# 12. North Western Plateau

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## 12.1 Introduction

This chapter examines water resources in the North Western Plateau 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.

Details for selected rivers, wetlands, groundwater, urban areas and agriculture are not addressed. At the time of writing, suitable quality controlled and assured information was not identified in the Australian Water Resources Information System (Bureau of Meteorology 2011a).

The chapter begins with an overview of key data and information on water flows in the region in recent times followed by a description of the region.

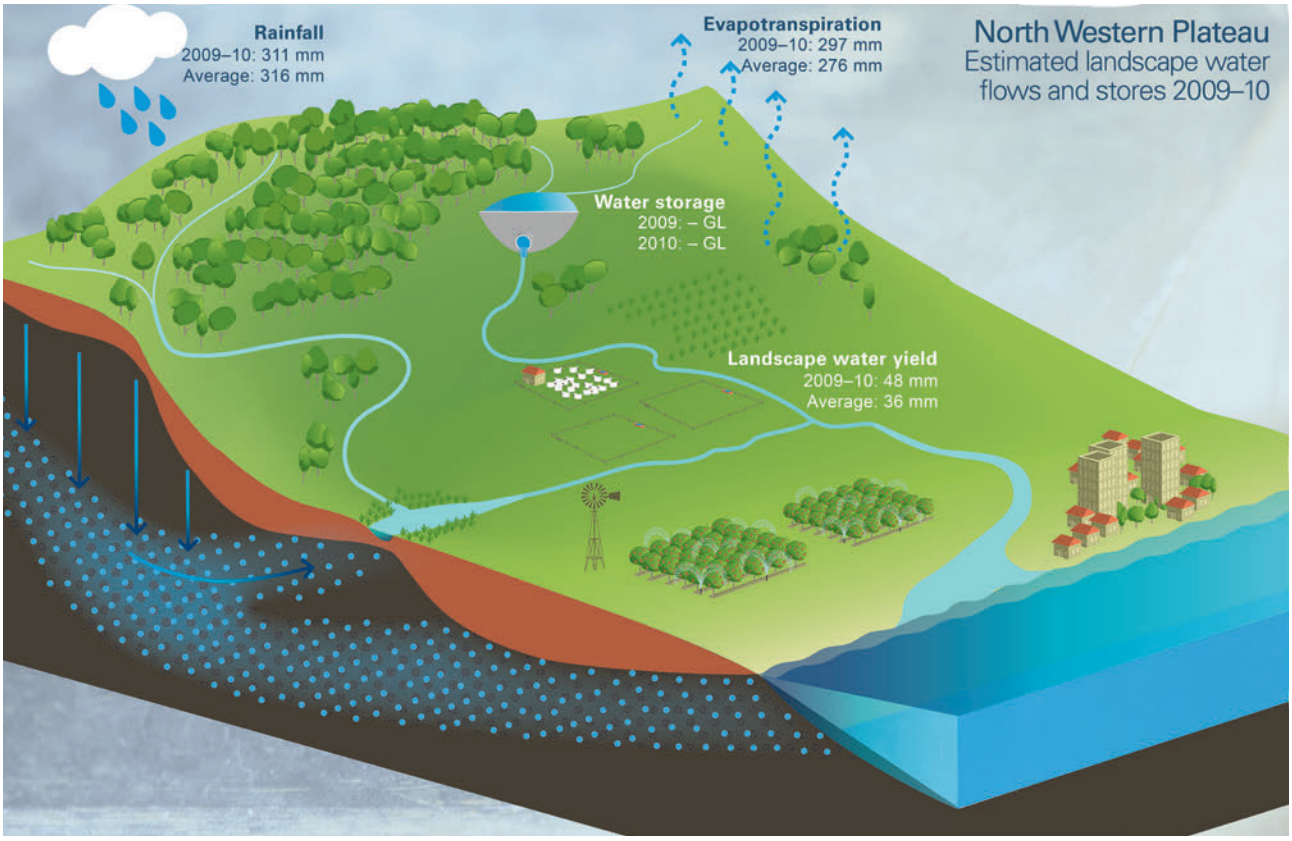



**Figure 12-1. Overview of annual landscape water flow totals (mm) in 2009–10 compared to the long-term average (July 1911 to June 2010) for the North Western Plateau region**

## 12.2 Key data and information

Figure 12-1 presents the 2009–10 annual landscape water flows in the North Western Plateau region (no information is available for major storages in the region). Only the most western and northern parts of the region were assessed due to model data limitations in the central Plateau that prevent a comprehensive assessment of regional totals. Hence, the regional totals given in Figure 12-1 (and Table 12-1) should be treated with caution. Regional rainfall and evapotranspiration totals for 2009–10 were approximately average. Very high rainfall in December 2009 generated a significant response in modelled landscape water yield[1] totals, which contributed greatly to the above average annual total.

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

## 12.3 Description of region

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

The coastline consists of tide-dominated strand plains and tidal creeks. Some dry lakes are scattered over the region, but aeolian landforms including dunes and sand plains dominate the landscape.

The region is home to the Eighty Mile Beach Ramsar coastal wetland site. Here, large tidal mudflats attract numerous migratory waders in spring. Other significant wetlands include springs in the hinterland that support unusual vegetation types.

Apart from some mining towns with variable populations and some small settlements along the Great Northern Highway, there are no significant population centres located in the region. Water supply is generally through rainwater collection and local groundwater bores. There are no reported major surface water storages or irrigated agriculture areas in the region.

The mix of land use in the region is illustrated in Figure 12-2. Most of the region is in a relatively natural state and 77 per cent is associated with nature conservation. Of the region, 22 per cent is used for grazing, along the western and northern boundaries. Irrigated agriculture and urban areas account for less than 0.01 per cent of the area.

The hydrogeology is dominated by the large area of outcropping fractured basement rock in the west and east of the region (Figure 12-3). The associated groundwater systems typically offer restricted low volume water resources. Other important hydrogeological groups are the Mesozoic sediment through the centre of the region and the surficial sediments in-filling paleovalleys in the East Murchison groundwater management unit — these groups are likely to offer more reliable groundwater resources. The major groundwater management units within the region include Canning–Kimberley, East Murchison, Goldfields and Pilbara.

The major watertable aquifers present in the region are given in Figure 12-3 (extracted from the Bureau of Meteorology's Interim Groundwater Geodatabase). Groundwater systems that provide more potential for extraction are labelled as:

- Mesozoic sediment aquifer (porous media – consolidated)
- Surficial sediment aquifer (porous media – unconsolidated).

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

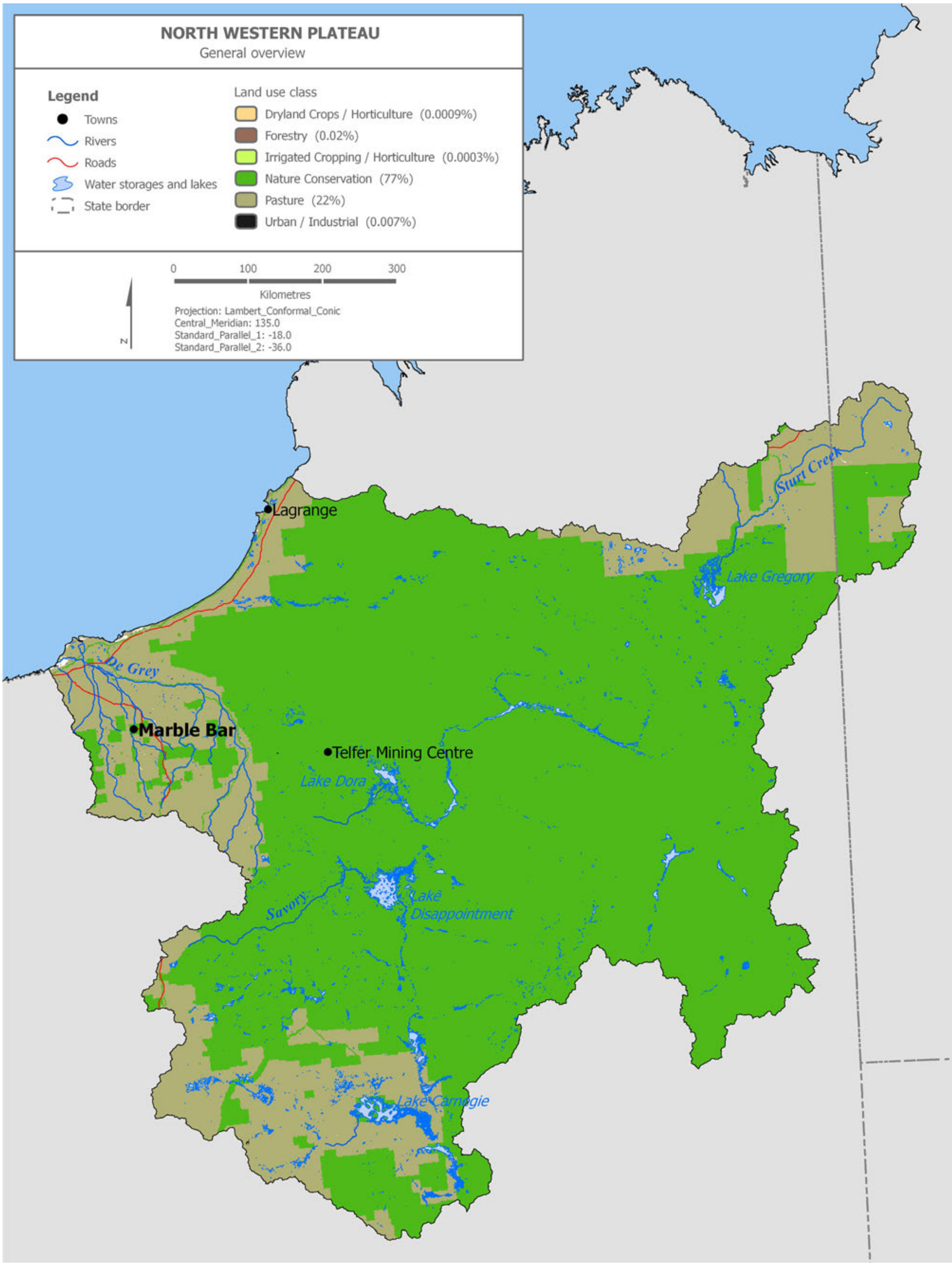



Figure 12-2. Key landscape and hydrological features of the North Western Plateau region (land use classes based on Bureau of Rural Sciences 2006)

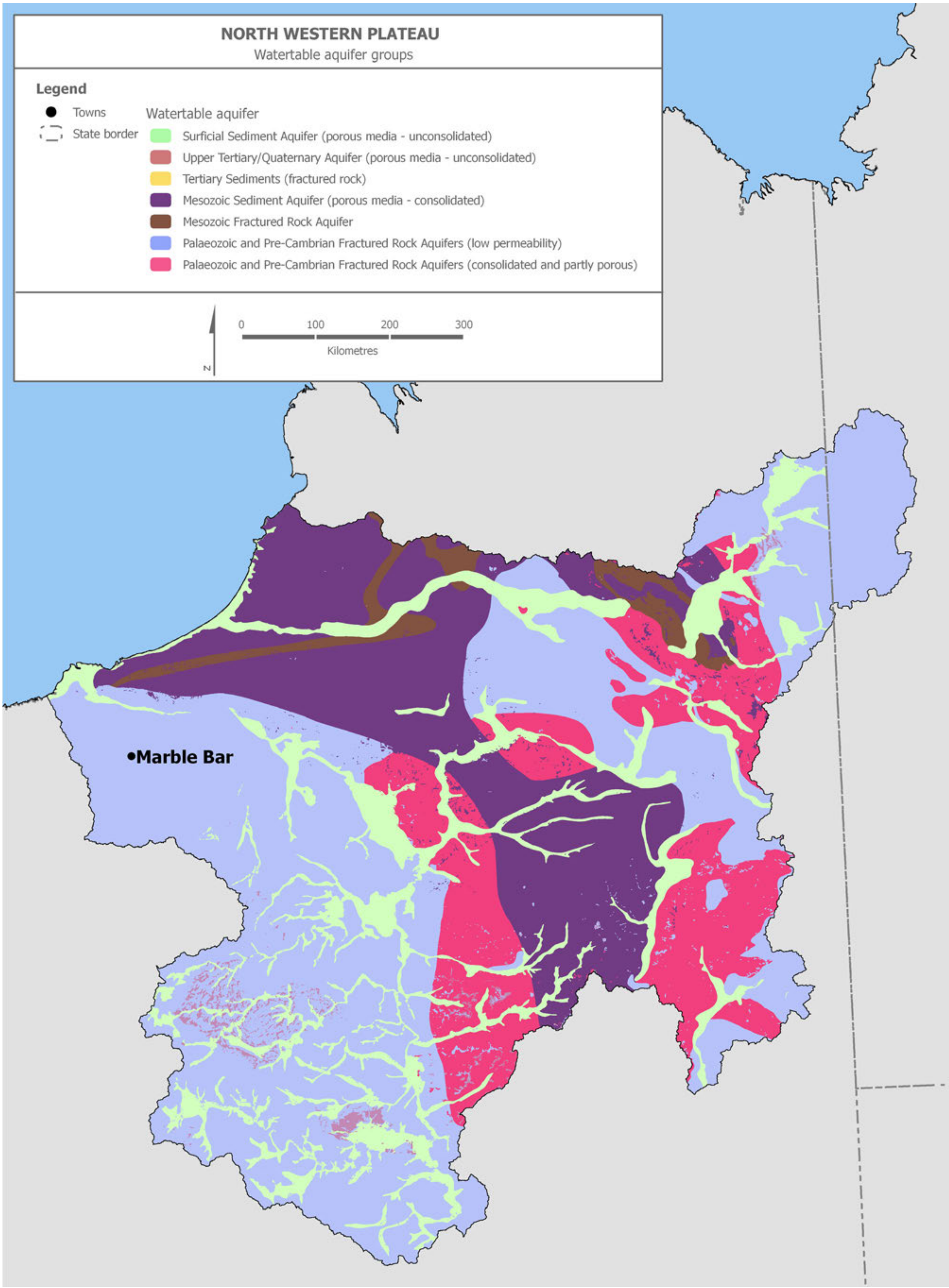



Figure 12-3. Watertable aquifer groups in the North Western Plateau region (Bureau of Meteorology 2011e)

## 12.4 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 centre and east 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 models used and the associated output uncertainties are discussed in Chapters 1 and 2, with more details presented in the Technical supplement.

Figure 12-4 shows that historically the modelled area of the North Western Plateau region has a very seasonal distribution of rainfall. The more tropical north and northeast of the region experiences a marked wet summer and dry winter, whereas the southwest of the region is largely arid with low annual rainfall. During 2009–10, the low rainfall conditions at the beginning of the year gave way to a very high December 2009 rainfall total. Almost a third of the annual rainfall for 2009–10 fell in the month of December. The remainder of the summer through to the end of the year generally experienced normal or lower than normal monthly rainfall. April and especially May 2010 were wetter than normal.

Evapotranspiration in northern Australia is largely constrained by water availability rather than energy, i.e. solar radiation, and therefore exhibits a seasonal pattern closely linked to rainfall. During 2009–10, regional evapotranspiration was higher than normal for December 2009 and January 2010 following the very high levels of rainfall in December.

Modelled landscape water yield for the region shows clear responses to high monthly rainfall, when levels of rainfall significantly exceed evapotranspiration losses, although water yield is generally very low relative to rainfall through much of the year. The very high December 2009 rainfall generated the second highest December modelled landscape water yield in the long-term record (July 1911 to June 2010). The remainder of the year returned to low monthly totals.

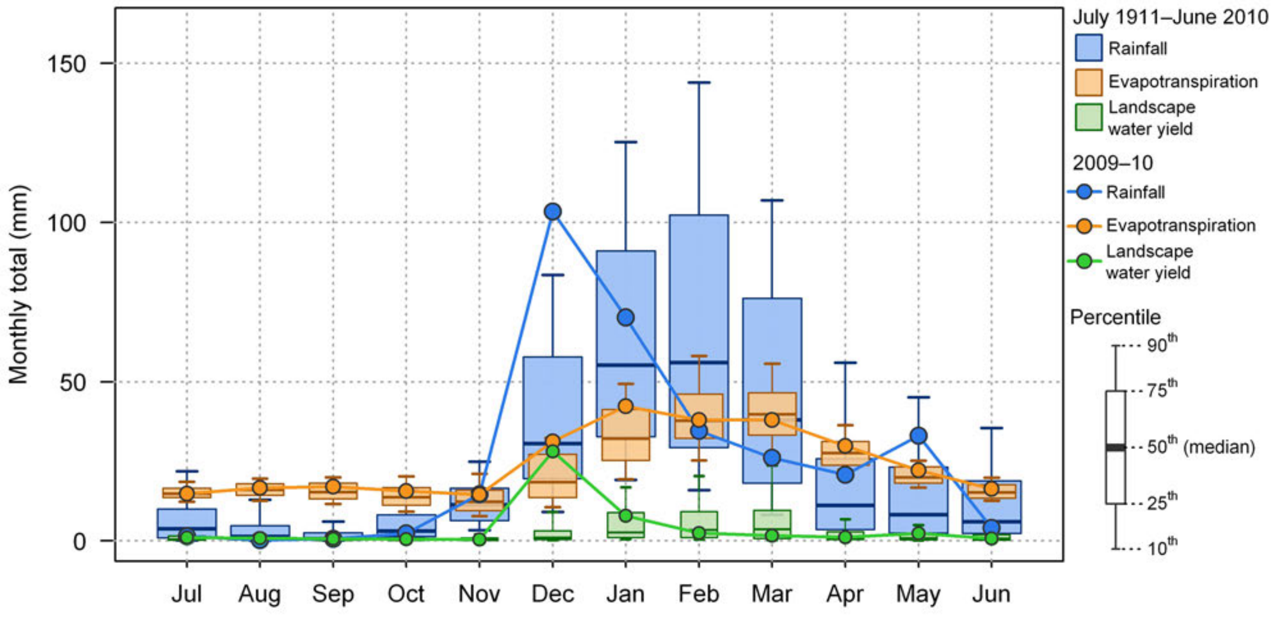



**Figure 12-4. Monthly landscape water flows for the North Western Plateau region in 2009–10 compared with the long-term record (July 1911 to June 2010)**

### 12.4.1 Rainfall

Rainfall for the North Western Plateau region for 2009–10 was estimated to be 311 mm, which is one per cent below the region's long-term (July 1911 to June 2010) average of 316 mm. Figure 12-5 (a) shows that during 2009–10, the highest rainfall occurred in the north and far northeast of the region with a decreasing annual rainfall gradient toward the drier inland areas in the southwest. Rainfall deciles for 2009–10, shown in Figure 12-5 (b), indicate rainfall was at an average or above average level across the north of the region. Below average and very much below average rainfall occurred in the west and southwest of the region.

Figure 12-6 (a) shows annual rainfall for the region over the past 30 years (July 1980 to June 2010). Over the 30-year period, rainfall ranged from 177 mm (1989–90) to 782 mm (1999–2000). The annual average for the period was 394 mm. Annual rainfall for the past three years (2007–08 to 2009–10) was consistently below the 30-year average. An extended period of relatively low annual rainfall in the late 1980s to early 1990s was followed by a period of higher rainfall in the late 1990s and early/ mid-2000s.

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 12-6 (b). The seasonal distribution of rainfall for the region is characterised by a wet summer and a dry winter season. Summer rainfall averages increased notably and varied over recent years whereas winter rainfall remained low.

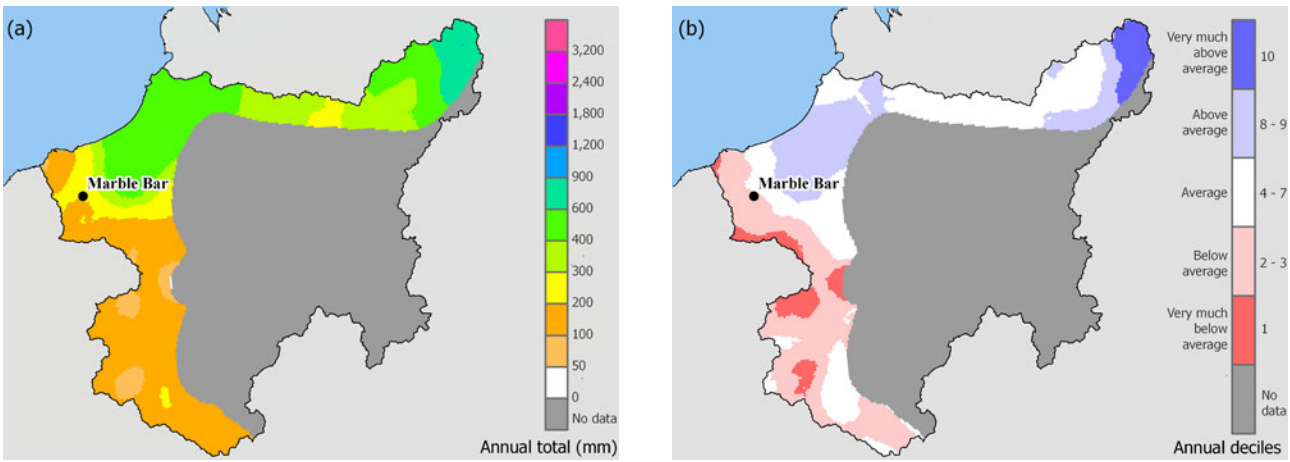



**Figure 12-5. Maps of annual rainfall totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the North Western Plateau region**

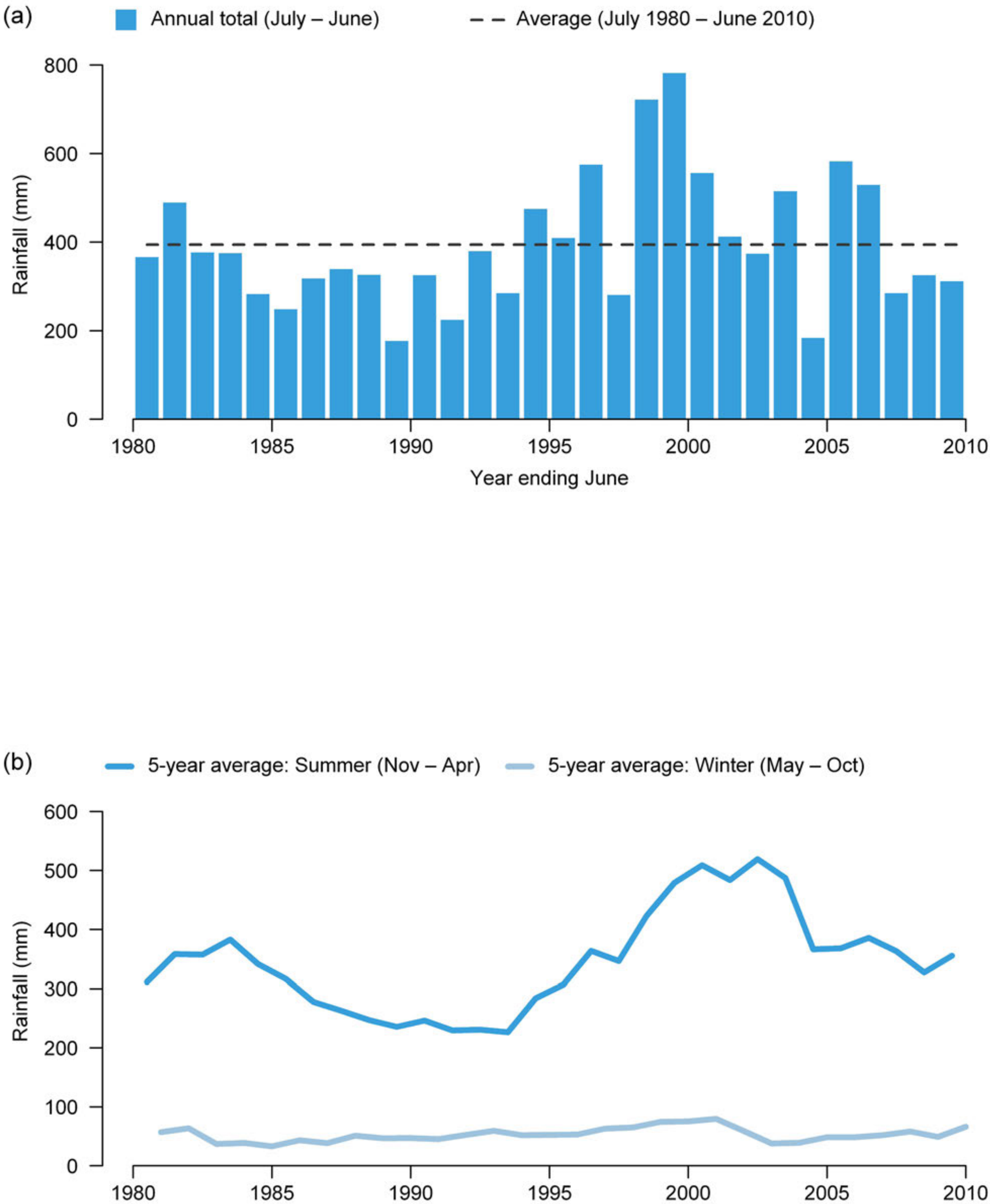



**Figure 12-6. Time-series of annual rainfall (a) and five-year (backward looking) moving average of November–April (summer) and May–October (winter) totals (b) for the North Western Plateau region**

## 12.4.1 Rainfall (continued)

Figure 12-7 provides a spatial representation of 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 of summer rainfall shows generally increasing rainfall across much of the region for which data are available, particularly across the west. Negative trends in summer rainfall are identified in the north and northwest of the region. The equivalent analysis of the winter period rainfall shows lower magnitude increases in seasonal rainfall across the region with the exception of some decreasing trends identified in the far south.

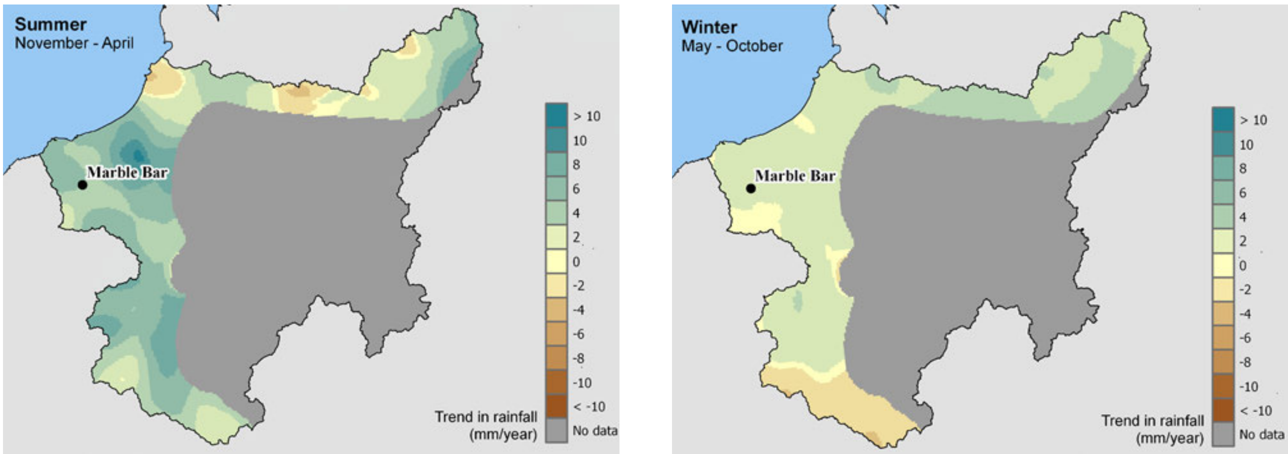



**Figure 12-7. Linear trends in summer (November–April) and winter (May–October) rainfall over 30 years (November 1980 to October 2010) for the North Western Plateau region. The statistical significance of these trends is often very low**

## 12.4.2 Evapotranspiration

Evapotranspiration for the North Western Plateau region for 2009–10 was estimated to be 297 mm, which is seven per cent above the region's long-term (July 1911 to June 2010) average of 276 mm. Figure 12-8 shows that evapotranspiration for 2009–10 was highest across the wetter north and northeast of the region and lowest in the drier far south of the region. The distribution of annual evapotranspiration across the region is very closely linked to the distribution of annual rainfall (Figure 12-5 [a]). Evapotranspiration deciles for 2009–10, shown in Figure 12-8 (b), indicate evapotranspiration was above average in the north and northwest of the region. Below average evapotranspiration is identified in the west and far south of the region.

Figure 12-9 (a) shows annual evapotranspiration for the past 30 years (July 1980 to June 2010). Over the 30-year period, evapotranspiration ranged from 222 mm (1990–91) to 442 mm (1999–2000). The annual average for this period was 318 mm. The relatively dry period in the late 1980s and early 1990s and the following wetter years in the late 1990s and early 2000s are clearly reflected in the annual evapotranspiration.

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 12-9 (b). The data show that variability in annual evapotranspiration over the 30 years is much more apparent in the higher summer period averages.

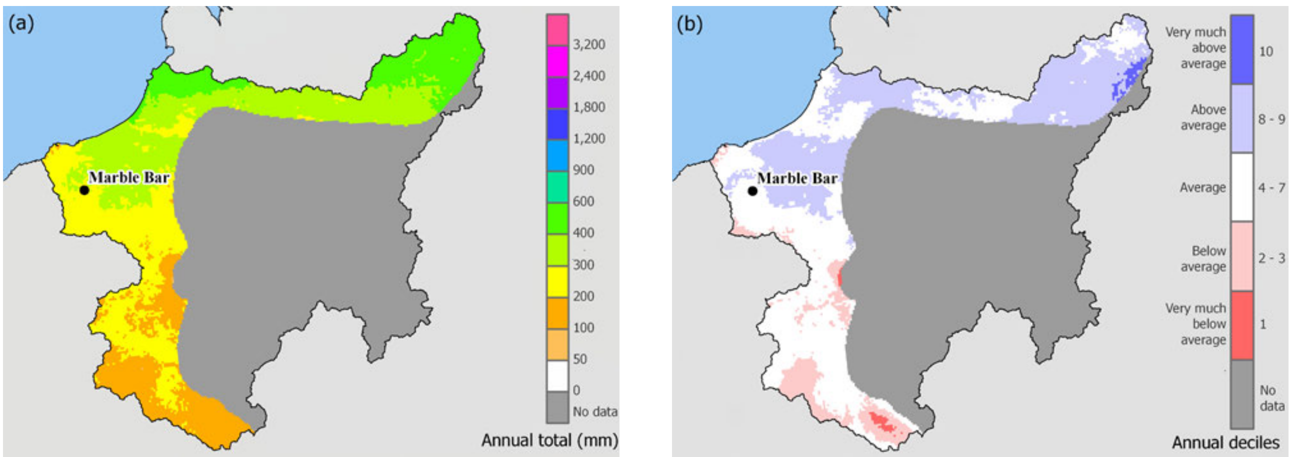
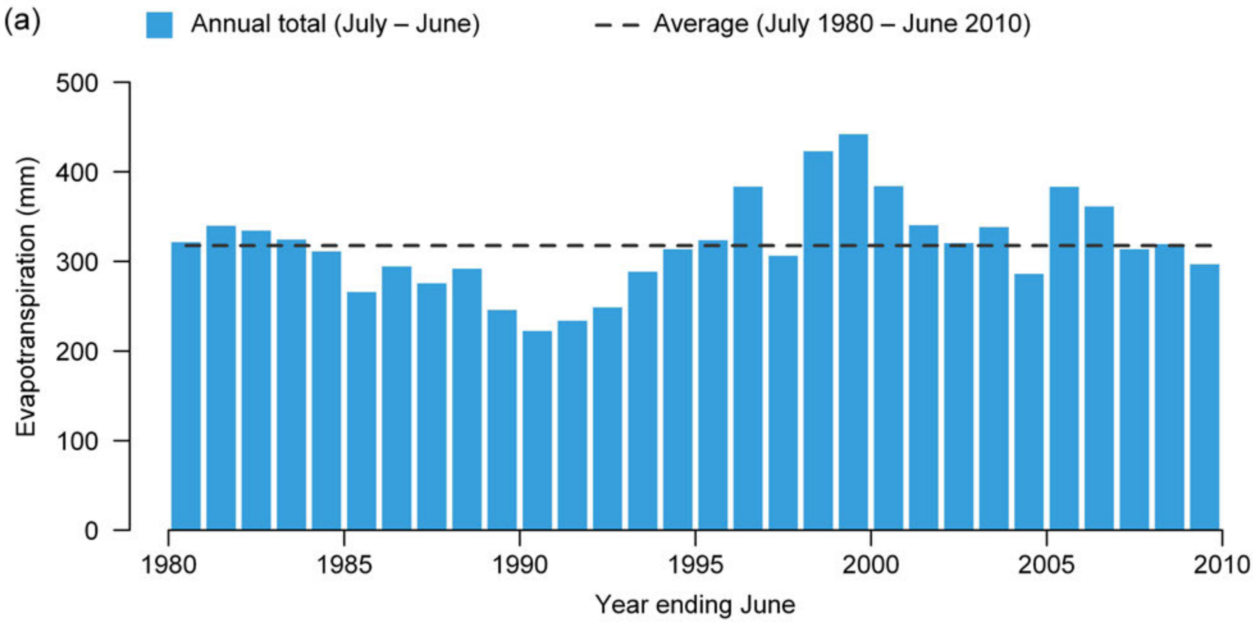



**Figure 12-8. Maps of modelled annual evapotranspiration totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the North Western Plateau region**



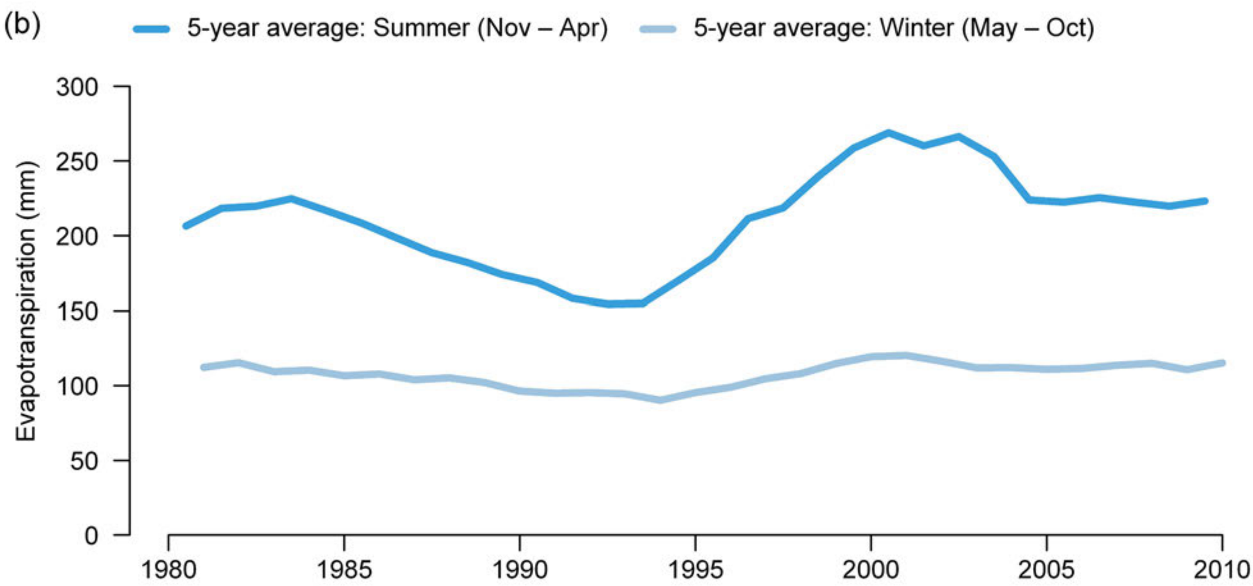




Figure 12-9. Time-series of modelled annual evapotranspiration (a) and five-year (backward looking) moving averages for summer (November–April) and winter (May–October) evapotranspiration (b) for the North Western Plateau region

## 12.4.2 Evapotranspiration (continued)

Figure 12-10 provides a spatial representation of summer (November–April) and winter (May–October) evapotranspiration 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 evapotranspiration over the 30 years.

In general, the analysis indicates slight increases in evapotranspiration over much of the region in both the summer and winter periods. These increases are of a higher magnitude in the summer period. The winter period map shows slight reductions in evapotranspiration across some areas to the west and far southwest of the region.

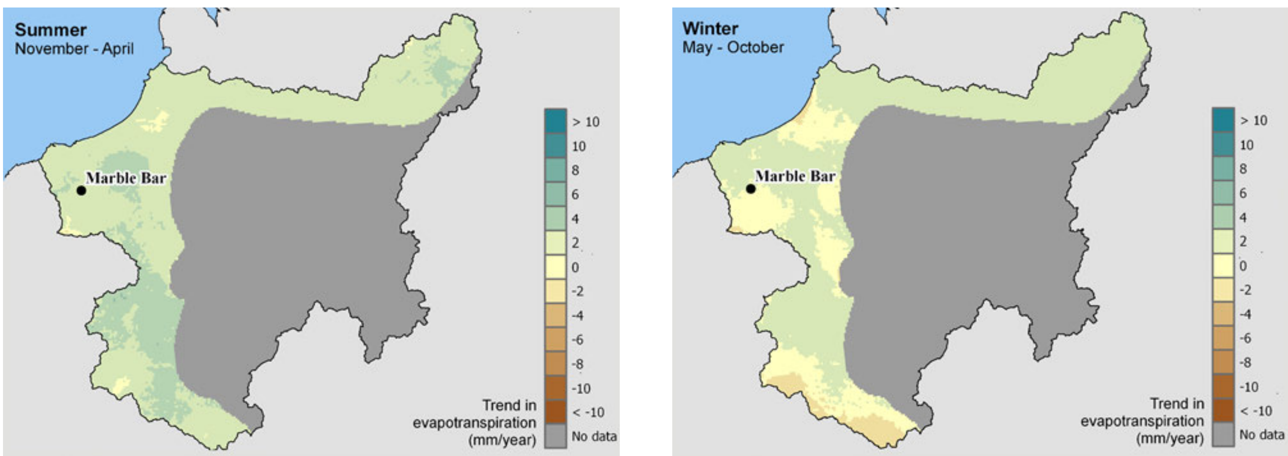


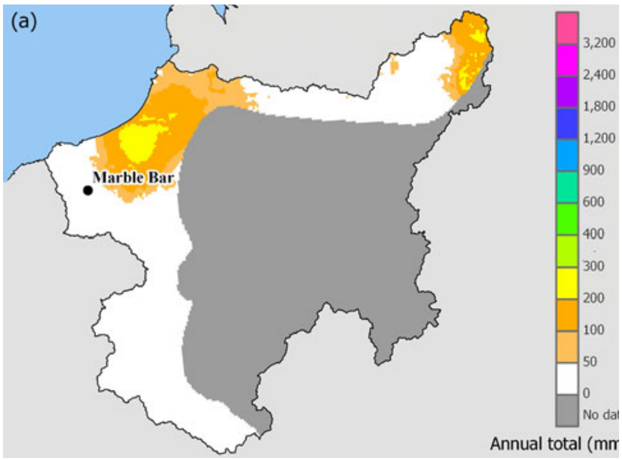

**Figure 12-10. Linear trends in modelled summer (November–April) and winter (May–October) evapotranspiration over 30 years (November 1980 to October 2010) for the North Western Plateau region. The statistical significance of these trends is often very low**

### 12.4.3 Landscape water yield

Landscape water yield for the North Western Plateau region for 2009–10 was 48 mm, which is 35 per cent above the region's long-term (July 1911 to June 2010) average of 36 mm. The pattern and distribution of landscape water yield for 2009–10, shown in Figure 12-11 (a), indicates that the highest water yield occurred across the wetter north and far northeast of the region. Landscape water yield deciles for 2009–10, shown in Figure 12-11 (b), demonstrate 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.

Figure 12-12 (a) shows annual landscape water yield for the past 30 years (July 1980 to June 2010). Over the 30-year period, landscape water yield ranged from 8 mm (1989–90) to 199 mm (1999–2000). The annual average for this period was 64 mm. The influence of low annual rainfall on annual modelled landscape water yield between the mid-1980s and mid-1990s and the high rainfall years of the late 1990s and early 2000s are clearly reflected in the data.

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 12-12 (b). Landscape water yield is higher for the summer period than for the winter. Variability in landscape water yield is clearly shown with both seasons experiencing increases between the lows of the early 1990s and peaks in the early 2000s.



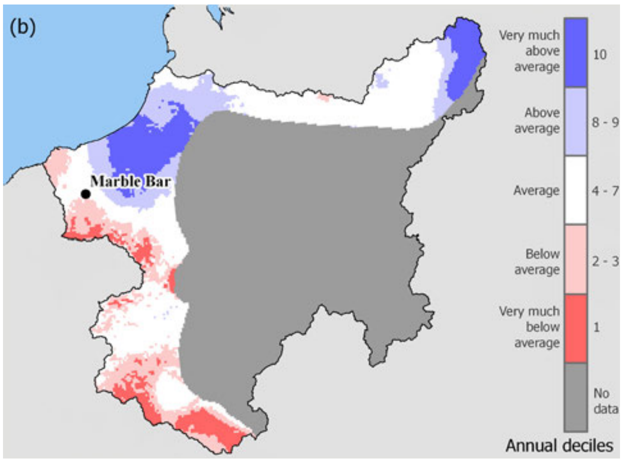




**Figure 12-11. Maps of modelled annual landscape water yield totals in 2009–10 (a) and their decile rankings over the 1911–2010 period (b) for the North Western Plateau region**

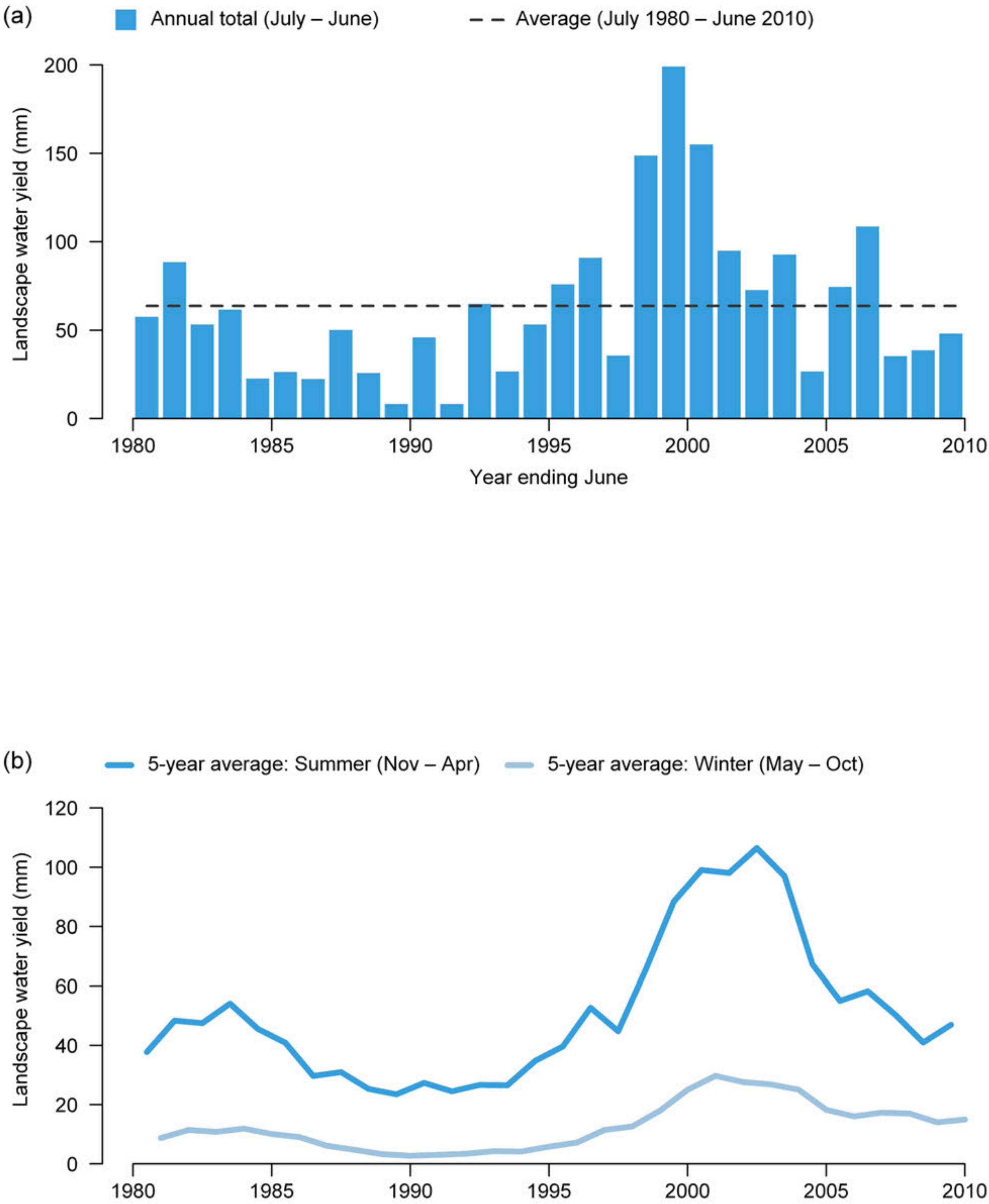



**Figure 12-12. Time-series of modelled annual landscape water yield (a) and five-year (backward looking) moving averages for summer (November–April) and winter (May–October) landscape water yield (b) for the North Western Plateau region**

### 12.4.3 Landscape water yield (continued)

Figure 12-13 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 water yield over the 30 years.

The summer period analysis shows decreasing trends across areas to the north of the region with the remainder of the region generally showing increases in seasonal landscape water yield. The winter period analysis shows a very slight positive trend across most of the region over the 30-year period.

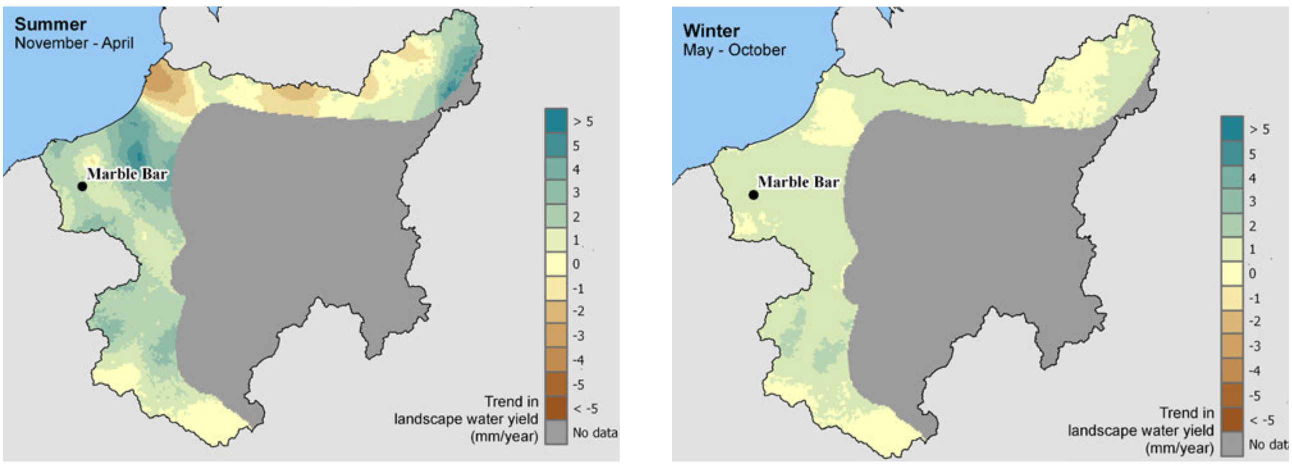



**Figure 12-13. Linear trends in modelled summer (November–April) and winter (May–October) landscape water yield over 30 years (November 1980 to October 2010) for the North Western Plateau region. The statistical significance of these trends is often very low**