

Shrubland change

Within the tall shrublands, large areas of the distinctive mallee and mulga vegetation have been altered by European land use; the mulga primarily by sheep grazing and the mallee by cultivation for crops and pasture. The reduced cover in the mulga and the replacement of mallee by sown pasture, together account for most of the change in the area of tall shrubland.

The total area of tall shrubland has fallen by about 35% over the last 200 years. In terms of the area involved this rivals the reduction of woodlands, but the greater part of this change has been a general decline in shrub density in the *Acacia* shrublands associated with pastoral land use.

Much former *Acacia* shrubland is now coded as tall open shrubland. In some areas *A. aneura*, *A. papyrocarpa*, *A. loderi* and *A. pendula* have become degraded and, apart from the diminution of tall shrubs, understoreys of low shrubs and grasses have also been modified.

In parts of the WA mulga the palatable species of the former low

shrub layer have been eliminated through grazing. In contrast, in western NSW, the historical increase in the low shrub layer is also a result of pastoralism. Overgrazing in parts of the mulga has led to a secondary succession dominated by annual grasses such as *Aristida* and *Enneapogon*, leaving the ground largely bare during dry times. These are examples of more widespread shifts in structure and floristic composition that have occurred in response to the new selection pressures imposed by alien herbivores.

Roughly 160 000 km² of tall shrubland have been cleared for cropping and pasture and this has been concentrated in former mallee

lands. In the east the clearing of mallee was well underway by the 1920s but it is a more recent development in the west. The area sown to wheat in WA almost trebled between 1961 and 1981, from 16 000 km² to 46 000 km². Most of this was cleared from tall shrub formations; mallee, mallee-heath, scrubs of *Acacia* and *Casuarina*, and mixed scrub-heaths. The clearing of mallee vegetation in several states has continued to push into areas both climatically and edaphically marginal for dryland wheat production.

Most of the area dominated by low shrubs is covered by species of saltbush (*Atriplex*), bluebush (*Maireana*) and other related genera of the family Chenopodiaceae. These have undergone an overall decline in shrub density and foliage cover across most of their original range. They are now mapped as low open shrubland, but to some extent this coding masks inherent shrub density variations not visible on

satellite imagery.

The biggest impact has been the advent and continued presence of sheep. Chenopod shrubs are both palatable and easily accessible to sheep and, during dry times, may constitute almost their entire diet. Nevertheless, these shrubs have survived sometimes intense grazing pressure over most of their range. Rabbits have also contributed to the decline of low shrubland. On the Nullarbor Plain, where there has been only limited sheep grazing, shrub thinning is attributed to the combined effects of rabbits, fire and drought.

Alpine vegetation has also been modified by grazing and burning. The former pattern of summer grazing and autumn burning resulted in a decline of sensitive species and accelerated soil erosion. In the Mt Kosciusko region grazing was phased out by the 1960s but some areas have yet to recover completely.

Grazing and feral animals

About two-thirds of Australia is subject to grazing by domestic stock. Most of the unused area has a hummock grass ground cover, is poorly watered, or is rugged and remote. A variety of feral animals has increased the often intense pressures on natural vegetation within pastoral areas and brought

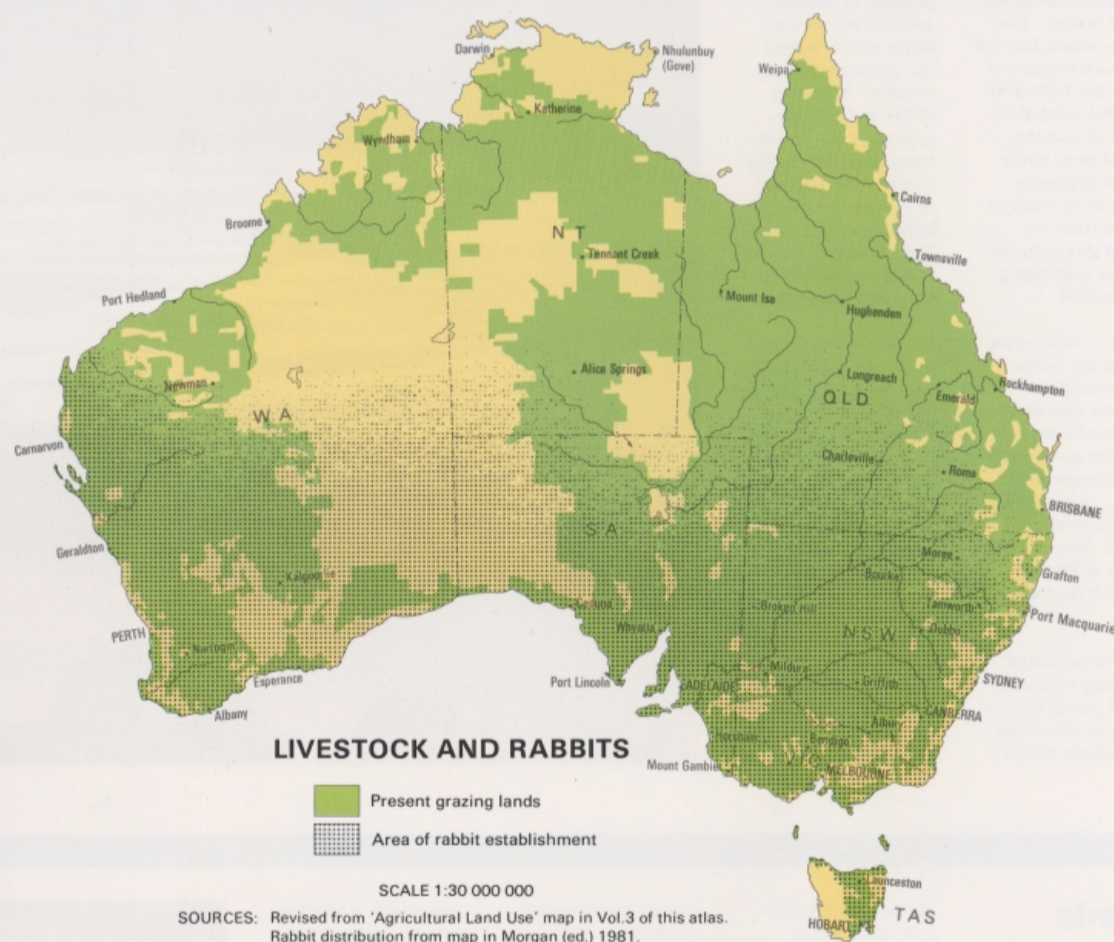
new patterns of plant predation to the undeveloped lands.

The rabbit has been the most destructive of the pest animals in the decline of several shrubland types and in the poor regeneration of a number of native

plant species, through increasing the grazing pressure on herbaceous plants and, during dry times, damaging shrubs and tree seedlings.

In the first half of this century huge rabbit populations (below) developed in southern Australia. After successful biological

control in the 1950s rabbit numbers declined sharply, but in recent years have increased again to some 200 million. The area where rabbit populations are well established is shown on this map, along with present grazing lands. They are frequently found further north, in isolated colonies on lighter soils.



Shrub regrowth

The increased incidence of woody shrubs is common in disturbed natural vegetation in many parts of the world. In the semi-arid grazing lands of north-western NSW and south-western Qld the unrestricted growth of inedible native shrubs has given rise to dense stands which suppress native pasture growth and severely reduce stock carrying capacity. The major infestations have occurred on the sandplain country to

west and north of Cobar and Bourke, but over half of western NSW is affected by woody shrub regrowth.

The major species involved come from the common inland genera *Cassia*, *Eremophila* and *Dodonaea* and most were only occasional components of the vegetation when settlers first moved into these areas. Massive germination of these shrubs has occurred in favourable seasons and they

have proved so difficult to control that they have been labelled 'woody weeds'. Dense regeneration of otherwise desirable plants such as mulga or cypress has also been included in this category.

The original vegetation of the worst affected areas was low open woodland or tall open shrubland with a ground cover of perennial tussock grasses. A combination of environmental factors has led to the increase of shrubs and the present ground cover of

annual grasses, but the exact mechanism of this shift is unclear because of the fundamental changes in the ecosystems of western NSW. Large scale devegetation and soil loss occurred as a result of drought and overgrazing over the last 100 years.

A decline in ground cover under grazing and the suppression of fires by landholders have reduced fire frequency. Ground cover is often too low in shrub infested areas to carry fire at all. More frequent burning in the past

probably prevented shrub establishment. The main woody weed species, however, appear to be well adapted to fire. Many, notably budda (*Eremophila mitchellii* pictured near Cobar) are able to resprout after fire. Several, including hopbush (*Dodonaea viscosa*), and punty bush (*Cassia eremophila*) display fire promoted germination and early reproductive maturity. Increasing the frequency of low intensity burns is seen as the best option for future control of the woody weeds.