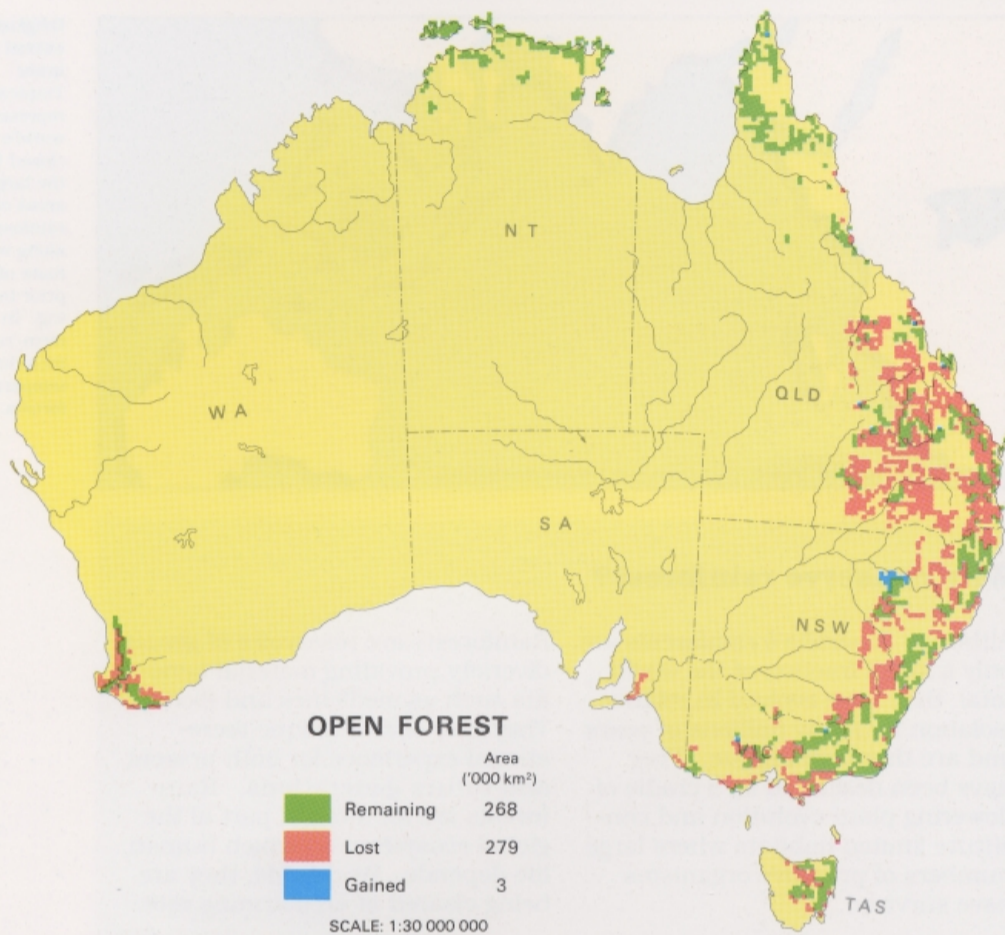


Open forest Trees 10–30 m high; 30–70% foliage cover

M3



Eucalypt open forest over low trees

Many *Eucalyptus* open forests of the coasts and ranges in south-eastern Australia have an understorey made up of low trees and tall shrubs (eM3L). *Acacia*, *Casuarina* and *Banksia* are common in the lower tree layer, as are saplings of the canopy trees. In the ground layer, grasses and bracken fern are common. The understoreys are often a variable mosaic depending on their fire history. The photo shows a stand of southern mahogany (*Eucalyptus botryoides*) over low trees of *Banksia serrata* and *Acacia* shrubs.



Open forests form the bulk of Australia's forested country and are the primary source for the nation's timber industry. Native open forests, with *Eucalyptus* hardwoods predominant, cover 3.5% of the continent, only about half of their original extent.

Roughly half of the existing 140 000 km² of open forests lie within state forests, with a further 50 000 km² set aside in national parks and other reserves. Large areas of state forest are harvested on a regular production cycle so that at any time different parts are at various stages of regeneration.

Open forests are generally confined to the coasts and nearby ranges though *Acacia* forests extend well inland in Qld. They exhibit a variety of subforms, with understoreys ranging from low trees and shrubs to tussock grasses or, in some cases, mostly bare ground.

Open forest with low trees and tall shrubs

M3L–M3S

Eucalyptus is the most widespread floristic type but, as indicated on the Natural Vegetation map, *Acacia* and *Casuarina* were once of regional importance. *Eucalyptus* forests (eM3L, eM3S) occur in coastal and upland areas in the south-western corner of WA; from Tas. to central Qld in the east; on Cape York Peninsula; and also in the Top End of the NT.

South of the Tropic these forests occur under lower rainfalls or on poorer soils than the tall open forests. They are smaller in stature and have a more open understorey of sclerophyllous low trees and tall shrubs, which include *Acacia*, *Banksia* and *Casuarina*. The large number of dominant species includes *Eucalyptus marginata* and *E. calophylla* in WA; *E. viminalis* and *E. obliqua* from Tas. to NSW; *E. radiata* and *E. sieberi* in Vic. and NSW; and *E. maculata*, *E. gummi-fera* and *E. crebra* in NSW and Qld.

In northern Qld and the NT the dominant *Eucalyptus* species include *E. tetradonta* and *E. miniata*. While these forests have some features in common with those further south, the woody understorey includes orthophyllous elements, such as *Terminalia* and *Buchanania*. Palms (e.g. *Livistona*) and cycads (e.g. *Cycas*) are also prominent in some areas, and there is a seasonally dense cover of tropical grasses. *Callitris intratropica* is present in some areas and is mapped as a co-dominant south of Cape Cockburn in the NT (epM3L).

The distribution of the northern forests is little changed except for some clearing near Darwin (eM1yG) and Cairns (vG4). But in the southern forests about half the original area has been cleared or thinned for native (yG3, eM1yG) or sown exotic pastures (yF3, yF4,

eM1yF). Coniferous plantations (pM3, pM4), seasonal crops and horticulture have also replaced some forests. Timber removal practices, burning, and grazing by cattle have modified both the tree density and the understorey in some remaining forests. Large sections of *Eucalyptus marginata* forest, the jarrah of south-western WA, have been degraded to woodland (eM2Z) by the 'dieback' fungus *Phytophthora cinnamomi*.

Only limited areas of *Acacia* forests of this subform (wM3L) appear on the Present Vegetation map. These are the relics of forests that occupied large areas of fertile heavy soils in eastern Qld, with outliers in northern NSW. Their distribution overlapped with that of the inland *Eucalyptus* forests, but extended further west into areas with annual rainfall below 500 mm. The principal species was *Acacia harpophylla*, though *Casuarina cristata* was often co-dominant (cwM3L, wcM3L) or even dominant (eM3L) on some soils. *Eucalyptus populnea* was also common in the more mixed forests. A wide range of low trees and tall shrubs, most frequently *Eremophila mitchellii* and *Geijera parviflora*, formed a variable understorey (Isbell 1962, Johnson 1964).

Most of the former forests of *Acacia* and *Casuarina* have been cleared to induce native pasture growth. In many cases the remaining tree layer contains only relics of the previously sub-dominant *Eucalyptus* species (e.g. eM1yG). Partly because *Acacia harpophylla* tends to regenerate in the native pastures, large areas in Qld (from near Clermont in the north to Goondiwindi in the south) have been further modified and sown to pastures of exotic grasses (yG3, yF4), or to seasonal crops on the better soils.

Open forest with low shrubs

M3Z

Eucalyptus is by far the most frequent dominant of these forests (eM3Z). The lower stratum is often dense and the shrubs are typically sclerophyllous, hence the term 'dry sclerophyll forest'. In south-

eastern Australia these forests are generally found on less fertile soils or under lower annual rainfalls (to less than 600 mm) than the previous *Eucalyptus* types (eM3L, eM3S).

M3

The more widespread dominant species include *Eucalyptus baxteri* and *E. obliqua* in SA and Vic.; *E. macrorhyncha* and *E. sideroxylon* in Vic. and NSW; *E. crebra* and *E. gummifera* in NSW; and *E. intermedia* and *E. acmenoides* in south-eastern Qld. Similar forests on the tip of Cape York Peninsula are dominated by *E. tetradonta* and *E. nesophila*.

The natural extent of these forests in the south-east has been reduced under European land uses. To

encourage native pastures, some areas have been modified by partial timber removal, burning and grazing. Other areas have been cleared for exotic pastures (**yfF3**, **yfF4**, **eM1yfF**) and seasonal crops, or for pine plantations (**pM4**). Some forests shown as **eM3Z** on the Present Vegetation map are kept in this condition by frequent burning of any taller understorey. Conversely, a remnant area near Adelaide has been invaded by tall exotic shrubs following disturbance and is now mapped as **eM3S**.

Open forest with tussock grasses and graminoids

M3G

Eucalyptus forests with a grassy understorey (**eM3G**) are prominent in the present vegetation of eastern Qld and north-eastern NSW. The characteristic species include *Eucalyptus drepanophylla*, *E. intermedia* and *E. tereticornis*, with *Themeda australis*, *Imperata cylindrica* and species of *Heteropogon* as the major grasses. In some cases the grassy rather than shrubby understorey is related to the presence of heavy soils, while in others it may have been due initially to regular burning by Aborigines. More recently, European forest management and grazing have led to the extension of grass understoreys in areas shown as **eM3L** on the Natural Vegetation map.

Some of the natural grassy forests (**eM3G**) in eastern Australia have been cleared or thinned (**eM2G**, **eM1yG**, **yG3**) to increase the grazing value of the native grasses. Others have been replaced by plantations of sugar cane (**vG4**), or by exotic grasses and legumes (**yfF4**, **yG3**, **yG4**) with some crops.

Some of the *Eucalyptus tetradonta*-*E. miniata* open forests in the Top End of the NT have only a sparse woody understorey and are there-

fore mapped as **eM3G**. The grasses in these areas include *Plectrachne pungens* and annual species of *Sorghum*.

In central Tas. a variable forest dominated by *Eucalyptus delegatensis*, with a grassy understorey including species of *Poa*, appears to show the results of clearing, burning and grazing.

Narrow fringing woodlands of *Eucalyptus camaldulensis* are widespread along the rivers of inland Australia. However, on the floodplains of the Murray River *E. camaldulensis* forms broad forest stands with a lower stratum of tussocky or tufted grasses and graminoids (**eM3G**).

Forests dominated by species of *Melaleuca* (**mM3G**) have a patchy distribution in low-lying coastal areas of Qld and the NT though the only areas now mappable are near Darwin, where *M. leucadendra* is a characteristic species. There are both grasses and graminoids in the herbaceous stratum. A former stand of similar vegetation south of Brisbane, dominated by *M. quinque-nervia*, has been replaced by sown exotic pasture (**yfF4**).

Open forest with no significant lower stratum

M3

The Present Vegetation map shows some areas along the Qld coast near Brisbane coded as **pM3** which replace former *Eucalyptus* forest (**eM3L**). These are plantations of the exotic *Pinus elliottii*, which have a more open canopy than those of *P. radiata* (**pM4**). Unmapped smaller coniferous plantations in the same region also include the native *Araucaria cunninghamii*.

The inland areas coded **pM3** in eastern Australia represent forests of *Callitris glaucophylla*. Stands of this native conifer typically have very sparse understoreys. According to Rolls (1981), the present-day 'Pilliga Scrub' in northern NSW appears to have developed from dense regrowth in historical times from a more open, mixed woodland (**peM2G**). The areas mapped in

central Qld may have been reduced by disturbance. The sensitivity of *Callitris* to fire is a contributing factor in the historical changes to these forests.

The present areas of **wM3** east of St George and **weM3** north of Morven in southern inland Qld are dominated by *Acacia catenulata*, with some admixture of *Eucalyptus* species. The other areas of **wM3** are relics of a much larger area of *Acacia aneura* forest, often accompanied by *Eucalyptus populnea* or *E. melanophloia* (**weM3**). Grasses and low shrubs may be present but are typically very sparse. *A. aneura* forest is found on distinctive red earth soils in areas with as little as 400 mm annual rainfall. Much of it has been cleared or thinned (e.g. to **weM1yG**) to induce a better growth of native grasses.



Shrubby open forest
Scribbly gum (*Eucalyptus signata*) and pink bloodwood (*E. intermedia*) are the dominant species in this stand (**eM3Z**) near Beerwah (Qld). The term 'dry sclerophyll forest' is often used to describe *Eucalyptus* open forest with a sclerophyllous low shrub understorey.



Grassy open forest near Gympie (Qld)
The largest natural areas of this forest type (**eM3G**) occur in eastern Qld, extending from inland of Brisbane along the coast to near Cooktown. The area of grassy forests has increased in south-eastern Australia with the modification by burning and grazing of other open forest types.



Mulga open forest in inland Qld

There is a marked absence of any understorey or ground cover in this dense mulga (*Acacia aneura*) forest (**wM3**). These open forests, with up to 1200 trees per ha and foliage cover of 30-40%, represent the optimum development of this species. The mulga open forests, often mixed with poplar box, formerly extended over a large area between Charleville and St George, but many have now been cleared to develop pasture for livestock grazing.