

CHAPTER 10

The South Western Slopes Bioregion



1. Location

The NSW South Western Slopes Bioregion is an extensive area of foothills and isolated ranges comprising the lower inland slopes of the Great Dividing Range extending from north of Cowra through southern NSW into western Victoria with an area of 8,657,426 ha. About 8,070,608 ha or 93.22% of this bioregion occurs in NSW, with the remainder in Vic. (IBRA 5.1). The NSW portion of the bioregion occupies about 10.1% of the state.

The bioregion is bounded by 6 other bioregions: the Riverina and Cobar Peneplain bioregions to the west, Darling Riverine Plains and Brigalow Belt South bioregions to the north, Sydney Basin to the northeast and the South Eastern Highlands Bioregion running along much of the eastern boundary.

The bioregion extends from Albury in the south to Dunedoo in the northeast. Towns located in the bioregion include Wagga Wagga, Mudgee, Cootamundra, Narrandera, Parkes, Gundagai and Young. Griffith lies just outside the western boundary and Crookwell lies just outside the eastern boundary of the bioregion.

The bioregion includes parts of the Murray, Murrumbidgee, Lachlan and Macquarie River catchments.

2. Climate

This bioregion is dominated by a sub-humid climate characterised by hot summers and no dry season. A temperate climate, with warm summers, occurs at higher elevations along the eastern boundary of the bioregion adjacent to the South Eastern Highlands Bioregion. Mean annual temperature increases across the bioregion from low temperatures in the south and east to higher temperatures in the north and west (Gibbons 2001).

Rainfall is distributed across the South Western Slopes Bioregion with high (up to around 1200mm) mean annual rainfall in the east, and lower values (around 400mm) for mean annual rainfall in the west (Gibbons 2001).

Mean Annual Temperature	Minimum Average Monthly Temperature	Maximum Average Monthly Temperature	Mean Annual Rainfall	Minimum Average Monthly Rainfall	Maximum Average Monthly Rainfall
11 – 17°C	-0.7 – 3.2°C	24.6 – 33.5°C	360 – 1266mm	25 – 64mm	38 – 152mm

3. Topography

The South Western Slopes Bioregion is a large area of foothills and ranges comprising the western fall of the Great Dividing Range to the edge of the Riverina Bioregion. A very wide range of rock types is found across the bioregion, which is also affected by topographic and rainfall gradients that decrease toward the west. These physical differences have an impact on the nature of the soils and vegetation found across the bioregion. Inland streams pass across the slopes in confined valleys with terraces and local areas of sedimentation. Geology, soils and vegetation are complex and diverse but typified by granites and meta-sediments, texture contrast soils and a variety of eucalypt woodlands, making this bioregion the southern equivalent of the Nandewar Bioregion.

4. Geology and geomorphology

The bioregion lies wholly in the eastern part of the Lachlan Fold Belt which consists of a complex series of north to northwesterly trending folded bodies of Cambrian to Early Carboniferous sedimentary and volcanic rocks. Granites are common and mostly located in large scale upfolded bodies of rock. Granite landscapes occur either as central basins surrounded by steep hills formed on contact metamorphic rocks, or as high blocky plateau features with rock outcrops and tors. Hilly landscapes developed on the sedimentary and volcanic rocks are controlled by structural features (bedding and faults) and typically form lines of hills extended along the strike of more resistant rocks such as quartzite. The valleys between ranges are either in granite or generally softer rocks such as shale, phyllite or slate.

Limited areas of Tertiary basalt with underlying river gravels and sands occur, and as the country becomes lower to the west and north, wide valleys filled with Quaternary alluvium and occasional lakes become the dominant landscape form.

At the western edge of the bioregion the alluvial fans of the Riverine Plain have largely buried bedrock forms. Remnants of earlier gravel deposition on these fans, indicative of higher river discharges than today, are found as terrace features in the valleys and as gravel outwash plains.

Some rock types and landscape features deserve special mention. Several limestone outcrops are known, all of which have developed karst topography and carry locally different vegetation. A narrow belt of serpentinite with chemically distinctive soil runs northwest from Tumut to Cootamundra. A very large number of mineral deposits have supported the mining industry over the past 150 years.

5. Geodiversity

Perhaps the greatest significance of this bioregion is the very diversity of its geology, geomorphology and biota. In addition to this there are a number of special features to be noted, as follows:

- several occurrences of limestone with well-developed karst landscape and rich fossil assemblages. Wellington Caves, for example, contains an abundance of extremely important Tertiary and Quaternary vertebrate fossils, the systematic study of which has only just begun despite 170 years of collecting;
- numerous fossil occurrences in other locations;
- the serpentinite belt with its unusual mineralisation, soils and vegetation;
- a very large range of economic mineral occurrences with their attendant mining heritage; and
- numerous sites exhibiting important structural features of folds and faults in the bedrock.

6. Soils

The overall pattern of soils in these landscapes is one where shallow, stony soils are found on the tops of ridges and hills. Moving downslope, texture contrast soils are the norm with subsoils derived from the underlying weathered rock and the topsoils being an homogenised surface mantle of coarser material derived from all parts of the slope. On valley floors subsoils have drabber colours indicative of poor drainage and they may accumulate soluble salts. Dryland salinity is widespread. Alluvial sands and loams are more common than clays in most parts of the landscape but alluvial clays become more important nearer to the Riverine Plain. Over the Quaternary, soils in these landscapes have accumulated a considerable quantity of wind-blown silt and clay from western NSW.

7. Biodiversity

7.1 Plant communities

In the higher rainfall eastern hill country, woodlands and open woodlands of white box (*Eucalyptus albens*) are dominant. To the west and north these give way to vegetation communities dominated by grey box (*Eucalyptus microcarpa*) and white cypress pine (*Callitris glaucophylla*). Other tree species characteristic of the bioregion include red stringybark (*Eucalyptus macrorhynca*) on higher slopes, with black cypress pine (*Callitris endlicheri*), kurrajong (*Brachychiton populneum*), red ironbark (*Eucalyptus sideroxylon*), white gum (*Eucalyptus rossi*), yellow box (*Eucalyptus melliodora*) and Blakely's red gum (*Eucalyptus blakelyi*) occupying the lower slopes. Valley flats are dominated by rough-barked apple (*Angophora floribunda*), with river oak (*Casuarina cunninghamia*) found along eastern streams and river red gum (*Eucalyptus camaldulensis*) lining the larger central and western streams.



Photo: NPWS

In the western half of the bioregion, where altitude and rainfall are lower, Dwyer's mallee gum (*Eucalyptus dwyeri*) dominates areas of granite-derived soils and red ironbark communities occupy areas of sandy soils derived from sedimentary rock. Other common trees include hill red gum (*Eucalyptus dealbata*), white cypress pine and red stringybark in the ranges and grey box woodlands, with yellow box, white cypress pine and belah (*Casuarina pauper*) occupying lower areas. Vegetation communities in the northwest are dominated by poplar box (*Eucalyptus populnea*), kurrajong, wilga (*Geijera parviflora*) and red box (*Eucalyptus intertexta*), and limited areas of bull mallee (*Eucalyptus behriana*), blue mallee (*Eucalyptus polybractea*), green mallee (*Eucalyptus viridis*) and congoo mallee (*Eucalyptus dumosa*) occur in the central west.

Towards the edge of the Riverine Plain, myall (*Acacia pendula*), rosewood (*Heterodendrum oleifolium*) and yarran (*Acacia homalophylla*) associations are found on grey clays. Yellow box, poplar box and belah associations occupy alluvial loams. River red gum grows along all streams, with some black box (*Eucalyptus largiflorens*), lignum (*Muehlenbeckia cunninghamii*) and river cooba (*Acacia stenophylla*) also occurring.

7.2 Significant flora

There are 36 threatened flora species listed in the schedules of the TSC Act in the South Western Slopes Bioregion (NSW NPWS 2001). Of these, 13 are endangered, 22 are listed as vulnerable and one species, *Euphrasia arguta*, is considered extinct in the bioregion.

7.3 Significant fauna

Sixty-seven species listed in the schedules of the TSC Act are found in the South Western Slopes Bioregion (NSW NPWS 2001). Of these, 13 are listed as endangered and 54 are listed as vulnerable.

As the South Western Slopes Bioregion has been intensively cleared and cultivated what remains is mostly fragmented vegetation, a landscape conducive to decline of bird populations. These woodland fragments are important for species such as the vulnerable superb parrot (*Polytelis swainsonii*) and the endangered regent honeyeater (*Xanthomyza phrygia*) as well as non-breeding swift parrots (*Lathamus discolor*). A decline in ground-feeding insectivores was recently observed in the bioregion while numbers of temperate forest birds increased (Australian Terrestrial Biodiversity Assessment 2002). Protection and enhancement of woodland fragments is necessary to prevent continued loss of woodland birds.

7.4 Significant wetlands

Three wetlands are identified as being of bioregional significance. The Barmedman/Yiddah Creek Floodplain is considered to be able to support 32,000 waterbirds (Kingsford *et al.* 1997). The endangered malleefowl (*Leipoa ocellata*), the vulnerable brolga (*Grus rubicundus*) and the painted honeyeater (*Grantiella picta*) have all been recorded in the floodplains (NSW NPWS 2001). The superb parrot has also been sighted. The endangered plant *Austrostipa wakoolica* has been recorded on this floodplain.

Lake Burrendong Reservoir is described as being in good condition and supported over 32,000 waterbirds in 1985, including the Eurasian coot (*Fulica atra*), maned duck (*Chenonetta jubata*) and great cormorant (*Phalacrocorax carbo*). In 1991, the reservoir supported 10,000 waterbirds including grey teal (*Anas gracilis*), Pacific black duck (*Anas superciliosa*) and maned duck (*Chenonetta jubata*). Vulnerable species sighted at the reservoir include the glossy black cockatoo (*Calyptorhynchus lathami*), turquoise parrot (*Neophema pulchella*) and Gilbert's whistler (*Pachycephala inornata*). The endangered swift parrot (*Lathamus discolor*) and regent honeyeater

(*Xanthomyza phrygia*) have also been recorded. The Lake also provides habitat for the endangered plant *Swainsona recta* (Australian Terrestrial Biodiversity Assessment 2002).

Wiesners Swamp located in Weisners Swamp Nature Reserve is also bioregionally significant, providing habitat for the vulnerable brolga (*Grus rubicundus*).

The biodiversity of the wetlands of the South Western Slopes Bioregion is affected by a range of threats. These include feral animals, exotic weeds, inappropriate recreational activities, erosion, increased nutrients, sedimentation, altered hydrology, salinity, water extraction and regulation, grazing pressure, pollution from gold mining, lakebed cropping when dry and indiscriminate duck shooting and commercial fishing.

8. Regional history

8.1 Aboriginal occupation

The South Western Slopes was traditionally Wiradjuri country, the largest Aboriginal language group in NSW. The Wiradjuri people travelled to the alpine regions of the South Eastern Highlands and Australian Alps bioregions for the annual summer feasts of bogong moths (HO and DUAP 1996).

Wiradjuri means “people of the three rivers”, these rivers being the Macquarie, Lachlan and Murrumbidgee (HO and DUAP 1996). For the Wiradjuri people, the three rivers were their livelihood and supplied a variety of consistent and abundant food provisions including shellfish and fish such as Murray cod (HO and DUAP 1996). In dry seasons the food from the rivers was supplemented with kangaroos and emus hunted for their meat, as well as fresh food gathered from the land between the rivers, including fruit, nuts, yam daisies, wattle seeds and orchid tubers (HO and DUAP 1996).

Evidence of the presence of the Wiradjuri people is common along the Macquarie and Lachlan Rivers in the northern half of the bioregion, but less so along the Murrumbidgee in the south, even though the Wiradjuri people lived on both sides of the Murrumbidgee (HO and DUAP 1996). Surviving carved trees are numerous in the northern part of the traditional Wiradjuri range, whereas there are only 3 of these surviving near the Murrumbidgee (HO and DUAP 1996). The reason for this is not clear, although the original presence of such carved trees is not necessarily indicated by their present-day distribution (HO and DUAP 1996). The Wiradjuri people generally moved around in small groups, using the river flats, open land and waterways with some regularity through the seasons as indicated by debris that has accumulated in these areas (HO and DUAP 1996).

Clashes between the new European settlers and the local Aboriginal people were common around the Murrumbidgee and even further north, particularly between 1839 and 1841. These violent incidents have been termed the “Wiradjuri wars” and involved removal of cattle and spearing of stockmen by the Wiradjuri people in response to killing of their people as well as loss of their fishing grounds and significant sites following invasion by the new settlers (HO and DUAP 1996). Settlers' concerns about the dangers of the Aboriginal people subsided during the 1840s as did the independence of the Wiradjuri people. By the 1850s, although corroborees were still being held on the hills surrounding Mudgee, the culture of the local Aborigines had been vitiated by disease, alcohol and mass European influx during gold rush periods (HO and DUAP 1996).

Despite their tragic recent past, the identity of the Wiradjuri people of the South Western Slopes Bioregion remains robust to the present day, a high degree of marriage within the Wiradjuri community contributing to this

strength of identity. Throughout the bioregion, the major Wiradjuri groups currently live in Condobolin, Peak Hill, Narrandera and Griffith, with significant populations at Wagga Wagga and Leeton and smaller groups at West Wyalong, Parkes, Forbes, Cootamundra and Young (HO and DUAP 1996).

8.2 European occupation

Charles Sturt and George Macleay observed the South Western Slopes Bioregion in 1829 and within 15 years pastoralists occupied most of the river frontages on the Murrumbidgee in the bioregion's south. Further north, John Oxley explored the region in 1817 and, soon after, pastoralists began to bring their cattle to the bioregion. By the 1820s, pastoralists were already making their mark on the landscape. On the southern bank of the Murrumbidgee, Peter Stuckey had introduced what were probably St Helena willows that grew along the river in competition with the native casuarinas and eucalypts (HO and DUAP 1996). Stock were already grazing in the southeast of the bioregion in 1826 and settlement extended west along the Murrumbidgee, with emancipists such as Charles Tompson and George Best settling near what is now Wagga Wagga. As Murrumbidgee frontages were occupied, settlement began to spread to the river tributaries, expanding north and south from the Murrumbidgee. As the traditional lands and lifestyles of the Aboriginal people were overtaken by Europeans, big pastoral properties developed around Mudgee and Rylstone, which became towns in 1837 and 1842 respectively. In the north of the bioregion, a similar pattern developed with the establishment of huge properties initially as cattle stations, with some stations changing to sheep not long after.

Cattle runs were established in Narrandera in 1832 and these were followed from 1840 by sheep stations (NSW NPWS 1991) such as Buckingham station which was well watered by nearby swamps and creeks even in the drought years (HO and DUAP 1996). Wheat was grown in the area for use on the stations. Albury began as a sheep station in 1835 on both sides of the Murray River and merged soon after with the nearby Wodonga run on what is now the Victorian side of the river (NSW NPWS 1991).

The so-called “Wiradjuri wars” led to the temporary departure of pastoralists from some runs in the area around 1839-40, so fearful were they of resistance by the local Aborigines determined to keep their land. However, most station owners returned later in the 1840s and sheep and cattle numbers grew. A severe drought hit the Murrumbidgee area in 1850-51 just as the gold rushes began and, despite the drought, the people of the bioregion saw success. As the drought yielded and the population of the area increased with the gold rush, meat prices soared and cattle and sheep farmers benefited. Production of beef, which had been increased to cope with demand during the gold rush, slumped in the decades following, while sheep numbers increased five-fold around the Murrumbidgee and Lachlan Rivers up to the 1870s (HO & DUAP 1996). Increased stock numbers led to further occupation of land and to accommodate this ongoing development pastoralists cleared what was left of the uncleared land in the area, sinking wells, building dams and fencing the land as they went.

Gundagai was among the first towns to be settled in the area, developing in the early 1840s around the Gundagai run that was established in 1826. The town fell victim to a devastating flood in 1844 and was shifted to higher ground on the opposite (southern) bank of the Murrumbidgee soon after. By the 1850s Gundagai was the principal town in the south of the bioregion even after destruction from flooding in 1852 and 1853 and again in 1870, the town recovering successfully each time. Eventually Gundagai was overshadowed by Wagga Wagga as the main road south from Dubbo and Forbes to Albury by-passed Gundagai, passing through Wagga instead which had grown considerably, almost doubling in population in the late 1850s. Wagga's

importance was also increased by a brief steamboat venture, increasing river traffic through the town in the 1870s.

Nearby Narrandera was gazetted as a town in 1863, growing from its importance as a road traffic centre and a base for a rapidly expanding timber industry, which relied on river transport until the railway took over in 1882. The railway also reached Albury in 1882 (NSW NPWS 1991). German settlers from SA had established vineyards there in the 1850s and other settlers from Vic were attracted to the region for small-scale farming in the 1860s (NSW NPWS 1991). Although gold was discovered at Albury in the 1850s, a major gold rush did not occur until the 1880s. Other towns in the bioregion sprang up away from the major rivers: Junee as a link in the Goulburn to Albury railway, Young and Adelong with gold rushes in the 1850s and 1860s.

Gold was discovered at Adelong in the east of the bioregion in 1852, initiating a township that remained small until 1857. Eighty companies were mining at Adelong between 1857 and 1859 and although Kiandra in the Snowy Mountains caught the focus about this time, a new rush began in Adelong in 1872. Relics of a crushing plant and waterwheels are still evident at Adelong. In the 1900s, shaft mining was replaced by dredging for gold in the alluvial gravel of Adelong Creek, the environmental effects of which are still seen today. Not only did dredging disturb the waterways, the steam dredges required major felling of local box and stringybark timber to use for fuel (HO and DUAP 1996).

Further north, the town of Temora experienced a small gold rush in 1869 and Young, to its east, had a major gold rush before this from September 1860. Temora attracted diggers from Adelong and Kiandra, including many Chinese miners. The area was rich in gold and the mining population mushroomed from 1,500 in October to 3,000 a month later, and by April the following year Temora supported a massive population of 10,000 miners. The Chinese miners were confined to a small area to mine and were the target of brutal rioting later in 1861 (HO and DUAP 1996). As a result, the NSW Chinese Immigration Restriction Act was passed later that year and satisfied miners who had caused the riots against the Chinese moved further north to mine at Forbes in the north of the bioregion. Dredging also began at Temora in 1900 in search of alluvial gold and although it met some success, it was all but finished in 1910. Copper mining, although rare in the bioregion, occurred in the 1870s at Snowball south of Gundagai, but lasted less than a decade before being reopened in 1895 when ore was sent north to Lithgow for treatment (HO and DUAP 1996).

Before the advent of the Murrumbidgee Irrigation Area at the turn of the century, fruit growing, especially cherries, was a successful enterprise around Young in the centre of the bioregion. Although cherries were planted in the region as early as 1847, the first commercial orchards were not a reality until they were planted by Nicole Jasprizza in 1878. Over time, more than 70 cherry orchards were established, and the market was more accessible when the railway reached Young in 1885. By 1933, Nicole Jasprizza was believed to have the largest cherry orchard in the world. Apples, grapes, pears, prunes, quinces, oranges and strawberries were also grown in the area, with Young apples rivalling cherries as the most lucrative crop.

Agriculture in the south of the bioregion made great improvements following the success of an experimental farm established near Wagga in 1892 by the state government. The farm tested strains of wheat and gave advice to farmers while encouraging the planting of new crops including maize, potatoes, grapes and other fruit. A series of dams and other water conservation innovations led to the inception of the Murrumbidgee Irrigation Area in the early 1900s. Soon after, towns such as Griffith on the western border of the bioregion and Leeton in the adjoining Riverina Bioregion were planned by Walter Burley Griffin, the American architect who designed the

nation's capital, Canberra. The town was built in 1916 with the intention that it would service a population of around 30,000, and although the town is growing rapidly even today, it has yet to reach this estimated population. Italian miners arrived in Griffith in 1913 from Broken Hill, providing the area with a multicultural flavour that remains today. After World War I, migration from Italy was rapid and Italian families were able to buy farms cheaply after soldier settlement abated in the 1930s. By 1933, Italians owned about 10% of the local fruit farms and almost 20 years on they owned almost half. In the last 30 years, the area around Griffith has developed a lucrative wine industry (HO and DUAP 1996).

West Wyalong near the centre of the bioregion is a significant location for gold fields (NSW NPWS 1991), with a new project, the Cowal Gold Project, undergoing exploration this year (NSW Department Mineral Resources website – <http://www.minerals.nsw.gov.au/>). Other basic industries are primary production, consisting of wheat and other cereals, sheep, wool and cattle and also tourism.

9. Bioregional-scale conservation

The South Western Slopes Bioregion contains conservation tenures that together occupy about 184,739.16 ha or 2.28% of the bioregion. Over half of this area is managed as national parks or nature reserves (NPW Act 1974) which cover an area of approximately 97,246.98 ha or 1.2% of the bioregion.

Reserves (Crown Land Act 1989) managed by the National Parks and Wildlife Service occupy 1,933.52 ha or 0.02% of the bioregion. Hill End and Yuranighs Aboriginal Grave Historic Sites occupy 0.0003% of the bioregion. However there are no Aboriginal areas, no state recreation areas and no regional parks in the bioregion.

Landholders on 7 properties have entered into voluntary conservation agreements. The area of these properties where conservation management is permanently agreed to occupies about 884.20 ha or 0.01% of the bioregion. In addition to this, landholders on 73 properties have agreed to have wildlife refuges over their properties, with the area covered approximately 71,924.67 ha or 0.89% of the bioregion. This figure could expand as mapping is updated. Landholders have also entered into property agreements within the bioregion. One hundred and twenty-seven properties manage 6,960.01 ha in conservation zones (or about 0.09% of the bioregion).

Eight flora reserves (managed under the provisions of the Forestry Act 1916) occupy 4,948.67 ha or 0.06% of the bioregion and contribute particularly towards flora conservation. State forests managed primarily for forestry activities under the Forestry Act 1916 occupy 115,248.11 ha or 1.43% of the bioregion.

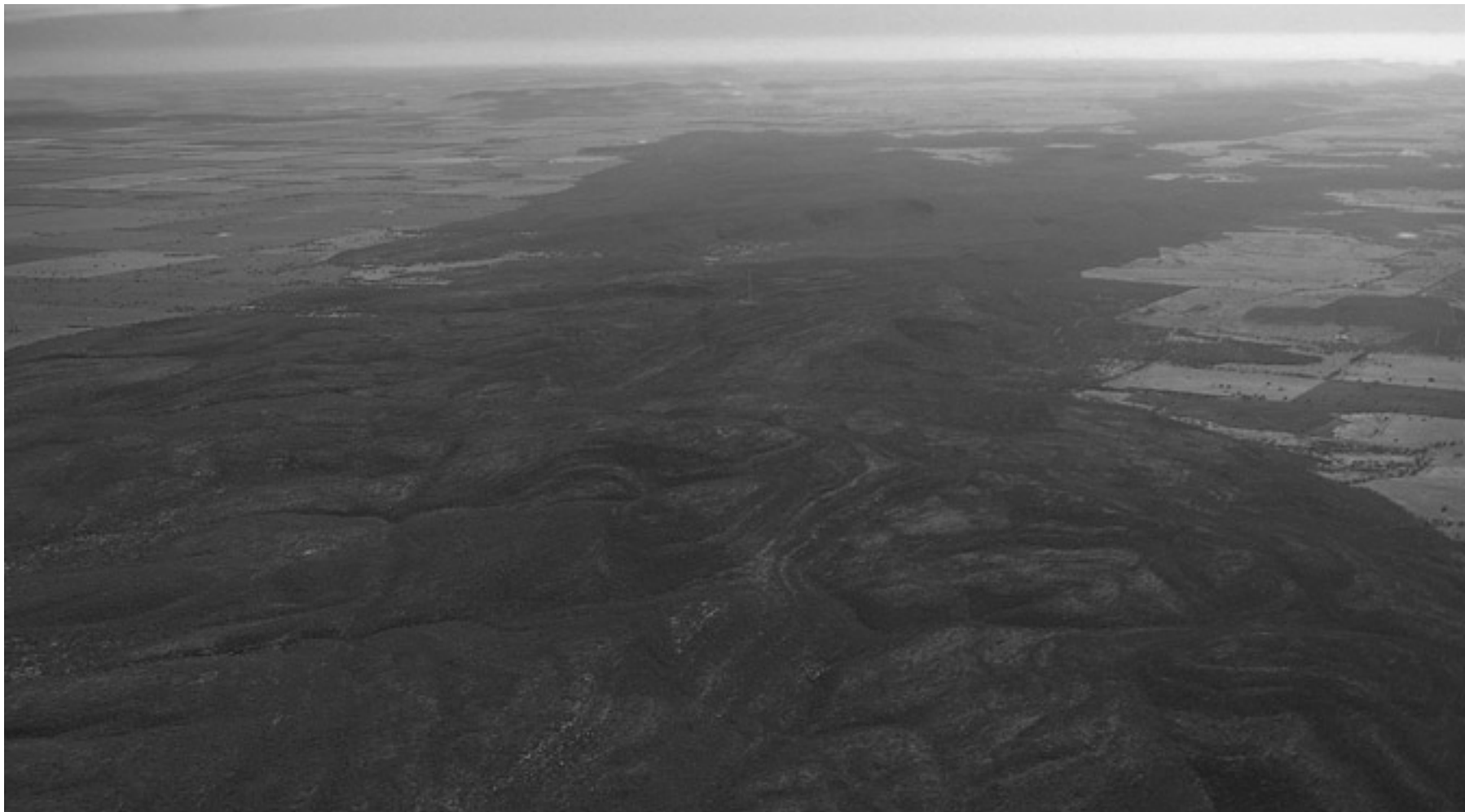


Photo: John Benson

10. Subregions of the South Western Slopes Bioregion

(Morgan and Terrey 1992)

Subregion	Geology	Characteristic landforms	Typical soils	Vegetation
Upper Slopes	Ordovician to Devonian folded and faulted sedimentary sequences with inter-bedded volcanic rocks and large areas of intrusive granites.	Steep, hilly and undulating ranges and granite basins. Occasional basalt caps, confined river valleys with terrace remnants.	Shallow stony soils on steep slopes, texture contrast soils grading from red subsoils on upper slopes to yellow subsoils on lower slopes. Alluvial sands, loams and clays.	Open forests and woodlands. Red stringybark on upper slopes with black cypress pine, kurrajong, red ironbark, white gum, white box, yellow box and Blakely's red gum on lower slopes. Merging west to yellow box, grey box and white cypress pine. Rough-barked apple on flats with river oak on upper tributaries and river red gum on lower and larger streams.
Lower Slopes	As for the Upper Slopes but with larger areas of Tertiary and Quaternary alluvium.	Undulating and hilly ranges and isolated peaks set in wide valleys at the apices of the Riverina alluvial fans.	Similar to the Upper Slopes but with more extensive red-brown earths on undulating plains and more extensive grey clays on alluvium.	Dwyer's gum on granite, red ironbark on sedimentary rocks Hill red gum, white cypress pine and red stringybark in the ranges. Grey box woodlands with yellow box, white cypress pine and belah on lower areas. Poplar box, kurrajong, wilga and red box in the north, limited areas of bull mallee, blue mallee, green mallee and congoo mallee in the central west. Myall, rosewood and yarran on grey clays, yellow box, polar box, and belah on alluvial loams. River red gum on all streams with black box in the west with some lignum and river cooba.

11. References

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