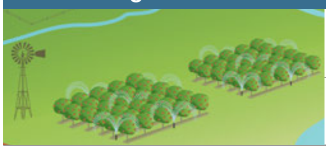
Bowling Green Bay	Great Sandy Straight	Moreton Bay	Southern Fitzroy River Floodplain complex
Average to above average in summer	Average to above average in late summer	Variable, above average in late summer	Average to exceptionally high in late summer

Urban water use (Brisbane and Gold Coast)



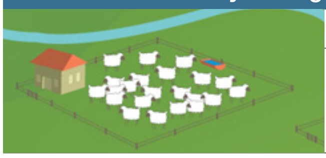
Water supplied 2009–10	Trend in recent years	Restrictions
176 GL	Steady (low relative to historical levels)	Eased from Medium level to Permanent Water Conservation

Annual irrigation water use in 2009–10 for the natural resource management regions



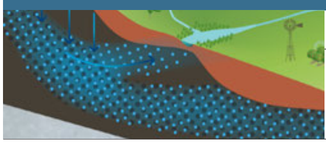
Burdekin	Burnett-Mary	Fitzroy	Mackay	South East	Wet tropics	Cape York
453 GL	252 GL	192 GL	179 GL	143 GL	107 GL	3 GL

Soil moisture for dryland agriculture



Summer 2009–10 (November–April)	Winter 2010 (May–October)
Average and above average in most areas, very much above average in the far west of the region	Above average to very much above average across almost the entire region

Groundwater levels for selected groundwater management units in 2009–10



Callide	Burdekin
Below average	Above average

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

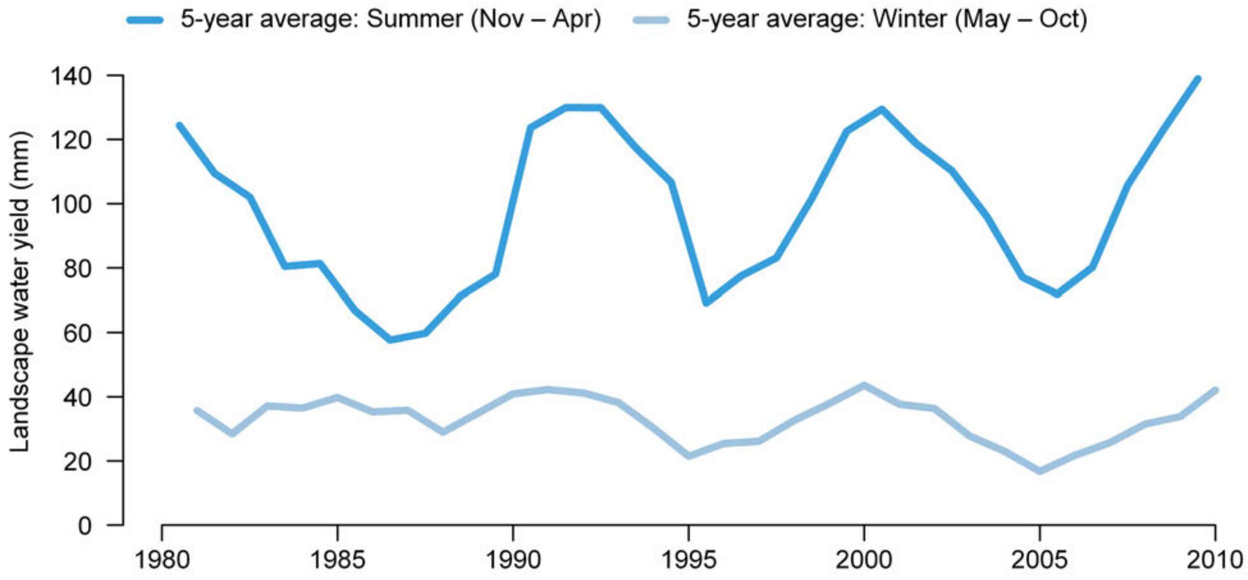


Figure 3-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the North East Coast region

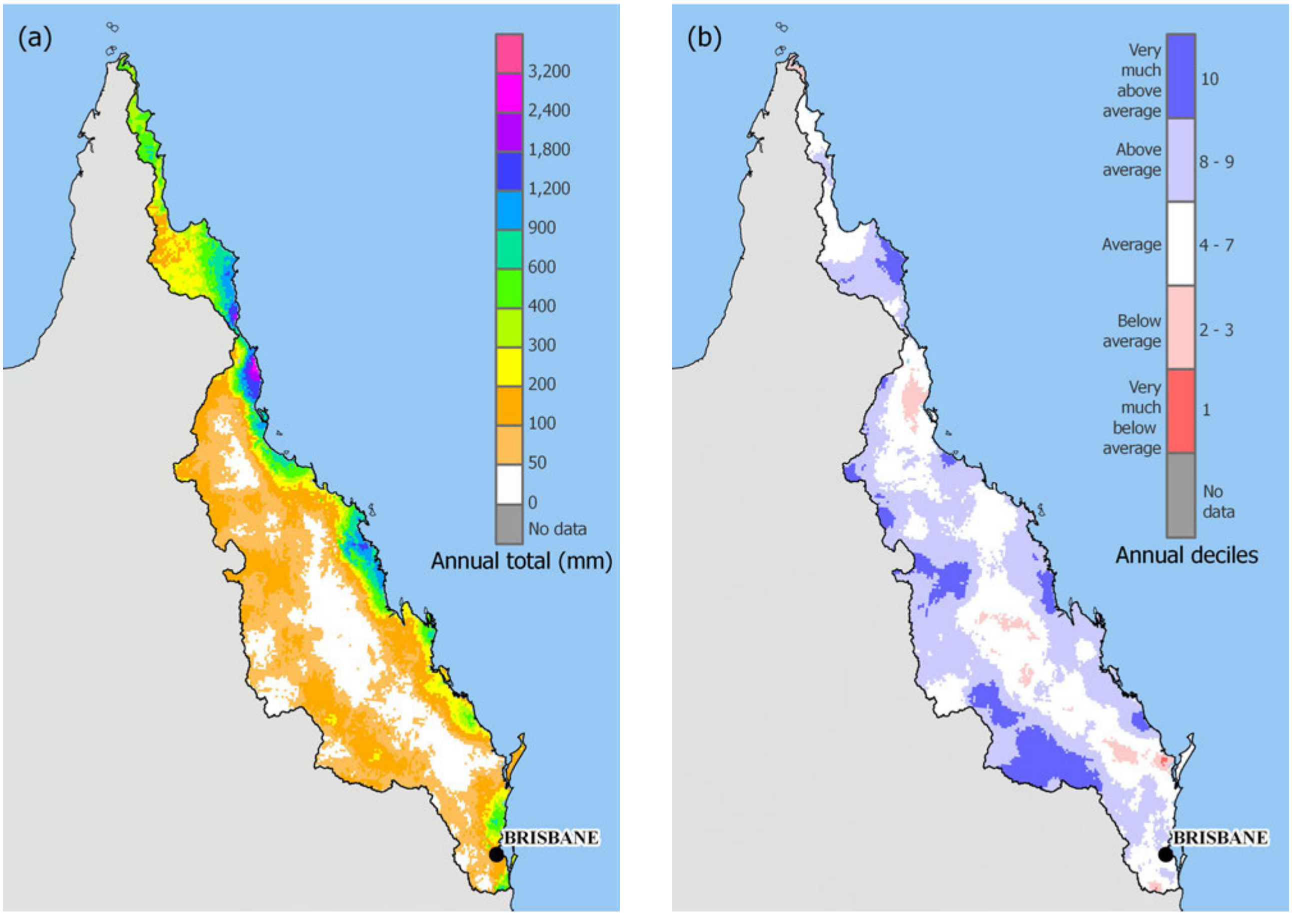


Figure 3-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the North East Coast region

4. South East Coast (NSW)

4.1 Regional overview

The South East Coast (NSW) region is part of the long, narrow area of eastern Australia between the Great Dividing Range and the sea. It is bound by the New South Wales–Queensland border in the north, and the boundary between the Towamba and East Gippsland river basins in the south. The region covers all of coastal New South Wales, with a total area of 129,500 km^2. The climate is warm and temperate with a moderate and generally reliable rainfall at the proximity of the coast.

The region has a population of over 4.7 million including the most populous city in Australia, Sydney, which is surrounded by heavily urbanised and industrialised areas.

The year 2009–10 was below average for rainfall and average for evapotranspiration. The landscape water yield total remained average, mainly due to the internal regional distribution of both rainfall and landscape water yield.

Soil moisture change reflected the below average rainfall amounts in combination with average evaporation totals. Deep soil moisture stores are estimated to have generally decreased across the region in 2009–10, indicating less favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Table 4-1 highlights the key water information in this region for 2009–10.

4.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 4-1. The data indicate a general reduction in regional landscape water yield for both the summer and winter seasons since the wetter period of the early 1990s. The relatively wet 1980s are reflected in increasing seasonal landscape water yield averages from the early 1980s through to the early 1990s.

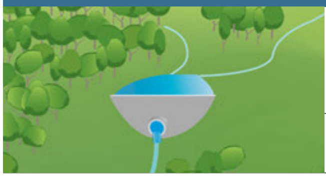
Figure 4-2 (a) provides spatial representation of landscape water yield totals throughout the region. Landscape water yield in 2009–10 was highest across the higher rainfall areas along the coast in the northern half and far south of the region. Landscape water yield deciles for 2009–10, shown in Figure 4-2 (b), indicate below average and very much below average landscape water yield across central and central-south areas of the region. Some areas in the central-north and far south experienced above average landscape water yields.

Table 4-1. Key information on water flows, stores and use in the South East Coast (NSW) region

Landscape water balance

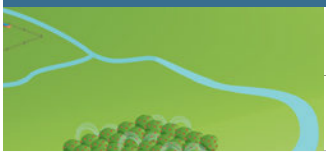
	During 2009–10			During the past 30 years	
	Region average	Difference from long-term mean	Rank (out of 99)*	Highest value (year)	Lowest value (year)
Rainfall	913 mm	-8%	39	1,491 mm (1988–89)	755 mm (2002–03)
Evapotranspiration	840 mm	+1%	55	923 mm (1988–89)	696 mm (1980–81)
Landscape water yield	140 mm	-8%	53	376 mm (1988–89)	62 mm (1997–98)

Surface water storage (comprising approximately 82% of the region's total surface water storage)



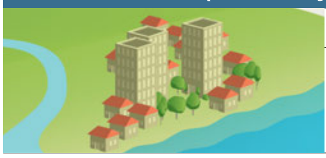
Total accessible capacity	July 2009		June 2010		
	Accessible volume	% of accessible capacity	Accessible volume	% of accessible capacity	% Change
3,679 GL	2,402 GL	65.3%	2,237 GL	60.8%	-4.5%

Measured streamflow in 2009–10



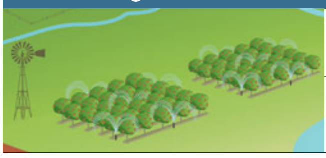
Far and mid-north coast rivers	Central coast rivers	South coast rivers
Average to above average	Below normal to exceptionally low	Below average to above average

Urban water use (Greater Sydney)



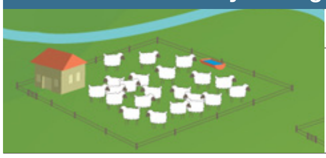
Water supplied 2009–10	Trend in recent years	Restrictions
506 GL	Steady	Eased from mandatory level 3 to Water Wise Rules

Annual irrigation water use in 2009–10 for natural resource management regions



Hunter–Central Rivers	Northern Rivers	Hawkesbury–Nepean	Southern Rivers	Sydney Metro
81 GL	34 GL	52 GL	13 GL	2 GL

Soil moisture for dryland agriculture



Summer 2009–10 (November–April)	Winter 2010 (May–October)
Average in most areas, above average in some central parts of the region	Above average and very much above average in the north and northwest, average in most other areas

*A rank of 1 indicates the lowest annual result on record, 99 the highest on record

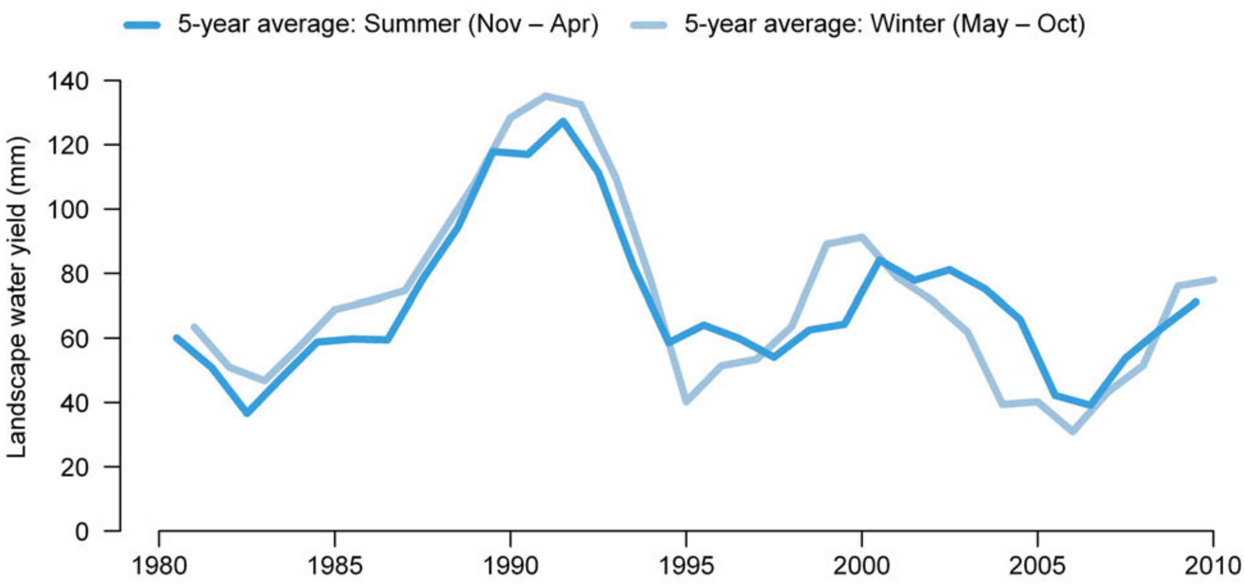


Figure 4-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the South East Coast (NSW) region

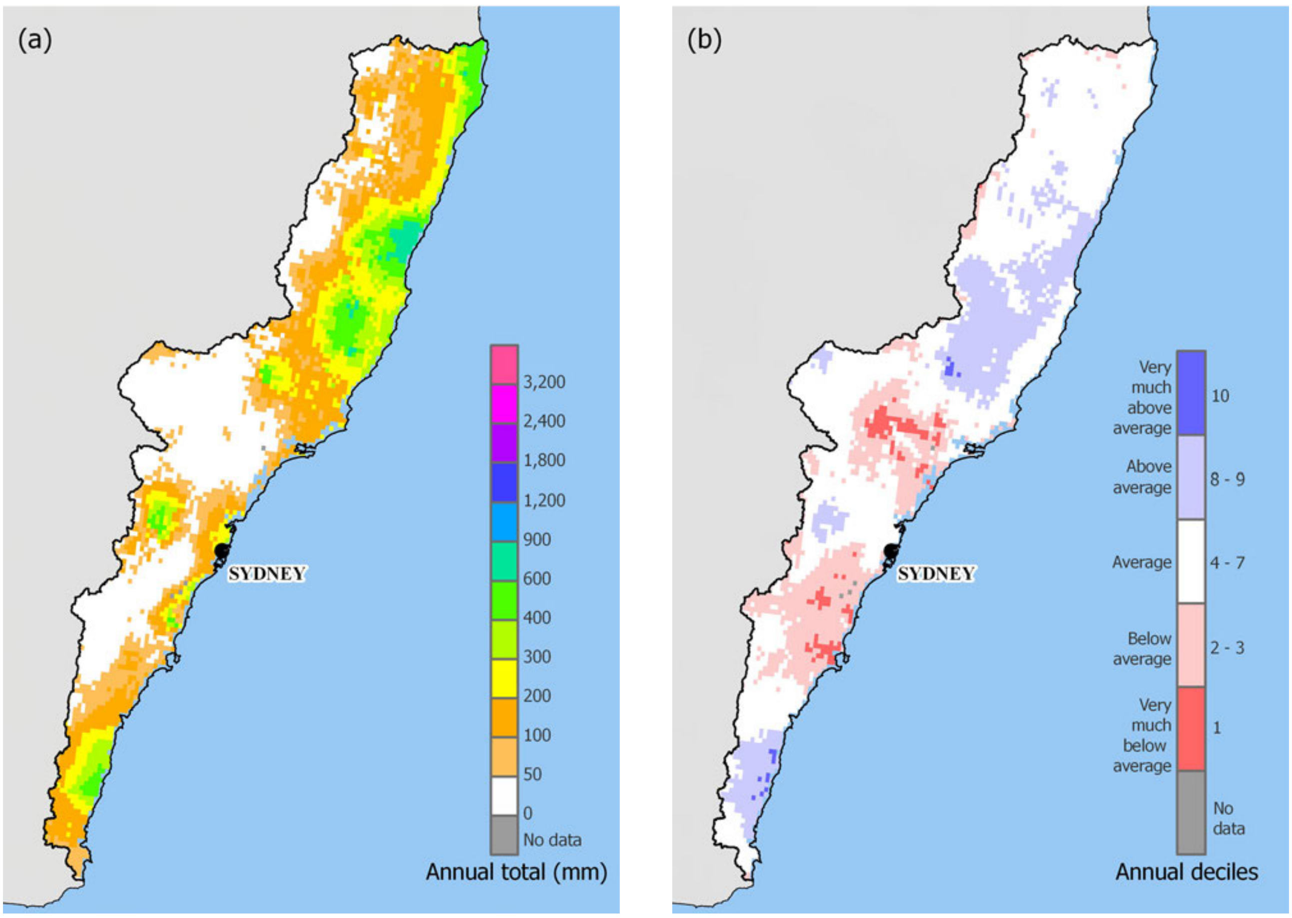


Figure 4-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the South East Coast (NSW) region

5. South East Coast (Victoria)

5.1 Regional overview

The South East Coast (Victoria) region is a long east-west strip in southern Victoria. It is bounded 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 covers approximately 134,600 km^2 of land area. The region's climate is warm and temperate which is merged with a moderate Mediterranean climate in the south.

The region supports a population of more than 4.4 million. The largest population centre is Melbourne in the south. Other centres with populations greater than 25,000 include Geelong, Ballarat, Melton, Warrnambool and Sunbury.

The year 2009–10 was average for rainfall and evapotranspiration. There was a substantial increase in the soil moisture content as a result of which the annual landscape water yield total was below average for the region as a whole. The northern highlands, however, received average landscape water yields and the surface water levels rose in the main water storages in this part of the region.

Deep soil moisture stores are estimated to have generally increased across the region in 2009–10, indicating more favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Table 5-1 highlights the key water information for this region for 2009–10.

5.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 5-1. Regionally, landscape water yield is consistently higher during the winter period, although the magnitude of this difference is much reduced towards the end of the period. The wet period experienced during the early and mid-1990s is clearly reflected in both the seasonal averages. Since the mid-1990s there is a clear downward trend, in particularly during the winter season.

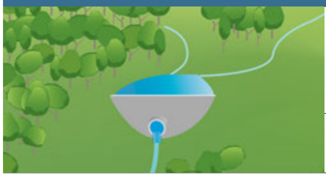
Figure 5-2 (a) provides a spatial representation of the landscape water yield during 2009–10, which shows a relatively low water yield across much of the region with the highest values occurring in the high rainfall areas along the north-eastern boundary of the region. Landscape water yield deciles for 2009–10, shown in Figure 5-2 (b), indicate landscape water yield was very much below average across the majority of the region with limited areas of average values.

Table 5-1. Key information on water flows, stores and use in the South East Coast (Victoria) region

Landscape water balance

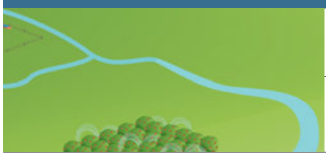
	During 2009–10			During the past 30 years	
	Region average	Difference from long-term mean	Rank (out of 99)*	Highest value (year)	Lowest value (year)
Rainfall	773 m	+5%	69	855 mm (1992–93)	571 mm (2002–03)
Evapotranspiration	603 mm	-1%	33	635 mm (1988–89)	535 mm (1982–83)
Landscape water yield	59 mm	-4 %	11	195 mm (1992–93)	41 mm (2008–09)

Surface water storage (comprising approximately 91% of the region's total surface water storage)



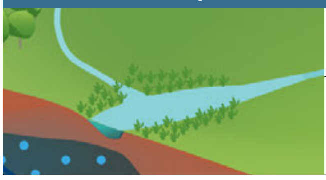
Total accessible capacity	July 2009		June 2010		% Change
	Accessible volume	% of accessible capacity	Accessible volume	% of accessible capacity	
6,940 GL	891 GL	12.8%	1,288 GL	18.6%	+5.8%

Measured streamflow in 2009–10



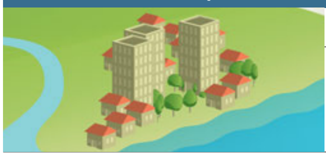
Western rivers	Inner western rivers	Eastern inland rivers	Eastern coastal rivers
Predominantly average	Below to very much below average	Predominantly average	Below to very much below average

Wetlands inflow patterns in 2009–10



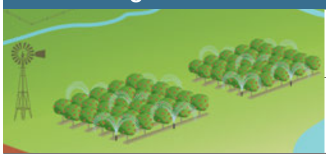
Western district lakes	Gippsland lakes	Reedy Creek – Connewarre wetland complex
Average to below average	Above average in late summer, else predominantly below average	Average to below average

Urban water use (Melbourne)



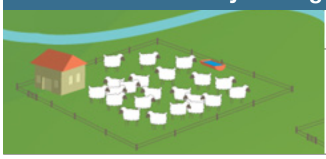
Water supplied 2009–10	Trend in recent years	Restrictions
349 GL	Slight decrease	Eased from level 3a to level 3

Annual irrigation water use in 2009–10 for the natural resource management regions



Southeast	West Gippsland	Glenelg Hopkins	Port Phillip and Westernport	Corangamite	East Gippsland
345 GL	282 GL	72 GL	79 GL	13 GL	16 GL

Soil moisture for dryland agriculture



Summer 2009–10 (November–April)	Winter 2010 (May–October)
Average to very much below average in the east, below average to very much above average in the west	Average to below average in the east, average to very much above average in the west

*A rank of 1 indicates the lowest annual result on record, 99 the highest on record

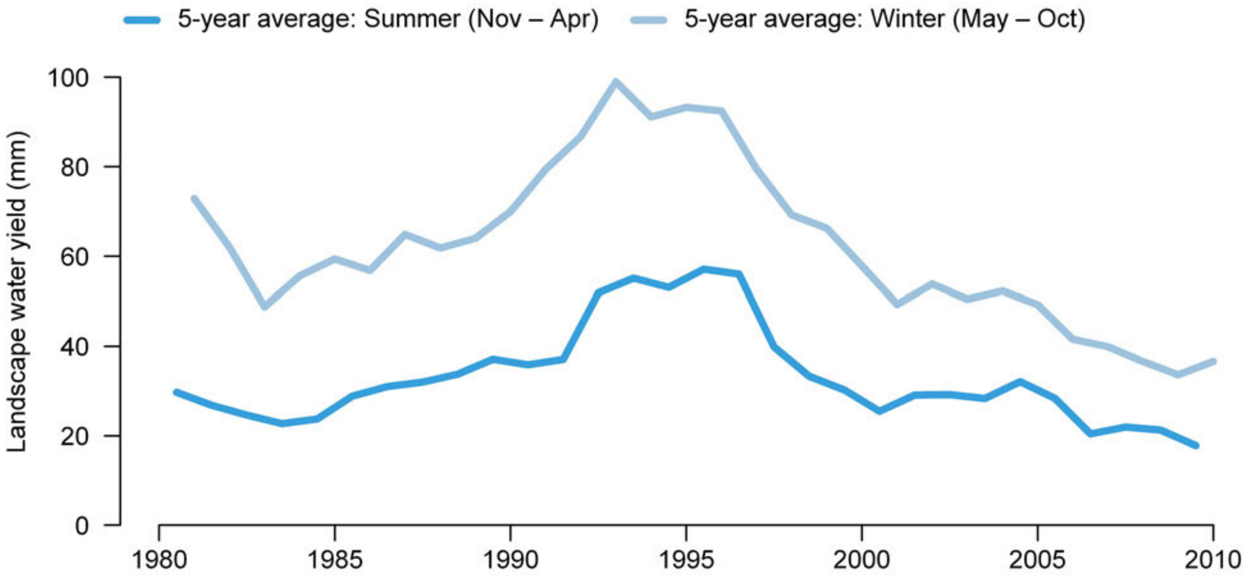


Figure 5-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the South East Coast (Victoria) region

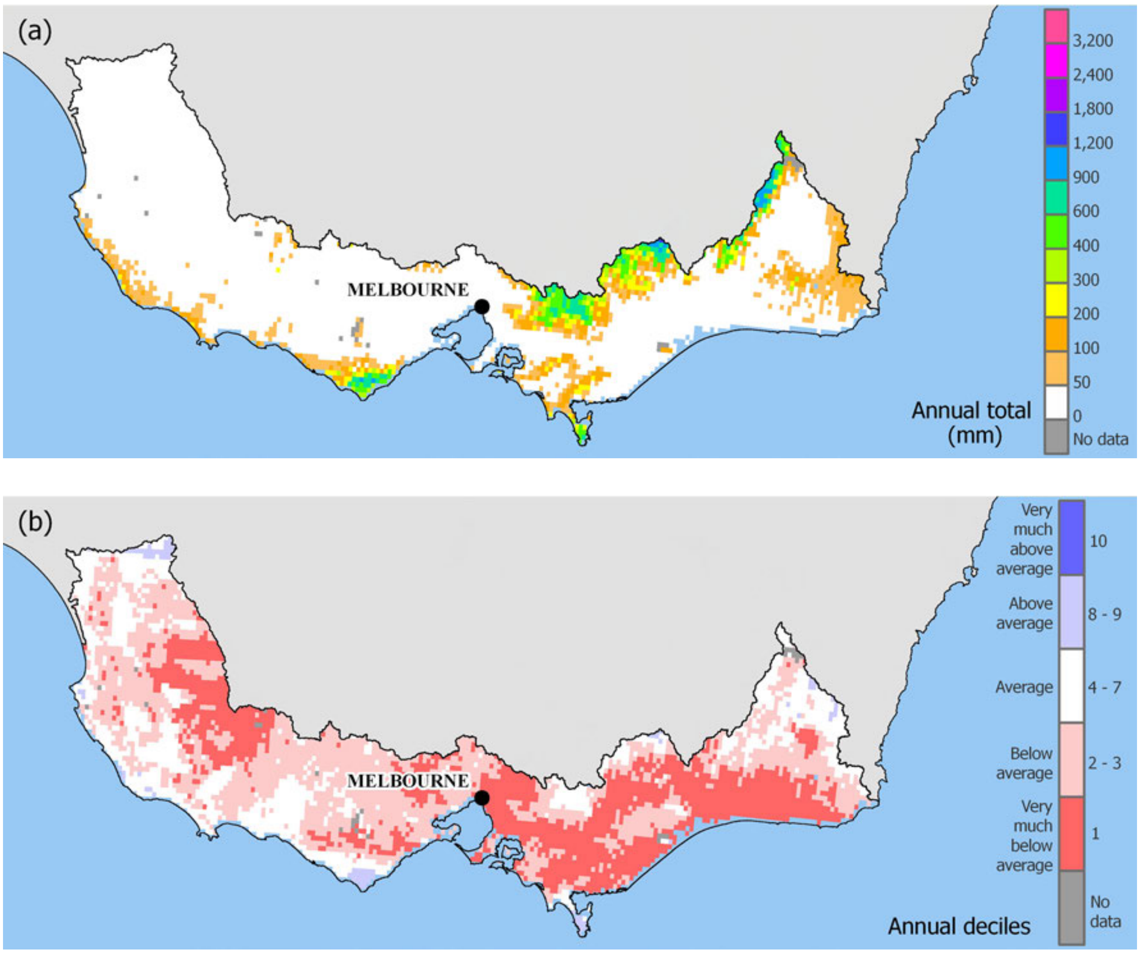


Figure 5-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and decile rankings over the 1911–2010 period (b) for the South East Coast (Victoria) region

6. Tasmania

6.1 Regional overview

Tasmania is the smallest of Australia's States with a total land size of approximately 68,000 km^2. It is separated from the Australian mainland by Bass Strait. River basins on the island vary in size from 685 to 11,700 km^2. The region has a cool temperate climate with snowfall occurring in late winter and early spring.

Tasmania's population is about 500,000, with more than 200,000 residing in Greater Hobart followed by Greater Launceston with a population of less than 100,000. Devonport and Burnie are other notable centres, both with populations less than 25,000.

The year 2009–10 was average for rainfall and evapotranspiration. However, as rainfall was in the top end of the average range and evaporation was close to average, a wet year in regards to landscape water yield took place.

Soil moisture levels, on the other hand, decreased by six per cent due to local patterns in rainfall and evapotranspiration and soil storage capacities. Surface water storage volumes rose substantially, in line with the landscape water yield result. Deep soil moisture stores are estimated to have generally decreased across the region in 2009–10, indicating less favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Table 6-1 highlights the key water information for this region for 2009–10.

6.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 6-1. Landscape water yield in winter is consistently very much higher than in summer, reflecting the seasonal nature of landscape water yield in the region. Landscape water yield for the winter period also exhibits a greater level of interannual variability compared to the summer period.

Landscape water yield total for the Tasmania region for 2009–10 was above the region's long-term (July 1911 to June 2010) average. Figure 6-2 (a) shows that landscape water yield for 2009–10 was highest across upland areas on the western side of Tasmania and very much lower across the lower lying areas of the centre and east of the region.

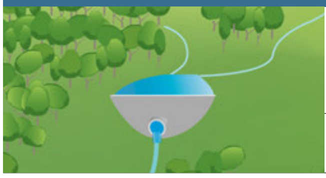
Landscape water yield deciles for 2009–10, shown in Figure 6-2 (b), indicate areas of above average and very much above average yield across the east and north of the region. Average conditions were experienced across much of the southwest of Tasmania with limited areas of below average yield.

Table 6-1. Key information on water flows, stores and use in the Tasmania region

Landscape water balance

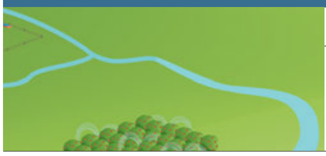
	During 2009–10			During the past 30 years	
	Region average	Difference from long-term mean	Rank (out of 99)*	Highest value (year)	Lowest value (year)
Rainfall	1,481 mm	+6%	69	1,568 mm (2003–04)	1,077 mm (2006–07)
Evapotranspiration	631 mm	0%	53	661 mm (1985–86)	556 mm (1994–95)
Landscape water yield	769 mm	+11%	74	832 mm (2003–04)	432 mm (1987–88)

Surface water storage (comprising approximately 100% of the region's total surface water storage)



Total accessible capacity	July 2009		June 2010		% Change
	Accessible volume	% of accessible capacity	Accessible volume	% of accessible capacity	
22,141 GL	10,209 GL	46.1%	11,969 GL	54.1%	+8.0%

Measured streamflow in 2009–10

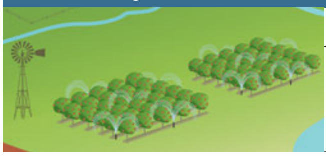


North western rivers	North eastern rivers	South eastern rivers
Above average	Above average to very much above average	Average to above average

Wetlands inflow patterns in 2009–10

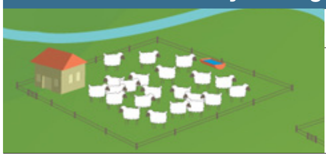
Lower Ringarooma Floodplain	Apsley Marshes estuarine
Above average in winter, average to below average in summer	Predominantly (very much) above average

Annual irrigation water use in 2009–10 for the natural resource management regions



North Tasmania	North West Tasmania	South Tasmania
139 GL	84 GL	59 GL

Soil moisture for dryland agriculture



Summer 2009–10 (November–April)	Winter 2010 (May–October)
Below average in the north and south, average and above average in the east	Generally average in the north and west, below average in the south

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

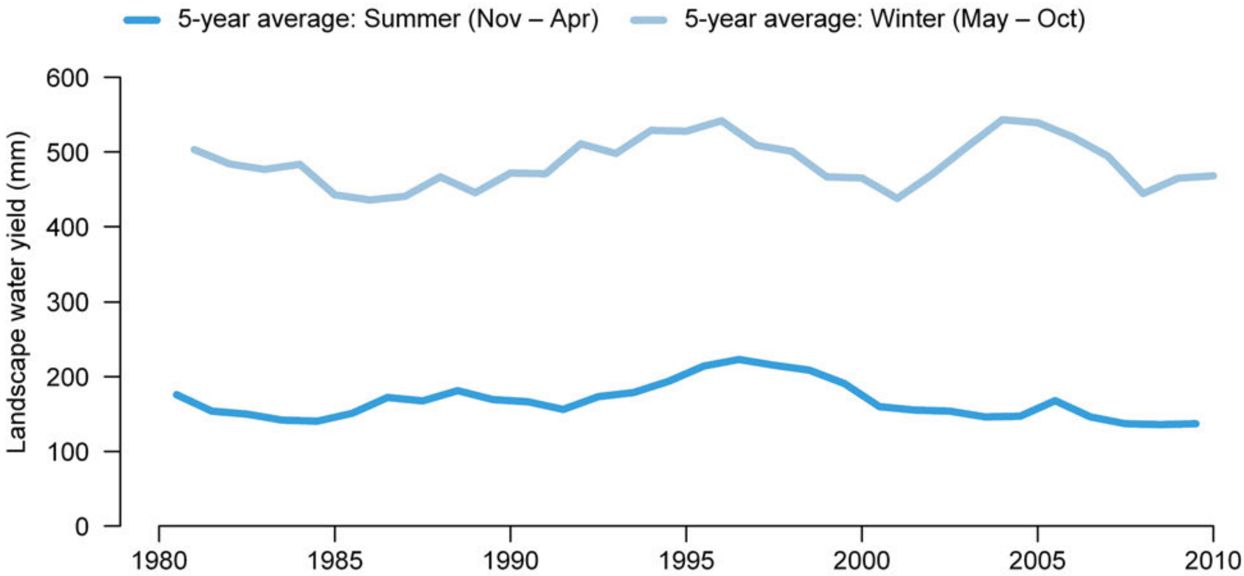


Figure 6-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Tasmania region

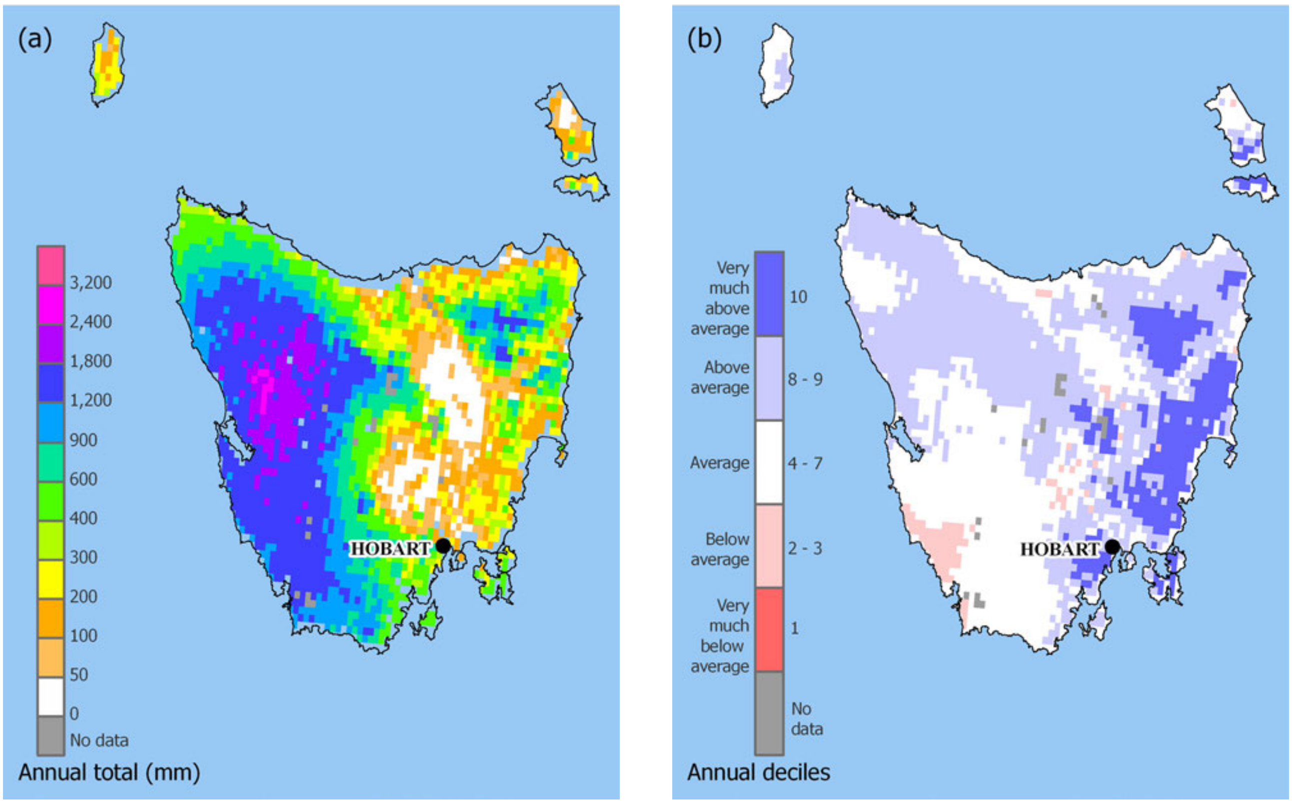


Figure 6-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Tasmania region

7. Murray–Darling Basin

7.1 Regional overview

The Murray–Darling Basin region covers more than one 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. It is bounded in the south and east by the Great Dividing Range. In the northwest (the border between the Paroo River and the neighbouring Bulloo River catchments) and southwest (the Wimmera River catchment), the boundaries are much less distinct.

The climatic conditions are diverse and vary from 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 has a population of over two million. The largest population centre is Canberra in the Murrumbidgee River basin. Other major centres with populations greater than 25,000 include Albury–Wodonga, Bathurst, Bendigo, Dubbo, Griffith, Mildura, Orange, Queanbeyan, Shepparton, Tamworth, Toowoomba and Wagga Wagga.

The year 2009–10 was a wet year for the Murray–Darling Basin region. The above average rainfall resulted in an above average landscape water yield. Evapotranspiration levels were average, which allowed for the total soil moisture to rise by ten per cent over the year. Surface water storage volumes also rose substantially.

Deep soil moisture stores are estimated to have generally increased across the region in 2009–10, indicating more favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Table 7-1 highlights the key water information for this region for 2009–10.

7.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 7-1. The graph shows that landscape water yield was estimated to be higher for winter than for summer until the early 1990s.

Figure 7-2 (a) shows landscape water yield for 2009–10 was highest in the New South Wales and Victorian Alps in the far southeast of the region. Relatively high levels of landscape water yield were also estimated to have occurred in the river basins of the central-east and northwest.

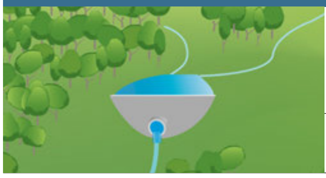
Landscape water yield deciles for 2009–10, shown in Figure 7-2 (b), indicate very much above average yield values across much of the centre and north of the region. Below average values occurred in the northeast and along much of the south-eastern and southern boundaries of the region.

Table 7-1. Key information on water flows, stores and use in the Murray–Darling Basin region

Landscape water balance

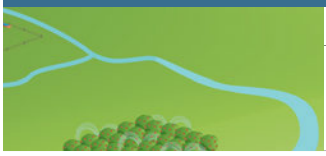
	During 2009–10			During the past 30 years	
	Region average	Difference from long-term mean	Rank (out of 99)*	Highest value (year)	Lowest value (year)
Rainfall	528 mm	+16%	81	615 mm (1988–89)	305 mm (2002–03)
Evapotranspiration	428 mm	+2%	55	517 mm (1983–84)	315 mm (1982–83)
Landscape water yield	45 mm	+30%	78	61 mm (1993–94)	13 mm (2006–07)

Surface water storage (comprising approximately 95% of the region's total surface water storage)



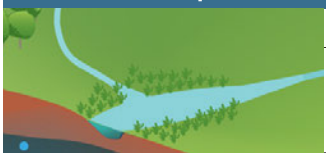
Total accessible capacity	July 2009		June 2010		% Change
	Accessible volume	% of accessible capacity	Accessible volume	% of accessible capacity	
25,210 GL	5,057 GL	20.1%	8,200 GL	32.5%	+12.4%

Measured streamflow in 2009–10



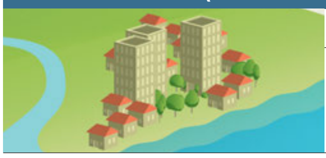
Central-north rivers	Eastern rivers	Southern rivers
Above average to very much above average	Below average to very much below average	Below average to very much below average

Wetlands inflow patterns in 2009–10



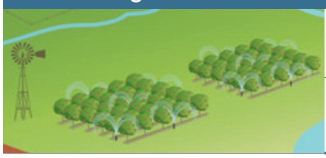
Currawinya lakes	Gwydir wetlands	Macquarie marshes	Barmah forest
Extremely high summer inflows	Predominantly below average	Predominantly below average	Predominantly below average

Urban water use (Canberra–Queanbeyan)



Water supplied 2009–10	Trend in recent years	Restrictions
42 GL	Steady (low relative to historical levels)	Continued Stage 3 restrictions

Annual irrigation water use in 2009–10 for the natural resource management regions



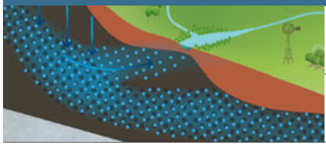
Murrumbidgee	Murray	Goulburn Broken	North Central (Vic)	Border Rivers – Gwydir
585 GL	318 GL	304 GL	363 GL	259 GL

Border Rivers – Maranoa Balonne	Namoi	SA Murray–Darling Basin	Mallee	Lachlan	Central West (NSW)
244 GL	214 GL	288 GL	320 GL	142 GL	117 GL

Lower Murray–Darling	Condamine	Western (NSW)	North East (Vic)	Wimmera	South West (Qld)
86 GL	166 GL	99 GL	28 GL	28 GL	5 GL

Table 7-1. Key information on water flows, stores and use in the Murray–Darling Basin region (continued)

Soil moisture for dryland agriculture		
	**Summer 2009–10 (November–April)**	**Winter 2010 (May–October)**
	Above average to very much above average in the west and centre, average to very much below average in eastern parts of the region	Very much above average over the most of the region, average over parts of the far south

Groundwater levels for selected aquifers in 2009–10						
	**Condamine**	**Narrabri Gunnedah**	**Cowra Lachlan**	**Shepparton Calivil**	**Murray Group**	**Renmark**
	Below average	Below average	Below average	Below average	Below average	Below average

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

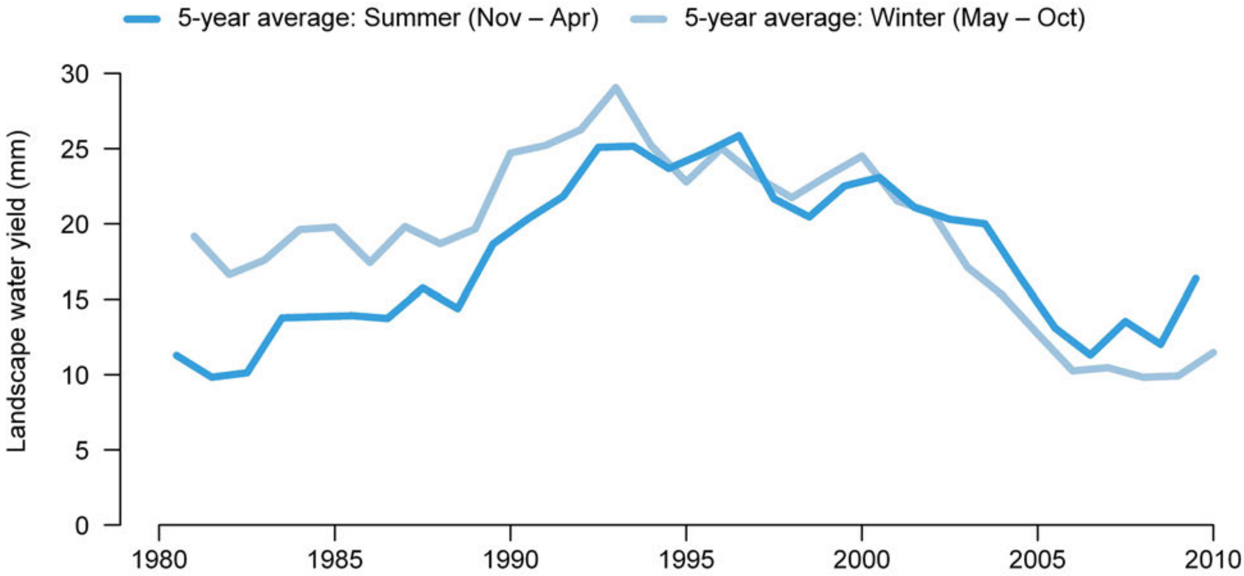


Figure 7-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Murray–Darling Basin region

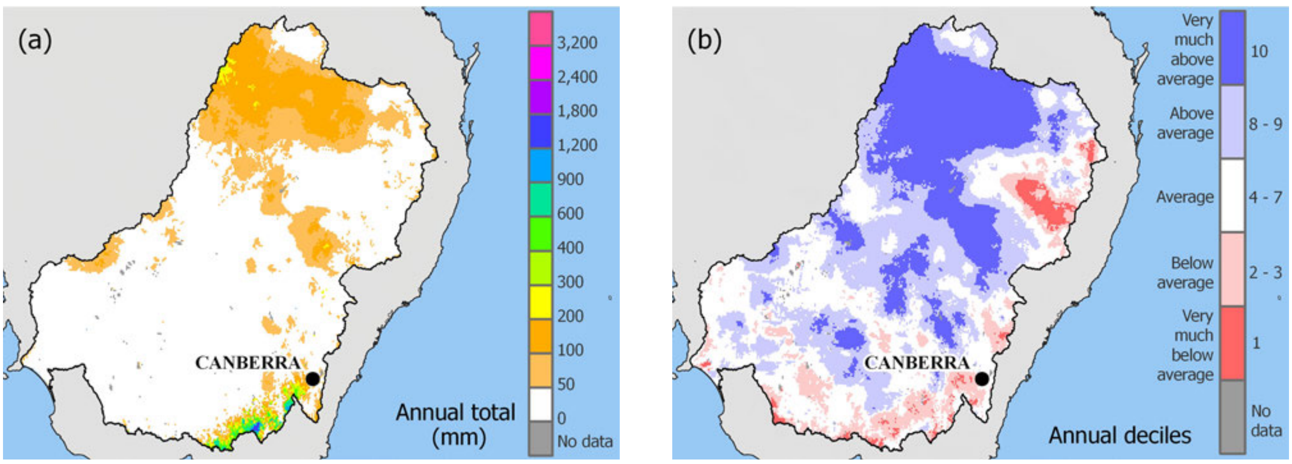


Figure 7-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Murray–Darling Basin region

8. South Australian Gulf

8.1 Regional overview

The South Australian Gulf region comprises an 117,700 km^2 area in South Australia surrounding the Gulf of St Vincent and Spencer Gulf. It stretches inland to 300 km north of the Spencer Gulf. The Murray–Darling Basin region is to the east, the Lake Eyre Basin region to the north and the South Western Plateau region to the west. The region has a Mediterranean climate in the southeast to semi-arid climate inland and to the north.

The South Australian Gulf region has a population of more than 1.25 million. Approximately 95 per cent of the population is concentrated in Adelaide with the rest sparsely distributed throughout the remainder of the region.

Rainfall and evapotranspiration were high during 2009–10. Surface water storage volumes varied substantially over the year, but by the end of the year the regional average level had only slightly changed.

The soil moisture content rose by a substantial amount especially in the region's north. High evapotranspiration lowered landscape water yield, although it reached slightly above average values. Deep soil moisture stores are estimated to have generally increased across the region in 2009–10, indicating more favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Some areas of the region have been excluded from the landscape water balance modelling results (classified as 'No data') due to the unreliability of rainfall data or absence of model parameter data for areas such as salt lakes, salt pans and inland water.

Table 8-1 highlights the key water information for this region for 2009–10.

8.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 8-1. Seasonal landscape water yield averages are shown to be similar for both summer and winter periods with considerable variability in water yield over the 30-year period. This variability in the data is largely influenced by the relatively wet period through the late 1980s and early 1990s, particularly the extremely high total of 1992–93.

Figure 8-2 (a) shows that during 2009–10, landscape water yield was low across much of the region. Highest values occurred in the north and southeast of the region, to the east of Adelaide, as a result of the very much above average rainfall experienced in these areas.

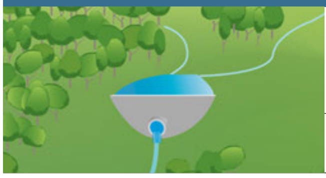
Landscape water yield deciles for 2009–10, shown in Figure 8-2 (b), indicate average and above average values across the much of the region. Very much above average values are identified to the north and centre of the region. Below average conditions were experienced across the southeast of the region with very much below average values identified across a limited area to the north of Adelaide.

Table 8-1. Key information on water flows, stores and use in the South Australian Gulf region

Landscape water balance

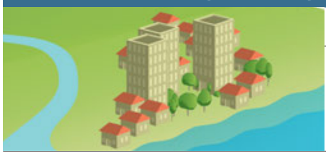
	During 2009–10			During the past 30 years	
	Region average	Difference from long-term mean	Rank (out of 99)*	Highest value (year)	Lowest value (year)
Rainfall	367 mm	+20%	85	491 mm (1992–93)	192 mm (1982–83)
Evapotranspiration	291 mm	+7%	78	308 mm (1986–87)	223 mm (1982–83)
Landscape water yield	24 mm	+4%	66	84 mm (1992–93)	9 mm (1982–83)

Surface water storage (comprising approximately 76% of the region's total surface water storage)



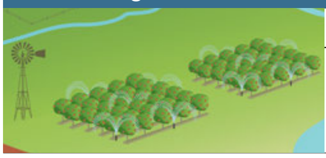
Total accessible capacity	July 2009		June 2010		% Change
	Accessible volume	% of accessible capacity	Accessible volume	% of accessible capacity	
197 GL	107 GL	54.3%	109 GL	55.3%	+1.0%

Urban water use (Adelaide)



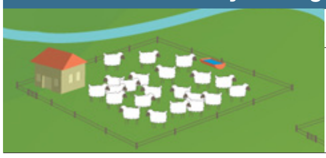
Water supplied 2009–10	Trend in recent years	Restrictions
126 GL	Decreasing	Steady at level 3 restrictions

Annual irrigation water use in 2009–10 for natural resource management regions



Adelaide and Mt Lofty Ranges	Northern and Yorke
66 GL	12 GL

Soil moisture for dryland agriculture



Summer 2009–10 (November–April)	Winter 2010 (May–October)
Above average in the north and west, very much above average in the northwest and average in the southeast	Predominantly above average over almost the entire region. Very much above average in the north

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

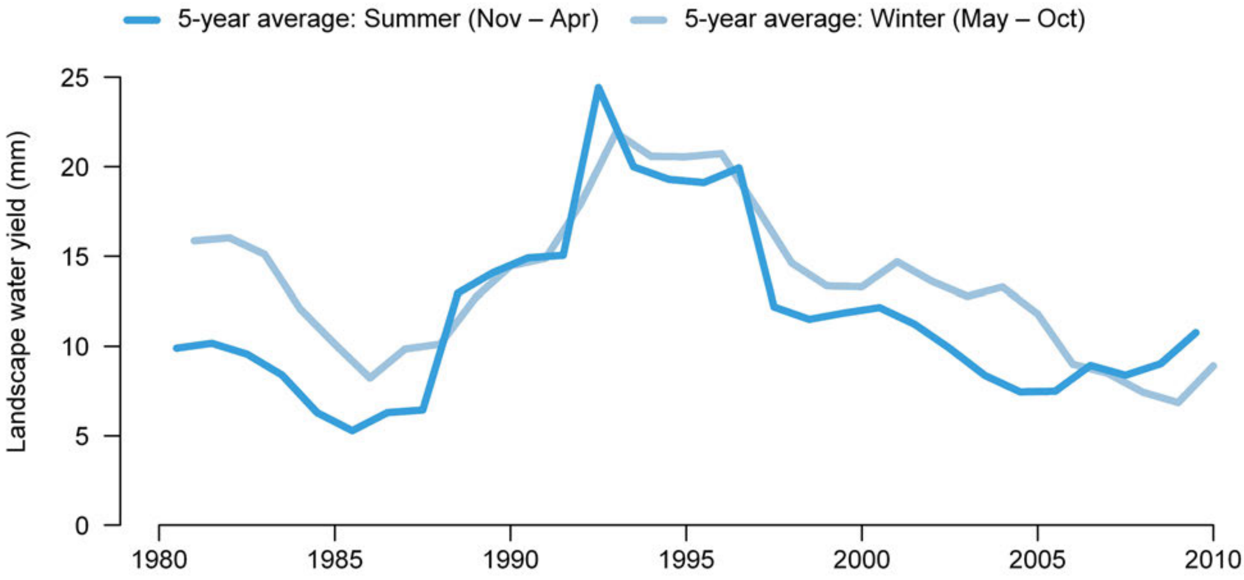


Figure 8-1. Time-series of five-year moving averages for summer (November–April) and winter (May–October) landscape water yield for the South Australian Gulf region

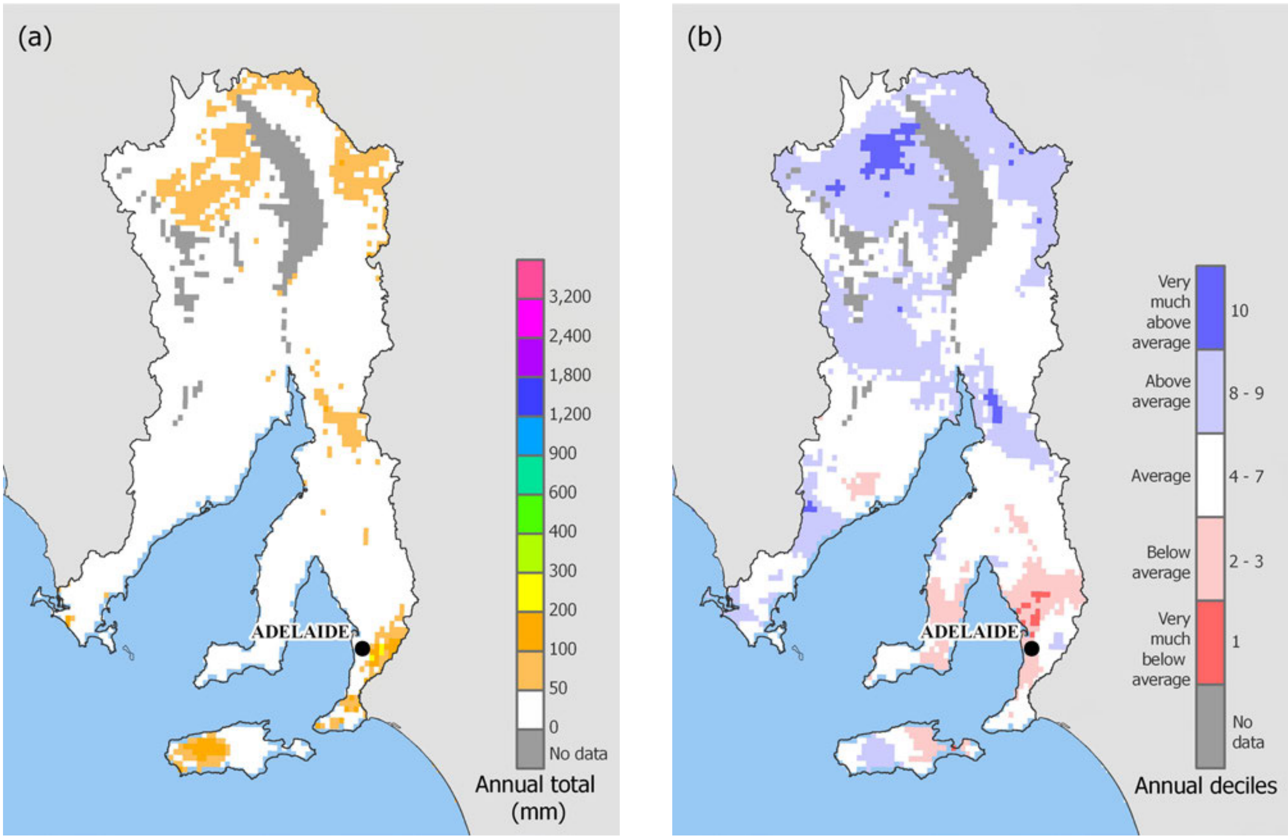


Figure 8-2. Maps of annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the South Australian Gulf region

9. South Western Plateau

9.1 Regional overview

The South Western Plateau region covers 1,093,000 km^2 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 on the southern boundary of the region. It is the driest region in Australia, except for the western and eastern parts of the region, which are semi-arid.

The region has a population of over 60,000 that is sparsely distributed, with 28,000 people residing in Kalgoorlie–Boulder and 12,000 in Esperance. Other towns, such as Ceduna, Coolgardie, Kambalda West and Streaky Bay, have between 2,000 and 3,000 inhabitants.

The year 2009–10 was average for rainfall and evapotranspiration. Landscape water yield was particularly low because of the rainfall deficit that occurred; however, it was only 5 mm below the long-term regional average for this dry region.

Soil moisture levels also slightly decreased. The region has no major surface water storage within its boundaries. Deep soil moisture stores are estimated to have generally decreased across the region in 2009–10, indicating less favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Large areas of the region have been excluded from the landscape water balance modelling results (classified as 'No data') due to the unreliability of rainfall data for these areas.

Table 9-1 highlights the key water information for this region for 2009–10.

9.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 9-1. The data show that the shifts between periods of high and low landscape water yield are reflected in both seasonal period averages. These variations are more apparent in the summer period than the winter. The winter season averages show a consistent decrease over the second half of the 30-year period, whereas the summer period averages show a more sudden reduction occurring in the mid-2000s.

Landscape water yield for the South Western Plateau region for 2009–10 was 6 mm, which is below the region's long-term average. Figure 9-2 (a) shows that for 2009–10, low levels of landscape water yield occurred across the entire region. Landscape water yield deciles for 2009–10, shown in Figure 9-2 (b), indicate very much below average values across much of the western side of the region. The central and eastern areas reflect a mix of average, below average and above average levels for the year.

Table 9-1. Key information on water flows in the South Western Plateau region

Landscape water balance	During 2009–10			During the past 30 years	
	Region average	Difference from long-term mean	Rank (out of 99)*	Highest value (year)	Lowest value (year)
Rainfall	220 mm	-5%	48	357 mm (1999–00)	165 mm (2007–08)
Evapotranspiration	222 mm	+2%	55	275 mm (1999–00)	193 mm (1990–91)
Landscape water yield	6 mm	-43%	29	41 mm (1994–95)	6 mm (1985–86)

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

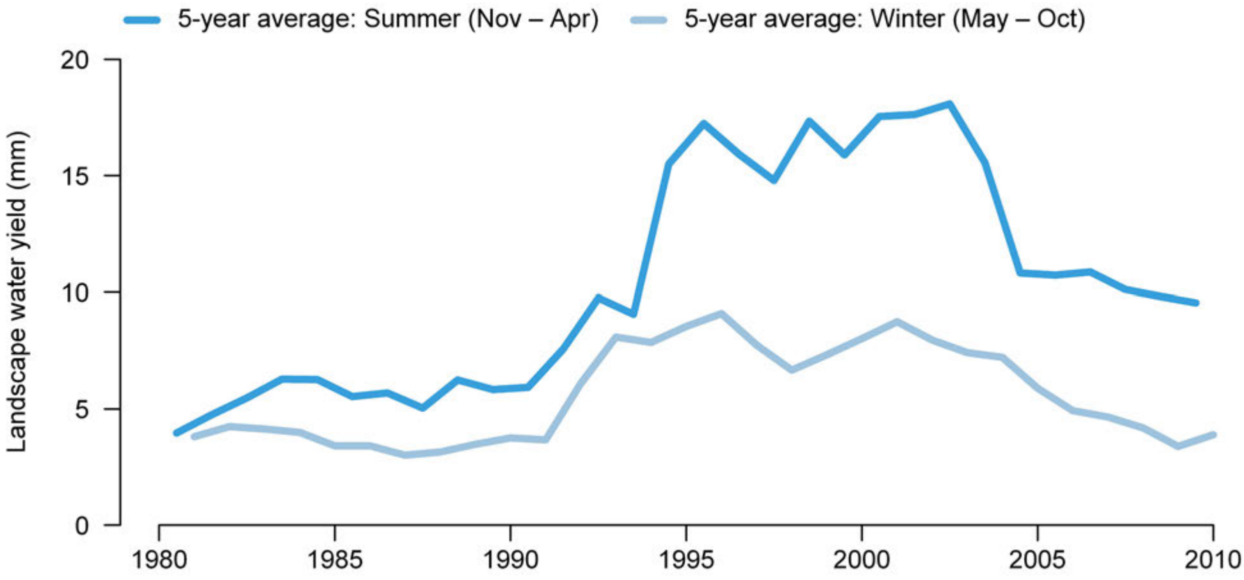


Figure 9-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the South Western Plateau region

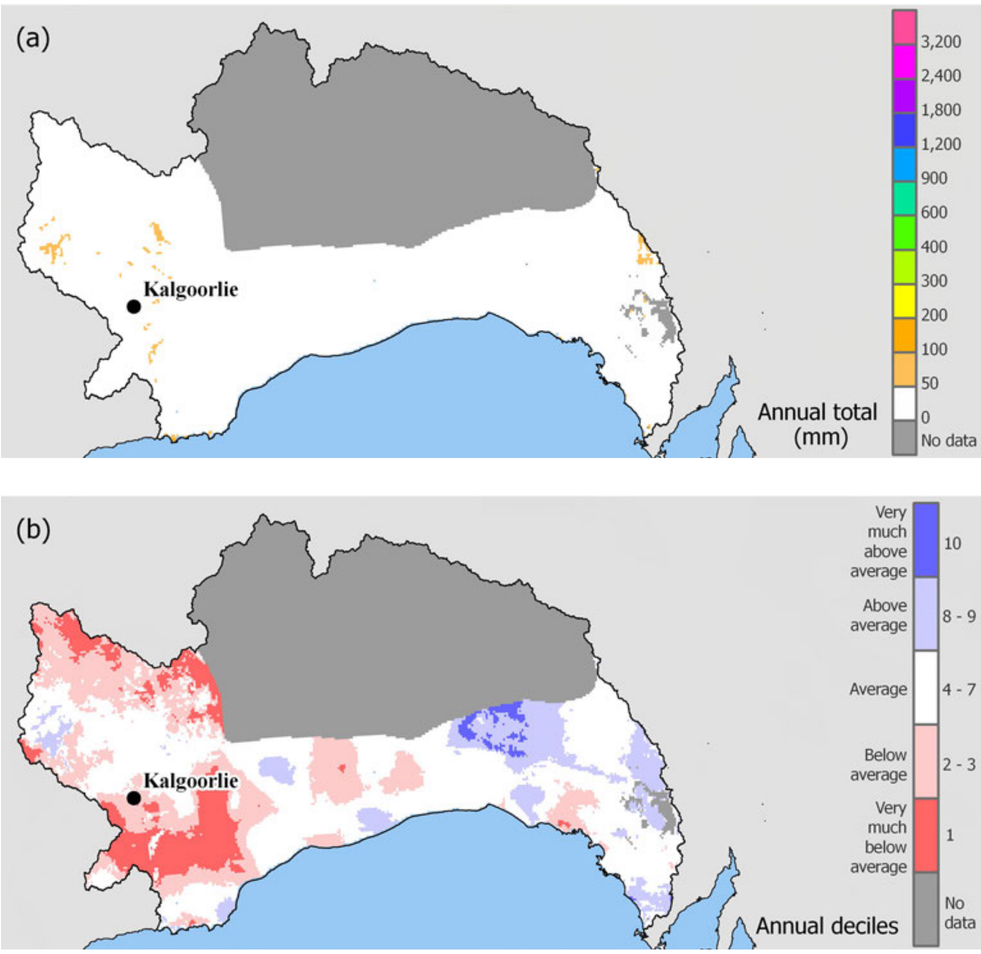


Figure 9-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the South Western Plateau region

10. South West Coast

10.1 Regional overview

The South West Coast region is bounded to the west by the Indian Ocean and to the south by the Great Australian Bight. It is bordered by the Pilbara–Gascoyne region to the north and by the South Western Plateau region to the east. The region covers an area of approximately 326,000 km^2. The climate is temperate with warm, dry summers and cool winters. Most rainfall occurs in the west (Darling Scarp) which reduces further inland.

The region has a population of around 2.1 million. The largest population centre is Perth on the central-west coast with 1.2 million people. Other centres with populations greater than 25,000 are Mandurah, Bunbury and Albany along the coast.

The year 2009–10 was below average for both rainfall and evapotranspiration. The rainfall deficit that occurred (where total evapotranspiration is higher than the total rainfall) resulted in a low regional average landscape water yield. It also substantially decreased soil moisture levels. In contrast, surface water volumes in the region's major storages increased slightly, as most of these storages are located in the few areas that had average landscape water yield amounts.

Deep soil moisture stores are estimated to have generally decreased across the region in 2009–10, indicating less favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

More detail on water flows, stores and use for the region in 2009–10 is given in Table 10-1.

10.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 10-1. Landscape water yield is consistently higher for the winter period than for the summer, and both seasons tended to increase during the wetter 1990s. Over the past ten years, there was a noticeable decrease in winter period averages.

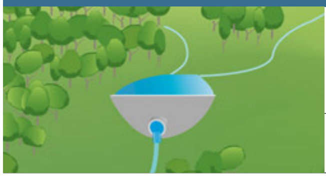
Figure 10-2 (a) shows landscape water yield for 2009–10 was very low across the majority of the region with the highest values observed in the far southwest of the region. Landscape water yield deciles for 2009–10, shown in Figure 10-2 (b), indicate that landscape water yield was at a below average or very much below average level across almost the entire region. Very limited areas of above average values were identified in the far north, south and east of the region.

Table 10-1. Key information on water flows, stores and use in the South West Coast region

Landscape water balance

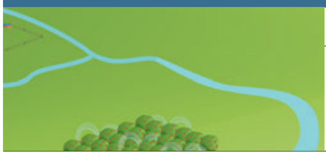
	During 2009–10			During the past 30 years	
	Region average	Difference from long-term mean	Rank (out of 99)*	Highest value (year)	Lowest value (year)
Rainfall	346 mm	-21%	11	562 mm (1998–99)	340 mm (2000–01)
Evapotranspiration	373 mm	-6%	15	476 mm (1999–2000)	348 mm (1990–91)
Landscape water yield	24 mm	-34%	20	71 mm (1999–2000)	14 mm (2006–07)

Surface water storage (comprising approximately 100% of the region's total surface water storage)



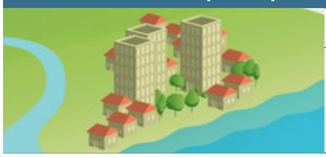
Total accessible capacity	July 2009		June 2010		% Change
	Accessible volume	% of accessible capacity	Accessible volume	% of accessible capacity	
959 GL	339 GL	35.3%	367 GL	38.3%	+3.0%

Measured streamflow in 2009–10



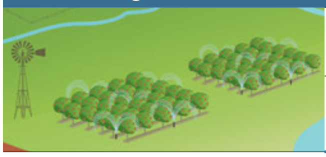
South coast rivers	Southwest coast rivers	North coast rivers
Predominantly above average	Average to above average	Average to below average

Urban water use (Perth)



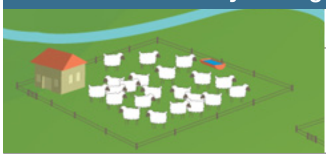
Water supplied 2009–10	Trend in recent years	Restrictions
266 GL	Gradually rising	Steady at level 5 restrictions

Annual irrigation water use in 2009–10 for natural resource management regions



South West	Swan	Northern Agricultural	South Coast	Avon
125 GL	62 GL	3.0 GL	5.6 GL	1.5 GL

Soil moisture for dryland agriculture



Summer 2009–10 (November–April)	Winter 2010 (May–October)
Below average in the coastal areas and parts of the northeast, average across the centre of the region	Very much below average across much of the entire region, average in the far north and southeast

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

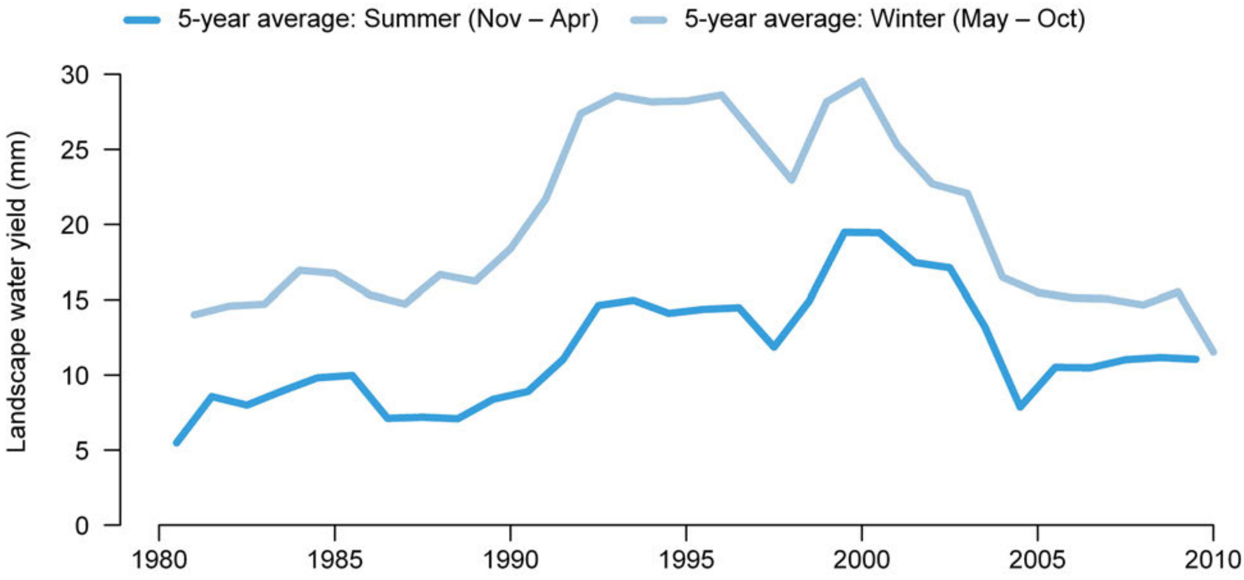


Figure 10-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the South West Coast region

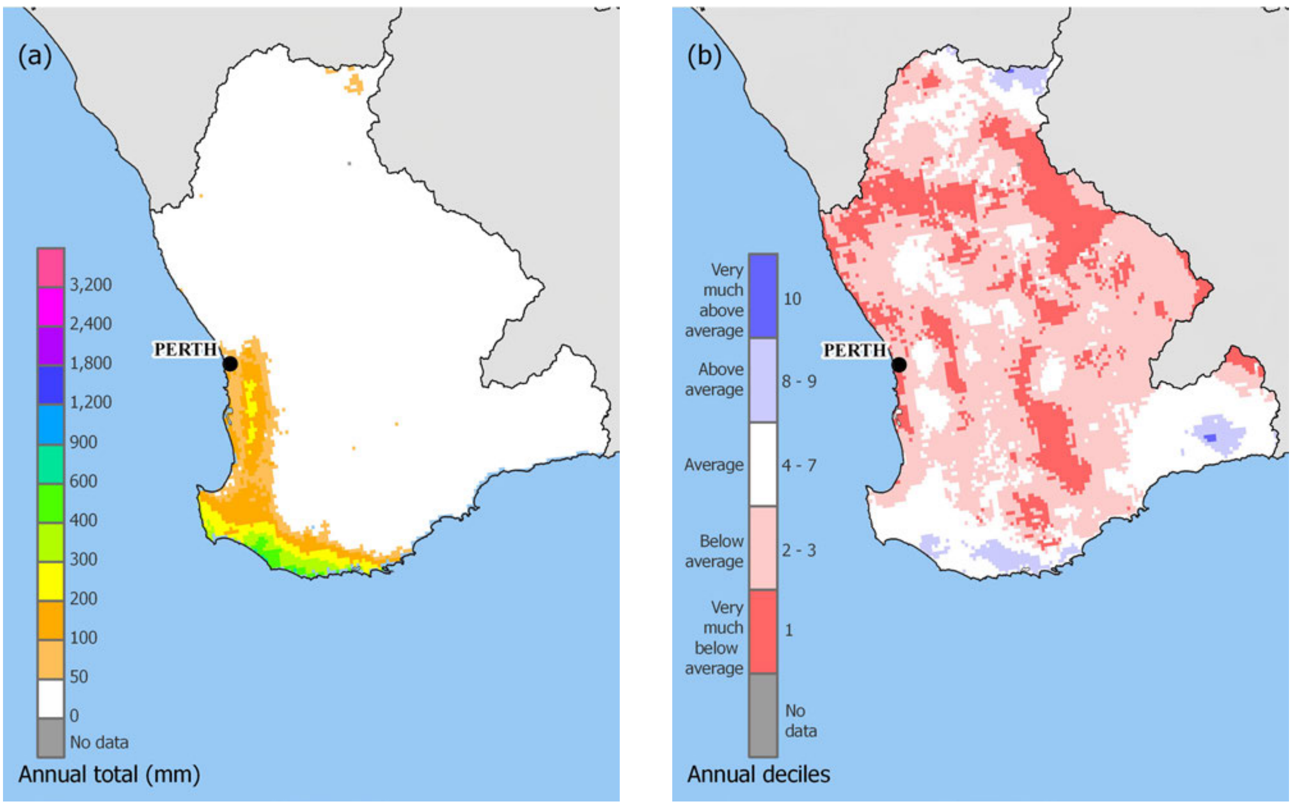


Figure 10-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the South West Coast region

11. Pilbara–Gascoyne

11.1 Regional overview

The Pilbara–Gascoyne region is the central western corner of Western Australia. It covers a long coastal section and some dry inland land bordered by the western plateau. The region covers about 478,000 km^2 of land area and has a population of approximately 75,000. The climate is arid subtropical, with temperate Mediterranean predominantly occurring in the south. Rainfall is generally low and variable. Irregular monsoonal rain occurs in the north.

The main city in the region is Geraldton with a population of 27,000. Other main towns are Karratha, Port Hedland (including South Hedland) and Carnarvon.

During 2009–10, rainfall total was the lowest in Australia. With limited water availability, evapotranspiration totals stayed well below average. The soil moisture content and landscape water were below average as well. Many areas in the region experienced no landscape water yield.

Deep soil moisture stores are estimated to have generally decreased across the region in 2009–10, indicating less favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

More detail on these water balance components for 2009–10 is given in Table 11-1.

11.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 11-1. The data show a consistent seasonal pattern during the first half of the 30-year period with very little variability in the averages of both seasons. The extremely high landscape water yield years at the end of the 1990s are reflected in increases in both the summer and winter season averages. The summer period shows greater increases compared to the winter period and remains relatively high through to the end of the period.

Landscape water yield for the Pilbara–Gascoyne region for 2009–10 was only 9 mm, below the region's long–term (July 1911 to June 2010) average. Figure 11-2 (a) shows the landscape water yield for 2009–10 was very low across almost the entire region. Landscape water yield deciles for 2009–10, shown in Figure 11-2 (b), indicate below average or very much below average annual landscape water yields for across much of the region. Average and above average values are identified across very limited areas to the southeast and far northwest of the region.

Table 11-1. Key information on water flows in the Pilbara–Gascoyne region

Landscape water balance	During 2009–10			During the past 30 years	
	Region average	Difference from long-term mean	Rank (out of 99)*	Highest value (year)	Lowest value (year)
Rainfall	132 mm	-49%	5	601 mm (1998–99)	132 mm (2009–10)
Evapotranspiration	195 mm	-14%	19	340 mm (1998–99)	176 mm (1990–91)
Landscape water yield	9 mm	-66%	12	149 mm (1999–2000)	9 mm (2009–10)

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

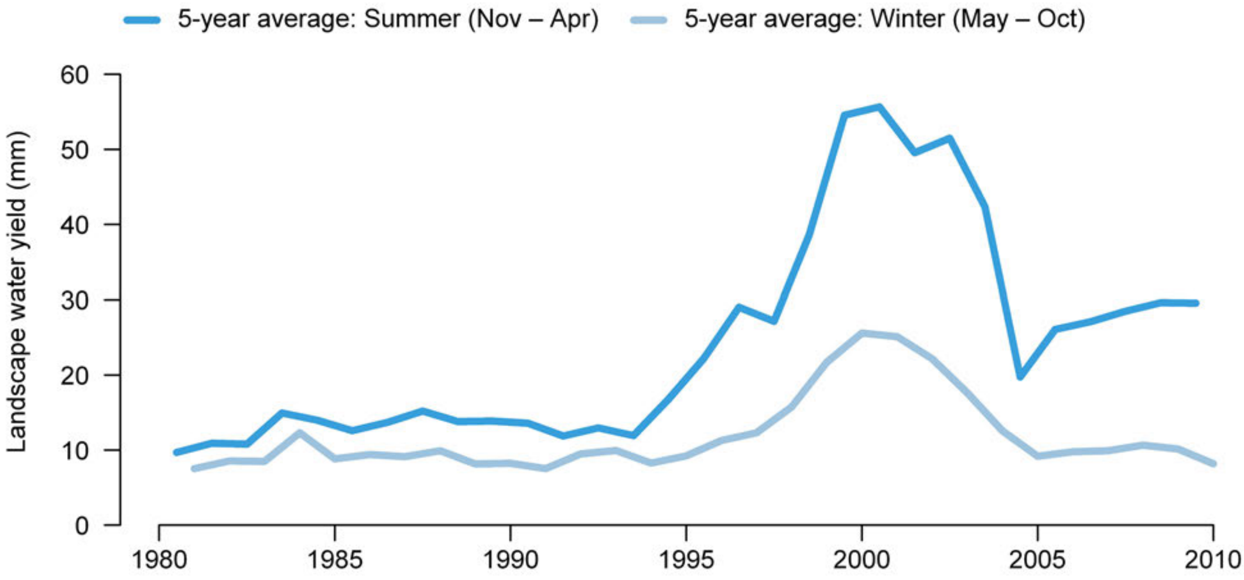


Figure 11-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Pilbara–Gascoyne region

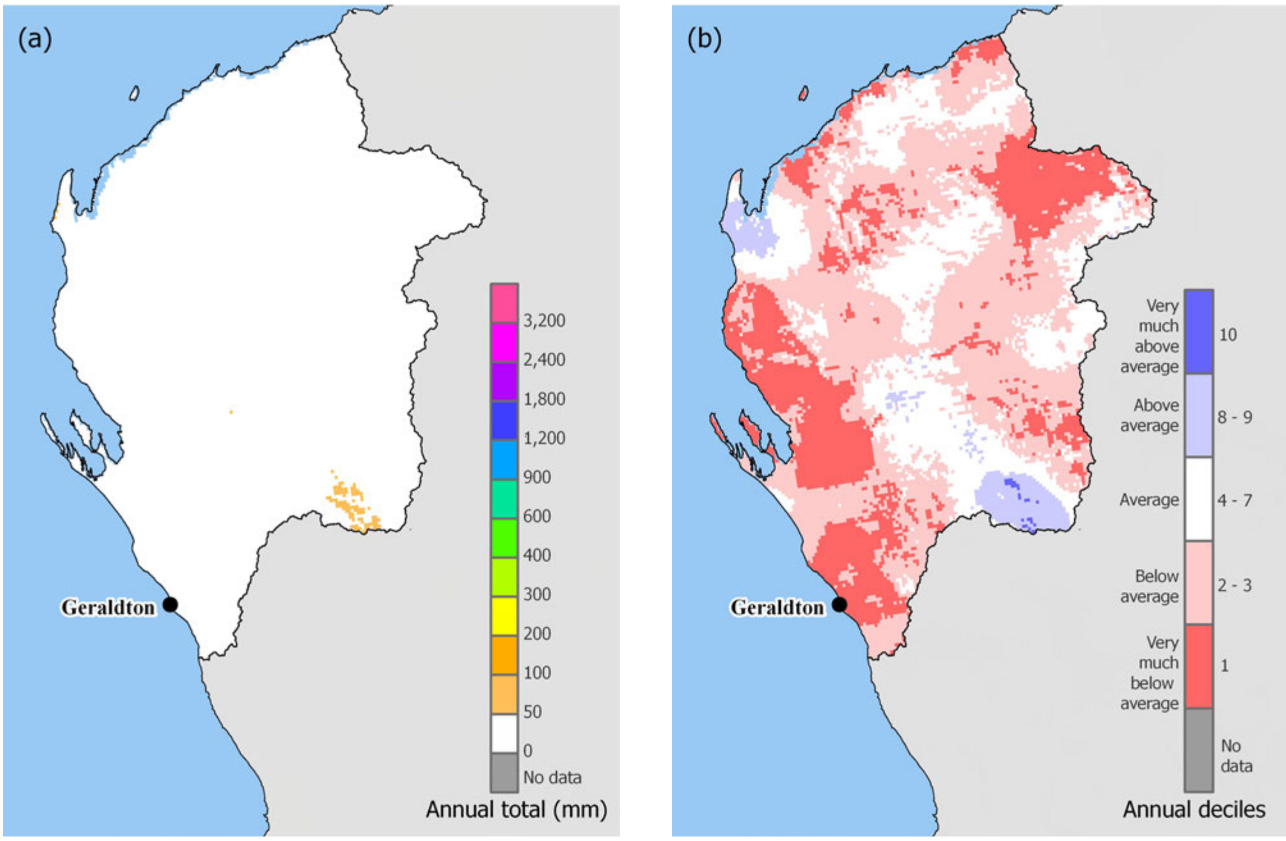


Figure 11-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Pilbara–Gascoyne region

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 km^2 of land area and only has some limited surface water resources present in the northern part of the region. The climate is very arid with evaporation greatly exceeding rainfall. The northern part is affected by erratic monsoonal rainfall in summer.

The year 2009–10 was average for rainfall and evapotranspiration. Landscape water yield was above average as a result of significant rainfall in December 2009. Soil moisture levels decreased substantially. There are no major surface water storages present in the North Western Plateau region.

Deep soil moisture stores are estimated to have generally decreased across the region in 2009–10, indicating less favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Large areas of the region have been excluded from the landscape water balance modelling results (classified as 'No data') due to the unreliability of rainfall data for these areas.

Table 12-1 gives an overview of the key findings extracted from the detailed assessments performed in this chapter.

12.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 12-1. Landscape water yield is higher for the summer period than for the winter. Variability in landscape water yield is shown with both seasons experiencing increases between the lows of the early 1990s and peaks in the early 2000s.

Landscape water yield for the North Western Plateau region for 2009–10 was above the region's long-term (July 1911 to June 2010) average. The pattern and distribution of landscape water yield for 2009–10, shown in Figure 12-2 (a), indicates that the highest water yield occurred across the north and far northeast of the region. Landscape water yield deciles for 2009–10, shown in Figure 12-2 (b), indicate that the areas of highest annual landscape water yield in the northwest and far northeast of the region experienced above average conditions. The west and southwest of the region experienced below average and very much below average landscape water yield for 2009–10.

Table 12-1. Key information on water flows in the North Western Plateau region

Landscape water balance	During 2009–10			During the past 30 years	
	Region average	**Difference from long-term mean**	**Rank (out of 99)***	**Highest value (year)**	**Lowest value (year)**
Rainfall	311 mm	-1%	52	782 mm (1999–2000)	177 mm (1989–90)
Evapotranspiration	297 mm	+7%	65	442 mm (1999–2000)	222 mm (1990–91)
Landscape water yield	48 mm	+35%	76	199 mm (1999–2000)	8 mm (1989–90)

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

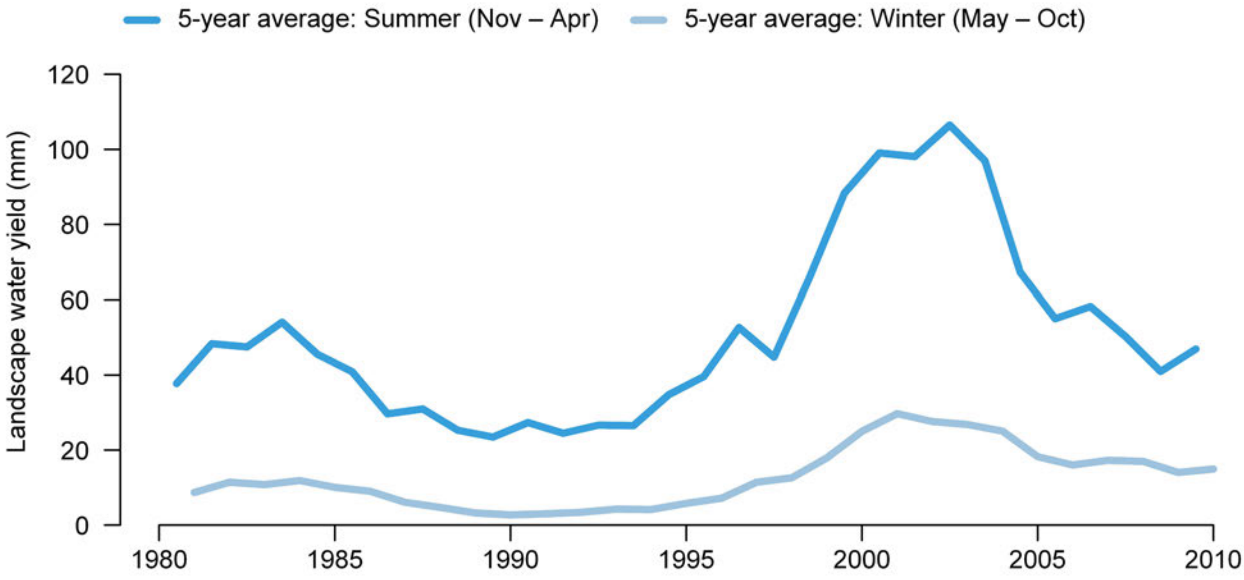


Figure 12-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the North Western Plateau region

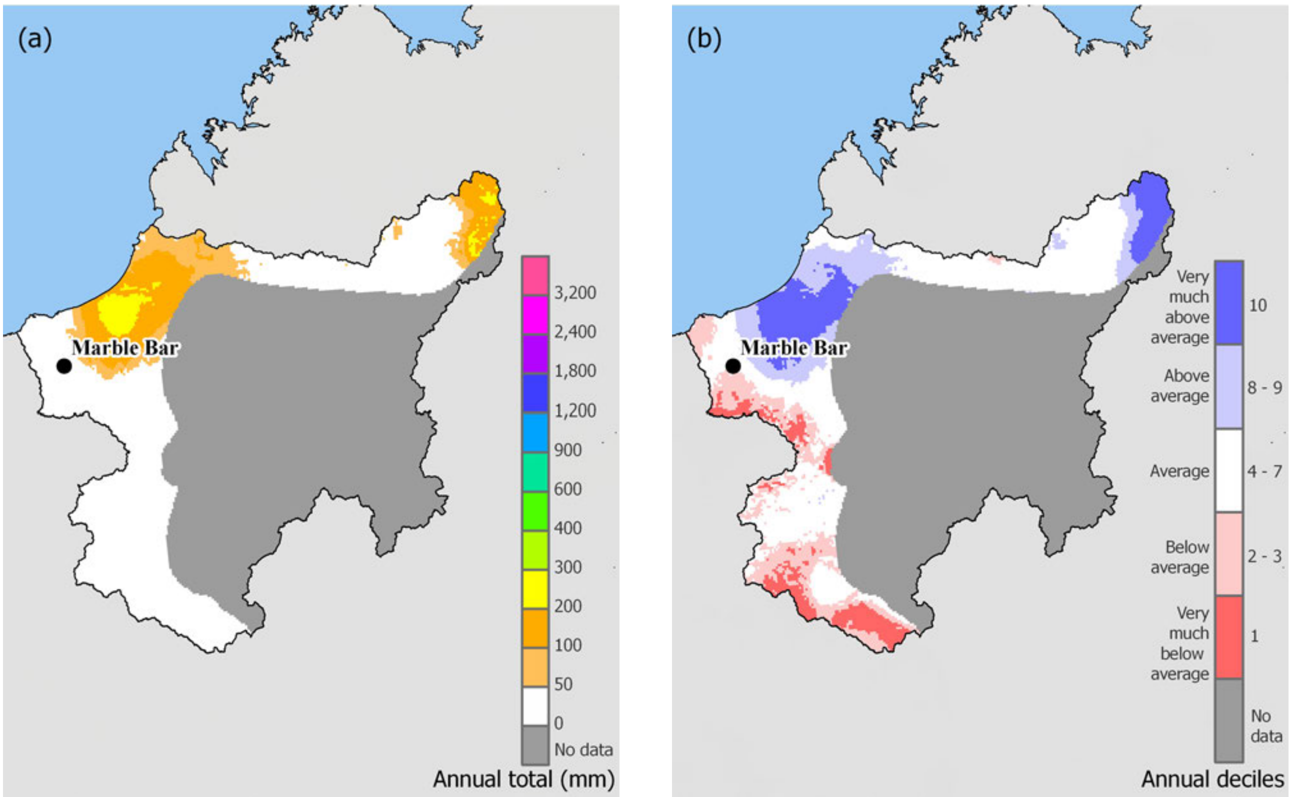


Figure 12-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the North Western Plateau region

13. Tanami – Timor Sea Coast

13.1 Regional overview

The Tanami – Timor Sea Coast region extends over a large area of northern Australia and is split between the Northern Territory in the east and Western Australia in the west. The region covers approximately 1,162,000 km^2 of land area and includes the basins of the Ord, Darwin, Daly, Fitzroy and Katherine rivers. It has a tropical climate with hot, wet summers and moderate, dry winters. Monsoonal rain occurs frequently, but is variable in quantity in different years.

Darwin, Palmerston, Broome, Katherine and Kununurra are the region's major towns.

The 2009–10 year was reasonably wet in the Tanami – Timor Sea Coast region. The annual evapotranspiration and landscape water yield were above average and a substantial increase in soil moisture occurred.

The surface water storage in the region decreased largely due to significant releases of water from Lake Argyle concurrent with average rainfall and run-off conditions in the Ord River basin.

Deep soil moisture stores are estimated to have generally increased across the region in 2009–10, indicating more favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Large areas of the region have been excluded from the landscape water balance modelling results (classified as 'No data') due to the unreliability of rainfall data for these areas.

Table 13-1 gives an overview of the key findings extracted from the detailed assessments performed in this chapter.

13.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 13-1. The data show a clear increase in summer period landscape water yield over the 30-year period, particularly since the early 1990s, with lower magnitude increases observed for the winter period.

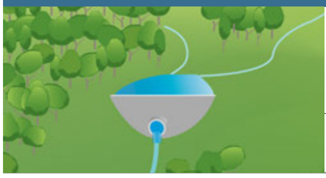
Landscape water yield for 2009–10 was above the region's long-term (July 1911 to June 2010) average. Figure 13-2 (a) shows landscape water yield for 2009–10 was highest in the coastal areas to the north of the region with a steep decreasing gradient to the south and west. Landscape water yield deciles for 2009–10, shown in Figure 13-2 (b), indicate average and above average landscape water yield across the majority of the region. Very much above average values are observed to the south of the region and across areas to the north and west.

Table 13-1. Key information on water flows, stores and use in the Tanami – Timor Sea Coast region

Landscape water balance

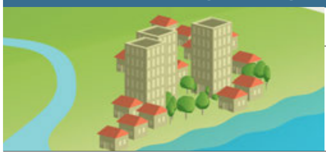
	During 2009–10			During the past 30 years	
	Region average	Difference from long-term mean	Rank (out of 99)*	Highest value (year)	Lowest value (year)
Rainfall	775 mm	+18%	82	1,132 mm (1999–2000)	411 mm (1991–92)
Evapotranspiration	602 mm	+9%	76	713 mm (2000–01)	502 mm (1992–93)
Landscape water yield	157 mm	+46%	85	315 mm (2000–01)	34 mm (1989–90)

Surface water storage (comprising approximately 100% of the region's total surface water storage)



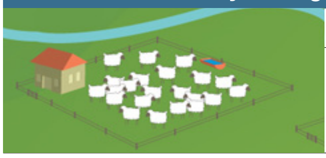
Total accessible capacity	July 2009		June 2010		
	Accessible volume	% of accessible capacity	Accessible volume	% of accessible capacity	% Change
10,683 GL	10,398 GL	97.3%	8,571 GL	80.2%	-17.1%

Urban water use (Darwin)



Water supplied 2009–10	Trend in recent years	Restrictions
35 GL	Steady (slightly down from recent years)	Not in place

Soil moisture for dryland agriculture



Summer 2009–10 (November–April)	Winter 2010 (May–October)
Generally average across much of the region, some areas of below average in the north and above average in the southeast	Very much above average across the entire region

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

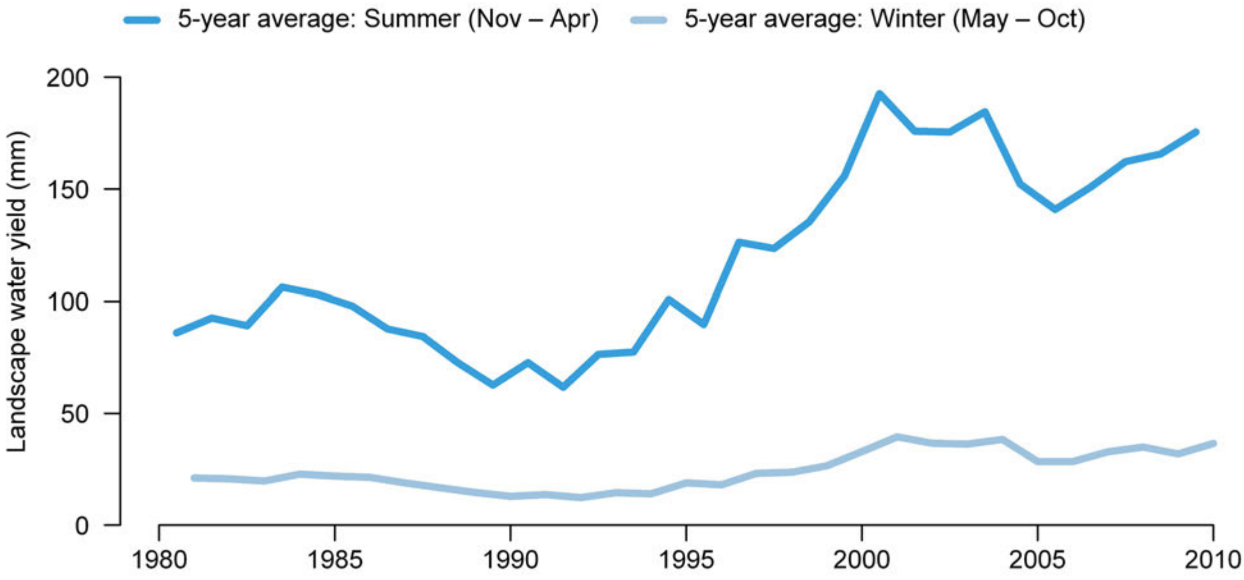


Figure 13-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Tanami – Timor Sea Coast region

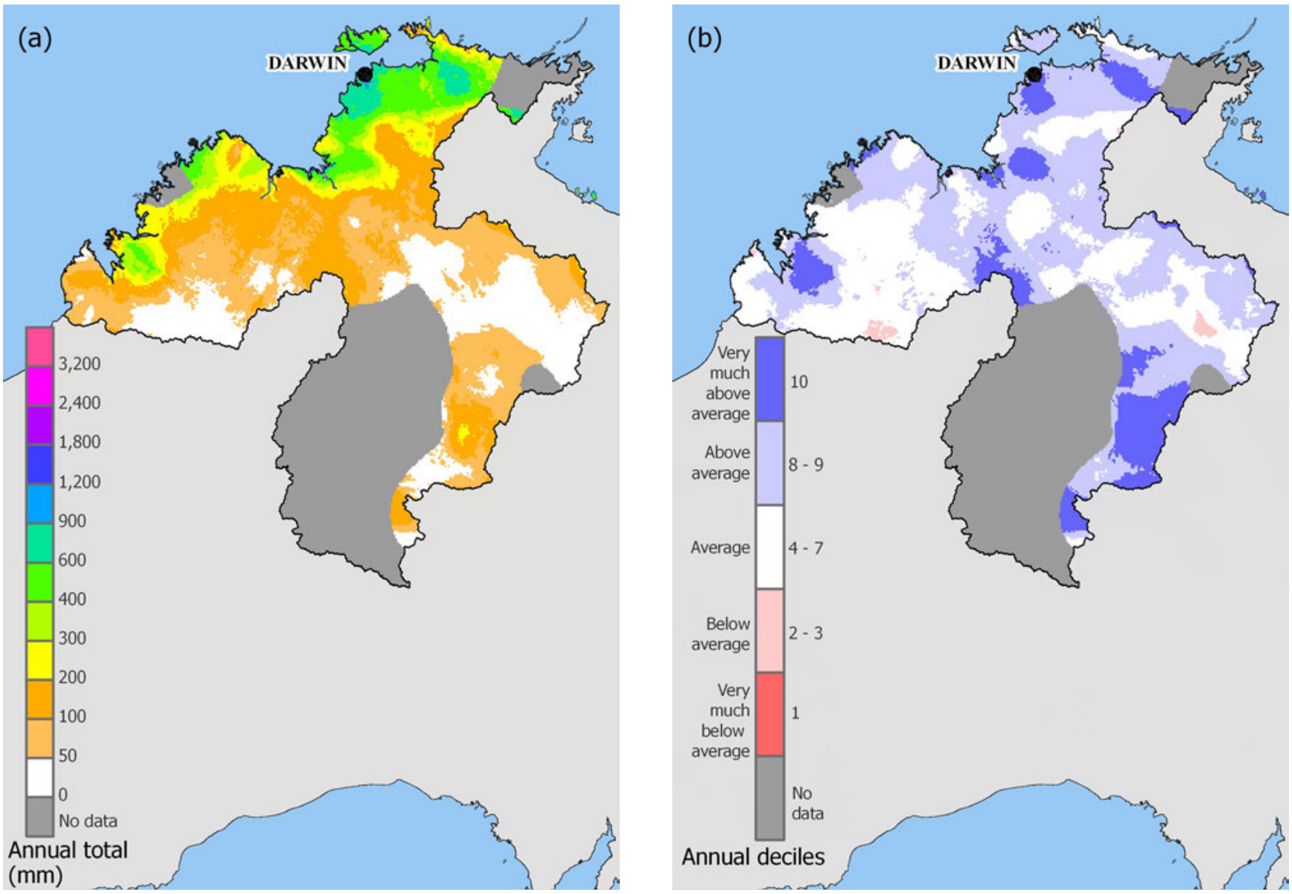


Figure 13-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Tanami – Timor Sea Coast region

14. Lake Eyre Basin

14.1 Regional overview

The Lake Eyre Basin region covers approximately 1.2 million km^2 of arid and semi-arid central Australia. It represents 17 per cent of the continent which 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 climate of the region is arid throughout and is driest in the northeast of Lake Eyre, but it receives some monsoonal rain from the upper reaches of the Diamantina and Georgina rivers.

The region is sparsely populated, with about 57,000 people. Approximately 26,000 live in Alice Springs. The major towns (with a population greater than 1,000) are Alice Springs, Birdsville, Longreach and Winton.

The Lake Eyre Basin region experienced very much above average rainfall in 2009–10. Hence, evapotranspiration and landscape water yield remained very much above average. Soil moisture levels increased substantially. There are no major surface water storages in the Lake Eyre Basin region.

Deep soil moisture stores are estimated to have generally increased across the region in 2009–10, indicating more favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Some areas of the region have been excluded from the landscape water balance modelling results (classified as 'No data') due to the unreliability of rainfall data or absence of model parameter data for areas such as salt lakes, salt pans and inland water.

Table 14-1 gives an overview of the key findings extracted from the detailed assessments performed in this chapter.

14.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 14-1. Landscape water yield was consistently higher during the summer period than for the winter period. The summer period average exhibited higher levels of variability over the 30-year period. The winter period showed a slight decreasing trend over time with a more noticeable reduction towards the end of the period.

Landscape water yield for the Lake Eyre Basin region for 2009–10 was above the region's long-term average. Landscape water yield for 2009–10, shown in Figure 14-2 (a), indicates that highest totals were experienced across the centre and northeast of the region. Lower levels are shown across the south. Landscape water yield deciles for 2009–10, shown in Figure 14-2 (b), indicate that much of the region experienced average or above average levels of landscape water yield. Very much above average values were observed across the region's centre.

Table 14-1. Key information on water flows in the Lake Eyre Basin region

Landscape water balance	During 2009–10			During the past 30 years	
	Region average	**Difference from long-term mean**	**Rank (out of 99)***	**Highest value (year)**	**Lowest value (year)**
Rainfall	387 mm	+60%	92	421 mm (1999–2000)	168 mm (2002–03)
Evapotranspiration	220 mm	+16%	81	242 mm (2000–01)	160 mm (1982–83)
Landscape water yield	74 mm	+111%	96	74 mm (2009–10)	22 mm (2005–06)

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

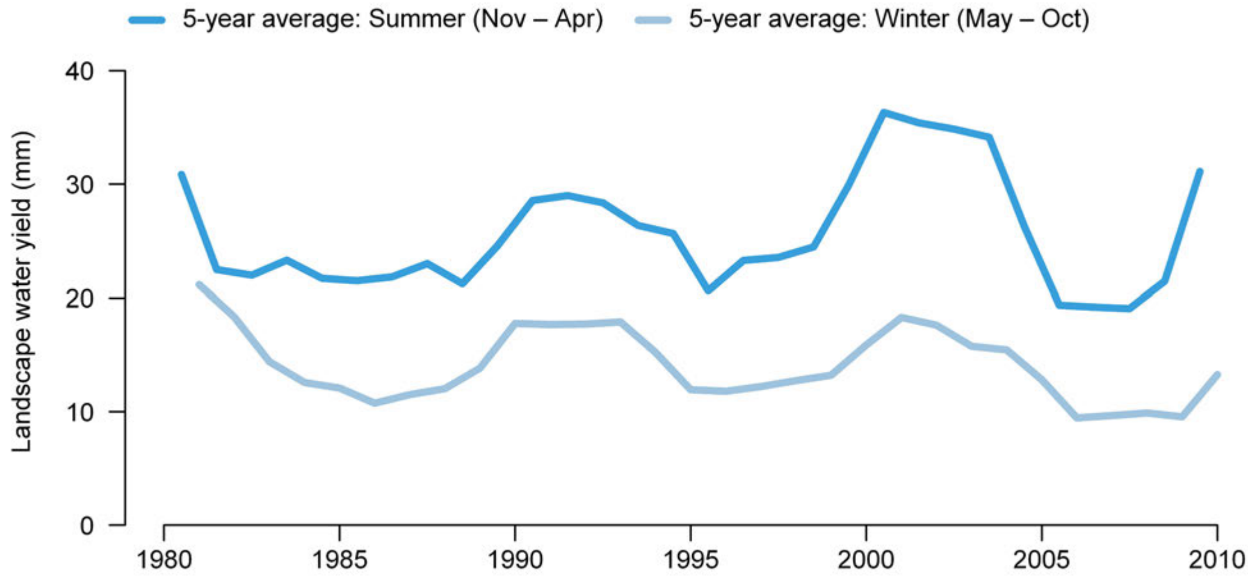


Figure 14-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Lake Eyre Basin region

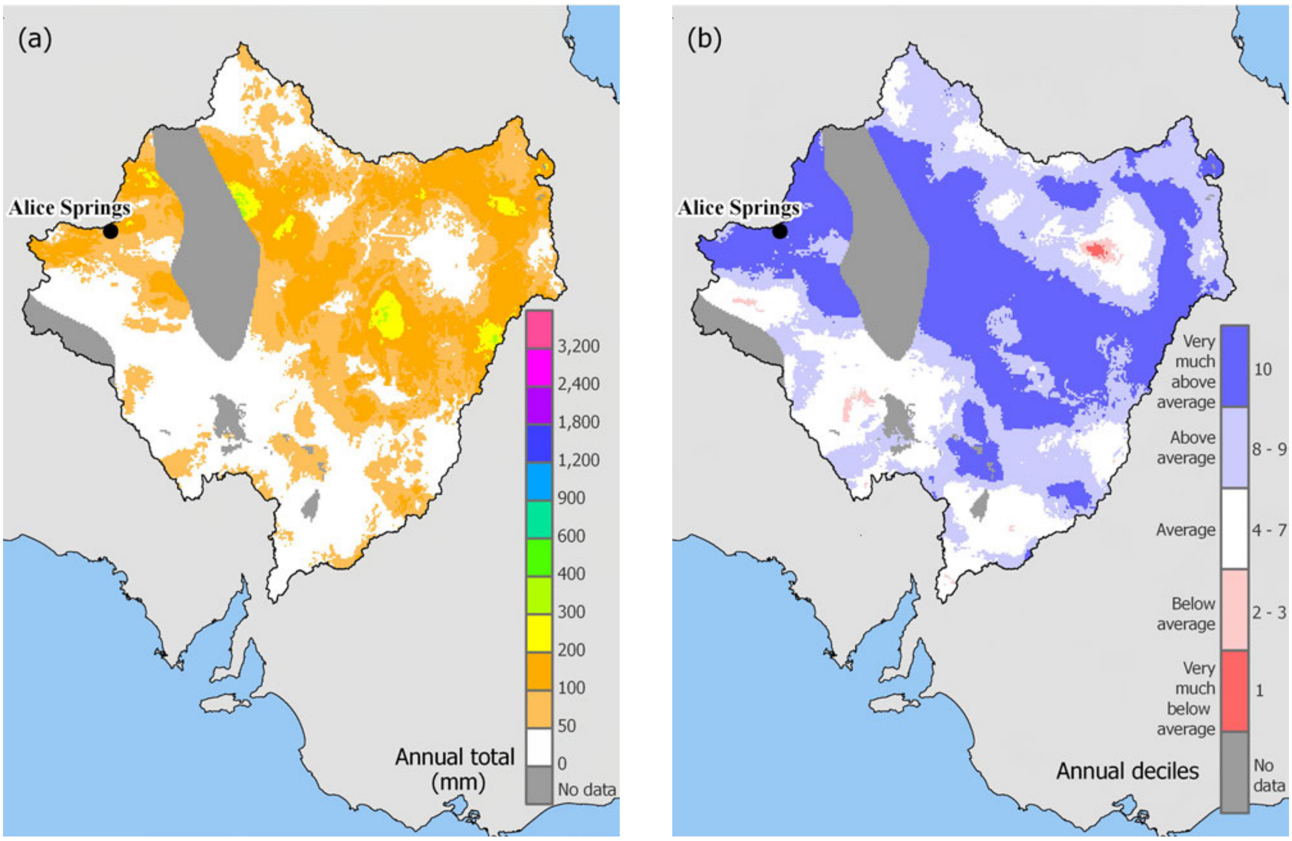


Figure 14-2. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Lake Eyre Basin region

15. Carpentaria Coast

15.1 Regional overview

The Carpentaria Coast region covers approximately 647,000 km^2. It is bounded to the west by Arnhem Land and Groote Eylandt, the largest island in the Gulf. To the east is the Cape York Peninsula. The climate is hot and humid with two distinct seasons per year. The dry season runs from about May to October and the monsoonal wet season from November to April.

The region has a population of about 56,000, 40 per cent of whom live in the mining town of Mount Isa. The Indigenous population is a significant component (greater than 25 per cent) of the population. Normanton, Doomadgee and Kowanyama are other populated (with more than 1,000 people) towns in the region.

Deep soil moisture stores are estimated to have generally increased across the region in 2009–10, indicating more favourable conditions for drainage of soil moisture below the root zone and potentially groundwater recharge.

Some areas of the region have been excluded from the landscape water balance modelling results (classified as 'No data') due to the unreliability of rainfall data for these areas.

The key data and information on water flows in the region are given in Table 15 1.

15.2 Recent trends in landscape water yield

An indication of patterns, trends and variability in the seasonal landscape water yield over the 30-year period summer (November–April) and winter (May–October) are presented using time-series and moving averages in Figure 15-1. Landscape water yield averages are consistently higher for the summer period. Both seasonal averages show increases in water yield since around 1989–90, with particularly marked increases in the higher summer period.

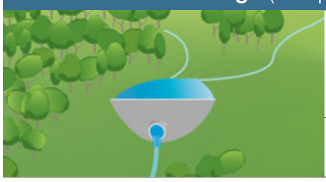
Landscape water yield for the Carpentaria Coast region for 2009–10 was above the region's long–term average. Figure 15-2 (a) shows that during 2009–10, the highest landscape water yield occurred in the coastal zone in the north and northwest of the region. Landscape water yield deciles for 2009–10, shown in Figure 15 2 (b), indicate much of the region experienced above average and very much above average values. Below average values are identified in a small area in the far north of the Cape York Peninsula.

Table 15-1. Key information on water flows and stores in the Carpentaria Coast region

Landscape water balance

	During 2009–10			During the past 30 years	
	Region average	**Difference from long-term mean**	**Rank (out of 99)***	**Highest value (year)**	**Lowest value (year)**
Rainfall	976 mm	+31%	89	1,181 mm (2000–01)	496 mm (1987–88)
Evapotranspiration	679 mm	+9%	82	805 mm (2000–01)	549 mm (1987–88)
Landscape water yield	268 mm	+99%	94	358 mm (2008–09)	47 mm (1987–88)

Surface water storage (comprising approximately 26% of the region's total surface water storage)



Total accessible capacity	July 2009		June 2010		% Change
	Accessible volume	**% of accessible capacity**	**Accessible volume**	**% of accessible capacity**	
99 GL	94 GL	94.9%	92 GL	92.9%	-2.0%

* A rank of 1 indicates the lowest annual result on record, 99 the highest on record

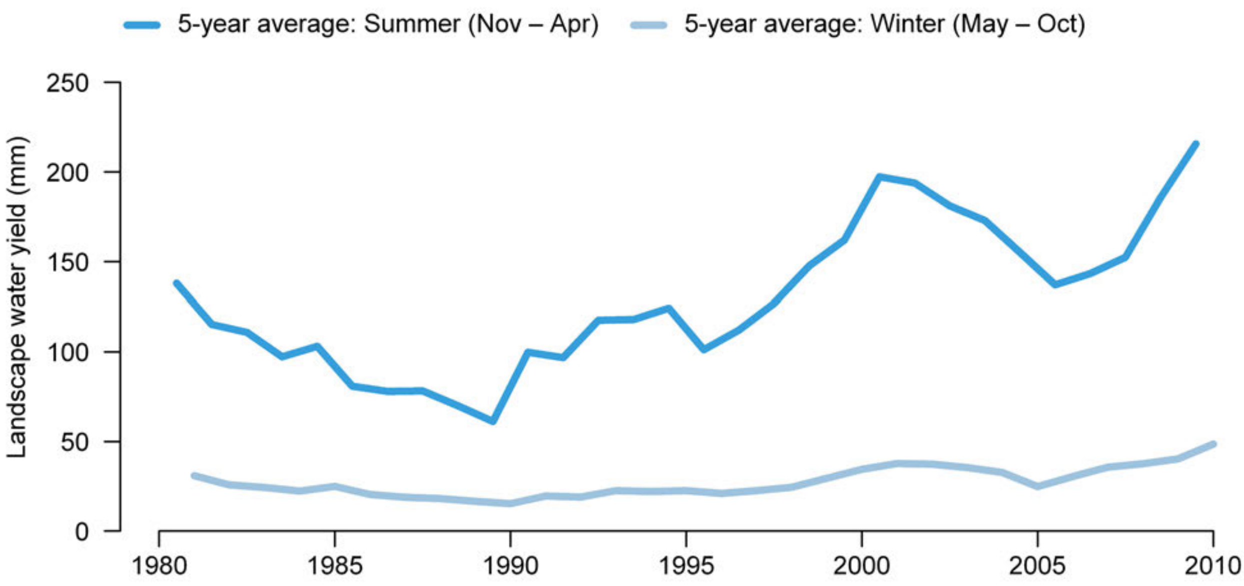


Figure 15-1. Time-series of five-year moving averages for modelled summer (November–April) and winter (May–October) landscape water yield for the Carpentaria Coast region

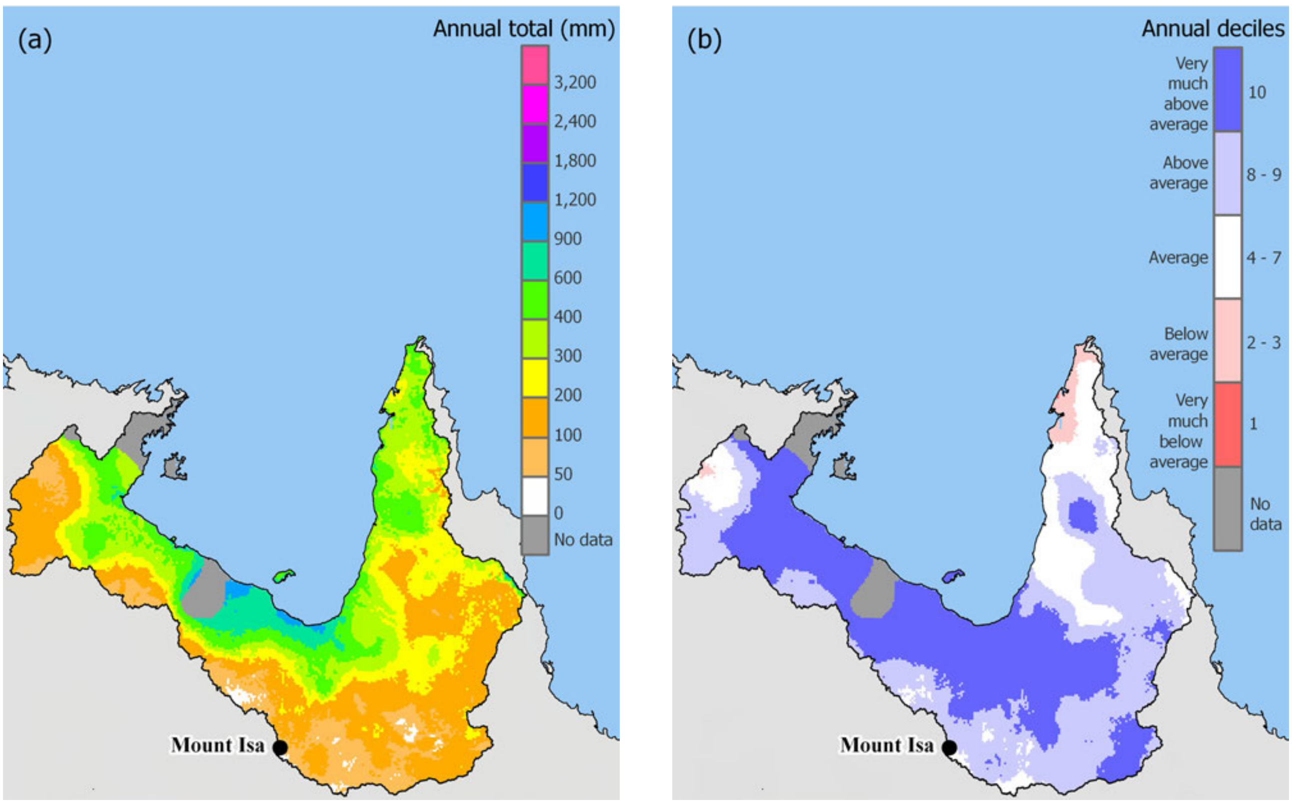


Figure 15-2. Maps of modelled landscape water yield totals (a) and deciles (b) for 2009–10 in the Carpentaria Coast region

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

For more information visit our website at www.bom.gov.au/water

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

Australian Government
Bureau of Meteorology