CHAPTER 11

# The Brigalow Belt South Bioregion



## 1. Location

The Brigalow Belt South Bioregion lies in northern NSW and southern Qld, extending from south of Dubbo in central-western NSW to the mid-Qld coast.The bioregion has a total area of 27,196,933 ha, of which 5,333,469 ha (19.61%) fall within NSW (Environment Australia 2000), occupying 6.7% of the state. The bioregion shares its borders with five other bioregions; the Nandewar and North Coast bioregions in the east, the Sydney Basin and South Western Slopes bioregions to the south and the Darling Riverine Plains Bioregion on its western border.

The towns of Baradine, Binnaway, Coonabarabran, Dubbo, Gunnedah, Merriwa, Moree and Narrabri occur within the bioregion.

Several major rivers flow through the bioregion including the MacIntyre, Gwydir, Namoi, Castlereagh, Goulburn, Talbragar and Macquarie Rivers, their catchments forming an integral part of the Murray-Darling River System. The Liverpool Range in the southeastern corner of the bioregion feeds the headwaters of the Hunter and Namoi Rivers.

## 2. Climate

The bioregion is located within the eastern subhumid region of Australia (NSW NPWS 2000a).

A subhumid climate, with no dry season and a hot summer, characterises the southeastern section of the bioregion, while a generally dry subtropical climate dominates to the northwest. Minor patches to the southeast of the bioregion fall within the temperate zone, with no dry season and a warm summer. To the far west of the bioregion and in the outlier enclosed within the Darling Riverine Plains Bioregion, the climate can be described as hot and semi-arid.

## 3. Topography

The bioregion forms the southern extremity of the Qld Brigalow Belt but is not dominated by brigalow (*Acacia harpophylla*). It consists of landscapes derived from both extensive basalt flows and quartz sandstones and consequently has very variable soils and vegetation depending on the local rock type or sediment source.

| Mean Annual Temperature | Minimum Average Monthly Temperature | Maximum Average Monthly Temperature | Mean Annual Rainfall | Minimum Average Monthly Rainfall | Maximum Average Monthly Rainfall |
|---|---|---|---|---|---|
| 10 – 19°C | -2.1 – 4°C | 22.9 – 34.7°C | 449 – 1015mm | 23 – 75mm | 58 – 120mm |

## 4. Geology and geomorphology

The bioregion's bedrock comprises horizontally bedded Jurassic and Triassic quartz sandstone and shale with limited areas of conglomerate or basalts. Some of the sandstone at the heads of streams forms a low but rugged topography of cliffs and small plateau features. Streams follow the direction of major joint planes in the narrow sandstone gorges, depositing colluvial fans of coarse sands and gravels in the wider valleys. Even further down valley the topography is more subdued, partly buried in alluvial debris and largely eroded to rolling plains. Evidence of larger stream courses of Quaternary age occur in the long, sand-filled channels and clay plains with gilgai, or shallow depressions between ridges in which rainwater collects.

These sedimentary rocks are the fingers' edge of the Surat Basin and the alluvial plains derived from them are important water intake beds for the Great Australian Basin, a large Jurassic-Cretaceous basin covering a large part of eastern Australia, of which the Surat Basin is a part. Some of the Jurassic sediments contain interbedded volcanics that are locally important in affecting soils and vegetation. The more important volcanics are the extensive basalt flows of the Liverpool Range and Warrumbungles (which represents the eroded core of an ancient shield volcano), and flow remnants of the Inverell Basalts at Croppa Creek.

The Liverpool Range is the largest lava field province in NSW, dated between 32 and 40 million years, with up to 400m thickness of basalt covering an area of over 6,000 km2. The lava fields did not have a central volcanic vent but erupted from multiple fissures.

All the volcanic flows covered a pre-existing topography that is now being exposed as a result of erosion, revealing buried river gravels and lake sediments that contain well-preserved plant and fish fossils and a long record of climate change through those slices of geologic time.

Today's landscape is dominated by Quaternary sediments in the form of alluvial fans and outwash slopes that resemble the larger fans of the adjacent Darling Riverine Plains Bioregion to the west but are composed of coarser sediment and fan out at slightly steeper angles. The relative distribution of sediment from basalt or sandstone has a major impact on soil quality and vegetation.

## 5. Geodiversity

The main features of interest are the landscapes themselves, especially:

- the numerous volcanic attributes of the Warrumbungles; and
- the major lava field of the Liverpool Range with its important grassland ecosystems.

Other features of significance are:

- the diatomite deposits formed in large freshwater lakes during the volcanic times;
- several springs and bogs such as Cuddies Spring, where Pleistocene animal fauna and a pollen record have been recovered in association with early human stone tools;
- excellent Jurassic fish fossils known from a limited outcrop in the Talbragar valley; and
- several important ephemeral wetlands which have a probable record of Quaternary climate change.

## 6. Soils

Soils vary greatly across this topography, as do microclimate and aspect, so it is necessary to differentiate areas of hill tops and plateau from slopes and valley floors in both sandstone and basalt areas as all of these factors affect the vegetation.

The sandstone ridge tops carry thin, discontinuous soils with stony, sandy profiles and low nutrient status. Downslope, texture contrast soils (soils that have a sharp increase in texture, ie. increase in clay content, on passing from surface soil layers to subsoil) are more common and are typically found with harsh clay sub-soils, while in the valley floors sediments tend to be sorted into deep sands with yellow earthy profiles, harsh grey clays, or more texture contrast soils with a greater concentration of soluble salts.

In basalt country the hill tops have stony, red or brown, well-structured clays with high nutrient values. Similar but often thicker soils are found on the slopes and the valley floors where they too accumulate clay materials.

## 7. Biodiversity

### 7.1 Plant communities

The sandstone areas of the bioregion support various forests and woodlands. Woodlands dominated by blue-leaved ironbark (*Eucalyptus fibrosa*), scribbly gum (*Eucalyptus rossii*), black cypress pine (*Callitris endlicheri*), whitewood (*Atalaya hemiglauca*) and rough-barked apple (*Angophora floribunda*) are found on stony sandstone plateau and streams. Silver-leaved ironbark (*Eucalyptus melanophloia*), spotted gum (*Eucalyptus maculata*) and smooth-barked apple (*Angophora costata*) occur on stony hills in the north of the bioregion. Narrow-leaved red ironbark (*Eucalyptus creba*), white cypress pine (*Callitris glaucophylla*), red stringybark (*Eucalyptus macrorhynca*), patches of mallee (*Eucalyptus* sp.) and broom heath (*Melaleuca uncinata*) occur on gentler sandstone slopes.

Pilliga box (*Eucalyptus pilligaensis*), with grey box (*Eucalyptus moluccanna*), poplar box (*Eucalyptus populnea*), fuzzy box (*Eucalyptus conica*), bull oak (*Casuarina luemhannii*), rosewood (*Heterodendrum oleifolium*), whitewood, wilga (*Geijera parviflora*), belah (*Casuarina cristata*), yarran (*Acacia homalophylla*) and budda (*Eremophila mitchellii*) occur on heavier alluvial soils in the west and north of the bioregion. Poplar box, pilliga box, Blakely's red gum (*Eucalyptus blakelyi*), white cypress pine and red ironbark (*Eucalyptus sideroxylon*) occur on coarser soils with occasional silver-leaved ironbark, white box (*Eucalyptus albens*) and fuzzy box in run-on sites. River red gum (*Eucalyptus camaldulensis*) lines all streams.

In the southern end of the bioregion the vegetation comprises narrow-leaved ironbark, white cypress pine and white box on hills and slopes. Patches of black cypress pine, hill red gum (*Eucalyptus dealbata*), the occasional kurrajong (*Brachychiton populneum*) and scrubby acacia species are present in rocky outcrops. Grey box (*Eucalyptus microcarpa*), yellow box (*Eucalyptus melliodora*) and rough-barked apple occur on valley floors, while river red gum lines larger streams and river oak (*Casuarina cunninghamiana*) the tributaries.

The vegetation on the northern basalts includes brigalow, belah, whitewood, wilga, budda and poplar box on the hills, with river red gum, belah, myall (*Acacia pendula*) and poplar box on the flats. White box with silver-leaved ironbark, white wood, bull oak and brigalow are present on alluvial clays. River red gum occurs on all streams.

Diverse grasslands dominate the Liverpool Plains. Common species include plains grass (*Stipa* sp.), panic grass (*Panicum* sp.), windmill grass (*Chloris* sp.) and blue grass (*Dicanthium* sp.) on black earths, with the occasional white box,

yellow box, poplar box and wilga. On the high (colder) ridge crests, silvertop stringybark (*Eucalyptus laevopinea*), manna gum (*Eucalyptus viminalis*) and mountain gum (*Eucalyptus dalrympleana*) are found with snow gum (*Eucalyptus pauciflora*) in cold air drainage hollows. Tallow wood (*Eucalyptus microcorys*), blackbutt (*Eucalyptus pilularis*) and blue gum (*Eucalyptus saligna*) occur on eastern slopes with small areas of vine forest. On northern slopes, white box with rough-barked apple occur with belah in the creeks. Yellow box and Blakely's red gum are found on slopes with a southerly aspect.

### 7.2 Significant flora

There are 3 endangered ecological communities within the bioregion listed under Schedule 1 of the TSC Act. These are the semi-evergreen vine thicket *Cadellia pentastylis* (poline or scrub myrtle) and carbeen open forest communities. The bioregion is important for the long-term viability of these vegetation communities which are predominantly found here, with a small area lying in the Nandewar Bioregion. The carbeen open forest communities are now restricted to the Brigalow Belt South Bioregion and very limited areas of the Darling Riverine Plains Bioregion.

Benson (1999) notes brigalow, box woodlands and plains grasses as the most threatened plant communities in the bioregion.

The grassy white box woodland community also occurs in this bioregion. It is nationally endangered and protected under the EPBC Act 1999.

At a species level there are 4 endangered and 12 vulnerable species listed in the schedules of the TSC Act. Records within the bioregion tend to be concentrated in the major reserves and forests of the bioregion such as Goonoo State Forest, the Warrumbungles, Mt Kaputar and the Pilliga.

### 7.3 Significant fauna

Although few systematic surveys have been conducted in the bioregion, records from a variety of surveys can be used to illustrate the vertebrate fauna of the bioregion, which consists of 18 amphibian species, 68 reptiles, 281 birds and 82 mammal species. Many of these species are considered threatened, including the endangered malleefowl (*Leipoa ocellata*), for which the bioregion contains important habitat, and the vulnerable koala (*Phascolarctos cinereus*) which has important populations in the Warrumbungles, the Pilliga and the area around Gunnedah (NSW NPWS 2000a). In this bioregion the tree species often selected by koalas include Blakely's red gum, river red gum and white box, while pilliga box, poplar box, narrow-leaved ironbark and rough-barked apple are occasionally used for food (NSW NPWS 2000a).

Another significant mammal species in the bioregion is the vulnerable eastern pygmy possum (*Cercartetus nanus*) which has a very patchy distribution, with more than 10 records of the species known from each of only 5 locations in NSW, the Pilliga State Forest being one of them (NSW NPWS 2000a).

As its name suggests, the Pilliga mouse (*Pseudomys pilligaensis*) is known only from the Pilliga State Forest, although its preferred habitat has not yet been established. It is thought to prefer mixed eucalypt forest with a shrubby understorey with logs and litter and may face threat from disturbance of ground storey vegetation. (NSW NPWS 2000a).

A species of hopping mouse (*Notomys*) is thought to be present in the remnant forests of the bioregion. It is known only from hairs and footprints and is yet to be found in the Brigalow Belt South.

The birds of the bioregion are highly diverse, mainly consisting of tropical woodland species and comprising the largest number of Australian resident species of any bioregion. There are no major populations of rare or threatened birds in the bioregion and although many birds within the bioregion have restricted ranges, none is endemic. Exotic species are low in numbers and those present are located mainly around towns.

Although bird species diversity is high relative to other NSW bioregions, the Brigalow Belt South Bioregion has experienced major declines in ground-nesting, ground-feeding insectivorous and grassland birds, a trend common to many parts of Australia. An increased reporting rate in the bioregion's rainforest and temperate forest taxa may reflect greater survey effort in these habitats. Reduction of bird diversity in habitat fragments and the continued loss of woodland and freshwater birds seem to be the prediction for the future. However, there was an increase in the numbers of mallard (*Anas platyrhynchos*), cattle egret (*Bubulcus ibis*) and the common myna (*Acridotheres tristis*).

Conservation of habitat is crucial to the survival of small grassland and woodland birds. This should include protecting a substantial and representative proportion of the woodland and grassland landscapes of the bioregion, as well as maintaining and increasing the connectivity between seasonally variable food sources. Ideally, these would be in blocks large enough to discourage invasion by exotic species or fragment specialists such as noisy miners.

### 7.4 Significant wetlands

Lake Goran is considered to be significant as it provides an important refuge for waterbirds and other species during times of drought (ANCA 1996). When inundated, it is an important waterbird habitat for species such as the red-necked stint (*Calidris ruficollis*), a migratory wader. Despite its significance, the lake's condition is considered to be degraded and tending towards further decline due mainly to salinity, increased flooding and pollution caused by runoff from surrounding agricultural lands.

## 8. Regional history

### 8.1 Aboriginal occupation

The Liverpool Plains were the homelands of the Kamilaroi people, a large tribe that supported many sub-groups (HO and DUAP 1996). When Charles Sturt encountered these people on the Macquarie River during his travels, he described them as "clean-limbed and stout, with pleasing faces and intelligent countenances" (HO and DUAP 1996).

### 8.2 European occupation

The explorer and then Surveyor General of NSW, John Oxley, first visited the bioregion in 1817 and again the following year when he reached the junction of the Macquarie and Talbragar Rivers near the current site of Dubbo. He noted the presence of the local Aboriginal people on the Macquarie River northwest of Dubbo and the suitability of the land for agriculture (NSW NPWS 2000b).

An Agricultural Convict Establishment, settled in the Wellington Valley in 1823 by Governor Brisbane, led to the first European community west of Bathurst and so began the era of pastoral occupation in the bioregion. The Establishment was shut down in 1828, by which time several stations had been set up in the vicinity. In the same year Charles Sturt arrived in the Wellington Valley on his way north. In subsequent years, pastoral occupation around Dubbo quickly escalated as it did throughout the colony (NSW NPWS 2000a).

The official settled area of the colony was divided into 19 counties and the region outside this designated area, including much of the Brigalow Belt South Bioregion, was considered to be "beyond the boundaries" and was thus officially out of bounds for settlement. However, these rules were soon

ignored and pastoralism continued to forge its way through the countryside (NSW NPWS 2000a).

Squatters moved into the bioregion around 1824 but it wasn't until 1836 that squatting licences were issued for grazing (NSW NPWS 2000a). By the early 1830s squatters were establishing runs, including "Dubbo", a run set up by Robert Dulhunty on the Macquarie, along the Talbragar River Valley and on the Macquarie River near Goonoo. By the 1840s pastoralists occupied most of the Macquarie and Talbragar River frontages (NSW NPWS 2000a).

During the early days of European settlement the local Aboriginal people were subjected to violence, disease, sexual exploitation and, as a result of these and other factors such as diminished resources, population decline. One of the notable elements of the interaction between Europeans and Aborigines at this time was the fierce resistance shown by the Aboriginal people (Bickford 1980). Often portrayed as a passive people that let the Europeans simply take their land, the local Aboriginal people were described as "becoming more audacious" in a record of 1842 (HO and DUAP 1996) and some records show a fear of the Aborigines among travelers. Conflict was particularly severe on the Namoi and Gwydir, with conflicting reports suggesting the death of at least 25 Europeans along with much stock and the wounding of many Aborigines and settlers. In 1849 native police were sent to the area and much of the Aboriginal resistance was suppressed by the mid-1850s.

However, despite losing their lands or being forced to share them with the new settlers, the local Aboriginal people of the bioregion resisted covertly, holding onto their traditional practices, including knowledge of languages, stories and sacred sites (Bickford 1980). In some cases, retention of traditional practices was not so covert. Aborigines were known to perform corroborees for audiences of Europeans, performances involving Aboriginal participants from throughout the region. On some occasions, European settlers also observed other traditions such as funerals and burial ceremonies (NSW NPWS 2000b).

The last recorded corroboree was held in 1881, coinciding with the opening of the railway in Dubbo. If such ceremonies occurred after this, they were held in secrecy to avoid intrusion by Europeans or simply to ensure privacy. As settlement by Europeans increased and government control over Aboriginal people strengthened, the importance of continuing traditional practices grew and the need for secrecy became more crucial (NSW NPWS 2000b).

From the 1840s to the 1880s, working relationships between European and Aboriginal people were established in the bioregion, and European station owners allowed the local Aboriginal people to live on their lands in what they termed "station camps". These made workers readily available to landholders while Aboriginal people living on them were able to remain in their country, continuing the cultural and economic practices that had linked them with the land from the beginning. The shortage of European labour during the gold rushes strengthened this system of "dual occupation" and, as a result, the Aboriginal labour force was crucial to the functioning of the pastoral economy between the late 19th and mid-20th centuries. This was particularly due to the willingness of the local Aboriginal people to remain on their homelands and retain the ability to practice spiritual and ceremonial traditions. In 1882 the total Aboriginal population of the area around Dubbo was recorded as being 741 people (NSW NPWS 2000b).

The Liverpool Plains southeast of Narrabri became a site for European settlement in the 1830s and was used mainly for sheep and cattle grazing until the 1880s (Hunt 1980). Wheat farming emerged around Dubbo in the south of the bioregion in the 1860s and by the 1880s cropping was beginning to occur extensively throughout the bioregion, especially on the lighter textured red soils at the footslopes of the Liverpool Ranges (NSW NPWS 2000a). Although there were also droughts at this time the intensification of cropping and demand for land for this purpose led to widescale clearing of forests and other native vegetation (NSW NPWS 2000a).

A transition from pastoralism to agriculturalism based on wheat occurred in the Dubbo area from the 1880s to the 1920s. This was prompted by a major change in land tenure and management. There was a push to "unlock the lands" to allow small selectors access to the vast lands formerly held under pastoral leases. These shifts were aided by legislation changing the nature of land holdings and while these helped unlock the land to small-time farmers, they effectively shut out Aboriginal people from their traditional lands. So began a period of struggle for the Aboriginal community of the Brigalow Belt South Bioregion (NSW NPWS 2000b).

In the 1890s, as agriculture around Dubbo increased, land enclosure continued to decrease property size. The conditions that had allowed dual occupation to occur in the past had now ceased. As a result, Aboriginal communities were driven from their homelands and onto reserves on the outskirts of towns. This served to alienate the Aboriginal community who could now no longer use the land as they had traditionally, due both to their limited access to the land and its changing ecology under agricultural production (NSW NPWS 2000b).

With the loss of their traditional lands, Aboriginal people were even more dependent on European landholders for use of the land than they had previously been on the squatters. They obtained work on the lands, engaged in timber cutting, feral animal shooting, shearing, domestic labour and worked as farm hands and stock hands. In this way they were involved in the local economy while remaining on their lands (NSW NPWS 2000b). Those who were unable to remain on their traditional lands and who lived on reserves or in fringe camps came increasingly under the control of the government which established the Aborigines Protection Board in the 1880s. While the Board was initially responsible only for the distribution of blankets and rations on the reserves, it began to exert a tighter grip on the lives of the Aborigines, placing ever more restrictions on the rights of the communities. Children in Aboriginal communities were increasingly the targets of the Board, which relied on the power vested in it by the Aborigines Protection Act 1909. By 1915, the strength of the Act had increased, giving the Board the power to remove Aboriginal children from their families where the wellbeing of the child was in question.

The reserve closest to Dubbo was the large Talbragar Reserve established in 1898 at the junction of the Macquarie and Talbragar Rivers, where John Oxley arrived in the region only 80 years before in 1818. Other local Aborigines lived in camps along the Macquarie River although the Talbragar Reserve was home to the core of the local community. Aboriginal families often chose to remain in or near reserves to allow their children to gain an education, but in the early to mid-1900s, they found themselves unofficially excluded from local public schools (NSW NPWS 2000b).

During these times, areas such as Goonoo Forest became more important to the Aboriginal community. The forest was dedicated as a formal public "reserve" in 1917, during the period when agricultural production was intensifying in the area. The protection of the forest enabled the Aboriginal people to use it to gather food, both plants and animals, and for social and spiritual purposes without close observation by Europeans (NSW NPWS 2000b).

Areas like Pilliga and Goonoo that were not dedicated in public forests came increasingly under threat from clearing for agriculture and settlement. The passage of the railway line further north and west also contributed to clearing as thousands of trees were felled for use as timber sleepers, further razing the land that had been cleared of timber for housing and fencing since the start of European settlement (NSW NPWS 2000b).

Since European settlement, timber getting has been a regular activity around the Pilliga and Goonoo State Forest areas (NSW NPWS 2000b). Forest management began in the bioregion with forest reserves dedicated in the 1870s. The Forest Conservancy Branch of the Department of Mines placed the

Photo: NPWS

initial Forest Reserves over abandoned Pilliga Crown Land holdings in 1971 (NSW NPWS 2000b), marking the Government's first direct involvement with forest management. Such forest management was driven not by an understanding of ecological process and impacts but by the proposed use of the timber (NSW NPWS 2000b). By the 1870s early landholders and explorers observed changes in the condition of the land and many people were aware of the impacts of agriculture on the landscape even before further damage was caused by drought and rabbits.

The 1950s saw the introduction of technology that allowed cultivation of the heavy-textured soils that had been used for grazing in the past. As a result, cropping on the footslopes of the Liverpool Ranges began to be replaced by grasslands which were used for grazing (NSW NPWS 2000b).

Commercial timber harvesting in the bioregion has concentrated mainly on white cypress (*Callitris glaucophylla*) and narrow-leaved ironbark (*Eucalyptus crebra*) in the last 100 years, although broad-leaved ironbark (*Eucalyptus. fibrosa*), bull oak (*Allocasurina luehmannii*), black cypress (*Callitris endlicheri*) and western box species (*Eucalyptus melliodora, Eucalyptus pilligarensis, Eucalyptus microcarpa* and *Eucalyptus populnea*) have all been harvested in the area in the last 80-100 years (Hartley *et al.* 2000).

Data collected in 1996-97 for the local government areas in the southern two-thirds of the bioregion reported that 34,970 people were employed and earning an average salary of $26,452 each, a figure lower than the NSW average at the time of $30,868 per person (Hartley *et al.* 2000). During this time imports to the region, one-third consisting of household consumables, exceeded exports. Compared to NSW averages, the southern part of the bioregion is much more dependent on agriculture, forestry and fishing while its proportion of mining, utilities and building industries is comparable to the state figures. Although manufacturing and service industries were found to be less than the state figures, the primary industries contribute more than 70% to the exports of the region (cited in Hartley *et al.* 2000).

The main industries, in terms of highest contribution to the economy of the region, are sheep, grains and beef, other agriculture, agricultural services, education, health, public administration, retail trade and wholesale trade.

The period between 1976 and 1991 was a period of high population growth in the region, fuelled by heightened agricultural development including increased irrigation areas. Between 1981 and 1996 the proportion of the employed population of the area was decreasing, apparently as a result of variable international commodity markets and poor seasonal conditions. Excluding Dubbo, the main town centre of the bioregion, the region appears now to be shedding jobs at the same rate as its population decreases, with population losses becoming more common in recent years (Hartley *et al.* 2000).

Early squatters in the Brigalow Belt South Bioregion grazed their cattle in the open woodlands common in the region at the time. After settlers initiated fire control measures, the woodlands were overwhelmed by dense cypress forest growth rendering these areas unsuitable for grazing (Hartley *et al.* 2000) and grazing was shifted to alternative areas. Grazing still occurs in the bioregion, and more recently has been used under grazing permits on State forest estate in the region, to reduce ground fuel, particularly in cypress forests in the Goonoo area, so reducing fire risks.

The mineral industry in the bioregion is based mainly on coal, as the region lies mostly within the Gunnedah Basin, which is a major coal-bearing sedimentary basin. Current mining titles are held for coal and some industrial minerals while exploration titles are held for coal, petroleum, gold, base metals, zeolites and clay minerals (Hartley *et al.* 2000). The majority of coal produced in the region, although comprising a small yield, is for export to overseas markets (Hartley *et al.* 2000).

In terms of tourism in the southern part of the bioregion, the area around Dubbo has both the highest level of visitation and the highest visitor expenditure, making it the major tourist centre of the area (Hartley *et al.* 2000).

## 9. Bioregional-scale conservation

The majority of the NSW bioregions have less than 20% of their area under conservation-oriented management. The Brigalow Belt South Bioregion is no exception with a total of 155,353 ha or 2.91% of its area held under a relatively limited range of the available conservation mechanisms.

Nineteen national parks and nature reserves are managed under the NPW Act 1974 in the Brigalow Belt South Bioregion, 5 of which are national parks and 14 are nature reserves. These occupy an area of 134,279 hectares or about 2.52% of the bioregion. A portion of these reserves is also protected and managed as wilderness, with just over 1,200 ha of Mt Kaputar National Park comprising parts of the Nandewar and Rusden wilderness areas, occupying about 1,207 ha or 0.02% of the bioregion.

Of the other mechanisms provided for under the NPW Act 1974 there are no historic sites, no Aboriginal areas, no state recreation areas and no regional parks in the bioregion. However, in terms of private land conservation areas, there are 2 voluntary conservation agreements which occupy 128.74 ha or 0.002% of the bioregion. Fifteen wildlife refuges occur on properties occupying about 16,041.85 ha or 0.30% of the bioregion. Six additional properties with wildlife refuges will soon be added to the conservation map.

Twelve property agreements (NVC Act 1997) have been entered into by landholders in the bioregion. The conservation zones of these property agreements occupy about 1,109.74 ha or 0.02% of the bioregion. The total area of private land conservation is thus 1,109.74 ha or 0.02% of the bioregion.

Some 10.60% of the bioregion is managed as State forests for a range of forestry practices under the Forestry Act 1916, including timber production and forest management. Nine flora reserves also occur within the bioregion and occupy 4,091.19 ha or 0.008% of the total area.

About 3,190,400 ha, or a considerable 60.85%, of the bioregion has been cleared.

## 10. Subregions of the Brigalow Belt South Bioregion

(Morgan and Terrey 1992)

| Subregion | Geology | Characteristic landforms | Typical soils | Vegetation |
|---|---|---|---|---|
| Inglewood Sandstones | Deeply weathered and lateritised Jurassic-Cretaceous sandstone with associated colluvial lower slopes and alluvial plains. | Undulating low hilly country. | Iron rich uniform profiles on hillcrests merging to harsh texture contrast profiles on lower slopes. Uniform sandy alluvium in stream lines. | Major vegetation types include narrow-leaved ironbark on hillsides, white cypress pine and bull oak on harsh texture contrast soils in gently undulating parts and poplar box on lower slopes and flats. Minor areas of brigalow-belah also occur. |
| Moonie-Barwon Interfluve<br>One land system only. | Cretaceous sandstones and claystones that are a small part of the Surat Sandstones subregion in Qld. | Low rounded hills, relief to 10m, local dendritic drainage patterns. | Stony red earths often with a gravel pavement. Soils become deeper downslope and accumulate calcium carbonate in drainage lines. | Poplar box, wilga, white cypress pine, budda, warrior bush, ironwood, and belah with mixed grasses underneath. |
| Northern Basalts | Tertiary basalts over Jurassic quartz sandstones and alluvial sediments derived from these. | Undulating low stony hills, long slopes with sandy wash and heavy clays in the valley floors. | Black loams on basalt ridges, deep sands on sandstone and texture contrast soils on slopes. Heavy grey clay on alluvial flats. | Brigalow, belah, whitewood, wilga, budda and poplar box on basalt hills. Silver-leaved ironbark, spotted gum and smooth-barked apple on stony hills. River red gum, belah myall and poplar box on basalt flats. Silver-leaved ironbark and white cypress pine in sandstone rocks, smooth-barked apple, white cypress, Blakely's red gum, Moreton Bay ash, poplar box, wilga, rough-barked apple, bull oak, on lower sandstone slopes. White box, with silver-leaved ironbark, white wood, bull oak and brigalow on alluvial clays. River red gum on all streams. |
| Northern Outwash | Tertiary and Quaternary alluvial fans and stream terraces. | Sloping plains with alluvial fans that are coarser and steeper than the Gwydir Fans downstream. | Red loams and heavy brown clays. | Poplar box with white cypress pine, wilga and budda on red soils, belah and brigalow on brown clays. |
| Pilliga Outwash | Quaternary alluvial fans largely derived from Jurassic quartz sandstone. | Long slopes broken by sandy abandoned stream channels, patches of heavy grey clay and incised stream channels. | Deep texture contrast soils with harsh clay subsoils, grey clay with gilgai. | Poplar box, pilliga box, Blakely's red gum, white cypress pine and mugga on coarser soils. Belah, brigalow, yarran, budda, wilga whitewood, rosewood on heavier soils. River red gum in creek lines, occasional silver-leaved ironbark, white box and fuzzy box in run-on sites. |

## 10. Subregions of the Brigalow Belt South Bioregion *CONTINUED*

| Subregion | Geology | Characteristic landforms | Typical soils | Vegetation |
|---|---|---|---|---|
| Pilliga | Horizontal Jurassic quartz sandstones, limited shales, Tertiary basalt caps and plugs plus the sediments derived from these rocks. | Stepped sandstone ridges with low cliff faces and high proportion of rock outcrop. Long gentle outwash slopes intersected by sandy stream beds and prior stream channels. A few patches of heavy clay. Includes the spectacular mountain landscape of volcanic domes, plugs and dykes in the Warrumbungles. | Shallow black earths and red loams on basalts. Extensive harsh texture contrast soils, linear patterns of deep yellow sand, stony red brown earths. | White box with white cypress pine and kurrajong on the basalt hills. Blue-leaved ironbark, white gum, black cypress pine, whitewood, and rough-barked apple on stony sandstone plateau and streams.<br>Narrow-leaved ironbark, white cypress pine, red stringy bark, patches of mallee and broom heath on gentler sandstone slopes. Pilliga box with grey box, poplar box, fuzzy box, bull oak, rosewood, wilga and budda on heavier soils in the west and north. River red gum lines all streams. |
| Liverpool Plains | Quaternary alluvial plains and outwash fans derived from Tertiary basalts. Permian and Triassic quartz sandstones with minor basalt caps. | Undulating hills and sloping plains with alluvial channels and floodplains. | Extensive black earths on low angle slopes. Brown clays, alluvial soils and red or brown texture contrast soils on slopes below sandstone. | Plains grass, panic, windmill grass and blue grass on black earths with occasional white box, yellow box, poplar box and wilga. White box and white cypress pine with rough-barked apple, hill red gum, occasional belah and mulga on texture contrast hillslope soils. |
| Liverpool Range | Multiple Tertiary basalt flows with intervening sediments and ash fall material, overlying Jurassic quartz sandstones and shale. | Undulating plateau top with steep margins grading to long footslopes. | Stony red brown loams on ridges, shallow stony clay soils on steep slopes grading to deep black earths on lower slopes. | Plateau: open forest of silvertop stringybark, manna gum and mountain gum. Snow gum in cold air drainage hollows. Tallow wood, blackbutt and blue gum on eastern slopes, small areas of vine forest.<br>Slopes: White box with rough-barked apple, belah in the creeks on northern aspects. Yellow box and Blakely's red gum on southern aspect. |
| Talbragar Valley | Near horizontal Mesozoic quartz sandstone, conglomerates and shales with minor Tertiary basalt caps and extensive alluvial wash plains. | Residual rocky hills, undulating long slopes and wash plains, wide valley floors with sandy streams. | Thin stony loams and texture contrast soils over most of the landscape with deeper sands and brown earths on valley floors. | Narrow-leaved ironbark, white cypress pine, white box on hills and slopes. Patches of black cypress pine, hill red gum, occasional kurrajong and scrubby acacia in rocky outcrops. Grey box, yellow box, rough-barked apple on valley floors. River red gum on larger streams and river oak on tributaries. |

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Photo: NPWS

# Brigalow Belt South Biogeographic Region (IBRA) - Location

Queensland

Mungindi
Weilmoringle
Lightning Ridge
Collarenebri
Moree
Wanalda
Tenterfield
Inverell
Glen Innes
Bingara
Grafton
Brewarrina
Walgett
Wee Waa
Mount Kaputar
Narrabri
Woolgoolga
Guyra
Coffs Harbour
Armidale
Ebor
Bellingen
Quambone
Coonamble
Baradine
Gunnedah
Walcha
Tamworth
Girilambone
Gulargambone
Coonabarabran
Hermidale
Binnaway
Quirindi
Wauchope
Nyngan
Gilgandra
Warren
Murrurundi
Nevertire
Mendooran
Coolah
Tarea
Barrington
Dunedoo
Cassilis
Scone
Merriwa
Tottenham
Dubbo
Forster
Muswellbrook
Wellington
Singleton
Mudgee
Maitland
Rylstone
Newcastle
Molong
Parkes
Orange
Forbes
Bathurst
Lithgow
Gosford
Blayney
Canowindra
Katoomba
Oberon
Cowra
Sydney

South Pacific Ocean

## Key

- Towns
- Roads
- Rivers
- Waterbodies
- Brigalow Belt South
- IBRA regions in NSW
- IBRA regions interstate

0 25 50 75 Kilometres

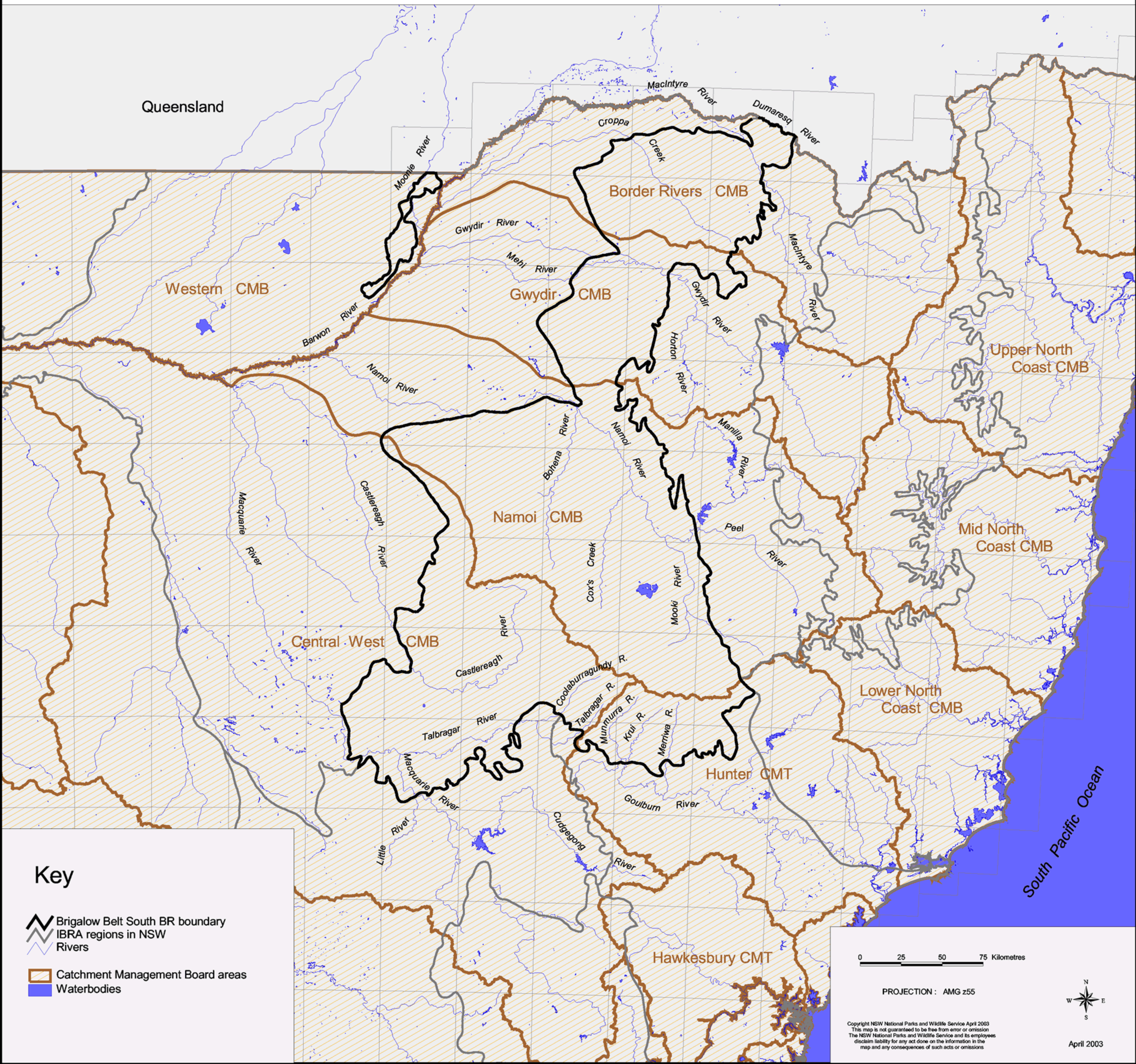
PROJECTION : AMG z55

N W E S



April 2003

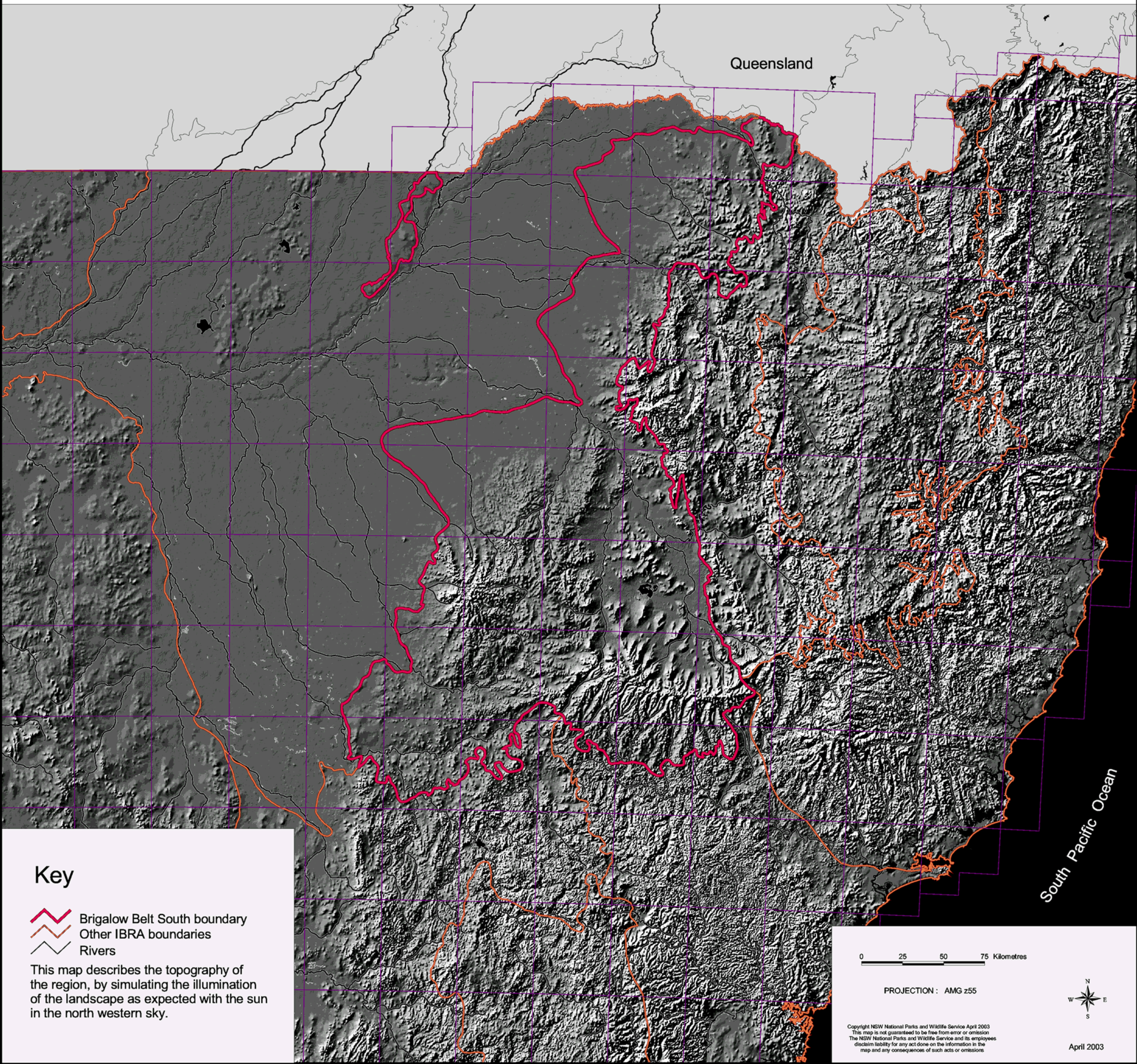
# Brigalow Belt South Biogeographic Region (IBRA) - Rivers






April 2003

# Brigalow Belt South Biogeographic Region (IBRA) - Topography




## Key

Brigalow Belt South 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

N
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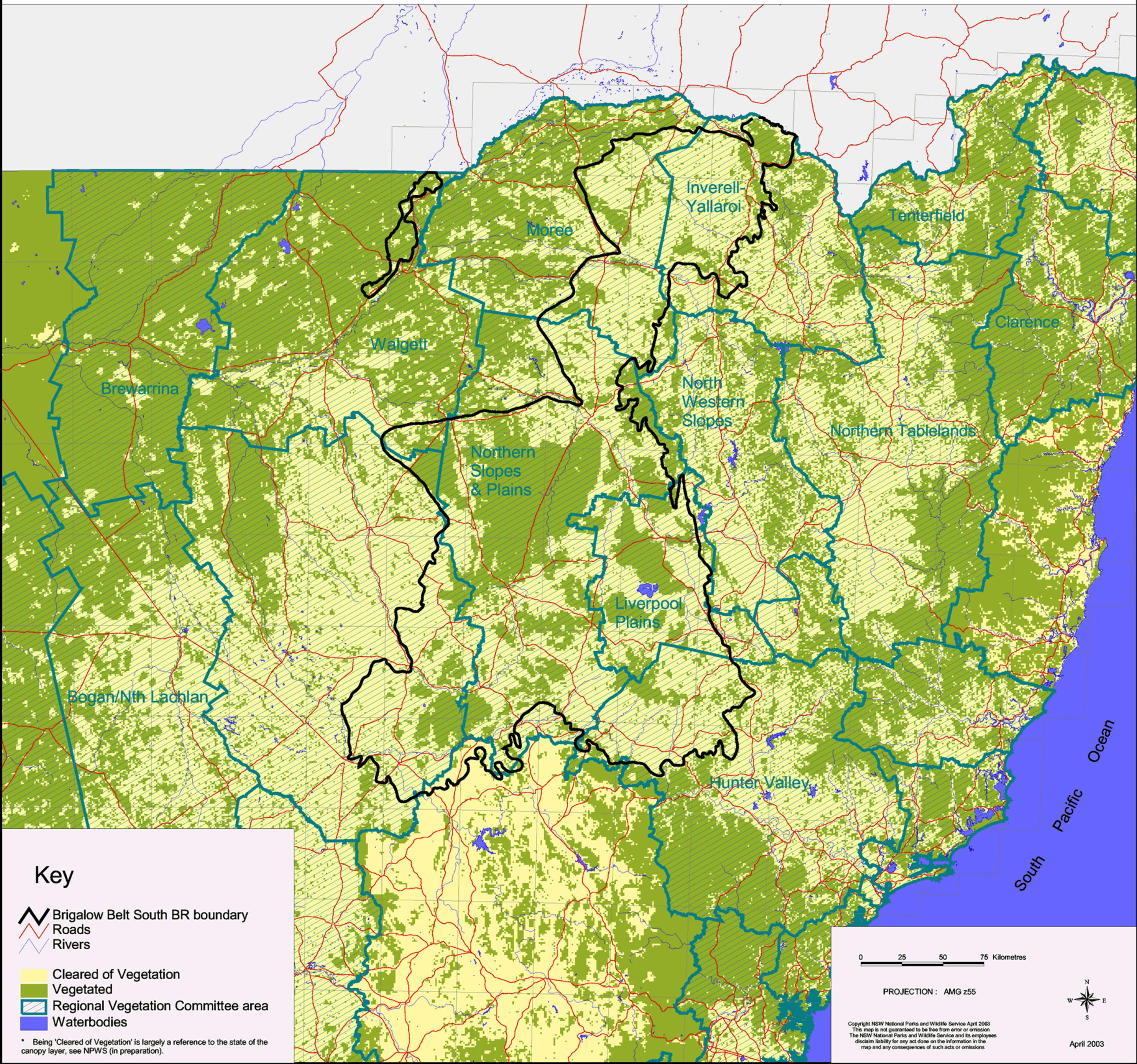
April 2003

# Brigalow Belt South Biogeographic Region (IBRA) - Vegetation




## Key

- Brigalow Belt South 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

# Brigalow Belt South Biogeographic Region (IBRA) - Tenure/Reserves

Queensland

South Pacific Ocean

## Key

- Brigalow Belt South BR boundary
- IBRA regions in NSW
- Roads
- Rivers
- Waterbodies

Wilderness (declared)
- on NPWS Estate
- on other tenure

NPWS Estate
- Aboriginal Area
- Crown Reserve
- Historic Site
- National Park/ Nature Reserve
- Regional Park
- State Recreational Area

Other tenure
- Marine Park (MPA)
- Voluntary Conservation Agreement
- Flora Reserve (SFNSW)
- State Forest (SFNSW)

0 25 50 75 Kilometres

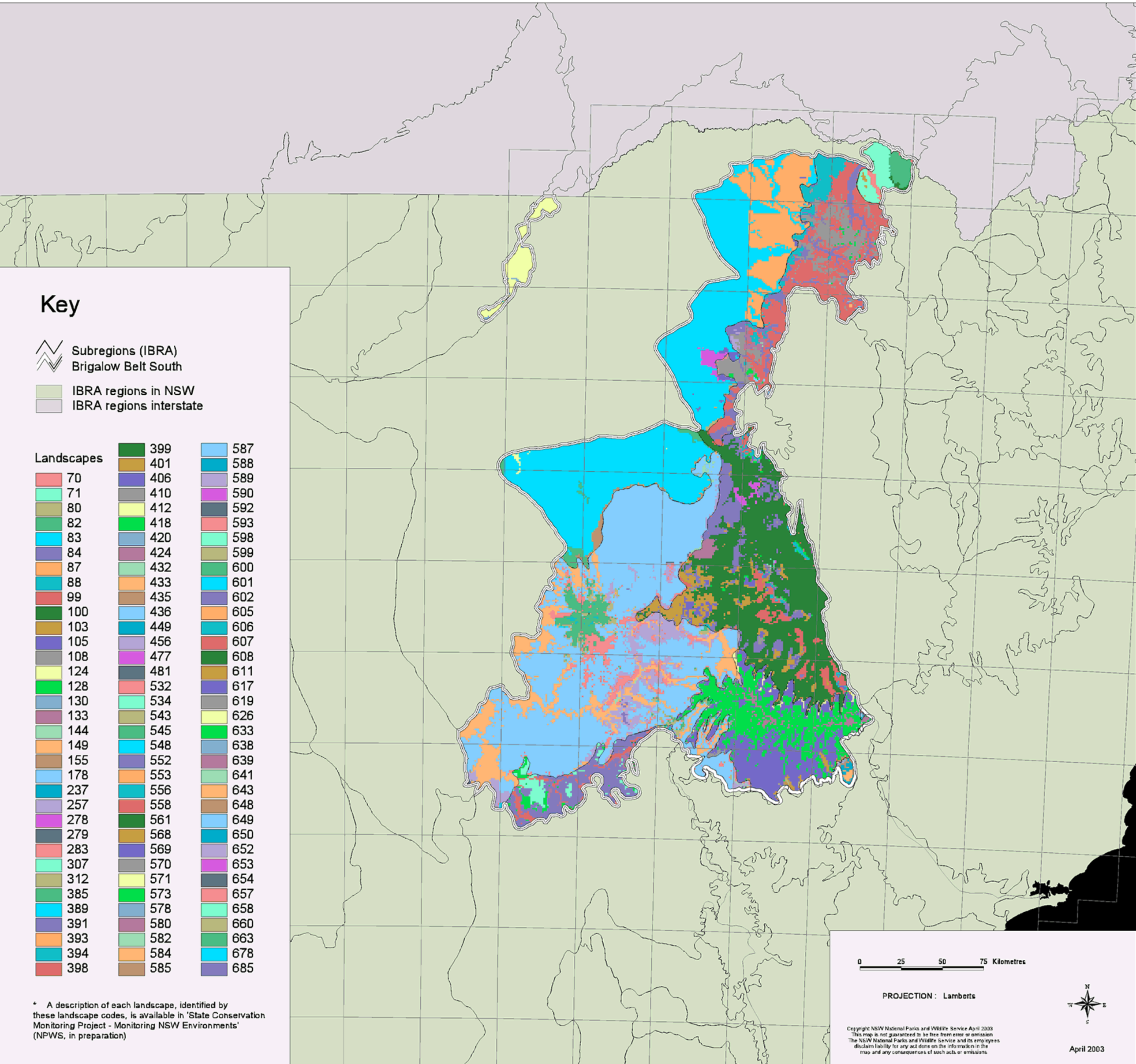
PROJECTION : AMG z55

N W E S



April 2003

# Brigalow Belt South Biogeographic Region (IBRA) - Subregions and Landscapes (NPWS, in preparation)




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