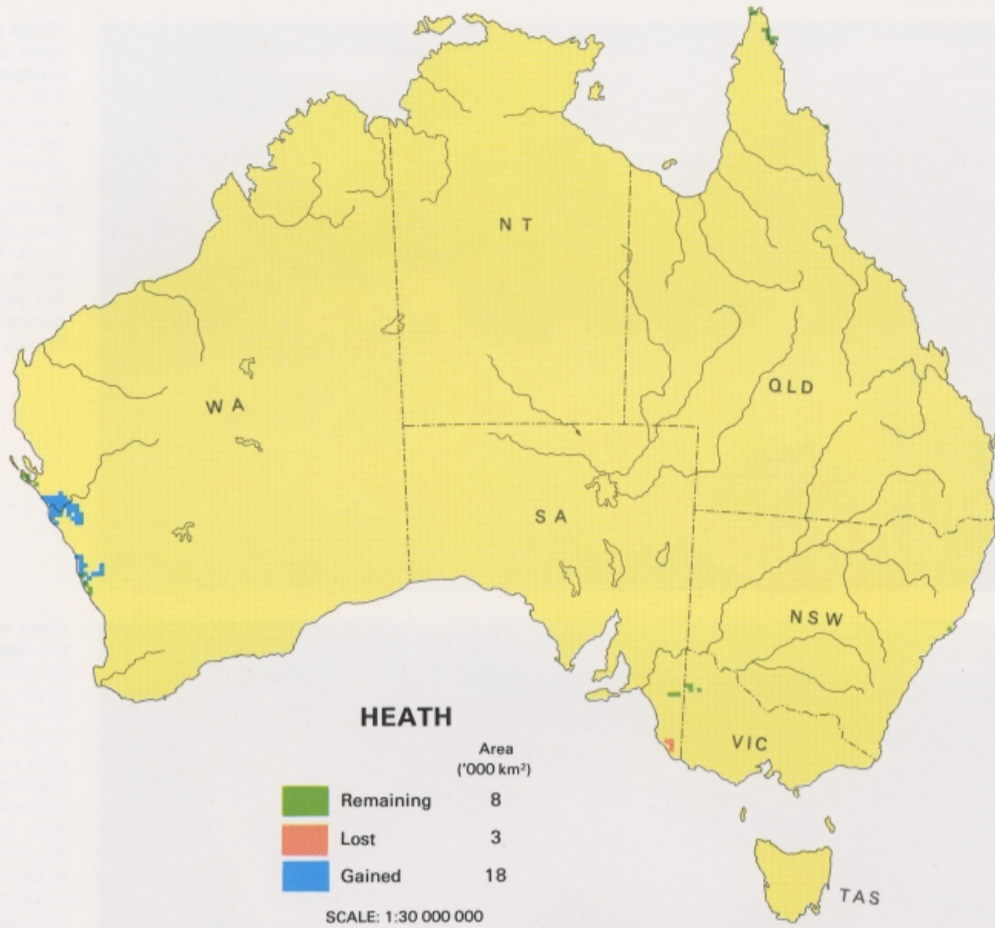


Low shrubs

Open heath Shrubs <2 m high; 30–70% foliage cover

Z3



The term 'heath' originates from Europe where it described members of the plant family Ericaceae and the low shrub communities dominated by its members. Australian heathlands are structurally similar but while members of the southern hemisphere equivalent of this family—the Epacridaceae—are common, several other families are also prominent.

Closed heath (Z4) usually occurs as denser patches within open heath (Z3) formations and is not mapped separately. Although the total mapped area of heathland is limited, it is a widespread formation of many coastal and alpine areas. The largest areas of open heath are in south-western WA, east of Adelaide and along the east coast from Cape York to Tas.

Heaths are a floristically very rich formation of diverse shrubby genera. There may be a ground layer of graminoids and forbs. In WA the heath flora contains about 2000 species and a number of endemic genera. Heaths are also an important fire-adapted habitat for a variety of native fauna.

Open heath is often a component of a mosaic with related vegetation types such as closed heath, scrub-heath, scrub and sedgeland. Soil and water-table depth are important factors in limiting the development of taller vegetation, but frequent burning also plays a role in maintaining the open heath structure.

Heaths have a patchy distribution in coastal or near-coastal situations throughout Australia under annual rainfalls ranging from more than 1600 mm (e.g. near Cape York) to less than 300 mm. They grow on a wide range of soil types,

all deficient in essential plant nutrients such as nitrogen and phosphorus.

The floristic composition of open heaths varies with soil type, but there are usually many species from a number of families including Proteaceae, Myrtaceae, Fabaceae and Epacridaceae (xZ3). The mapped examples east of Adelaide are dominated by *Banksia ornata*, *B. marginata* and *Allocasuarina pusilla* (bcZ3). In the temperate examples many of the shrubs are ericoid, but there is a tendency towards broader leaves in the tropical areas. Species of *Xanthorrhoea* are often present. There may be a ground layer of graminoids, especially Cyperaceae and Restionaceae, together with some forbs (xZ3G).

It is often difficult to separate open heath from scrub-heath (xS2Z), since the predominance of either form in some areas depends on the frequency of fires. Large areas in WA shown as scrub-heath on the Natural Vegetation map are now generally kept in the open heath condition (xZ3) by frequent burning.

Some former areas of open heath in Tas. and SA have been replaced by sown exotic pastures; large applications of fertiliser are needed to maintain the new vegetation.



Heath on sand dunes, Cape York Peninsula

The largest mapped area of heath in eastern Australia extends from the sand dunes at Shelburne Bay (above) to the centre of northern Cape York Peninsula.



Springtime in the heaths of WA

It is the heathlands of the south-west which truly make WA the 'Wildflower State'. There are about 2000 plant species and many endemic genera in the WA heath flora. These two photos (right) show the variation in species composition found at different locations along the west coast.



Low shrubland Shrubs <2 m high; 10–30% foliage cover

Z2

Low shrublands formerly covered about 5% of Australia. The major part of this area is still dominated by saltbush and bluebush, but shrub density and foliage cover has declined as a result of grazing. Saltbush country has been important to the wool industry for well over a century and is still primarily devoted to sheep grazing. Although highly variable in structure, the treeless alpine vegetation of south-eastern Australia and Tas. has also been coded as low shrubland.

Low shrubland with tussock grasses and graminoids

Z2G

The extent of the grassy low shrublands of Chenopodiaceae (**k22G**) is much reduced on the Present Vegetation map, though they still occupy parts of the large areas now generalised as **kZ1yG**. They occur mainly on calcareous or saline soils across southern Australia, generally within the 100–350 mm annual rainfall range.

The principal genera are *Atriplex*, including the taxonomic complexes currently classified as *A. vesicaria* and *A. nummularia*; and *Maireana*, including *M. sedifolia*, *M. astrotricha* and *M. pyramidata*. The local predominance of these widespread species is related to the physical and chemical characteristics of the soil. More succulent chenopod shrubs ('samphires', including species of *Halosarcia* and *Sclerostegia*) may also be present in low-lying saline areas. *Chenopodium auricomum* occurs in some areas mapped as **kZ2G** on heavy clay soils south and east of Newcastle Waters in the NT.

The herbaceous stratum includes perennial grasses such as *Eragrostis*, *Danthonia* and *Stipa* on heavy soils. Species of *Astrelba* are also present on such soils in the north. On lighter and more elevated soils there is a seasonally fluctuating ground layer of grasses such as *Stipa* and *Enneapogon*, and also forbs, especially species of *Sclerolaena* and of Asteraceae.

Most of these low shrublands have been grazed by sheep in the south and cattle in the north. While the dominant shrubs can withstand some grazing, at least in the higher-rainfall areas, the shrub layer has generally been reduced under pastoralism (e.g. to **kZ1yG**, **kZ1xF**, or even **yG2**). On the Nullarbor Plain, which is largely ungrazed because of the lack of water, this reduction has been attributed to

the combined effects of rabbits, fire and drought (Mitchell and others 1979). However, it is difficult to separate the relative roles of these factors, both on the Nullarbor Plain and in pastoral areas.

There are a few mapped examples with a floristically diverse shrub stratum (**xZ2G**). The most distinctive are those found above the tree-line in alpine areas. The tree-line reaches a maximum altitude of about 1800 m in the Snowy Mountains and the Victorian alpine areas, and about 1350 m in Tas., but it is obscured by the effects of cold air drainage. The treeless areas carry a mosaic of shrubby and herbaceous vegetation which is generalised as low shrubland with tussock grasses and graminoids (**xZ2G**).

The shrub layer contains species from many families, including Epacridaceae, Myrtaceae and Proteaceae. The herbaceous layer includes tussock grasses of the genus *Poa* and forbs of the family Asteraceae. Cyperaceae, including species of *Carex*, are prominent on the wetter soils. In the past, grazing caused some changes to this vegetation. Large areas are now within national parks but are subject to the effects of recreational activities.

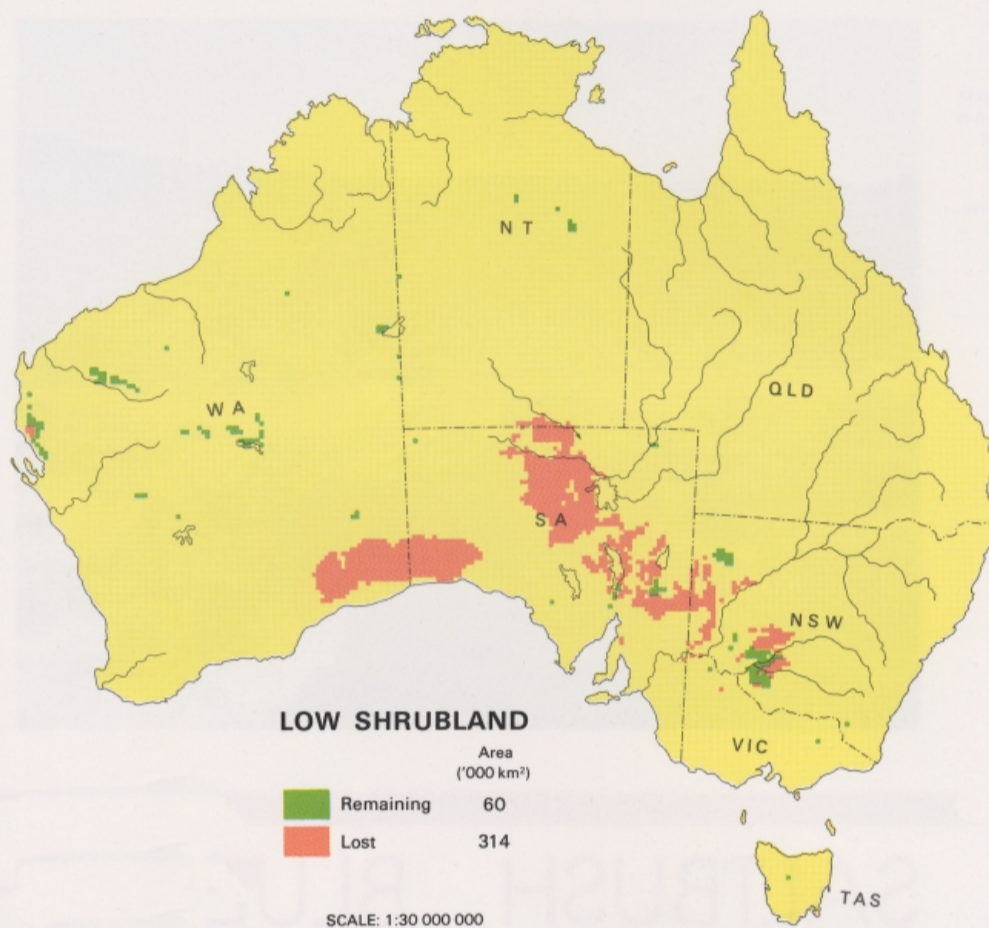
Two small areas are mapped as **xZ2G** in the western interior of Australia. One is on lake flats in the Tanami Desert, with chenopods and other low shrubs; the other is on a sandplain in north-western SA. On Rottnest Island, near Perth, the natural vegetation of *Callitris preissii* (**pL4**) has been reduced by clearing, burning and browsing by wallabies to a grassy low shrubland dominated by the semi-succulent *Acanthocarpus preissii*, with *Stipa variabilis* prominent in the ground layer (**xZ2G**).

Low shrubland with other herbaceous plants

Z2F

Saline coastal flats to the north and south of Carnarvon (WA) carry low chenopod shrublands, with species of *Atriplex*, *Maireana* and *Halosarcia* and a distinctive ground layer of seasonal forbs, including Asteraceae (**kZ2F**). Part of this area is now coded as **kZ1zF**, while further south the decline of *Acacia* tall shrubland (**wS2Z**) has extended the area of **kZ2F**.

The same code (**kZ2F**) has been used on the Natural Vegetation map for a similar low shrubland on saline duplex soils north of Port Augusta (SA). This area is now occupied by more open vegetation (**kZ1xF**). It may previously have had a more perennial forb element, as exists in the present vegetation of the area mapped as **kZ2F** in north-western Vic.



Alpine vegetation on the NSW Snowy Mountains
Diverse mixtures of low shrubs, including the dwarf conifer *Podocarpus lawrencii*, with tussock grasses and forbs (above) are a major part of this mosaic coded as **xZ2G**.

Cushion plants and tussock grass, Heard Island

The vegetation of Macquarie and Heard islands in the Southern Ocean is similar to the herbaceous component of the Australian alpine vegetation. The photo shows *Poa* tussocks, Pringlea, and the cushion plant *Azorella* selago, which is common to both islands. The vegetation of Macquarie Island has been modified by introduced rabbits.

Saltmarsh near Port Augusta (SA)
Low shrubland of samphires (*Halosarcia* and *Sclerostegia*) on a salt flat at the head of the Spencer Gulf. Similar vegetation grows on the margins and beds of inland salt lakes.



Low shrubland with no significant lower stratum Z2

This subform is dominated mostly by succulent species of Chenopodiaceae (samphires). The total area of **kZ2** is small, despite examples being widespread on highly saline soils in low-lying coastal areas (where they are largely included in the 'littoral complex') and the arid interior. The principal genera include *Halosarcia* and *Sclerostegia*, which occur as dwarf shrubs generally less than 1 m in height. The ground between these shrubs is usually quite bare. On higher ground the shrub layer may also include species of *Atriplex* and *Maireana*, together with non-chenopods of similar form such as species of *Frankenia*.

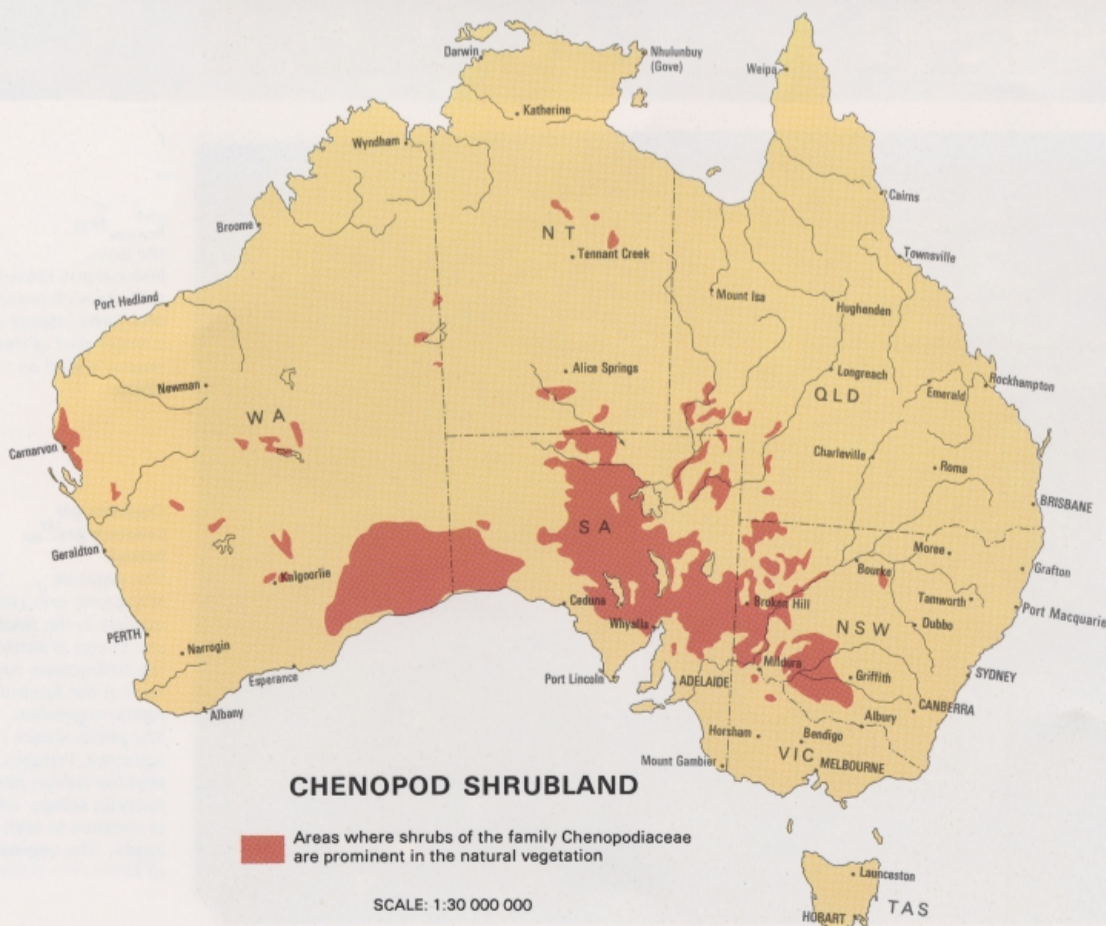
The area occupied by this type is

increasing under settlement, as the rising of saline water-tables in agricultural regions causes land salinisation (Woods 1983). However, most of the acutely affected sites are too small to map at 1:5 million scale.

The examples mapped as **xZ2** represent a range of vegetation types. Some areas of low shale hills to the south of the Hamersley Range (WA) carry low shrubs, notably *Eremophila* and *Cassia*, with only very sparse seasonal forbs and grasses. Goyder Lagoon, on the Diamantina floodplain in north-eastern SA, is occupied by a low shrubland of *Muehlenbeckia cunninghamii*. St. Peter Island in the Great Australian Bight also carries sparse low shrubs.

SALTBUSH, BLUEBUSH AND SAMPHIRES

Saltbush and bluebush plains in SA
Saltbush and bluebush occur across southern Australia from the western edge of the Nullarbor Plain in WA to the eastern part of the Riverine Plain in southern NSW. They occur on calcareous soils or, as the name suggests, on saline soils. In SA they extend north on the western side of Lake Eyre and into the NT, mainly on red duplex soils.



Plants from several genera of the family Chenopodiaceae dominate this vegetation. Species of *Atriplex* (saltbush) and *Maireana* (bluebush) are the most prominent, while *Chenopodium* may dominate in flood-prone situations. One of the most widespread and economically important species is *Atriplex vesicaria*, the bladder saltbush (above), found from WA to NSW. The samphires occur in low-lying

saline areas such as dry lake beds.

The structure of the treeless chenopod shrubland has been described as 'steppe' because of its low stature (generally <1.5 m) and uniformity but one species—*Atriplex nummularia*, the 'old man saltbush'—may attain a height of 3 m. Chenopod shrubs also form the understorey for low woodlands and tall shrublands of *Acacia* and *Casuarina* over exten-

sive areas of southern Australia.

On the Present Vegetation map the coding of large tracts of chenopod shrubland has been changed from **kZ2G** to **kZ1yG**, indicating a general reduction in shrub density and cover. Although saltbush recovers well after drought, there is evidence that the population numbers are reduced by continuous grazing. The trend in pastoral

country has been toward a decrease in perennial vegetation. This has been demonstrated for several chenopod shrubs, including *Maireana sedifolia* and *Atriplex vesicaria*. Over the eastern part of the Riverine Plain in NSW, the former *Acacia pendula* woodland with an *Atriplex nummularia* understorey has been largely replaced by short grasses as a result of clearing and grazing.

Low open shrubland Shrubs <2 m high; <10% foliage cover

Z1

Many of the natural occurrences of this formation are found in the arid interior of Australia. Here, some low open shrublands occur in extreme environments such as rocky ranges or the skeletal soils of erosional landscapes.

Low open shrubland with hummock grasses **Z1H**

The few mapped areas are generally dominated by species of *Acacia* (**wZ1tH**) and, except for one example on the Qld-SA border, are confined to coastal areas in north-western WA. There is a range of

species, *Acacia tetragonophylla* being a fairly widespread example. The principal hummock grasses are *Triodia pungens* and *T. base-dowii*. In one area *Acacia* is co-dominant with other genera (**xZ1tH**).

Low open shrubland with tussock grasses **Z1G**

Most of the present chenopod low open shrubland (**kZ1yG**) in southern Australia results from the general decline in plant numbers and cover in former low shrubland (**kZ2G**). Certain species have tended to increase in these modified shrublands, such as *Maireana aphylla* and the non-chenopod *Nitraria billardieri*. There have also been changes in the herbaceous layer, such as the widespread appearance of the seasonal exotic volunteer forb *Carrichtera annua*.

Some other present areas of this type reflect the removal of a former taller overstorey, such as *Acacia pendula*. There are also natural

examples of **kZ1yG** in low rainfall areas or on poor soils. Some of these have also been modified under pastoralism (to **yG2** or **kF1**).

Examples of this subform in the interior of Australia are found on shallow soils on terrain that ranges from plains to rugged hills. *Acacia* species, especially *A. kempeana* (**wZ1yG**), are frequent dominants, though in some areas several genera including *Acacia*, *Cassia* and *Eremophila* are present (**xZ1yG**). The tussock grasses include *Aristida* and *Erneapogon*, with *Astrebla* on some heavier soils. The ground layer usually also contains forbs, such as *Helipterum* and *Ptilotus*.

Low open shrubland with other herbaceous plants **Z1F**

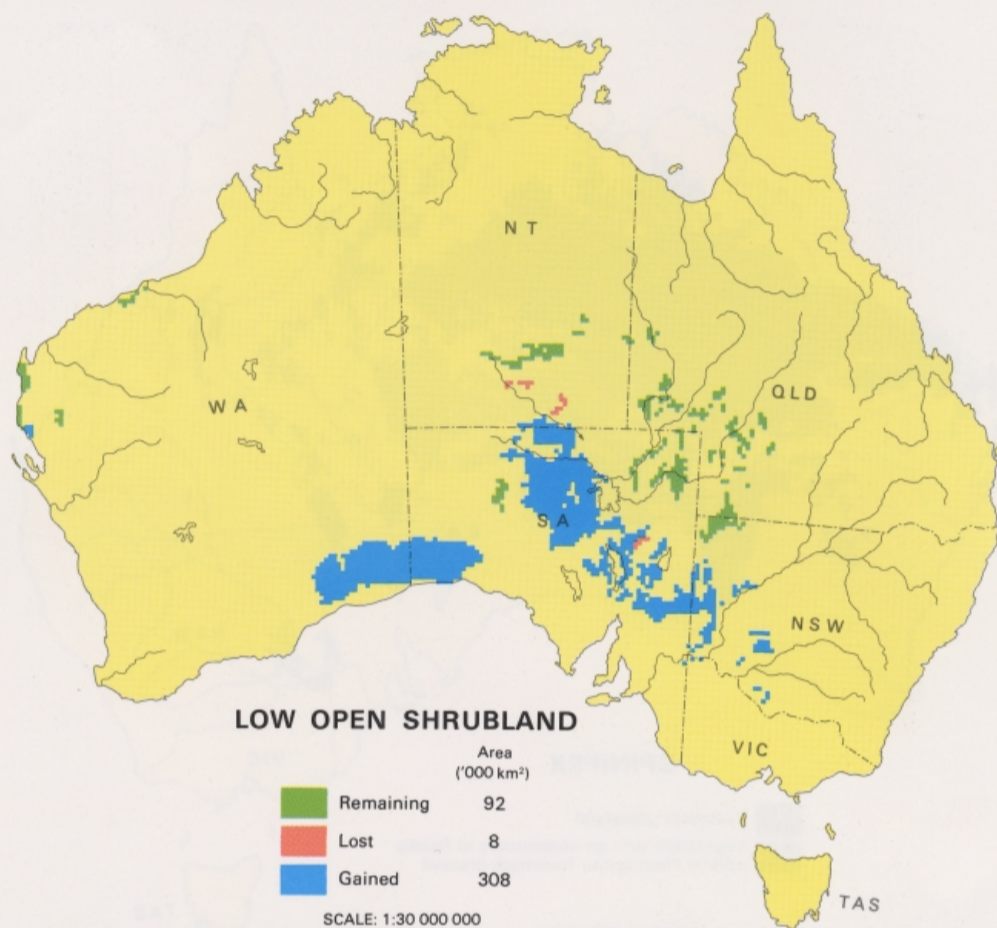
Although some examples on the Present Vegetation map (**kZ1xF**, **kZ1zF**) result from historical changes, those in arid south-western Qld and north-eastern SA are natural. They occur on clay plains between dunes and the dominant low shrubs include *Atriplex nummularia* and *Chenopodium*

auricomum. Herbaceous species of *Atriplex* and *Sclerolaena* (**kZ1kF**) or a wider range of forbs (**kZ1xF**) usually dominate the ground layer. This is a generalisation of the average cover and composition of vegetation that fluctuates greatly with seasonal conditions, including occasional flooding.

Low open shrubland with no significant lower stratum **Z1**

Several areas of stony plains and tablelands in south-western Qld are occupied by low open shrublands of *Acacia stowardii* (**wZ1**), with an extremely sparse ground

cover of tussock grasses and forbs. There is also very sparse vegetation (**kZ1**) on Lake Woods, south of Newcastle Waters (NT) and on salt flats in central Australia.



Bluebush low open shrubland near Renmark (SA)

Most of the saltbush and bluebush country of southern Australia is coded as **kZ1yG** on the Present Vegetation map. Sheep grazing has resulted in a general decline in foliage cover and shrub density. In the area pictured pearl bluebush (*Maireana sedifolia*) and low bluebush (*M. astrotricha*) occur over a typical disclimax association of sparse grasses and chenopod forbs.



Witchetty bush near Alice Springs

This vegetation type is common on rocky hills across central Australia. *Acacia* species are often dominant, but many areas have a mixed shrub cover including *Cassia* and *Eremophila*. This photo shows witchetty bush (*Acacia kempeana*) and *Cassia* species over sparse tussock grasses.



Low open shrubland near Lake Eyre

On the wide stony plains along the western side of Lake Eyre the only vegetation cover is a Chenopod low open shrubland (far left). Saltbushes are the principal shrubs but on saline areas bordering the salt lakes dwarf samphires are often dominant.