CHAPTER 9

The Cobar Peneplain Bioregion

1. Location

The Cobar Peneplain Bioregion lies in central NSW west of the Great Dividing Range. It is one of only two of the state's bioregions to occur entirely within the state, the other being the Sydney Basin Bioregion. The bioregion extends from just south of Bourke to north of Griffith, has a total area of 7,334,664 ha, and occupies 9.2% of the state. The bioregion is bounded to the north and east by the Darling Riverine Plains Bioregion, to the east by the South Western Slopes Bioregion, and by the Riverina and Murray Darling Depression Bioregions to the south and west. The northwestern part of the Cobar Peneplain Bioregion falls in the Western Division.

The Cobar Peneplain Bioregion encompasses the townships of Cobar, Nymagee, Byrock, Girilambone, Lake Cargelligo and Rankins Springs with Louth and Tottenham lying at its boundary.

In the north of the bioregion, Yanda Creek, a major stream, discharges directly into the Darling River which meanders across the bioregional boundary in the northwest. In the east, several small streams flow occasionally into the Bogan River as it crisscrosses the eastern boundary of the bioregion (Morgan and Terrey 1992). The Lachlan River traverses the bioregion in the south with contributions of minor runoff from smaller streams (Morgan and Terrey 1992). The bioregion lies wholly within the Murray-Darling Basin and includes the Barwon, Macquarie, Yanda, Darling, Lachlan and Murrumbidgee catchments.

2. Climate

The Cobar Peneplain is one of 6 bioregions that lie in Australia's hot, persistently dry semi-arid climatic zone. This climate is complemented by patches of sub-humid climate on the southeastern boundary of the bioregion and, in the south, these areas are characterised by virtually no dry season and a hot summer (Stern *et al.* 2000).

Throughout the year, average evaporation exceeds the average rainfall. Rainfall tends to be summer dominant in the north of the bioregion and winter dominant in the south (Creaser and Knight 1996, Smart *et al.* 2000a).

Temperatures are typically mild in winter and hot in summer and exceed 40°C for short periods during December to February (Creaser and Knight 1996). Frosts are frequent in the winter months (Smart *et al.* 2000a) and the lowest daily mean temperature in the bioregion is -6.1°C recorded in Lake Cargelligo in July and August. The hottest period in the bioregion occurs between November and March, with the hottest daily mean temperature in the bioregion being 47.8°C, recorded in Cobar in January.

Mean Annual Temperature	Minimum Average Monthly Temperature	Maximum Average Monthly Temperature	Mean Annual Rainfall	Minimum Average Monthly Rainfall	Maximum Average Monthly Rainfall
15 – 19°C	1.6 – 4.2°C	30.8 – 35.3°C	258 – 537mm	14 – 36mm	30 – 60mm

3. Topography

The Cobar Peneplain Bioregion is a subdued bedrock-controlled landscape in the centre of semi-arid NSW. Described as a low undulating plain, the Cobar Peneplain is easily distinguished from most of the surrounding bioregions which are relatively flatter landscapes of floodplains (Riverina and Darling Riverine Plains bioregions) and sandplains and dunefields (Murray Darling Depression Bioregion). The Cobar Peneplain is a prominent topographical landscape of rolling downs and flat plains punctuated by stony ridges and ranges and is formed on the northwesterly extension of the Lachlan Fold Belt. The more elevated areas of the Cobar Peneplain are characterised by shallow, red soils and aeolian sands associated with the Darling River and the Murray Basin mantle in the lower areas in the west and south, while alluvial deposits from the Bogan River fringe the Peneplain in the east.

4. Geology and geomorphology

The Cobar Peneplain bioregion is based on Palaeozoic rocks largely within the Lachlan Fold Belt. It is lapped by the Murray Basin and the Great Australian Basin and although it is described as a peneplain, the implications attached to this word concerning tectonic stability, landscape and soil genesis should not be uncritically accepted.

The region contains a wide range of bedrock types that exert a strong influence on topography. Rock outcrops form low ranges or lines of residual hills controlled by structure (bedding, folds and faults). Rocks in the eastern half of the bioregion are older (Ordovician), more deformed and more highly mineralised than those in the west (Devonian), although the dominant structural trends in both are northwest. Quartz sandstones, conglomerates and siltstones with low angle folds are typical of the younger rocks, and these form prominent multiple ridges like the ranges at Mt Grenfell up to 300m high, or the more complex folds seen in the Cocoparra Ranges near Griffith. Topography on the older rocks around Cobar is more subdued as residual hills, low rounded ridges, and stony slopes formed on softer, more weathered shales, phyllites and cherts, with only occasional features such as Mt Boppy standing as much as 100 m above the plain.

Igneous rocks are more common in the southern part of the region and granites north of Nymagee make attractive landscapes of rugged peaks and tors. Very small areas of basalt lava are found from Griffith to north of Cobar, with the most interesting being the rare example of 10-16 million year old leucitite lava capping the tabletop peak of El' Capitan.

During the Tertiary and possibly as recently as 5 million years ago, marine sediments were deposited in the Murray Basin with the coastline being the southwestern edge of the Cobar Peneplain. In the Quaternary, after these shallow seas receded, sands were mobilised by wind to form dunes and sandplains that advanced onto the peneplain. A drainage system of wide shallow valleys with a few lakes also developed despite the low rainfall and low gradients. Today the creeks respond to local rainfall but only occasionally deliver water to the Bogan or Darling Rivers.

5. Geodiversity

Significant landscape features include the following:

- the Gunderbooka Range and the Mt Grenfell Ranges are good examples of structural and lithological control of topography. They are also important as sites of cultural and archaeological significance to Aboriginal people;
- Gunderbooka and other peaks stand in isolation on the plains and are likely to have high local endemism in the biota;
- the downs and plains are ecologically distinctive with their apparent uniformity, absence of surface water and well-developed biotic patterning of mulga groves caused by interactions between topography, runoff, soil and vegetation; and
- important mining heritage is present at a number of locations, particularly Cobar, which has been the state's largest copper producer, as well as smaller mines at Nymagee, Mt Hope, Canbelego, Mineral Hill, Tottenham, Ardlethan and elsewhere.

Special geological features include:

- leucitite lavas of El Capitan;
- columnar lavas of the Ambone Volcanics;
- Devonian freshwater fish fossils in the Mt Grenfell area; and
- archaeology and palaeo-environmental potential of Barnato Lakes.

6. Soils

Soils across the bioregion are reasonably uniform and relate closely to topographic position and local geology. On ridge crests they are thin, stony, well-drained red loams. Downslope the soil thickens as a colluvial mantle, usually with a large proportion of stones and with an increasing texture contrast between topsoil and subsoil. On lower slopes the stoniness decreases, red subsoils give way to yellow subsoils, carbonate levels increase and soil drainage is more impeded. Brown clays are more common than grey clays in drainage lines, red sands and earthy sands are widespread but there are only a few areas of sandplain and dunefield.

7. Biodiversity

7.1 Plant communities

The vegetation of the Cobar Peneplain is regionally distinctive. The bioregion is characterised by an undulating to hilly landscape with shallow, red earth soils where the vegetation is mainly open woodlands of bimble or poplar box (*Eucalyptus populnea*), red box (*Eucalyptus intertexta*) and white cypress (*Callitris glaucophylla*).

The more arid areas are dominated by mulga (*Acacia aneura*) (Morgan and Terrey 1992). In the north, mulga and poplar box are dominant. In the southwest, poplar box, red box and white cypress pine become more common, and in the far south, poplar box and white cypress pine dominate. Red ironbark (*Eucalyptus sideroxylon*), hill red gum (*Eucalyptus dealbata*) and grey box (*Eucalyptus microcarpa*) woodlands occur on the eastern edges of the bioregion, extending into the South West Slopes Bioregion. Western vegetation communities dominated by belah (*Casuarina pauper*), wilga (*Geijera parviflora*) and rosewood (*Alectryon oleifolius*) are not well represented. Likewise river red gum (*Eucalyptus camaldulensis*) and black box (*Eucalyptus largiflorens*) are limited as there are few large streams in the region. Grasslands are not common in the bioregion.

Mallee is widespread on rocky ridges and sandplains. Typical species include pointed mallee (*Eucalyptus socialis*), Dwyer's mallee gum (*Eucalyptus dwyeri*), grey mallee (*Eucalyptus morrisii*), green mallee (*Eucalyptus viridis*), mallee broombush (*Melaleuca uncinata*), hill tea-tree (*Leptospermum trivalve*), currawang (*Acacia doratoxylon*), other Acacia sp. and woody shrubs.

Degradation of the Cobar Peneplain Bioregion by heavy grazing has resulted in vast areas being covered by a dense regrowth of woody shrubs (Morgan and Terrey 1992). This shrub layer consists of *Eremophila, Dodonaea* and *Senna* spp. which are unpalatable to stock (Creaser and Knight 1996). The encroachment and proliferation of such species is a major problem

throughout the semi-arid rangelands of NSW (EPA 1997) and hence these species, although native, are known as woody weeds.

Despite the problems of grazing and woody weeds, the dominant woodlands of the bioregion are both structurally and physically intact. In fact, the woodlands of the Cobar Peneplain Bioregion are the most extensive woodland communities to remain in western NSW (Morgan and Terrey 1992).

7.2 Significant flora

Pilaar is the Ngiyampaa name for the belah tree, a significant and special plant to the *Pilaarrkiyalu* or belah tree people of the Cobar Peneplain (Harris *et al.* 2000). *Pilaarr* is a symbol of who the people are and represents their kinship with their *ngurrampaa* or campworld (Harris *et al.* 2000).

Mallee woodland communities (*Eucalyptus spp.*) are widespread throughout the Cobar Peneplain Bioregion, occurring mainly on rocky hills and ridges. Pointed mallee (*Eucalyptus socialis*) communities mainly occupy the sandplain areas while Dwyer's mallee gum (*E. dwyeri*) and grey mallee (*E. morrisii*) occur in shallow soils on crests of ridges in the centre of the bioregion (Cunningham *et al.* 1981). Green mallee (*E. viridis*) communities extend between Griffith and Cobar and further east on low ridges (Cunningham *et al.* 1981). Despite the diversity of mallee species in the bioregion, as much as 90% of the original mallee communities throughout the Cobar Peneplain Bioregion have been cleared, leaving the remnant mallee stands vulnerable to local extinction (Morton *et al.* 1995). Mallee is therefore considered to be of high conservation significance in the bioregion.

The Cobar Peneplain Bioregion supports 19 flora species that are listed in the TSC Act (NSW NPWS 2001). Of these, 9 are listed as vulnerable and 9 as endangered, with one species, *Osteocarpum pentapterum*, presumed extinct in NSW (TSC Act 1995).

Several species found in the Cobar Peneplain Bioregion are listed as vulnerable in the Commonwealth EPBC Act 1999. These include *Bertya "opponens"*, a member of the *Bertya* genus found in mallee communities on shallow soils on ridges in the Cobar-Coolabah area (Bowen and Pressey 1993). The curly-bark wattle (*Acacia curranii*) is also found and occurs only in the Cobar Peneplain Bioregion (NSW NPWS 2001).

The Cobar greenhood orchid *Pterostylis cobarensis* is regionally endemic to the bioregion and is listed as vulnerable in both the TSC and EPBC Acts (Bowen and Pressey 1993, cited in Morton *et al.* 1995). It is under threat by both grazing and noxious weed invasion (NSW NPWS 2001). The winged peppercress (*Lepidum monoplocoides*) is listed in both the TSC and EPBC Acts as endangered and is found mainly in the Cobar Peneplain Bioregion, although some sightings are recorded in the Darling Riverine Plains Bioregion (NSW NPWS 2001). Six species listed as threatened in the EPBC Act are also found in the bioregion.

Other threatened plants include *Lomandra patens, Bothriochloa biloba, Rhodanthe citrina, Monotaxis macrophylla* and *Goodenia occidentalis* as well as *Kunzea* aff. *ambigua, Phebalium obcordatum,* and *Elachoma hornii,* all of which have been described as rare to the region (Morton *et al.* 1995).

7.3 Significant fauna

Fauna surveys undertaken during the Cobar Peneplain bioregional assessment found that the major vegetation types were largely indicative of the fauna found there (NSW NPWS 2000b). For example, vegetation type contributed to fairly accurate predictions of the distribution of bird species and particular bird assemblages (Masters and Foster 2000).

Some fauna species are widespread across the bioregion, occurring across all major vegetation types. For example, reptiles include Carnaby's wall skink

Photo: Murray Ellis

(*Cryptoblepharus carnabyi*) and south-eastern morethia (*Morethia* sp.) which are both fairly widespread west of the Great Dividing Range (Cogger 1992). The bioregion also supports a range of mammals that inhabit much of the Peneplain such as the short-beaked echidna (*Tachyglossus aculeatus*), eastern grey kangaroo (*Macropus giganteus*) and inland mastiff-bat (*Mormopterus* sp.), as well as many woodland birds such as the blue-faced honeyeater (*Entomyzon cyanotis*), rainbow bee-eater (*Merops ornatus*) and mistletoe bird (*Diacaeum hirundinaceum*).

The kultarr (*Antechinomys laniger*) is a dasyurid which is known as the "marsupial mouse" due to its large ears, long tail and irregular hopping gait (NSW NPWS 2000b). The distribution of the kultarr has declined in NSW and the species now occurs in a patchy distribution to the west of the Bogan River, which borders the Cobar Peneplain Bioregion (Dickman *et al.* 1993, cited in Morton *et al.* 1995). Although the species is not directly affected by human activity, the changes in, or intensification of, land use, is thought to threaten its security (Strahan 1983). The kultarr is now listed as endangered in Schedule 1 of the TSC Act 1995.

The now sparse distribution of the greater long-eared bat (*Nyctophilus timoriensis*) and yellow-bellied sheathtail bat (*Saccolaimus flaviventris*) can be mainly attributed to loss of habitat. These bats rely on trees for roosting and the absence of sufficient vegetation has rendered them at risk of predation by cats (Dickman *et al.* 1993, cited in Morton *et al.* 1995). Both species are listed as vulnerable in Schedule 2 of the TSC Act 1995.

The bird species of the bioregion are fairly typical of semi-arid climatic zones, although this bioregion is unusual in that it contains a higher than average proportion of endemic Australian bird species, a reflection of its regionally distinct dry climate. Declines of these species in the small areas of woodland in the bioregion are likely to continue unless adequate representative areas of woodland are protected from clearing and over-grazing.

Despite the scarcity of remnant mallee stands in the bioregion this vegetation supports significant populations of the also vulnerable (TSC Act 1995) striated grasswren (*Amytornis striatus striatus*) (Garnett 1992, cited in Morton *et al.* 1995). The shining bronze-cuckoo (*Chrysococcyx lucidus*) and speckled warbler (*Sericornis sagittatus* or *Chthonicola sagittata*) also rely on these small remnants, and are considered to be in decline in the bioregion (Smith *et al.* 1994, cited in Morton *et al.* 1995).

There are 43 faunal species listed as threatened under Schedules 1 and 2 of the TSC Act 1995 (Smart *et al.* 2000b). Thirty-six of these are listed as vulnerable and 7 are listed as endangered. Although not formally listed in legislation, other fauna species (64 birds, 12 mammals, 23 reptiles and 8 frogs) are identified as being of conservation concern because their numbers are declining or they are locally extinct within the bioregion (NSW NPWS 2000a).

Of the 88 mammal species found in the Western Division at the time of European settlement, 27 were thought to be regionally extinct by the 1990s (Main 2000). In the Cobar Peneplain Bioregion these species include the bilby (*Macrotis lagotis*) and the bridled nail-tail wallaby (*Onychogalea fraenata*), both formerly found in the bioregion and now listed as species presumed extinct in NSW under Schedule 1 Part 4 of the TSC Act 1995.

In addition to the various native animals that typically inhabit the Cobar Peneplain, many feral animals are now commonly seen throughout the bioregion. Of the mammals in the bioregion, domestic livestock, goats, rabbits and foxes were the most conspicuous during surveys (NSW NPWS 2000b). Such species as the fox (*Vulpes vulpes*) are becoming more widespread through western NSW and together with cats (*Felis catus*) prey on the native species of the bioregion (NSW NPWS 2000b).

7.4 Significant wetlands

Lake Brewster is the only wetland of national significance in the bioregion. Considered to be in fair condition, the status of this wetland is declining due to threats by European carp and other feral animals, exotic weeds and altered hydrology. Despite these disturbances, the lake remains an important refuge habitat for water birds as it retains water longer than nearby natural lakes during drought.

Lake Cargelligo is the only bioregionally significant wetland wholly within the Cobar Peneplain. It is described as being in fair condition, affected somewhat by feral animals, exotic weeds, increased water flows and grazing pressure. The site is important for several vulnerable species including brolga (*Grus rubicundus*), freckled duck (*Stictonetta naevosa*), Major Mitchells cockatoo (*Cacatua leadbeateri*), blue-billed duck (*Oxyura australis*), black-breasted buzzard (*Hamirostra melanosternon*) and western blue-tongued lizard (*Tiliqua occipitalis*). The endangered malleefowl (*Leipoa ocellata*) has also been sighted at the lake.

8. Regional history

8.1 Aboriginal occupation

The Cobar Peneplain Bioregion has been managed and occupied by Aboriginal people for at least 40,000-50,000 years (Flannery 1994, Palmer

Photo: Murray Ellis

1994). The bioregion falls within the traditional homelands of several Aboriginal language groups and within these groups are communities living in what they term their "home country". The main language groups are Ngiyampaa in the centre, Ngemba in the north east and Wiradjuri in the south, with the Paakantkji group occupying the area along the northwestern border of the bioregion.

The Ngiyampaa people traditionally occupy the area towards the centre of the bioregion, southwest of Cobar (Smart *et al*. 2000b). To distinguish themselves from other language groups in the area, they refer to themselves as the people who speak Ngiyampaa the Wangaaypuwan (Wongaibon) way, that is, they use the word *wangaay* for "no". Ngiyampaa people also group themselves according to their home country so that the Pilaarrkiyalu (Belah Tree People), Nhiilyikiyalu (Nelia Tree People) and Karulkiyalu (Stone Country People) all occupy different areas of the Ngiyampaa language group within and around the bioregion (Smart *et al*. 2000b). Some Karulkiyalu refer to themselves as Ngemba because their home country to the north of Cobar borders the two language groups. However, these people still speak the Wangaaypuwan way. The Ngemba people in the far north of the bioregion and the Darling Riverine Plains Bioregion use the word *wayil* for "no" and hence refer to themselves as the people who speak Ngemba the Wayilwan way. To the west of this group, also in the north of the bioregion, is the homeland of the Paakantkji or Darling River People who are traditionally linked to the plains of the Darling River from near Bourke south to Wentworth (NSW NPWS 2000c). Paakantji means "belonging to the river" and these people traditionally occupied the Darling River floodplains, spending more time in the Darling Riverine Plains Bioregion (NSW NPWS 2000c). The southern and eastern parts of the bioregion are traditionally occupied by the Lachlan River people known as Kaliyarrkiyalung, who are part of the Wiradjuri language group and use the word *wirraay* for "no" (NPWS 2000c). Wiradjuri is one of the largest language groups in NSW (NSW NPWS 2000c).

The Ngiyampaa (words shown in **bold**), Paakantji (words are underlined) and Ngemba language groups were divided further by a totemic system, where sections of each group comprised individuals linked to an animal or plant totem (Main 2000). The people were traditionally responsible for protecting their totem and would usually refuse to eat the totem that they identified with. Not all totems were food items. Some individuals were responsible for significant stands of vegetation such as grey mallee (**mali**, kaarima, *Eucalyptus morrisii*) which was important for spear timber (Main 2000).

8.2 European occupation

After the first settlement at Port Jackson, western NSW was not explored immediately. This was due to several factors including the need to maintain law and order and the colony's focus being on development in the Sydney area (Austral Archaeology 2000). However, between 1817 and 1846 major exploration of the area west of the Blue Mountains was undertaken by Oxley, Sturt and Mitchell (Whitney 1997) and by 1830 European squatters began to occupy large areas of land in the west (Denny 1994). By 1850 land settlement had occurred through the Cobar Peneplain, as far west as Wilcannia in the Darling Riverine Plains bioregion (Denny 1994).

Newspaper reports in the 1850s printed enticing descriptions of the plains between what are now the townships of Louth and Bourke, encouraging settlers to utilise the productive grazing country of the Cobar Peneplain (Main 2000). Sheep (**thumpa**, *Ovis aries*) and cattle (**kurrukun**, kiyata, *Bos taurus*) were grazed along the Darling River and by the 1860s about half a million sheep and 40,000 cattle occupied its banks. Riverboats on the Darling increased the accessibility of the pastoral country on the Peneplain and wool production in the area was prolific (Main 2000). The first river steamers reached Bourke and Wilcannia in 1859 (Clelland 1984), providing an important transportation link from the wool stations of the Cobar Peneplain.

The settlement of Europeans in the Cobar Peneplain Bioregion and the rest of NSW brought disease and violence to local Aboriginal communities. By 1860 the Aboriginal population of the bioregion had been decimated and this saw an end to many traditional land management practices (Main 2000) that were rapidly replaced by high agricultural production, which had an impact on biodiversity. Prior to settlement of the land by Europeans, forests in the bioregion were open eucalypt and cypress pine woodlands with a grassy understorey (Anon. 1988). The Aboriginal people of the bioregion preserved these open woodlands by regularly burning the vegetation (Anon. 1988), a technique known as "fire-stick farming". When Europeans arrived they reduced burning practices and extended the area in which their stock could graze by ringbarking and clearing the woodlands (Cunningham *et al*. 1981, Anon. 1988). Of 88 mammal species recorded at European settlement, almost 30 were extinct by 1990 (Main 2000). The end of traditional practices such as fire-stick farming led to devastating bushfires in the 1860s and 1870s. The extinction of many medium-sized mammals of the area has been partly attributed to these great fires (Main 2000) as they could not burrow underground like small mammals to avoid the flames. The loss of these species may have also had an impact on the vegetation of the area.

Louth, in the north-west of the bioregion, was established as a 40-acre (about 16 ha) property on the Darling River in 1865 (Clelland 1984). Later it played a key role in the development of mining at Cobar. By 1870 the township of Bourke, just north of the bioregion, was a thriving river port (Clelland 1984). That same year copper was discovered at the Kuburr (Cobar) waterhole and the area was soon established as the Cobar Copper Mine. This was soon followed by the discovery of copper and the establishment in 1871 of two mines – the Cornish, Scottish and Australian (CSA) mine and the United (Occidental) – but these were closed temporarily when they did not achieve immediate financial success. By 1873 Cobar began to establish itself as a permanent township, growing from its former status as a mining outpost (Clelland 1984). Some travellers did not look upon the landscape favourably, an early poem reporting:

> *There's not a mountain, dale, or valley,*
> *No babbling brooks make sudden sally;*
> *Just sand hills fringed with stunted mallee,*
> *That's Cobar.*

In 1877 severe drought conditions took hold of the area, but rainfall improved in the following years (Clelland 1984). Stock numbers declined during this severe drought. Drought followed by several wet years after 1878 allowed many of the cypress pine stands of the area to regenerate unimpeded and a large proportion of these forest stands remained into the 1980s (Anon. 1988). The 1870s also saw the appearance of rabbits which, along with grazing and drought, added to the struggle of the vegetation of the bioregion and much of western NSW (Cunningham *et al*. 1981).

Copper mining commenced in Nymagee in 1878. The commercial mine commenced operation in 1880 (Clelland 1984) as did the local school at Nymagee. Sawmilling in the bioregion began around 1876 when mills were located at Cobar, Canbelego and Coolabah to produce timber for the mining industry and developing towns in the area (Anon. 1988). High demand for firewood for the smelters meant that forests around Cobar were cleared extensively. The mill at Coolabah operated until it burnt down in 1980 (Anon. 1987).

The separation of NSW into Western, Central and Eastern Divisions in 1884 (Whitney 1997) meant that the western proportion of the Cobar Peneplain was held under Western Lands Leases which, due to the restrictions placed on the lands, were used mainly for grazing (Clelland 1984).

The railway reached Bourke in 1885 (Clelland 1984) and was approaching Cobar from Nyngan by the 1890s. The Great Cobar Mine was closed in 1889 due to low yield and heavy rains which made transport difficult and restricted the provision of adequate supplies (Clelland 1984). The mine was later taken over and reopened by the end of the 1890s. Many other mines progressed alongside the Great Cobar, mining copper, gold, silver and lead. In 1889 gold was discovered near Canbelego (between Cobar and Nyngan) and in 1893 there was a rich find at Mt Drysdale (Clelland 1984).

Droughts in the bioregion have occurred in approximate cycles of 20 years' duration over approximately the last 100 years (Anon. 1988). Following the drought of the 1870s, a great drought gripped the Cobar Peneplain between 1895 and 1902 and although rain fell intermittently during this time, overstocking of the land teamed with rabbit and woody weed infestation meant that pastoralists were hit hard financially (Clelland 1984), and lost thousands of sheep.

By the late 1800s violence towards Aboriginal people had abated somewhat and European pastoralists began to cooperate with survivors, allowing them to remain on their traditional lands in exchange for ecological knowledge and technical skills (Main 2000). It has been estimated that by the turn of the century Aboriginal workers undertook 30 per cent of pastoral labour in northwestern NSW (Main 2000).

The main land use in the bioregion is pastoralism (Creaser and Knight 1996), with sheep being the dominant grazing stock while cattle are grazed intermittently according to fluctuations in price and market availability. Land degradation marked by soil erosion and woody weed infestation has occurred in the Cobar Peneplain and this is due largely to overstocking with sheep, cattle and domestic animals (Creaser and Knight 1996) and to feral animals such as rabbits and goats. Subsisting on edible shrubs and trees, goats are farmed in some areas in an attempt to increase incomes from these otherwise unproductive lands (Morgan and Terrey 1992). Cropping occurs opportunistically in the western parts and annually in the southeast.

The bioregion straddles the Western and Central Divisions (Whitney 1997), separating the bioregion into two distinctive landscapes. Cleared freehold land lies to the east of the Western Division boundary (63% of the Central Division component of the Cobar Peneplain is cleared) and to the west lies the vegetated pastoral leases of the Western Division (where less than 21% of this part of the bioregion has been cleared). Widespread clearing and cropping has occurred on the leasehold lands of the Western Division (Nymagee-Rankin Springs province, Morgan and Terrey 1992).

The bioregion encompasses the townships of Cobar, Nymagee, Byrock, Girilambone, Lake Cargelligo and Rankins Springs with Louth and Tottenham at its boundary, while Nyngan, Condobolin and Griffith lie just outside the bioregion. As population records are not kept on the basis of bioregional boundaries, the current population of the Cobar Peneplain Bioregion is difficult to calculate. However, it is likely that the population is in the order of 10,000-15,000 (Dick 2000). Approximately 5,474 people live in the Cobar local government area itself (Australian Bureau of Statistics website – http://www.abs.gov.au) with the majority of the remaining population living on rural properties throughout the bioregion, mainly in the east and south. This is a reflection of the increase in property size from east to west. Most small towns and villages on the Cobar Peneplain are experiencing a decline in population as people, especially the young, move to larger centres outside the region to continue their education or seek employment (Australian Bureau of Statistics 1999, cited in Dick 2000). As the state's largest copper producer and a significant producer of gold, lead, silver and zinc (Creaser and Knight 1996), the bioregion is a lucrative mining region. Together with Broken Hill, Orange and New England, the other 3 major areas in NSW for metallic mineral production, the area around Cobar contributes significantly to the industry value of $1.27 billion (1999-00) (NSW Department of Mineral Resources website – http://www.minerals.nsw.gov.au). There are 7 mines around Cobar: Peak Gold Mine, McKinnons, Girilambone Copper, CSA, Mineral Hill, Tritton and Elura, which principally mine from 3 major mining belts at Cobar, Canbelego and Girilambone. The Cobar belt holds major mineral deposits and its 60 km length passes through the Cobar town area (Creaser and Knight 1996). Together, the 7 mines in the bioregion contain resources of almost 50 million tonnes with a maximum yield of about 8% for the metals mined in the region.

The cessation of operations at the CSA mine in Cobar occurred in early 1998 and soon after recommenced operations in March 1999, but only produced a little over 2,000 tonnes of copper metal in 1998-99 (Department of Mineral Resources website – http://www.minerals.nsw.gov.au). Girilambone Copper Company, just inside the Cobar Peneplain Bioregion, produced copper metal from mining and processing operations near Girilambone in northern New South Wales until mining ceased in early 2000. Concentrates of lead and zinc with silver by-product are produced from mining operations located at Broken Hill and the Elura mines near Cobar. The Elura zinc-lead-silver deposit is the largest mineral deposit yet found in the Cobar Basin (Department of Mineral Resources website – http://www.minerals.nsw.gov.au). The Tritton copper deposit, located 85 km east of Cobar, is the newest project in the bioregion. It is likely that Cobar suffers from fluctuations in population due to mines closing and reopening. Cobar had experienced a local economic boost from mining until the CSA mine closed and over 300 people left the community (NSW NPWS 2000c).

Both the area south of Canbelego and the area around the Lachlan River have several scattered state forests, most of which have been managed for timber production (Morgan and Terrey 1992), mainly for white cypress pine (Anon. 1988).

9. Bioregional-scale conservation

Areas under conservation management in the bioregion occupy 182,623.45 ha or 2.49% of the total. Mechanisms provided for under the NPW Act 1974 are responsible for most of the conserved area. The majority of this is taken up by the 2 national parks and 9 nature reserves which occupy 116,450.90 ha or 1.59% of the bioregion. None of these reserves is also managed as wilderness under the Wilderness Act 1987.

Of the remaining conservation tenures under the NPW Act 1974, there are no Aboriginal areas, no state recreation areas and no regional parks in the bioregion, but there is one historic site of 1,365.09 ha or 0.02% of the bioregion.

No landholders have entered into voluntary conservation agreements under the NPW Act 1974, although landholders on 11 properties have agreed to wildlife refuges and these collectively occupy an area of 60,077.73 ha or 0.82% of the bioregion.

Under the provisions of the Forestry Act 1916 State Forests occupy an area of 81,139.24 ha or 1.11% of the bioregion, and there is one flora reserve which occupies 1,703.70 ha or 0.02% of the bioregion.

There are six property agreements under the NVC Act 1997 with an area of 2,481.55 ha or 0.03% of the bioregion.

10. Subregions of the Cobar Peneplain Bioregion

(Morgan and Terrey 1992)

Subregion	Geology	Characteristic landforms	Typical soils	Vegetation
Boorindal Plains	Quaternary alluvial blanket over weathered Ordovician and Silurian low grade metamorphosed sedimentary rocks, such as phyllite.	Undulating plains with wide valleys and occasional low stony rises. Gilgai widespread in depressions and swamps.	Red earths and red texture contrast soils with stony lag gravels on slopes. Brown clays and harsh texture contrast soils in depressions and swamps.	Dense mulga, ironwood, poplar box and red box with dense shrubs on ridges and slopes. Dense poplar box with lignum, budda, emu bush, narrow-leaf hop bush and grasses on lower slopes and depressions.
Barnato Downs	Devonian quartzose sandstones in ridges, finer sedimentary rocks under the plains often covered by a mantle of Quaternary alluvium.	Steep ridges and rocky slopes controlled by bedding and joints in bedrock. Relief to 150m, length of ranges up to 40 km. Undulating low ridges and stony rises on softer rocks with a mantle of Quaternary colluvium and alluvium. Sands and minor clay deposits in stream lines. Lakes at Barnato.	Thin, discontinuous stony profiles on ridges, thickening downslope to stony, red, texture contrast soils and red earths on the plains. Valleys generally texture contrast soils with calcium carbonate in subsoil, small areas of cracking brown clays or red sands.	Mulga, red box and grey mallee on crests, white cypress pine and poplar box on slopes. Red box, mulga, white cypress pine and polar box on plains. Areas of belah rosewood and yarran. Pointed mallee in the south. Woody shrubs widespread.
Canbelego Downs	Fine grained Ordovician and Silurian metasedimentary and sedimentary rocks, such as phyllite, slate and chert.	Undulating plateau with low stony ridges and stony rises, relief to 20m. Long low angle slopes and wide (>500m) valleys. Some central sandy channels, a few swamps.	Shallow red loams or stony loams on crests merging to red earths on slopes, plains and through the valley floors. Minor sand deposits along streams, yellow texture contrast soils in swamps.	Mulga with green mallee, red box and numerous woody shrubs on ridges and slopes. Poplar box, white cypress pine, yarran shrubs and grasses in the valleys. River red gum and polar box with sedges, lignum and nardoo in swamps and larger creeks.
Nymagee Downs	Ordovician to Devonian granites, quartzose sandstones, phyllites, slates and acid volcanics. Quaternary aeolian sands and alluvium.	Low hills and ridges with steep slopes. Form controlled by rock type, rounded hills with tors on granite, asymmetric strike ridges in sedimentary rocks. Sandplains from adjacent bioregions lap onto lower slopes.	Gritty red and yellow earthy sands on granite. Stony red earths and texture contrast soils on sedimentary rocks. Calcareous red earths in sandplains, minor earths and grey clays in alluvium.	Dwyer's mallee gum, white cypress pine, kurrajong, golden wattle on granite crests, poplar box and red box on slopes and creeks. White cypress pine, red box, belah with mallee, western wattle grey box and rosewood on crests and slopes of Sedimentary rocks. Mallee communities on sandplains. Dense poplar box and white cypress pine in creek lines.
Lachlan Plains	Devonian quartz sandstone and conglomerate, small areas of granite, and Quaternary colluvial slope mantles and alluvium.	Strike ridges of resistant rocks often following fold patterns. Low rounded hills of granite with sparse outcrop. Wide short valleys connecting to Lachlan floodplains.	Shallow stony or gritty red earths on crests and slopes, thickening downslope as rubbly mantles often with a texture contrast. Deep sandy alluvial soils in valleys with small areas of grey clay in swamps.	Dense currawang, Dwyer's mallee gum and white cypress pine on rocky crests. Same with red ironbark, mallee broombush, hill tea-tree and poplar box on slopes. Poplar box, white cypress pine, mallee, kurrajong, yarran and wilga in valleys. Poplar box and black box in minor swamps.

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Cobar Peneplain Biogeographic Region (IBRA) - Location

Wanaaring
Collarenebri
Brewarrina
Bourke
Walgett
Mount Oxley
Mount Gunderbooka
Louth
Byrock
White Cliffs
Quambone
Coonamble
Mount Drysdale
Girilambone
Mount Grenfell
Cobar
Hermidale
Gulargambone
Wilcannia
Nyngan
Emmdale
Warren
Gilgandra
Nevertire
Nymagee
Dunedoo
Tottenham
Dubbo
Menindee
Wellington
Trundle
Ivanhoe
Condobolin
Parkes
Molong
Mossgiel
Lake Cargelligo
Forbes
Hillston
Canowindra
Rankins Springs
Booligal
Grenfell
Cowra
West Wyalong
Young
Griffith
Boorowa
Temora
Leeton
Hay
Narrandera
Coleambally
Lockhart
Wagga Wagga

Key

- Towns
- Roads
- Rivers
- Waterbodies
- Cobar Peneplain
- IBRA regions in NSW
- IBRA regions interstate

0 25 50 75 Kilometres

PROJECTION : AMG z55

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W E
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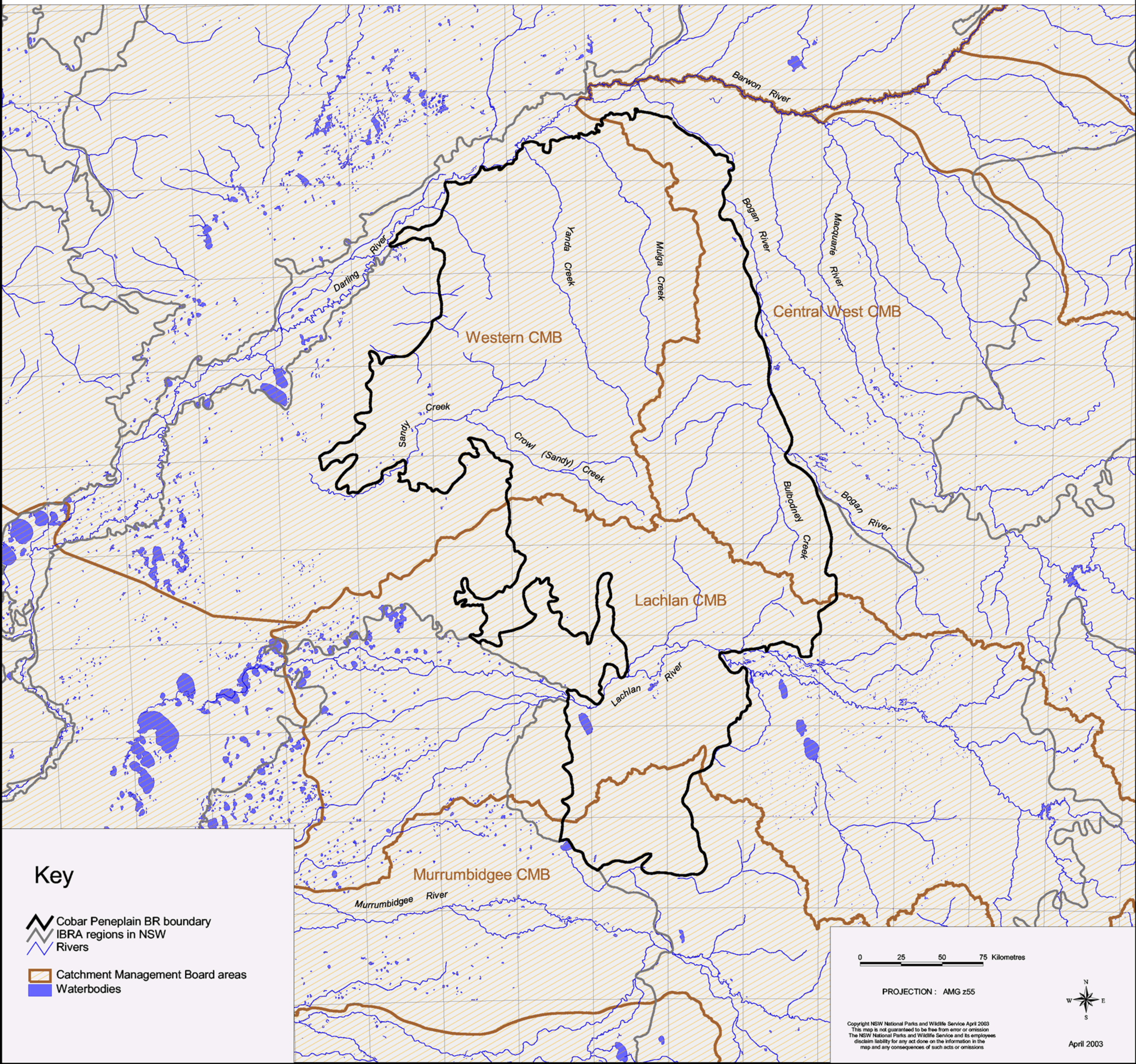
April 2003

Cobar Peneplain Biogeographic Region (IBRA) - Rivers



Key

- Cobar Peneplain BR boundary
- IBRA regions in NSW
- Rivers
- Catchment Management Board areas
- Waterbodies

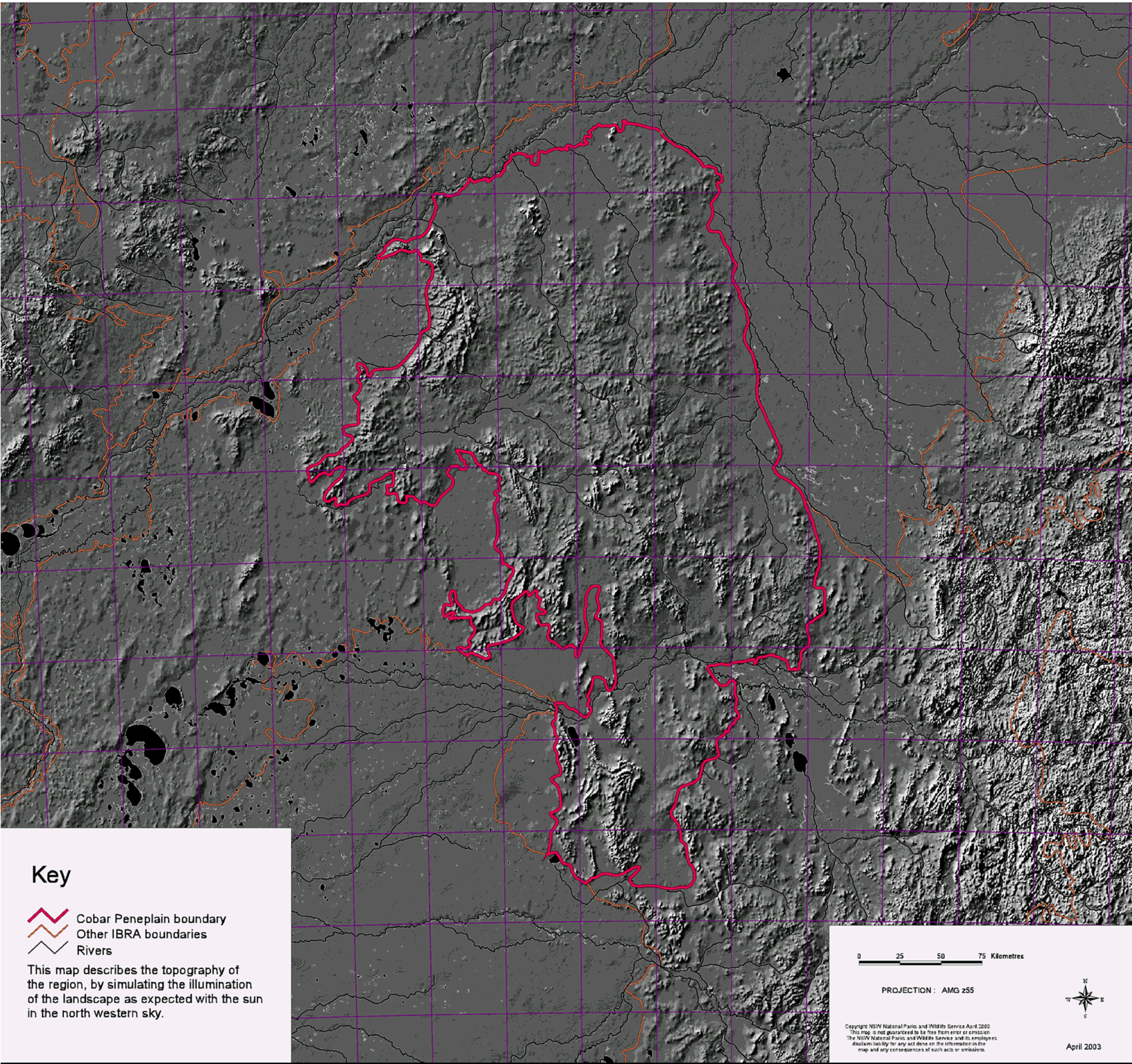
0 25 50 75 Kilometres

PROJECTION : AMG z55

N W E S

April 2003

Cobar Peneplain Biogeographic Region (IBRA) - Topography



Key

Cobar Peneplain boundary
Other IBRA boundaries
Rivers

This map describes the topography of the region, by simulating the illumination of the landscape as expected with the sun in the north western sky.

0 25 50 75 Kilometres

PROJECTION : AMG z55

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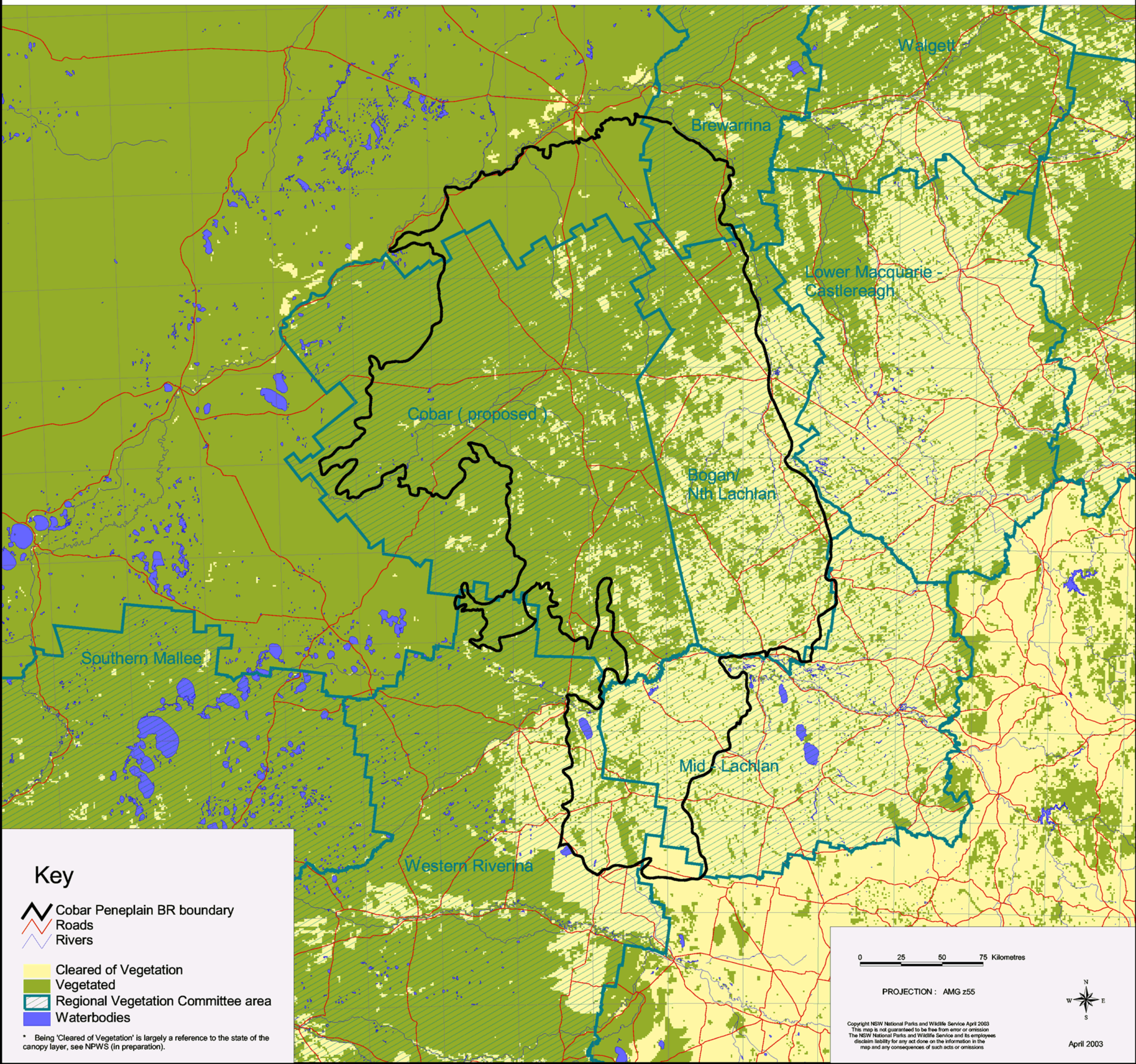
April 2003

Cobar Peneplain Biogeographic Region (IBRA) - Vegetation



Key

- Cobar Peneplain BR boundary
- Roads
- Rivers

- Cleared of Vegetation
- Vegetated
- Regional Vegetation Committee area
- Waterbodies

* Being 'Cleared of Vegetation' is largely a reference to the state of the canopy layer, see NPWS (in preparation).

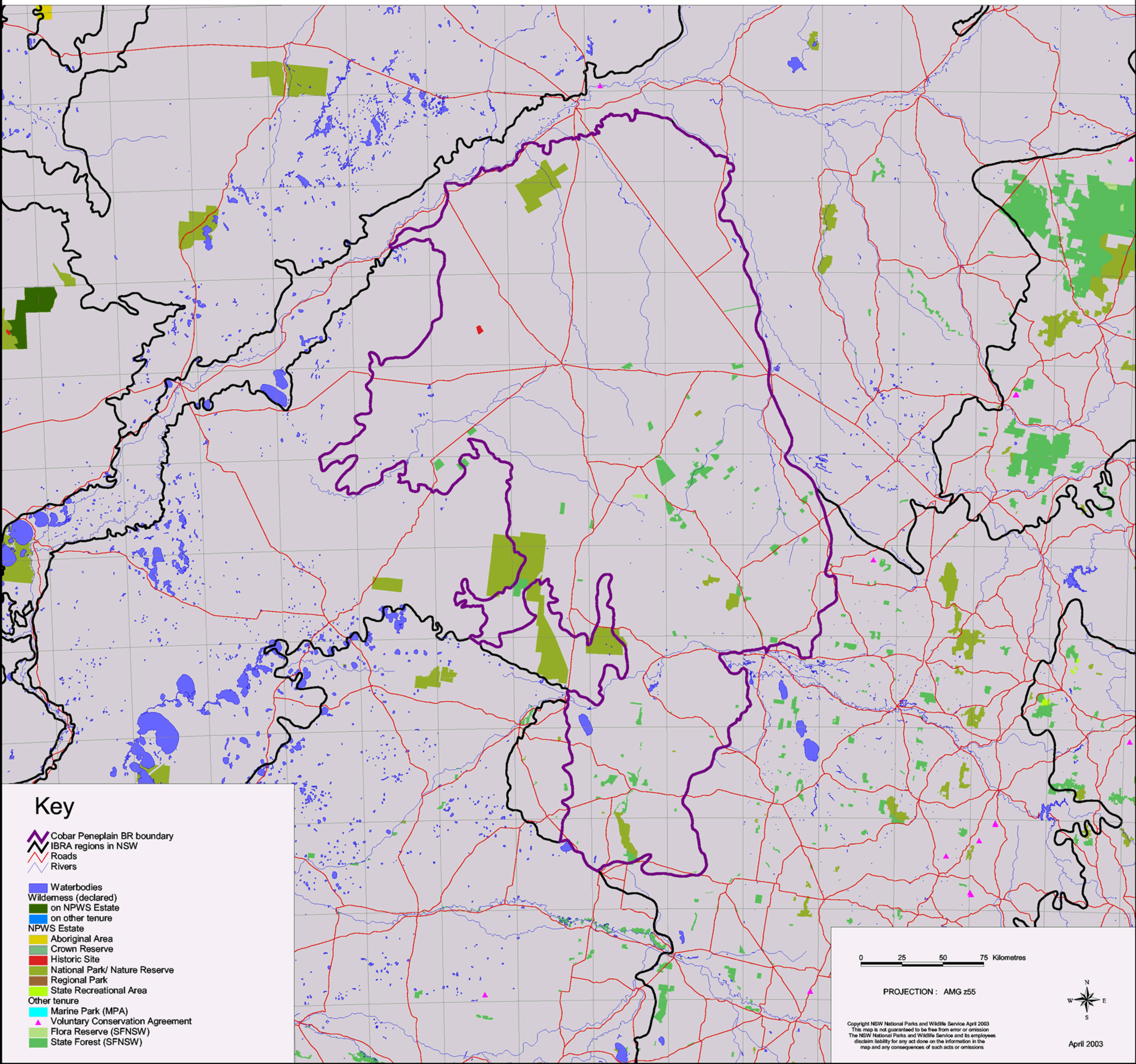
0 25 50 75 Kilometres

PROJECTION : AMG z55

N W E S

April 2003

Cobar Peneplain Biogeographic Region (IBRA) - Tenure/Reserves



Cobar Peneplain Biogeographic Region (IBRA) - Subregions and Landscapes (NPWS, in preparation)

Key

Subregions (IBRA)
Cobar Peneplain

IBRA regions in NSW
IBRA regions interstate

Landscapes

343	489	623
348	490	624
351	492	627
352	493	630
357	500	646
361	501	655
364	502	675
366	503	697
367	504	709
368	506	723
369	517	735
371	527	738
372	537	754
384	544	755
404	550	756
409	551	760
411	575	769
417	576	777
447	577	802
448	579	803
451	581	808
472	586	812
476	603	820
479	604	823
480	612	824
	615	830
	618	831
	622	840

* A description of each landscape, identified by these landscape codes, is available in 'State Conservation Monitoring Project - Monitoring NSW Environments' (NPWS, in preparation)

0 25 50 75 Kilometres

PROJECTION : Lamberts

N
W E
S

April 2003