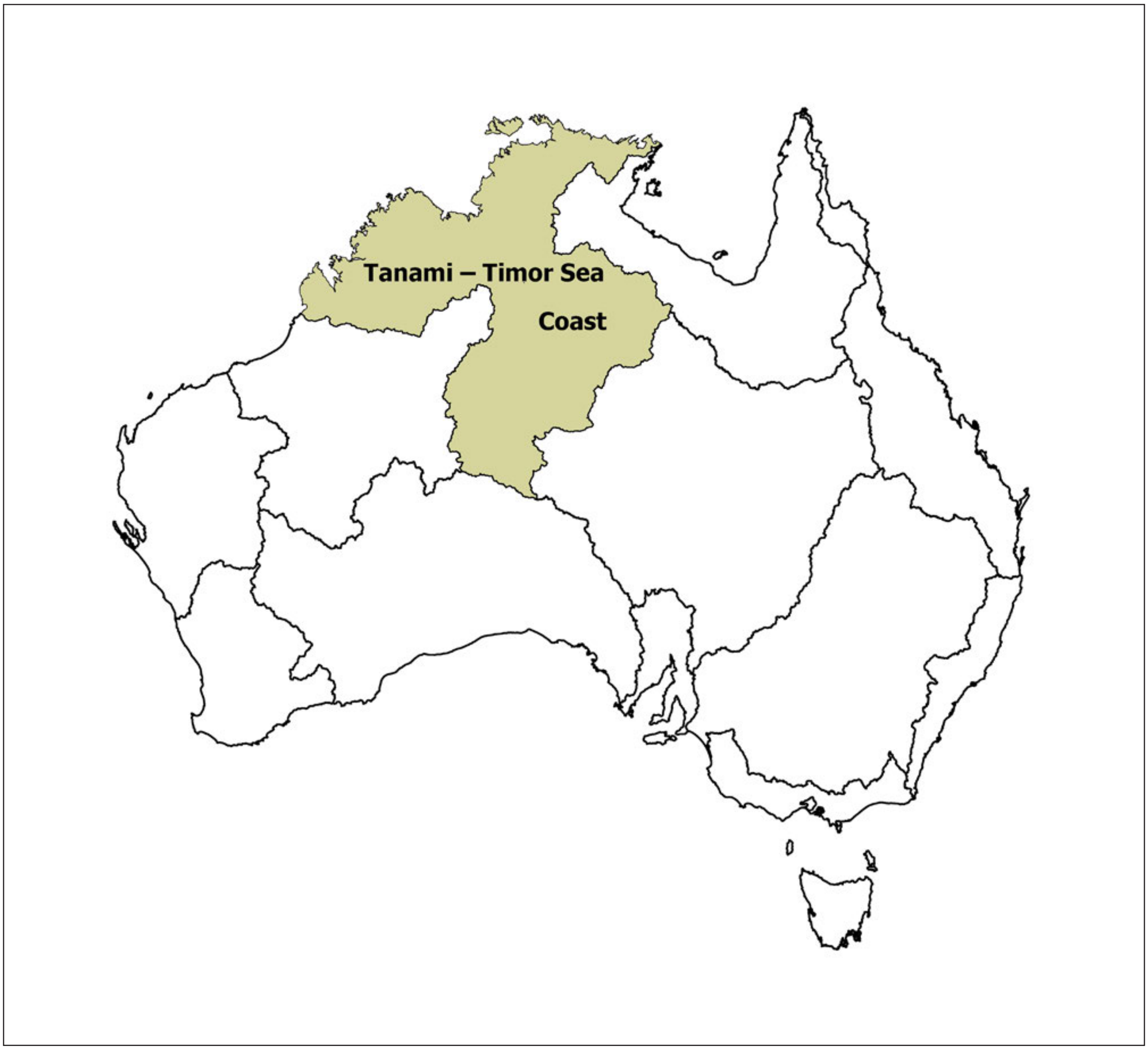
13. Tanami – Timor Sea Coast

13. Tanami – Timor Sea Coast



13.1 Introduction

This chapter examines water resources in the Tanami – Timor Sea Coast region in 2009–10 and over recent decades. Seasonal variability and trends in modelled water flows, stores and levels are considered at the regional level. Information on water use is also provided for selected urban centres and irrigation areas. The chapter begins with an overview of key data and information on water flows, stores and use in the region in recent times followed by a brief description of the region.

Water quality, which is important in any water resources assessment, is not addressed. At the time of writing, suitable quality controlled and assured surface water quality data from the Australian Water Resources Information System (Bureau of Meteorology 2011a) were not available. Groundwater and water use are only partially addressed for the same reason. In future reports, these aspects will be dealt with more thoroughly as suitable data become operationally available.

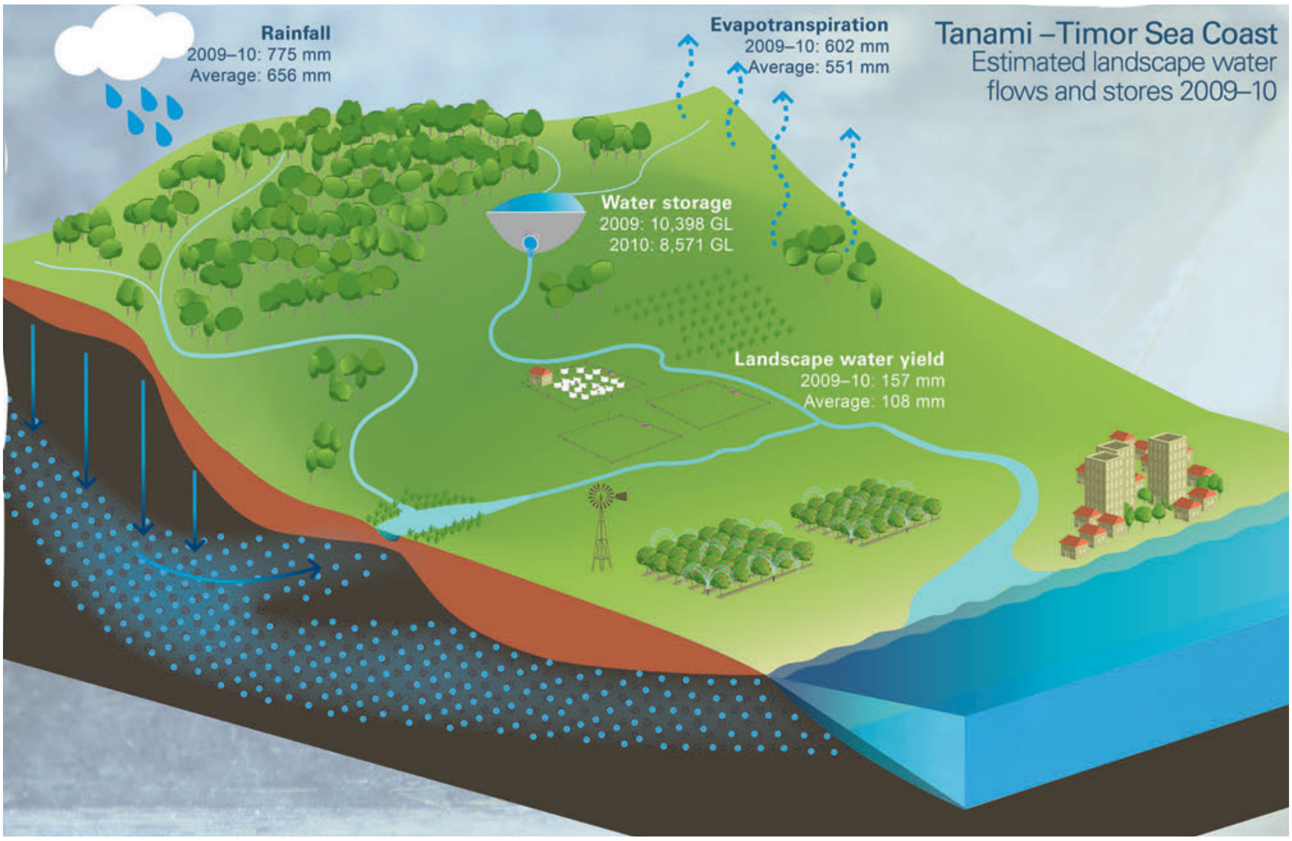


Figure 13-1. Overview of annual landscape water flow totals (mm) in 2009–10 compared to the long-term average (July 1911 to June 2010) and accessible surface water storage volumes (GL) for the 1st July 2009 and 30th June 2010 for the Tanami – Timor Sea Coast region

13.2 Key data and information

Figure 13-1 presents the 2009–10 annual landscape water flows and the change in accessible surface water storage in the Tanami – Timor Sea Coast region. The region experienced above average annual rainfall and evapotranspiration for 2009–10 (see Table 13-1) and the relatively high levels of water availability also resulted in above average modelled landscape water yield[1] and also an increase in soil moisture conditions. Total accessible surface water storage in the region decreased over the year, largely due to significant releases of water from Lake Argyle concurrent with average rainfall and run-off conditions in the Ord River basin.

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

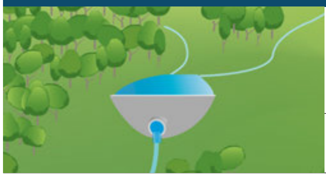
1. See Section 1.4.3 of Chapter 1–Introduction for the definition of this term.

Table 13-1. Key information on water flows, stores and use in the Tanami – Timor Sea Coast region[2]

Landscape water balance

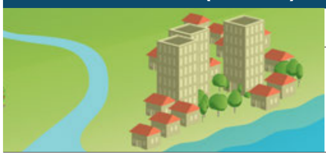
	During 2009–10			During the past 30 years	
	Region average	Difference from long-term mean	Rank (out of 99)*	Highest value (year)	Lowest value (year)
Rainfall	775 mm	+18%	82	1,132 mm (1999–2000)	411 mm (1991–92)
Evapotranspiration	602 mm	+9%	76	713 mm (2000–01)	502 mm (1992–93)
Landscape water yield	157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



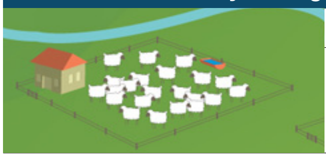
Total accessible capacity	July 2009		June 2010		% Change
	Accessible volume	% of accessible capacity	Accessible volume	% of accessible capacity	
10,683 GL	10,398 GL	97.3%	8,571 GL	80.2%	-17.1%

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

2. See Section 1.4.3 of Chapter 1–Introduction for the definition of these terms.

13.3 Description of region

The Tanami – Timor Sea Coast region extends over a large area of northern Australia between the Northern Territory to the east and Western Australia to the west. The region covers approximately 1,162,000 km^2 of land area and includes the river basins of the Ord, Darwin, Daly, Fitzroy and Katherine rivers.

The topography of the region generates two dominant drainage patterns with high density northern rivers draining to the Timor Sea and drier rivers draining predominantly south to inland ephemeral lakes (Figure 13-2). The region extends across distinctive climatic zones and is dominated by a humid tropical climate to the north and a very dry arid climate to the south. River flows in the tropical northern zone experience distinct seasonal patterns, with approximately 90 per cent of the average annual discharge occurring in the four-month wet season from December to March.

The region is very sparsely populated and Darwin is the major urban centre. The two main urban surface water supply systems are the Darwin River reservoir (accessible storage capacity of 259 GL) providing water supplies for Darwin, and diversions from the Katherine River that supply the town of Katherine. Most other communities in the region rely heavily on groundwater supplies. More details of the region's significant urban water systems are described in Section 13.6.

The Ord Irrigation Scheme, located in the Ord River catchment in the far northeastern part of Western Australia, is the largest area of irrigated agriculture in the region. The Ord River is highly regulated downstream of the Ord River Dam, impounding Lake Argyle (accessible storage capacity of approximately 10,700 GL). The main industries within the Ord River catchment are agriculture, horticulture, tourism and mining. Water supply to the Ord Irrigation Scheme is described in Section 13.7.

Land use in the region mainly consists of pasture and natural conservation land (Figure 13-2). Some of the most famous natural attractions in Australia are located in this region, including the Kimberleys and Kakadu National Park.

The hydrogeology of the region is dominated by the Kimberley hard rock plateau and Canning Basin sedimentary rocks. In the hard rock plateau, groundwater occurs in lesser but valuable quantities in fractured rocks and surficial river alluvium. Substantial quantities of confined and unconfined groundwater of varying quality occur in the sedimentary basins. The extensive groundwater resources associated with the widespread fractured and cavernous limestone of the Daly Basin are important for the region. A more detailed description of the groundwater occurrence in the region is given in Section 13.5.

In the northern part of the region, watertables in shallow aquifers respond dramatically to the seasonal rains, often rising and falling several metres each year. Many shallow aquifers fill to capacity, and drain slowly to the rivers and the coast during the dry season. For example, the extensive aquifers of the Tindall Limestone and Oolloo Dolostone (in the Daly River basin) are often the primary sources of water that keep local streams flowing year-round (CSIRO 2009). Shallow groundwater is often of good quality (low salinity), reflecting the annual fill-and-spill cycle, and can provide good supplies of potable water. However, groundwater extractions adjacent to streams may need regulation to ensure groundwater input to streamflow does not fall below critical limits.

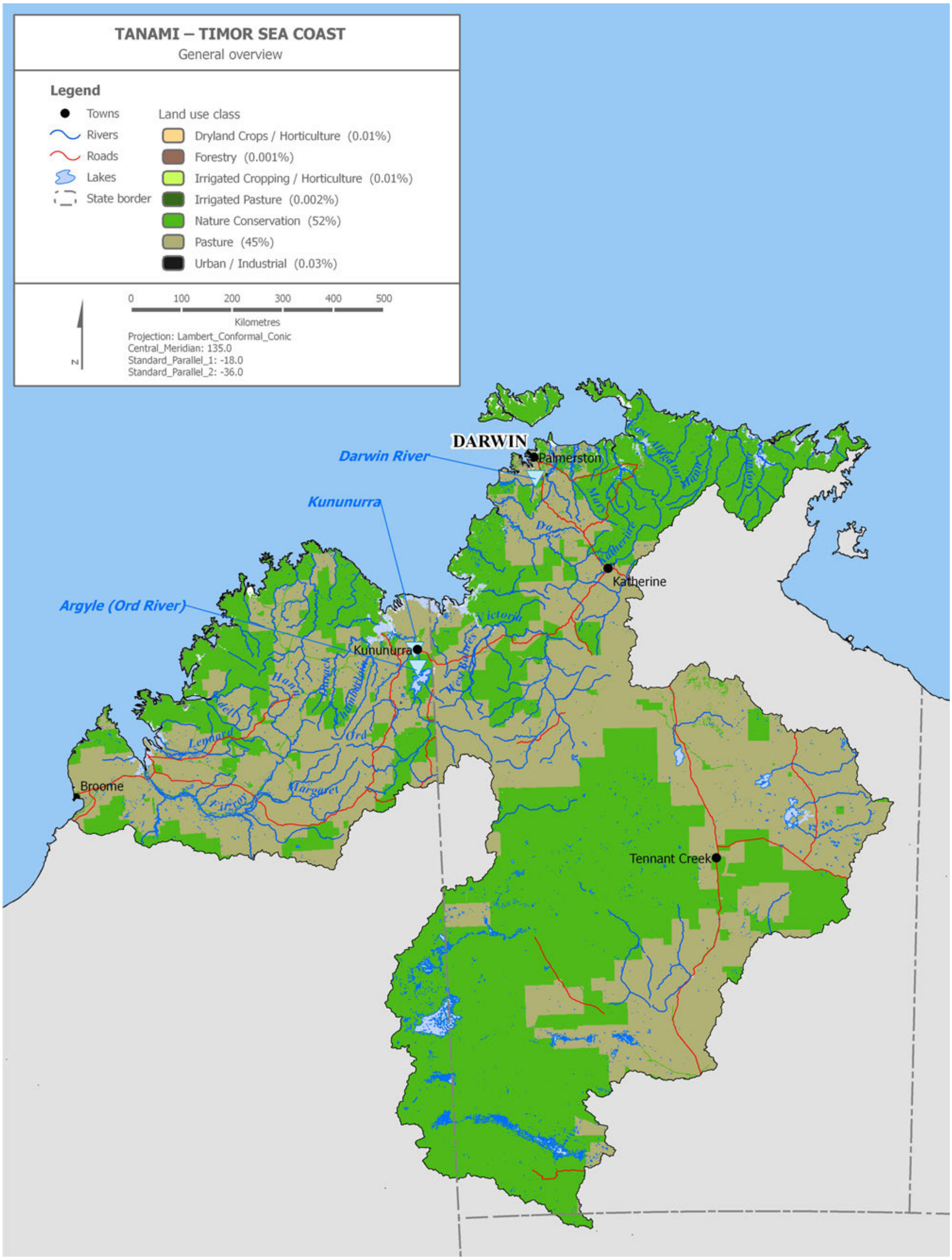


Figure 13-2. Key landscape and hydrological features of the Tanami – Timor Sea Coast region (land use classes based on Bureau of Rural Sciences 2006)

13.3 Description of region (continued)

Groundwater recharge rates are variable across the landscape, and depend on soil type, vegetation and topography as well as rainfall amount and other climate variables. The complex interplay between these parameters means there is not always a direct correlation between rainfall and groundwater recharge rates. Pathways for water infiltration to watertables can be complex and may change in importance through the year. Rivers may recharge aquifers during the wet months, while discharging groundwater may keep rivers flowing during the dry months (CSIRO 2009).

In the higher rainfall areas of the north (over 800 mm/year), recharge is relatively high and occurs regularly each year. In the low rainfall areas of the south, recharge is very low and occurs infrequently. This, and the interconnection between surface water and groundwater, has a major influence on reliability and long-term sustainability of groundwater supplies. In general, groundwater data are very sparse for most aquifers across the project area.

Darwin, Palmerston, Broome, Katherine and Kununurra are the major towns in the region. Darwin has the largest population and is subject to an extreme range of climatic conditions. The Water and Power Corporation of Northern Territory and the Water Corporation of Western Australia are the region's main water providers.

Surface and groundwater are both sources of water for the cities and towns in the region. Most of the urban area is concentrated in Darwin, Broome, Katherine and Kununurra. Surface water is a major source of water for Darwin and Katherine while smaller communities usually rely on groundwater supplies. In rural areas, domestic production bores are the main sources of water. The pastoral industry across the region also uses groundwater. Large scale irrigated agriculture occurs predominantly along the Ord River and, at a smaller scale, near Darwin and Katherine.

The major watertable aquifers present in the region are given in Figure 13-3. The region is dominated by fractured rock groundwater systems that may provide a low volume groundwater resource, and by the extensive regional karstic system in the central-east part of the region that can provide high yield. The extensive aquifers of the Tindall Limestone and Oolloo Dolostone within the Daly River basin, for example, may support the use of over 100 GL/year (CSIRO 2009). Groundwater systems that provide great potential for extraction are labelled as:

- fractured and karstic rocks, regional scale and local scale aquifers
- Mesozoic sediment aquifer (porous media – consolidated).

Figure 13-4 shows the classification of watertable aquifer as fresh and saline water according to the salinity levels. Shallow groundwater generally has good quality throughout the region, reflecting the annual fill-and-spill cycle, and can be a good source of local supplies of potable water. The areas with high salinity values are relatively small.

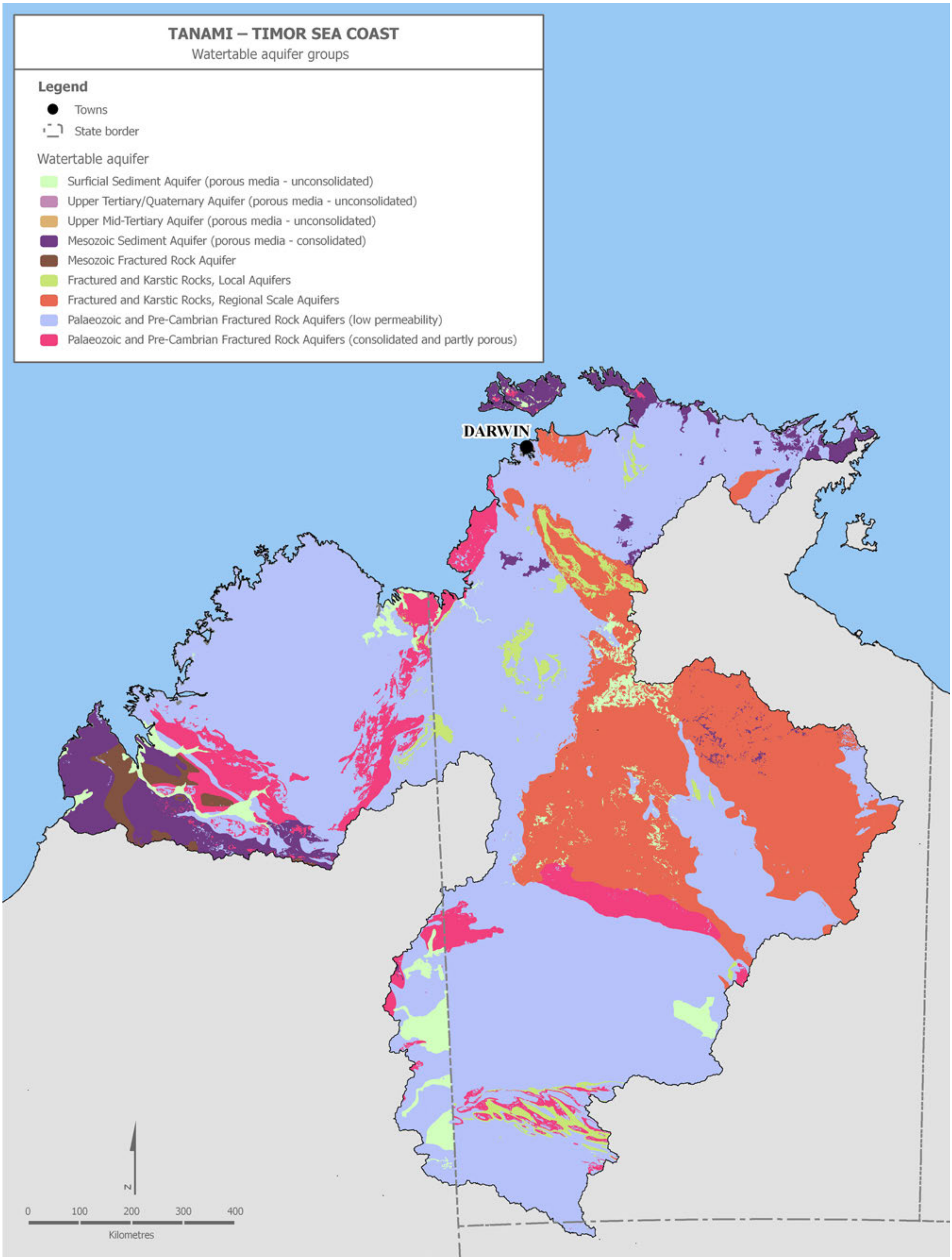


Figure 13-3. Watertable aquifer groups in the Tanami – Timor Sea Coast region (Bureau of Meteorology 2011e). The discontinuity in aquifers across the state border is the result of different state-based aquifer classification systems

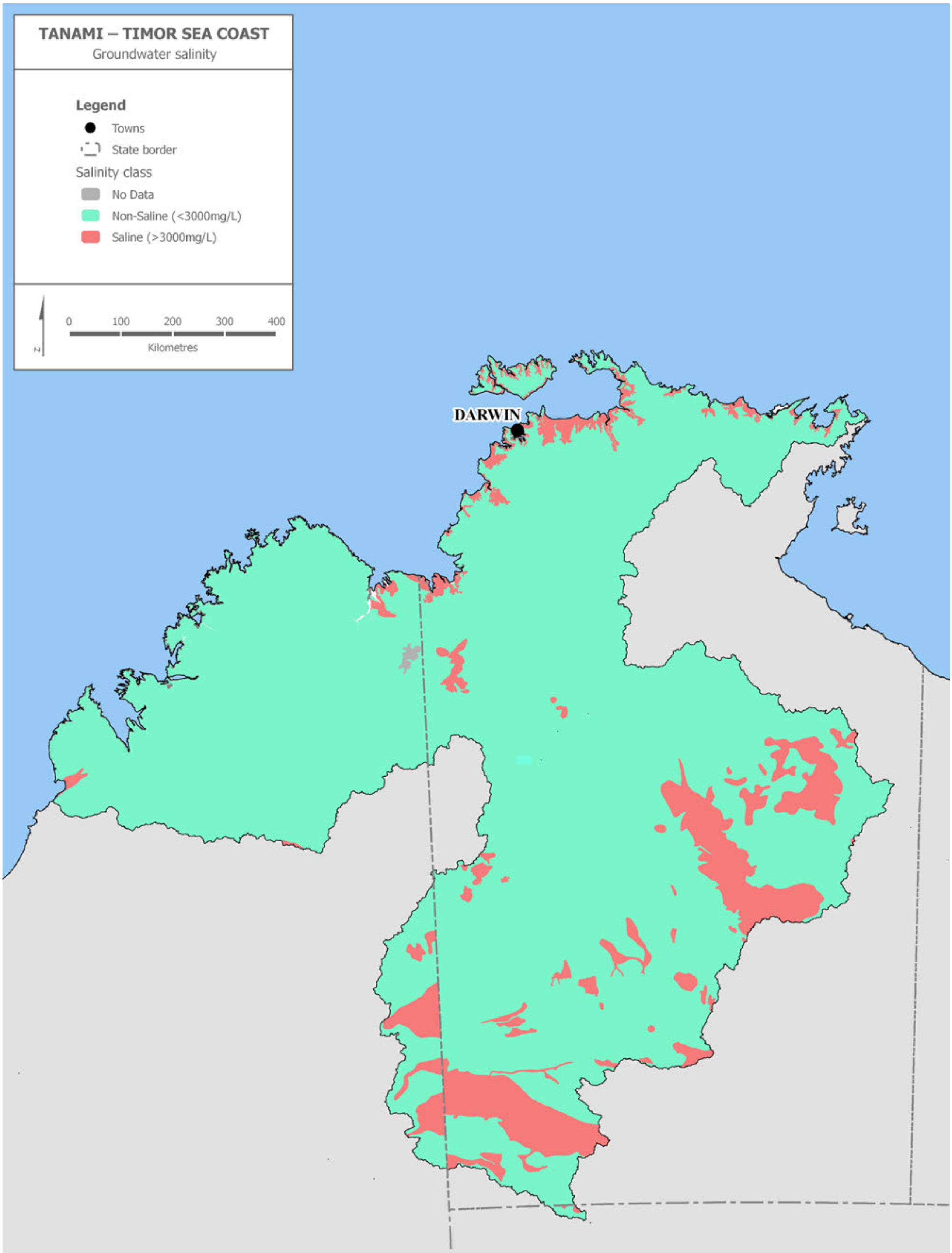


Figure 13-4. Watertable salinity classes within the Tanami – Timor Sea Coast region (Bureau of Meteorology 2011e). The discontinuity in salinity classes across the state border is the result of different state-based aquifer classification systems

13.4 Recent patterns in landscape water flows

The landscape water flows analyses presented in this section were derived from water balance models and are estimates of the real world situation. 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. The models used and the associated output uncertainties are discussed in Chapters 1 and 2, with more details presented in the Technical supplement.

Figure 13-5 shows that the Tanami – Timor Sea Coast region experiences a highly seasonal distribution of rainfall. The north of the region in particular has a very dominant summer wet season and dry winter season. Inland areas to the south and southwest of the region have lower annual rainfall. During 2009–10, rainfall was at relatively normal levels through the dry period at the beginning of the year. The historically wetter months of November to April were largely wetter than normal, with the exception of March 2010, and relatively high rainfall continued through to May 2010.

Evapotranspiration is strongly constrained by water availability in Australia's far north and therefore the seasonal distribution of monthly evapotranspiration is very closely linked to seasonal rainfall patterns. In 2009–10, monthly evapotranspiration was at a normal to slightly above normal level as a consequence of readily available moisture, particularly during the very wet summer months.

The region's seasonal pattern of modelled landscape water yield is also closely linked to the pattern of monthly rainfall. During the start of 2009–10, landscape water yield was constrained to very low levels, particularly from July to November 2009. A higher than normal landscape water yield response occurred during the high rainfall months of December to January, when monthly rainfall significantly exceeded the evaporative losses.

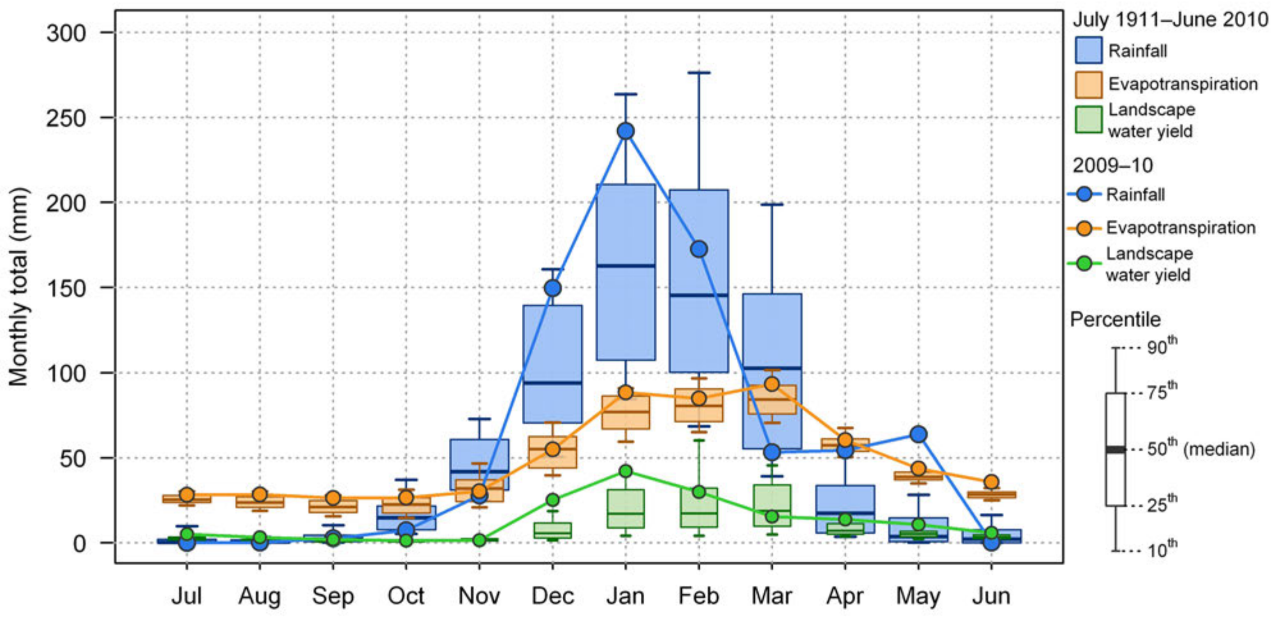


Figure 13-5. Monthly landscape water flows for the Tanami – Timor Sea Coast region in 2009–10 compared with the long-term record (July 1911 to June 2010)

13.4.1 Rainfall

Rainfall for the Tanami – Timor Sea Coast region for 2009–10 was estimated to be 775 mm, which is 18 per cent above the region's long-term (July 1911 to June 2010) average of 656 mm. Figure 13-6 (a)[3] shows that during 2009–10, the highest rainfall occurred in coastal areas in the north of the region. Rainfall deciles for 2009–10, shown in Figure 13-6 (b), indicate rainfall was above average across large parts of the region and very much above average in areas of the far north and southeast. Below average rainfall was experienced across limited areas through the region's centre.

Figure 13-7 (a) shows annual rainfall for the region over the past 30 years (July 1980 to June 2010). Over the 30-year period, annual rainfall ranged from 411 mm (1991–92) to 1,132 mm (1999–2000). The annual average for the period was 751 mm. The data indicate that annual rainfall was generally lower during the first half of the 30-year record when compared to annual rainfall over the second half of the period.

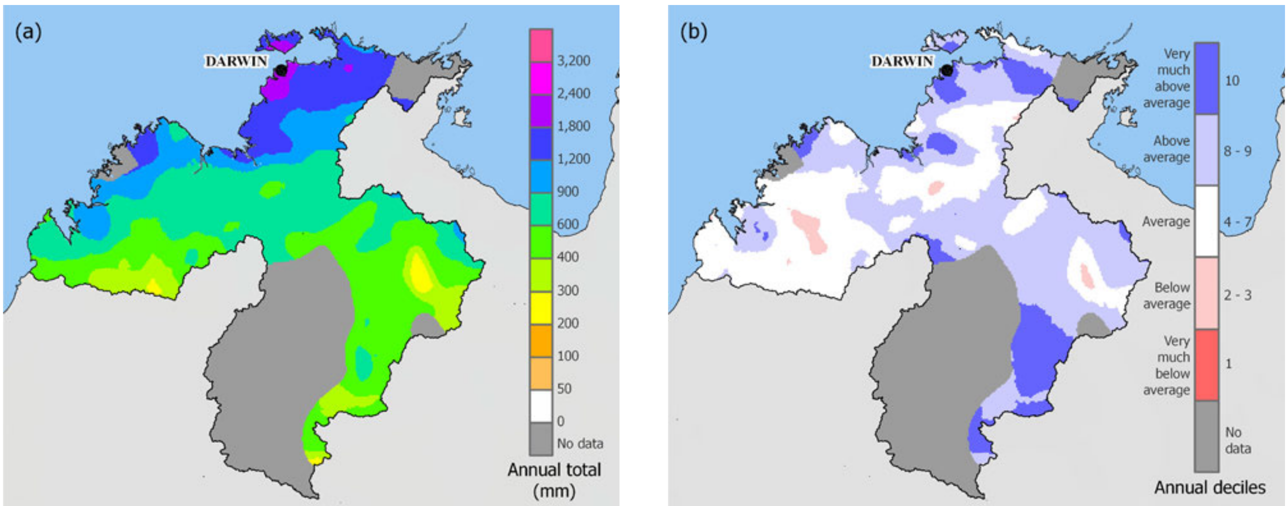
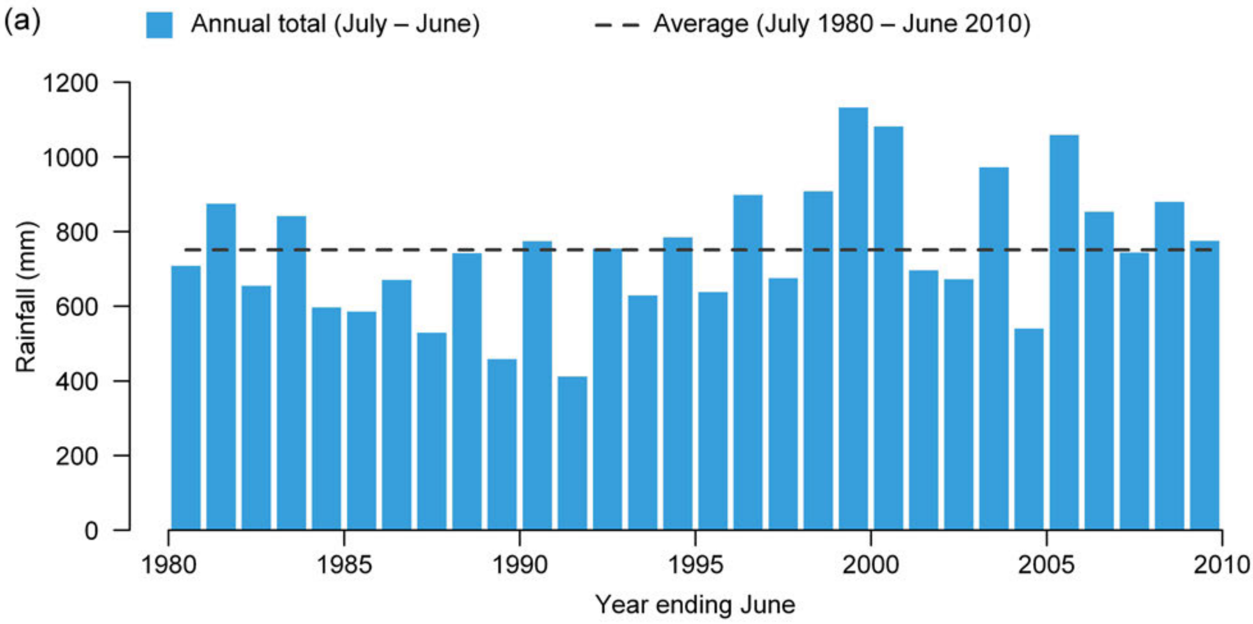


Figure 13-6. Maps of annual rainfall totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Tanami – Timor Sea Coast region

3. Areas where rainfall interpolation was assessed to be greater than 20 per cent unreliable for any period of the long-term record were excluded from the landscape water balance modelling (classified as 'No data'). More details are presented in the Technical supplement.



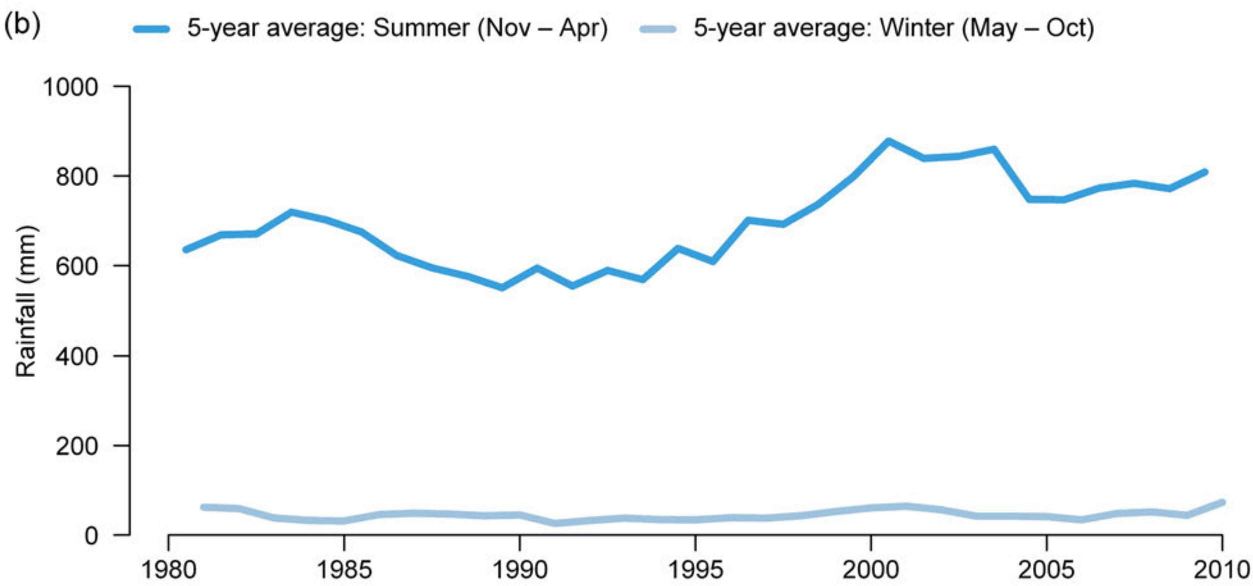


Figure 13-7. Time-series of annual rainfall (a) and five-year (backward looking) moving average of November–April (summer) and May–October (winter) totals (b) for the Tanami – Timor Sea Coast region

13.4.1 Rainfall (continued)

An indication of patterns, trends and variability in the seasonal rainfall over the 30-year period summer (November–April) and winter (May–October) are presented using moving averages in Figure 13-7 (b). The data show the highly seasonal nature of rainfall for the region, characterised by very high summer rainfall and dry winters. Summer rainfall averages show an increasing trend over the 30-year period.

Figure 13-8 provides a spatial representation of the summer (November–April) and winter (May–October) rainfall trends throughout the region between November 1980 and October 2010. The linear regression slope calculated for each 5 x 5 km grid cell depicts the change in seasonal rainfall over the 30 years.

The analysis indicates increasing rainfall in the summer period across the majority of the region with particularly strong positive trends in the far north. Slight reductions in summer rainfall are identified across limited areas in the far south and northwest. The analysis of the lower winter period indicates slight increases in rainfall across the region. No change in rainfall or slight negative trends in winter rainfall are observed in the far east of the region.

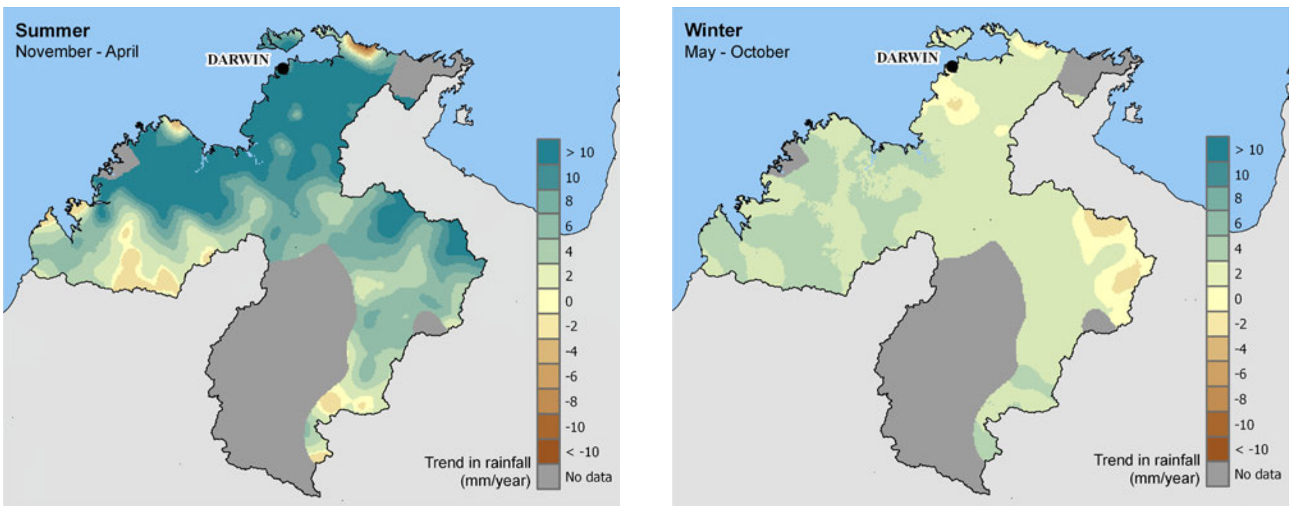
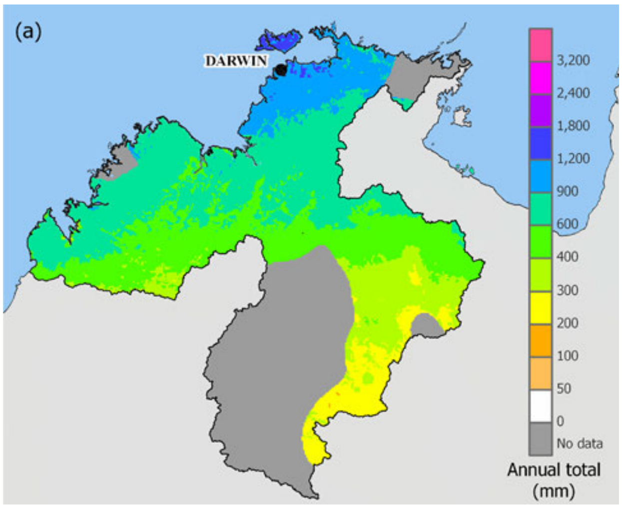


Figure 13-8. Linear trends in summer (November–April) and winter (May–October) rainfall over 30 years (November 1980 to October 2010) for the Tanami – Timor Sea Coast region. The statistical significance of these trends is often very low

13.4.2 Evapotranspiration

Evapotranspiration for the Tanami – Timor Sea Coast region for 2009–10 was estimated to be 602 mm, which is nine per cent above the region's long-term (July 1911 to June 2010) average of 551 mm. Figure 13-9 (a) shows that evapotranspiration for 2009–10 was closely related to the distribution of annual rainfall. Highest values occurred in the region's far north with decreasing gradient to the drier inland areas in the south and southeast. Evapotranspiration deciles for 2009–10, shown in Figure 13-9 (b), indicate average or above average levels across most of the region, with very much above average values of the west. A very limited area of below average evapotranspiration is identified in the north of the region.

Figure 13-10 (a) shows annual evapotranspiration for the past 30 years (July 1980 to June 2010). Over the 30-year period, annual evapotranspiration ranged from 502 mm (1992–93) to 713 mm (2000–01). The annual average for this period was 597 mm. The data show that annual evapotranspiration was consistently higher over the wetter second half of the 30-year period.



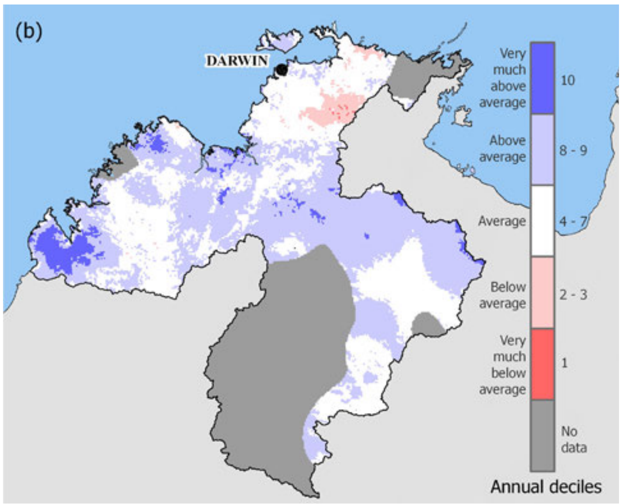
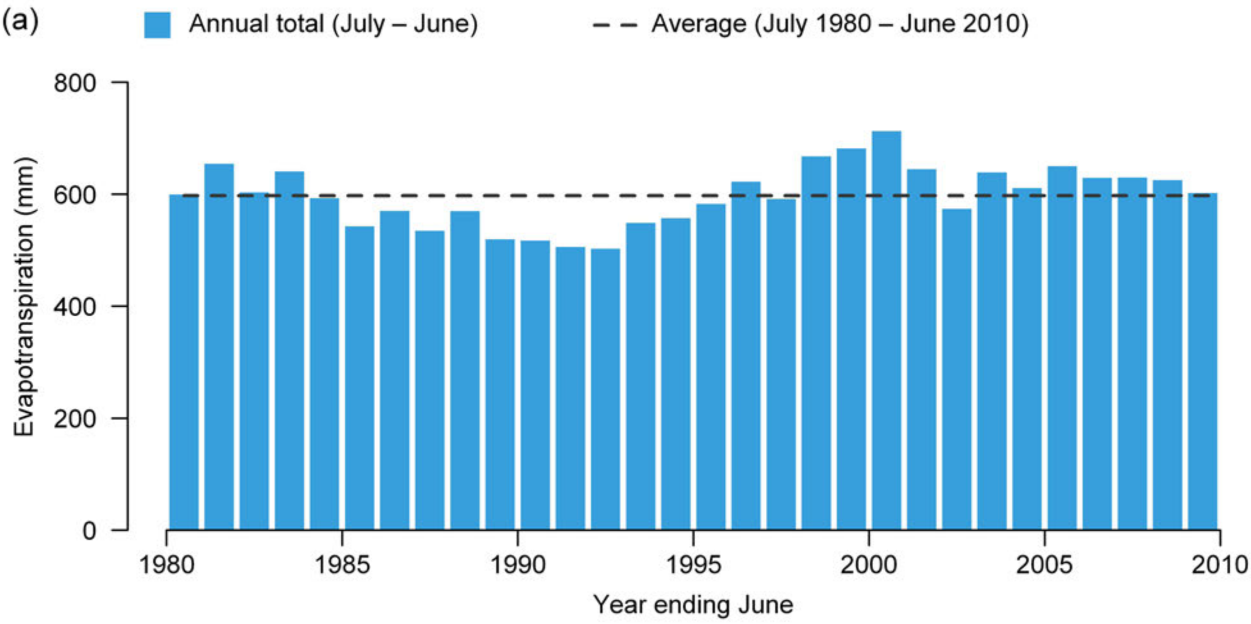


Figure 13-9. Maps of modelled annual evapotranspiration totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Tanami – Timor Sea Coast region

(a)



(b)

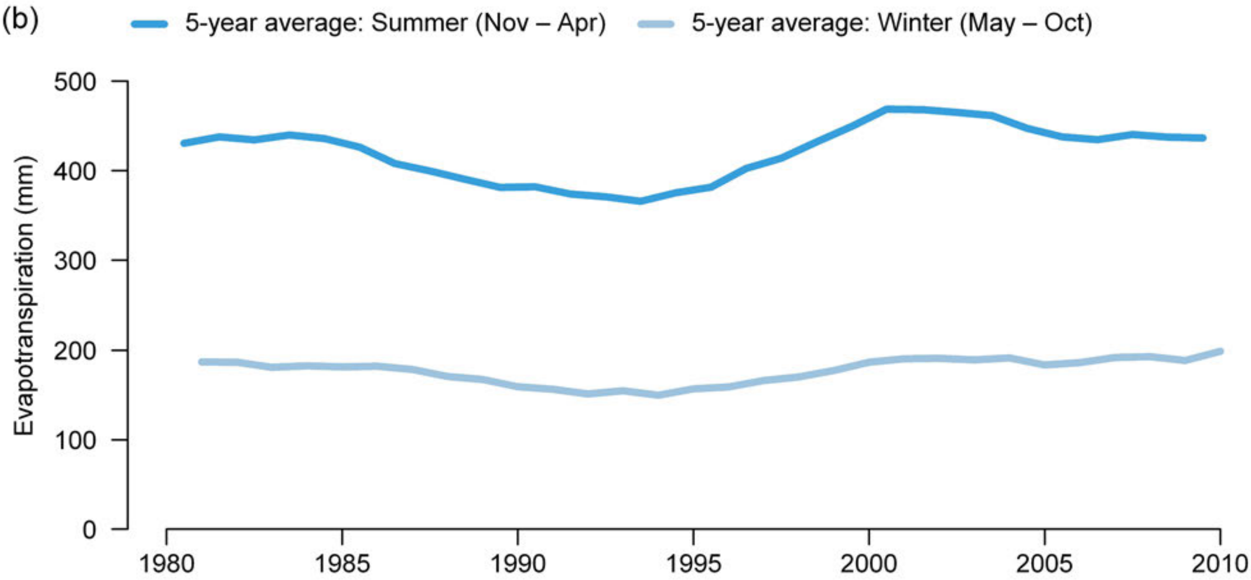


Figure 13-10. Time-series of modelled annual evapotranspiration (a) and five-year (backward looking) moving averages for summer (November–April) and winter (May–October) evapotranspiration (b) for the Tanami – Timor Sea Coast region

13.4.2 Evapotranspiration (continued)

An indication of patterns, trends and variability in the seasonal evapotranspiration over the 30-year period summer (November–April) and winter (May–October) are presented using moving averages in Figure 13-10 (b). The graph shows summer evapotranspiration is consistently higher than winter. Increases in annual evapotranspiration over the second half of the 30-year period are reflected in both seasonal averages, particularly in the summer.

Figure 13-11 provides a spatial representation of trends in summer (November–April) and winter (May–October) evapotranspiration throughout the region between November 1980 and October 2010. The linear regression slope calculated for each 5 x 5 km grid cell depicts the change in seasonal evapotranspiration over the 30 years.

General increases in evapotranspiration are observed across almost the entire region for the summer period, with limited areas of very slight negative trends in the coastal areas of the far north. The winter period analysis shows slight increases in evapotranspiration across much of the region. The stronger increases in summer evapotranspiration are also reflected in the five-year moving averages (Figure 13-10 [b]).

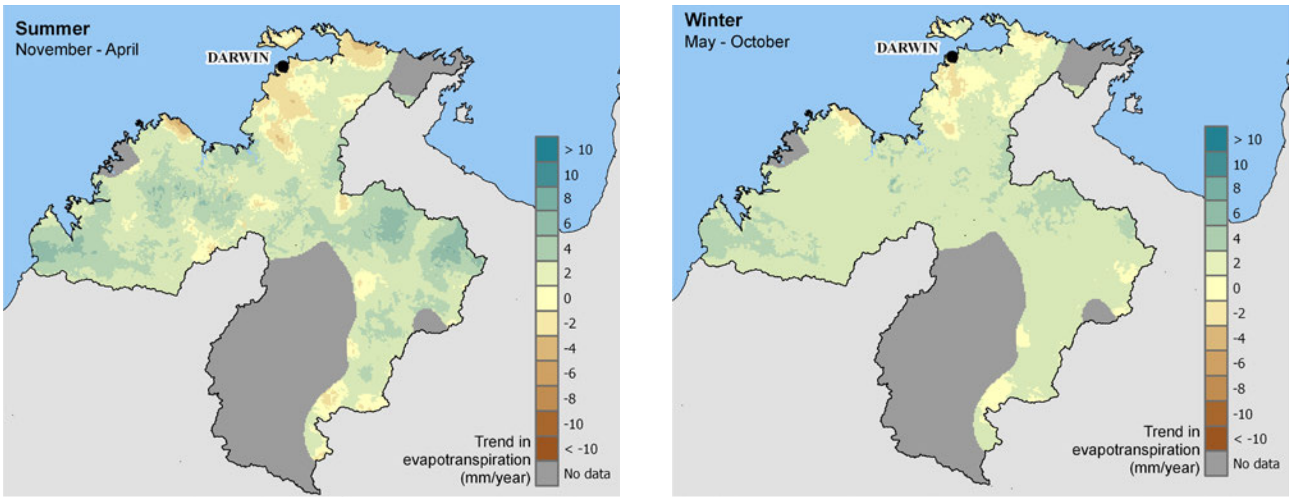


Figure 13-11. Linear trends in modelled summer (November–April) and winter (May–October) evapotranspiration over 30 years (November 1980 to October 2010) for the Tanami – Timor Sea Coast region. The statistical significance of these trends is often very low

13.4.3 Landscape water yield

Landscape water yield for the Tanami – Timor Sea Coast region for 2009–10 was estimated to be 157 mm, which is 46 per cent above the region's long-term (July 1911 to June 2010) average of 108 mm. Figure 13-12 (a), shows that 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 13-12 (b), indicate average and above average landscape water yield across the majority of the region. Very much above average values are observed to the southeast of the region and across areas to the north and west.

Figure 13-13 (a) shows landscape water yield for the past 30 years (July 1980 to June 2010). Over the 30-year period, landscape water yield ranged from 34 mm (1989–90) to 315 mm (2000–01). The annual average for the period was 150 mm. The data clearly show that, as observed for rainfall, landscape water yield is consistently much higher during the second half of the 30-year period.

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 moving averages in Figure 13-13 (b). 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.

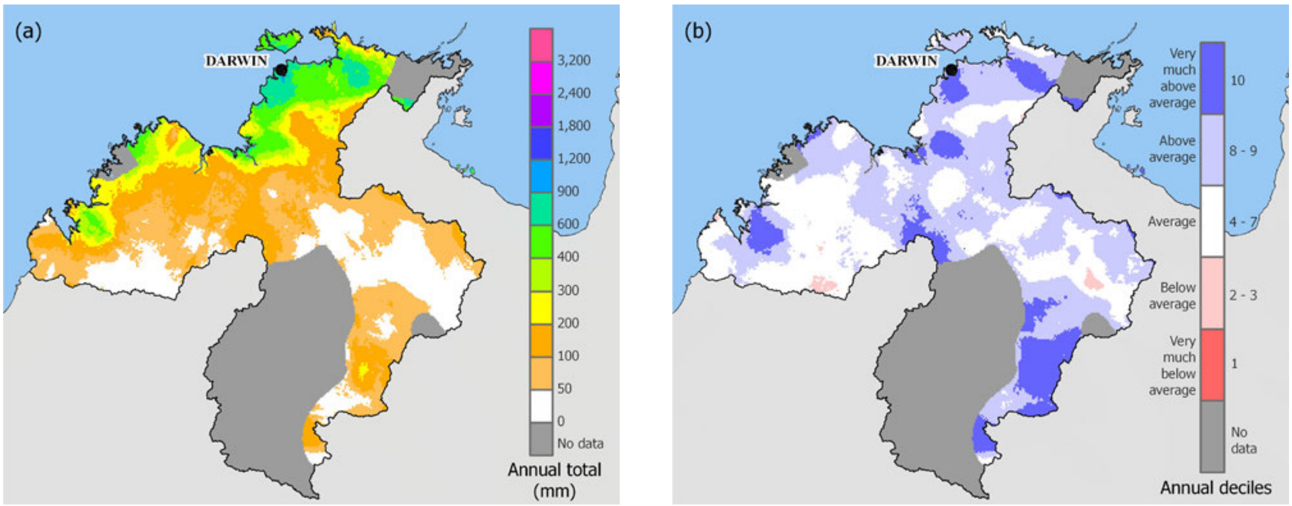
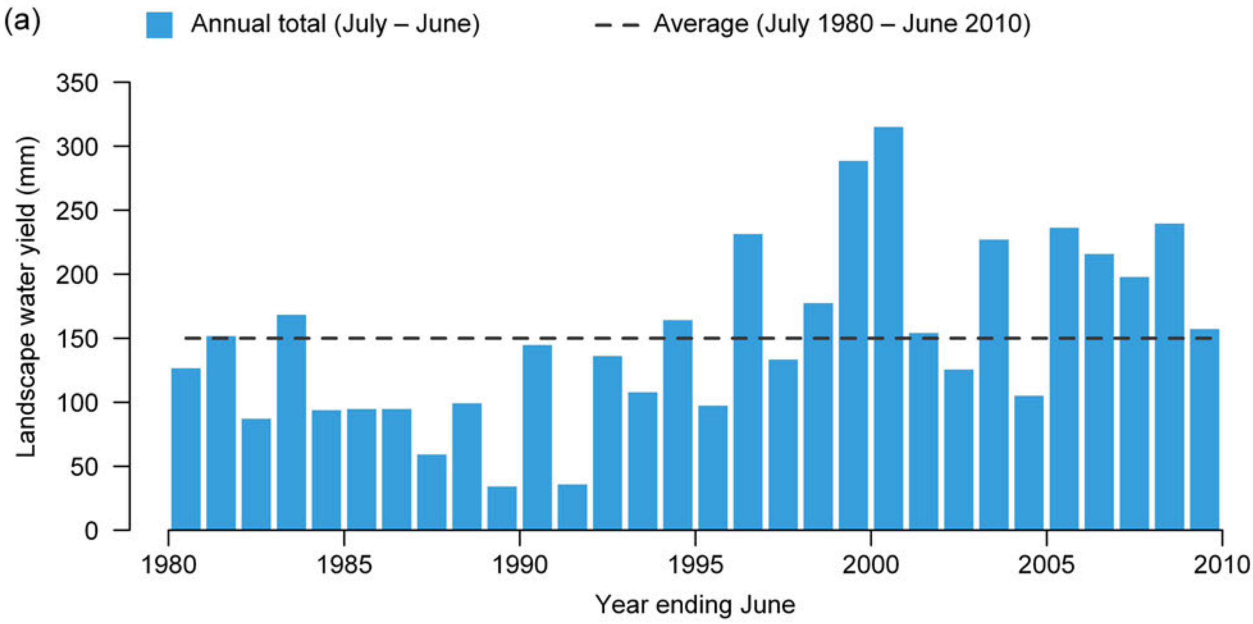


Figure 13-12. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the Tanami – Timor Sea Coast region



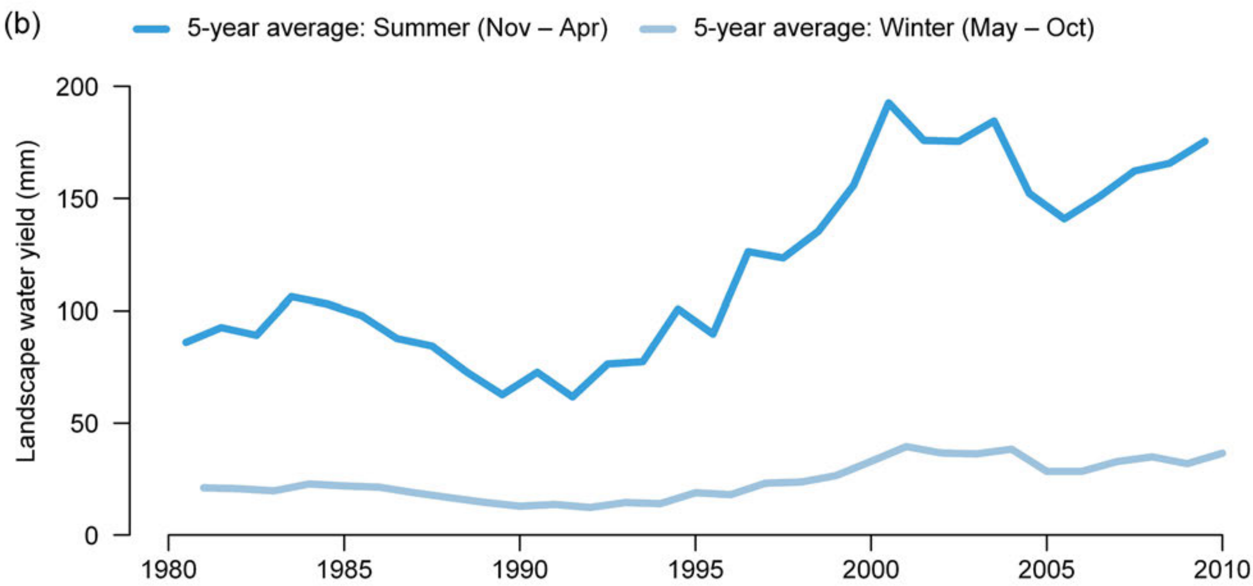


Figure 13-13. Time-series of modelled annual landscape water yield (a) and five-year (backward looking) moving averages for summer (November–April) and winter (May–October) landscape water yield (b) for the Tanami – Timor Sea Coast region

13.4.3 Landscape water yield (continued)

Figure 13-14 provides a spatial representation of summer (November–April) and winter (May–October) landscape water yield trends throughout the region between November 1980 and October 2010. The linear regression slope calculated for each 5 x 5 km grid cell depicts the change in seasonal landscape water yield over the 30 years.

Strong positive trends in summer landscape water yield are identified in the region's far north, where strong positive trends are also identified in the equivalent summer rainfall analysis (Figure 13-8). Slight negative trends are identified in the far south and west. Winter period landscape water yield show slight increases over the 30-year period in northern areas with no clearly identifiable trends across the south and east of the region.

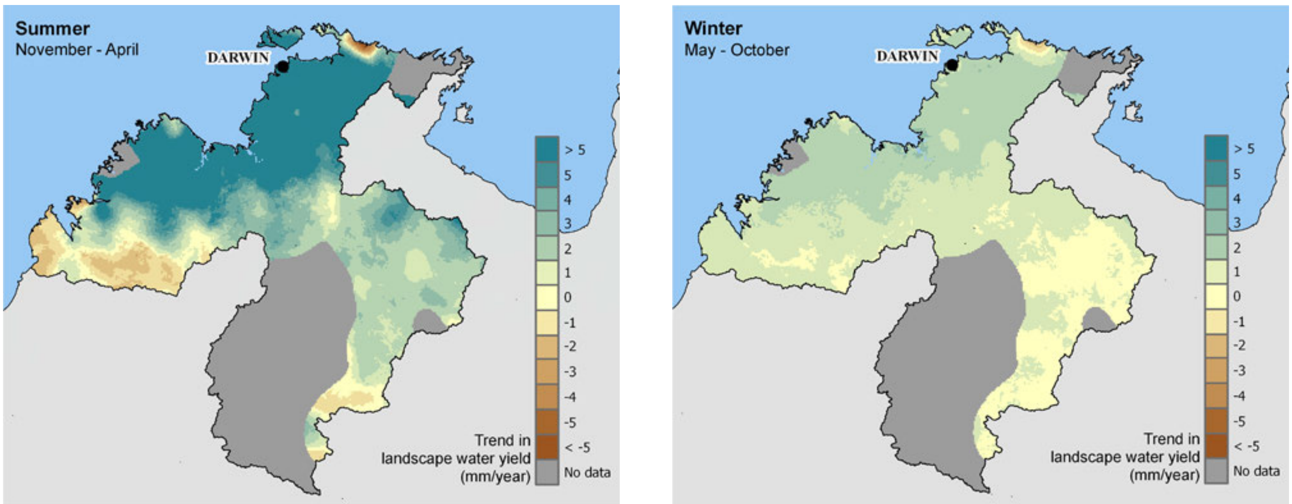


Figure 13-14. Linear trends in modelled summer (November–April) and winter (May–October) landscape water yield over 30 years (November 1980 to October 2010) for the Tanami – Timor Sea Coast region. The statistical significance of these trends is often very low

13.5 Rivers, wetlands and groundwater

The groundwater management units within the region are key features that control the extraction of groundwater through planning mechanisms. Figure 13-15 shows that most of the major groundwater management units within the Northern Territory are located within the fractured and karstic rocks (see Figure 13-3).

The status of rivers, wetlands and groundwater for the Tanami – Timor Sea Coast region were not able to be addressed in this report. At the time of writing, suitable quality controlled and assured data from the Australian Water Resources Information System (Australian Bureau of Meteorology 2010a) were not available.

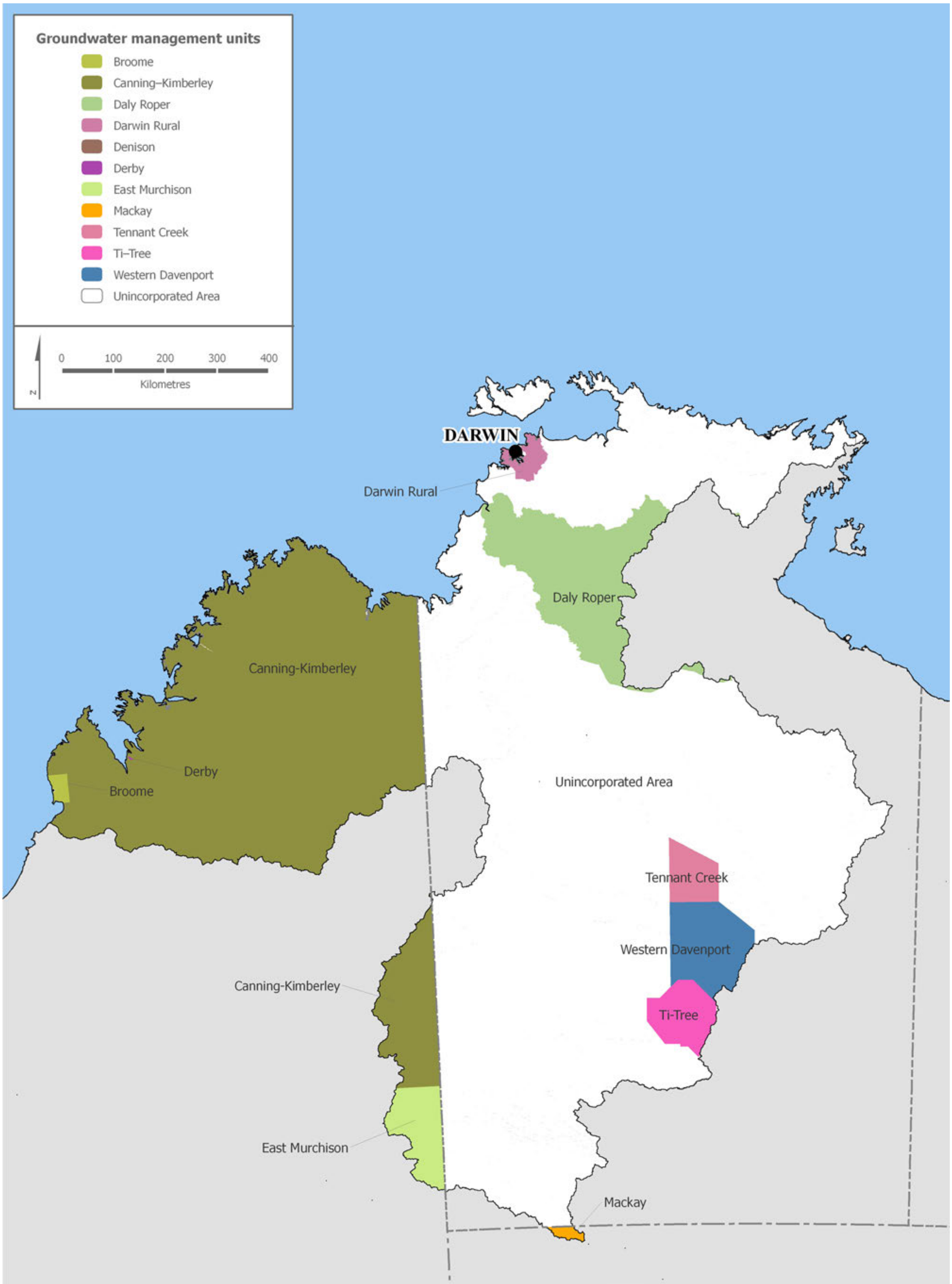


Figure 13-15. Major groundwater management units in the Tanami – Timor Sea Coast region (Bureau of Meteorology 2011e)

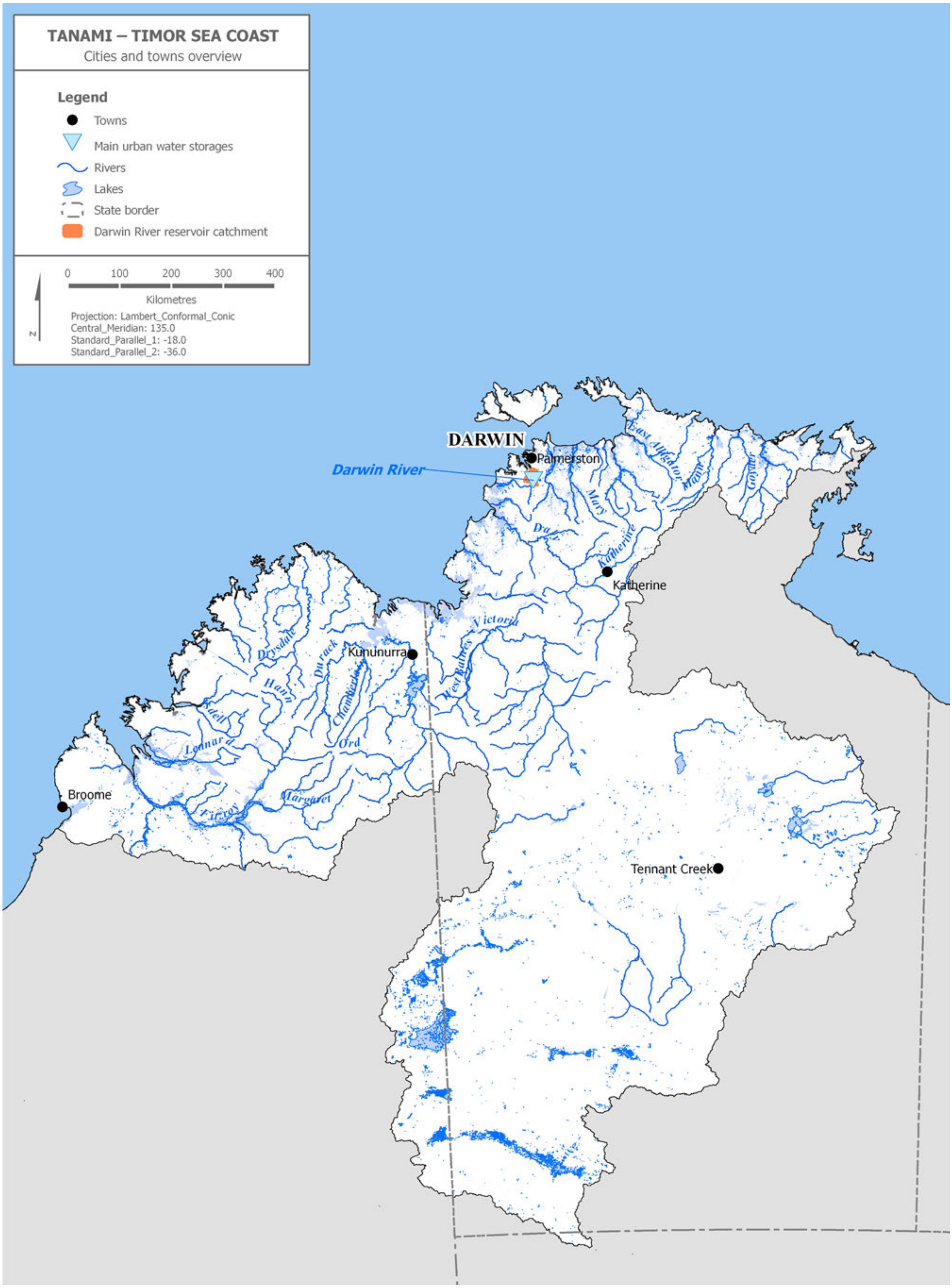


Figure 13-16. Urban areas and supply storages in the Tanami – Timor Sea Coast region

13.6 Water for cities and towns

13.6.1 Regional overview

Darwin, Palmerston, Broome, Katherine and Kununurra are the major urban centres in the Tanami – Timor Sea Coast region. These are shown in Figure 13-16 in relationship to the rivers and major water storages. Surface and groundwater are both significant sources of water in the region. Small communities rely mainly on groundwater supplies.

The Darwin–Palmerston area is the major urban centre with a population of 114,000. The major supply storage for the area is the Darwin River reservoir. Broome represents the next largest urbanised area and is located at the southwestern extreme of the Dampier Peninsula in the southwest of the Kimberley district. Water supplies to Broome and the surrounding areas are sourced mainly from groundwater. Katherine is the third largest centre in the region and also depends on groundwater for most of its supply and Kununurra also relies largely on groundwater.

The Power and Water Corporation is owned by the Northern Territory Government and supplies water to both Darwin and other communities in the Northern Territory. The Water Corporation of Western Australia supplies groundwater to the towns of Broome and Kununurra. In the Northern Territory, management of groundwater and surface water resources is the responsibility of the Northern Territory Department of Natural Resources, Environment, the Arts and Sport.

The Darwin–Palmerston area with a population of 114,000 receives water supplies from the Northern Territory Power and Water Corporation. Water is supplied from a combination of surface water and groundwater sources. Most of this water is sourced from the Darwin River reservoir and is supplemented from Howard East and McMinns bore fields.

In 1972, the Darwin River reservoir was built to address growing water needs arising from the increasing population in the supply area. The reservoir has an accessible storage capacity of 259 GL and is the largest in the region. It is located approximately 45 km southeast of Darwin.

Darwin has a tropical savannah climate with distinct wet and dry seasons, which impacts greatly on the availability of surface water in the storages and recharge to the groundwater. Most of the annual rainfall is experienced from December to April. The timing of the onset of regular evening storms, together with the presence or absence of dry season rainfall, significantly influences water consumption.

13.6.2 Darwin water supply area

Sources and supply of urban water in recent years

Figure 13-17 illustrates the different sources of water from 2005–06 to 2009–10. Data were obtained from the *National Performance Report for 2009–10* (National Water Commission 2011a). On average about 88 per cent of the water sourced is from surface water. Groundwater sourced constitutes on average about 11 per cent of the supply. The use of recycled water is very limited; (approximately one per cent).

The use of surface water ranged from about 35 to 38 GL between 2005–06 and 2009–10. Despite no water restrictions being in place, there was less surface water used in 2009–10 as compared to 2008–09 which may be due to increased community awareness of the need to conserve water. Groundwater use was 3.6 and 5.5 GL in 2005–06 and 2009–10, respectively. This illustrates an increasing trend in groundwater use for the area.

The use of recycled water is less in Darwin than compared with other major cities in Australia. About 0.36 GL of water was sourced from recycling in 2005–06. Most of the recycled water was used for a range of activities such as the irrigation of agriculture, vineyards, market gardens, conservation areas and golf courses.

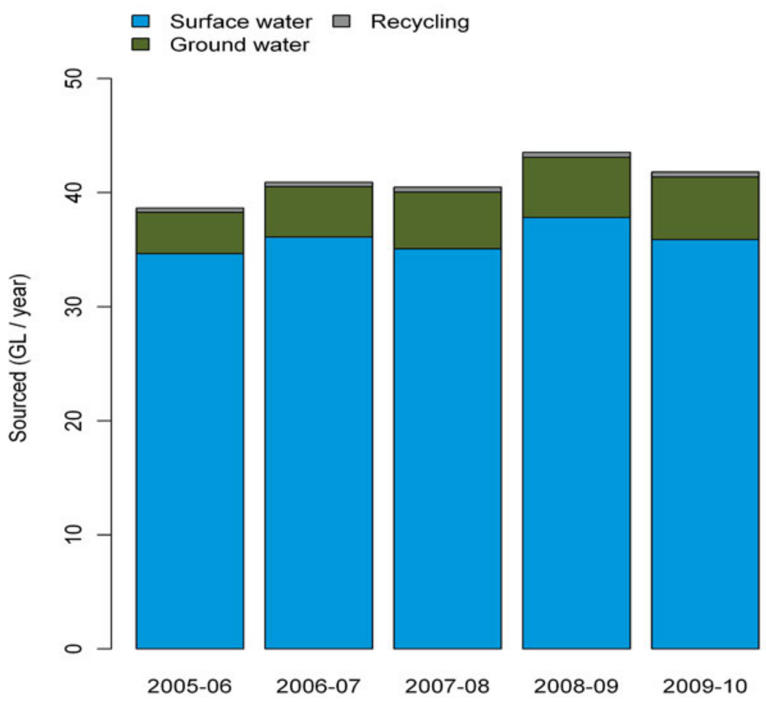


Figure 13-17. Total urban water sourced for the Darwin water supply area from 2005–06 to 2009–10

13.6.2 Darwin water supply area (continued)

Figure 13-18 (National Water Commission 2011a) shows total volume of water delivered to residential, commercial, municipal and industrial consumers by the Power and Water Corporation. From 2005–06 to 2008–09, between 50 and 55 per cent of the water was supplied for residential use and between 41 and 45 per cent was for commercial, municipal and industrial use. The total water use increased slowly from 35 GL to 38 GL between 2005–06 and 2008–09 largely due to population increase. The commercial, municipal and industrial use of water was about 16 GL in 2005–06 and 15 GL in 2009–10. Similarly, the water used for other purposes dropped from 1.6 GL to 0.6 GL during this period.

Based on the figures provided in the *National Performance Report* (National Water Commission 2011a) for population and total water supplied, the per capita water use is estimated to be 892 litres/day in 2005–06 and 855 litres/day in 2009–10. This represents per capita water savings of 37 litres/day. This water saving did not arise from water restrictions and may be due to an increased public awareness of the need to conserve water.

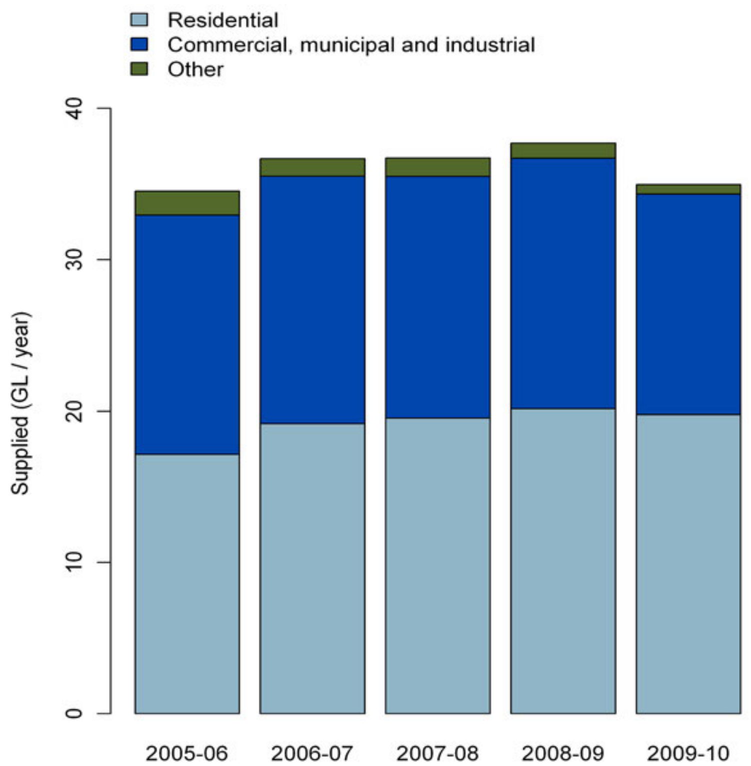


Figure 13-18. Total urban water supplied to the Darwin water supply area from 2005–06 to 2009–10

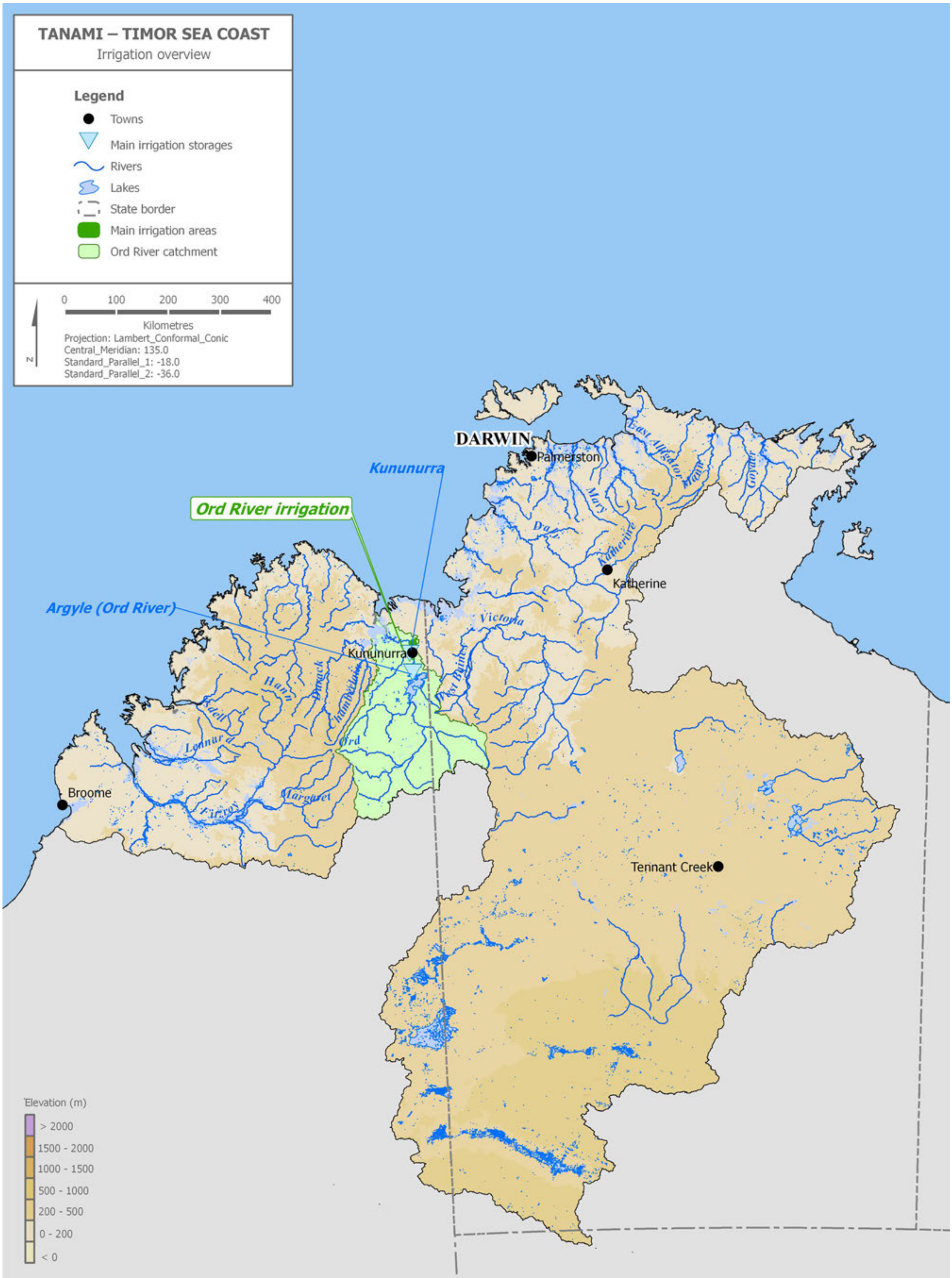


Figure 13-19. Context map of irrigation areas and infrastructure in the Tanami – Timor Sea Coast region

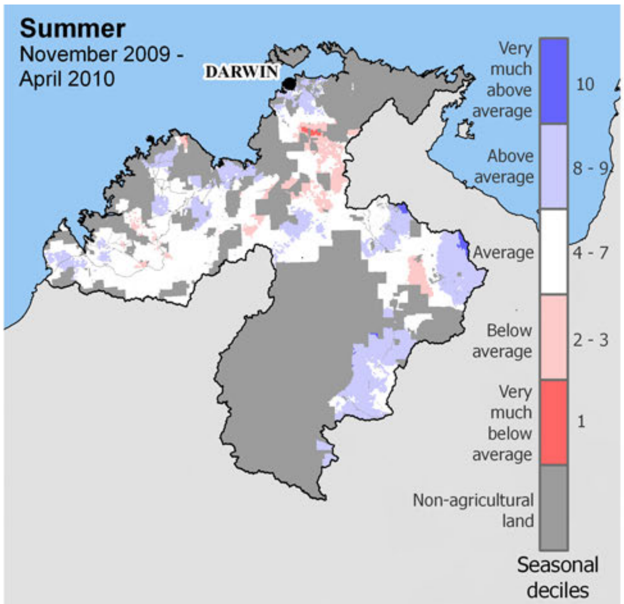
13.7 Water for agriculture

The Tanami – Timor Sea Coast region extends across a range of climatic zones including a humid tropical climate to the north and arid conditions across the southern inland areas. In addition to nature conservation, much of the region is pastoral lands. Irrigated agriculture constitutes only a very small portion (0.01 per cent) of the region and is concentrated in the Ord River catchment (Figure 13-19).

13.7.1 Soil moisture

Upper soil moisture content during the summer (November to April) of 2009–10 shows a mix of average, below average and above average conditions across dryland agricultural areas. Below average conditions were estimated in some central areas to the south of Darwin (Figure 13-20).

Upper soil moisture content for the winter (May to October) of 2010 shows a notable increase since the summer period. Almost the entire region demonstrates very much above average conditions (Figure 13-20). This increase in soil moisture is a result of above average summer and autumn rainfall experienced through to April and May 2010.



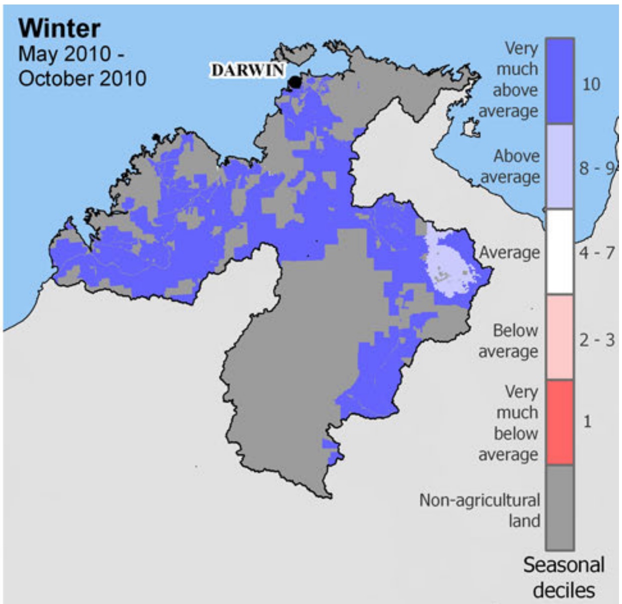


Figure 13-20. Deciles rankings over the 1911–2010 period for modelled soil moisture in the summer (November–April) and winter (May–October) of 2009–10 for the Tanami – Timor Sea Coast region

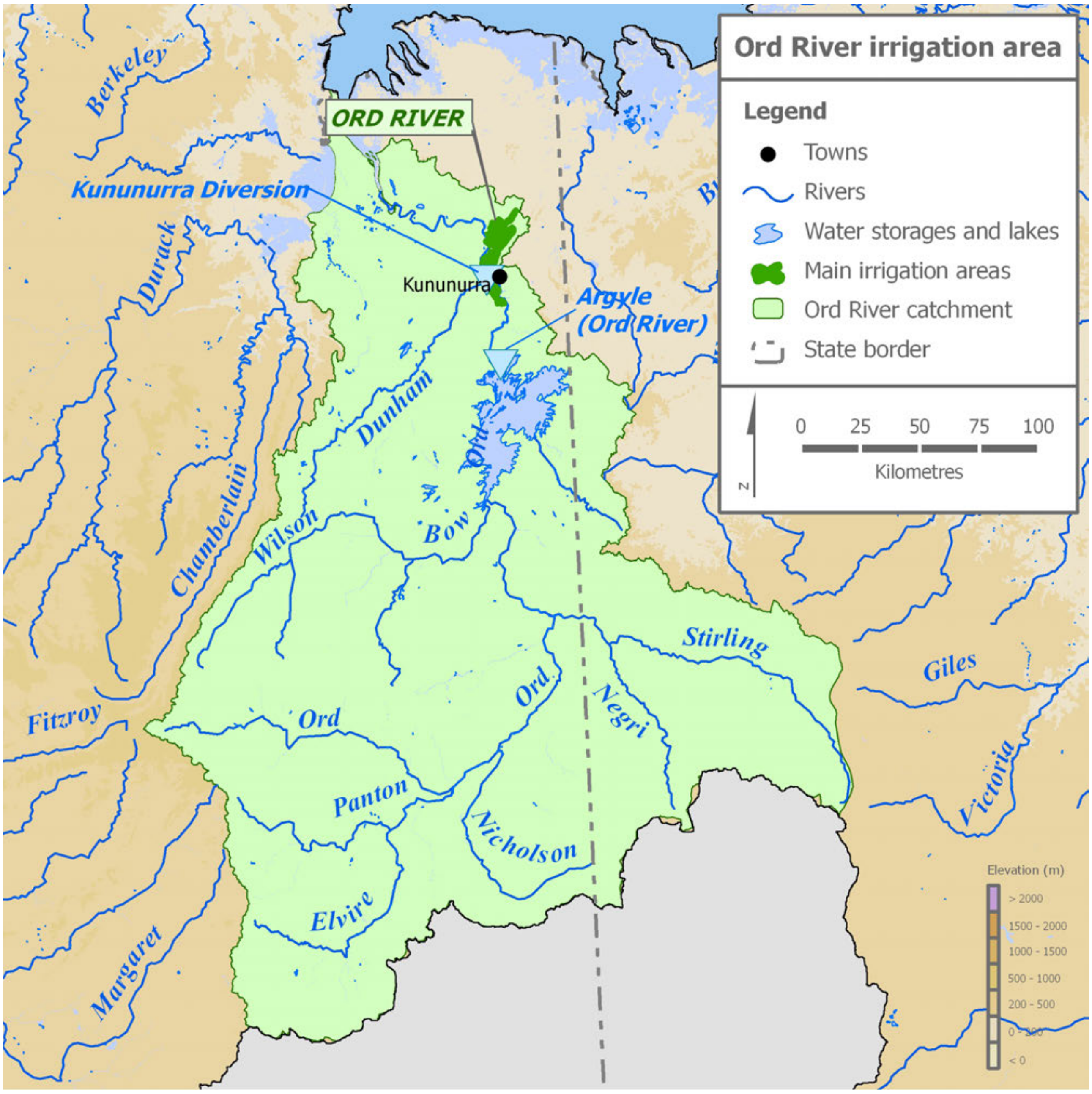


Figure 13-21 Overview map of the Ord River catchment

13.7.2 The Ord River Irrigation Area

The Ord River catchment, located in the east of northern Western Australia, contains the region's major irrigation area. The Ord River, 650 km long, is one of the major rivers of Western Australia. The main tributaries of the Ord River include the Negri, Wilson and Bow rivers (upstream of Lake Argyle), and the Dunham River, which joins the Ord River downstream of the Kununurra Diversion dam.

Rainfall is highly seasonal in the catchment, with over 90 per cent of annual rainfall occurring during the wet season (November to March). Average annual rainfall ranges from 780 mm in the north to 450 mm in the south.

Construction of major dams enabled the development of a 15,000 ha irrigation scheme at Kununurra as well as the generation of hydro-power. The main industries within the Ord River catchment are agriculture, horticulture, tourism and mining.

The Ord River dam was constructed in 1972 and this backs up river flows to form Lake Argyle which is the largest irrigation water storage in Australia (Figure 13-21). It has a hydro-power station which supplies over 90 per cent of the power to the towns of Wyndham and Kununurra, as well as to the Argyle diamond mine. The Kununurra Diversion dam, located 50 km downstream of Lake Argyle, enables water to be diverted for extensive irrigation areas near the town of Kununurra (Government of Western Australia Department of Water 2010a). Lake Argyle has an accessible storage capacity of approximately 10,700 GL. Water is released from Lake Argyle through a hydro-power outlet and a series of controlled release valves at the bases of the dam. Additional flow is released through a spillway plug to provide the dry season flow. These combined releases provide inflow into Lake Kununurra from where it is diverted to the Ivanhoe Plains systems and the Packsaddle pumping stations (Ord Irrigation 2011). The Ord Irrigation Cooperative provides water and drainage services to the farms within the Ord Irrigation Area.

13.7.2 The Ord River Irrigation Area (continued)

Annual rainfall (1907–2004) at Lake Argyle ranges from 302 to 1,637 mm and has a mean of 693 mm. Simulation of the Ord River system over a 100-year period showed that, despite the large storage capacity of Lake Argyle, prolonged dry periods could have a major impact on water supply reliability (Government of Western Australia Department of Water 2010b). It does, however, buffer the system against isolated drier years. Open water evaporation also accounts for a large component of loss from the lake.

The historic data (Figure 13-22) shows that the volume of water in the lake regularly exceeded its total storage capacity for short periods. In 2009–10, the water level in the storage changed from 95 per cent to just below 80 per cent of the accessible storage capacity.

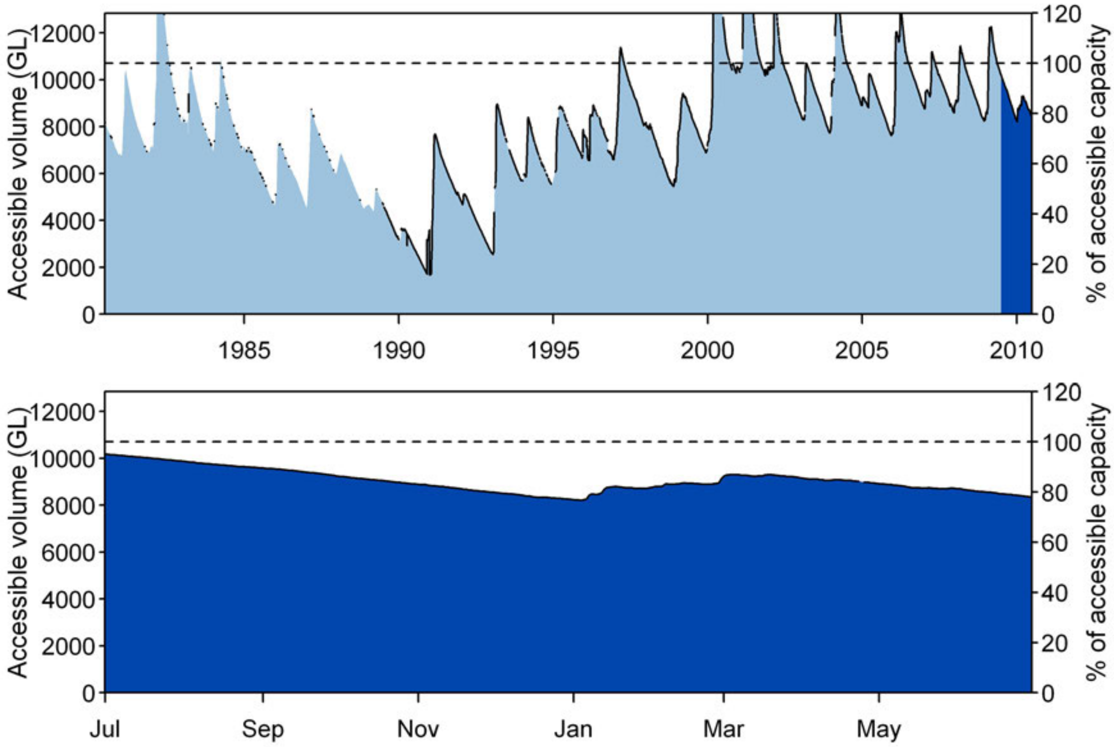


Figure 13-22. Water storage volumes available for irrigation at Lake Argyle since 1980 (left) and during 2009–10 (right). Gaps in the black line indicate unavailable data points