

Influences on vegetation

Despite the profound effect of humans, especially over the past 200 years, the physical environment remains the overriding influence on the distribution of Australia's vegetation types.

Environment

The amount and structure of the plant cover follows the overall gradient in precipitation in showing a decline towards the interior of the continent. Water availability is the primary factor in the confinement of woodland and forest to the margins of the continent. It has also tended to concentrate most of the vegetation changes that have resulted from European settlement within these same areas, as can be seen by comparing the summary maps on pages 6 and 7. This pattern is greatly complicated by soil factors, including the distribution of heavy clay soils and of calcareous or saline soils. Elevation is of only limited significance, as Australia is a country of generally subdued relief.

The seasonal distribution and effectiveness of rainfall are also important determinants of the nature of vegetation. The occurrence of a summer maximum in the north and a winter maximum in the south has a major impact on the the growth and reproductive patterns of plants. It has given

rise to separate monsoonal and mediterranean floristic elements within the vegetation.

In global terms, Australia is an arid continent and its interior is only sparsely vegetated. But compared to other areas with similar rainfall Australia's deserts are well-vegetated, stabilised by a fluctuating cover of grasses and shrubs. That this vegetation cover is fragile and dependent upon the unreliable rains for its continuance is often demonstrated during a run of dry years. When it does rain across the inland the major vegetation change is the rapid growth of ephemerals, which carpet the landscape only to disappear again within months. These flushes of vegetation growth follow the general pattern of seasonal distribution of rainfall across the continent.

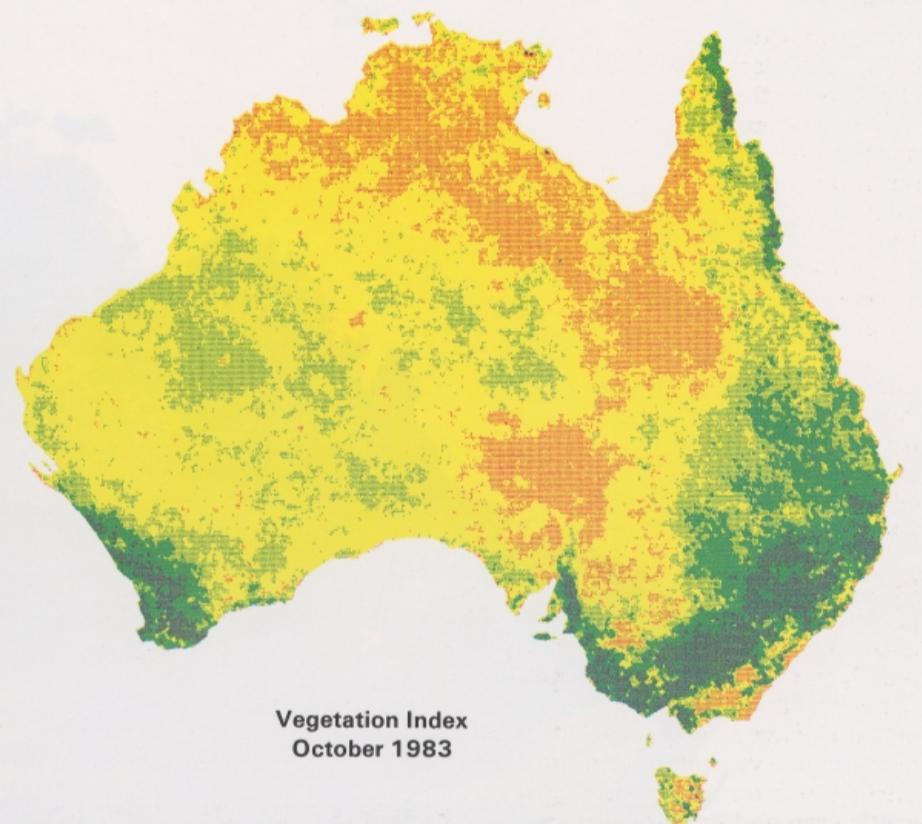
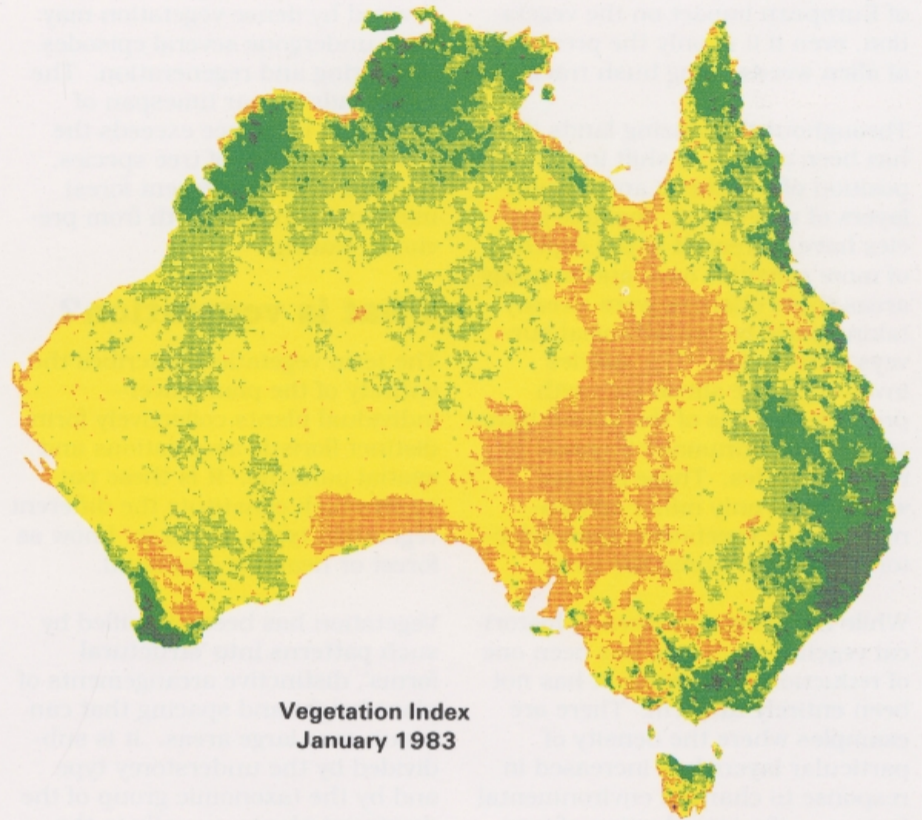
The marked seasonal fluctuations in the herbaceous vegetation have been intensified by European settlement, in particular through the establishment of sown pastures and seasonal crops. This is clearly recognisable on the satellite image maps on this page.

Contrasting wet and dry seasons in Kakadu National Park, NT

The top photograph shows the growth in understorey vegetation in January, the height of the 'wet' in the Top End. The same scene in October, near the end of the 'dry' (below), has virtually no herbaceous plant material.



SEASONAL VEGETATION CHANGE



The strong seasonal contrast in the availability of water for plant growth across Australia is clearly visible on this pair of satellite image maps. The maps were derived from data collected by the Advanced Very High Resolution Radiometer (AVHRR) instruments onboard the US National Oceanographic and Atmospheric Administration (NOAA) series of meteorological satellites and they provide a measure of the amount of actively growing vegetation for January and for October 1983.

Known as Vegetation Index maps, they enhance that part of the total reflectance signal which is a

response to the cover of live plant material. The satellite's scanners detect reflectance in a number of discrete wavelength bands within the electromagnetic spectrum. Vegetation indices are based on the ratio of the reflectance signals in the near infrared and the visible red parts of the spectrum. Where vegetation is dense and actively photosynthesising, the ratio of the signals (the vegetation index) will be greater. The index used to make these maps is termed the Normalised Difference Vegetation Index (NDVI).

Each of the maps is composed of a mosaic from a number of images taken over a

week during the month, with cloudy pixels removed where possible. On the map for January, however, parts of coastal southeast Australia and Tasmania appear to have less plant cover than in reality, because cloud covered these areas during the entire week of sampling.

The colours range from dark green, indicating areas with the most abundant plant cover, through to red, where there is little or no actively growing vegetation. The vegetation index largely reflects changes in the growth of the herbaceous layer as this is where variations in the amount of green vegetation cover are

most pronounced. Areas covered by dense evergreen trees and shrubs exhibit less seasonal variation.

The effects of the monsoon rains in January stand out clearly as a 'greening up' across northern Australia in contrast to the very sparse cover over these areas in October, the end of the dry season. The agricultural areas in the south-east and south-west display the highest index values on the October index map. This is the height of the growing season for wheat, other cereals and improved pastures after the winter rains across southern Australia.

Aboriginal

The plant cover of Australia might be regarded as approximating natural vegetation prior to European settlement (Carnahan 1986). Human influence was limited to the hunting and gathering activities of the Aboriginal population, and possibly to the beginnings of the domestication of plants (Hynes and Chase 1982).

Aboriginal burning regimes may have had very significant effects in many places, although it is true that fires caused by lightning are part of the natural environment of Australia. Interpretation of pollen and charcoal fragments from lake bed sediments suggests that this aspect of Aboriginal land use had an impact on the composition of vegetation communities over many thousands of years. The evidence of the Aboriginal use of fire is irrefutable, but the actual effects on vegetation are a matter of considerable debate (Nicholson 1981). In any case they were of a very different nature from the later European disturbance.

European

European settlement brought with it a range of land uses with a range of effects on the natural vegetation. Urban development has caused marked changes in the plant cover, but it directly affects little more than 0.1% of the land surface. To this must be added the area indirectly affected, as most cities are now surrounded by a belt of 'rural retreats'.

Commercial forestry takes various forms, including selective extraction of native timbers, clear-felling, and plantations using exotic species. These currently affect about 2% of the total area of the country.

Cropping and intensive animal production occupy less than 10% of the total area, concentrated mostly in the better watered parts of temperate Australia. These activities have required the removal of the native vegetation and the introduction and maintenance of exotic crop and pasture species under regimes of cultivation and intensive management.

The most widespread form of land use is extensive livestock grazing which affects about 60% of Australia. The obvious effects of pastoralism, namely changes in species composition and reduced cover, result from grazing, browsing, and trampling by sheep and cattle on a flora and vegetation that evolved in the absence of hoofed animals. These effects have been compounded by overgrazing, by the removal of some woody plants, by new patterns of burning, and by the deliberate or accidental introduction of a range of exotic plants and animals, notably rabbits. The only significant effects of Europeans on the rest of the country are from recreational activities and mining or mineral exploration in some locations.

The flora

The probable distribution of the major floristic groups of Australian vegetation immediately before European settlement is shown on the map below.

Native flora

The distinctive appearance of most Australian vegetation is due to the dominance of a few widespread genera. *Eucalyptus* or *Acacia* trees and shrubs dominate the natural vegetation over about 75% of the continent, and preserve its original character in many modified areas. Hummock grasses (*Triodia* and the closely related *Plectrachne*) form a prominent understorey in more than 25% of the vegetation.

There are more than 500 species of *Eucalyptus*, nearly all of which are endemic to Australia. Their crowns cast relatively little shade, as they have sparse foliage with vertically hanging leaves. Although *Acacia* is not confined to Australia, there are more than 700 native species. Most of these have a distinctive foliage consisting of flattened leaf stalks (phyllodes), which resemble simple leaves but tend to present their edge to the light.

The endemic genera *Triodia* and *Plectrachne* are members of the family Poaceae (formerly Gramineae). They exhibit the hummock grass growth form, with a mass of repeatedly branched stems bristling with long spine-like leaves giving the appearance of a mound up to a metre or more in height. Hummock grasses are commonly called 'spinifex', a name that is liable to cause confusion with the botanical genus *Spinifex*, a creeping coastal grass.

Some other spatially important elements of the flora are also distinctively Australian. *Casuarina* is a largely endemic genus of trees and shrubs in which the leaves are reduced to vestigial teeth and the slender branchlets function as leaves. Others, such as the low shrubs of the family Chenopodiaceae and the tussock grasses, have counterparts elsewhere.

Australian trees and shrubs are predominantly evergreen with hard and tough (sclerophyll) leaves that are often small or reduced; 'ordinary' (orthophyll) leaves are prominent only in moist forests. The hummock grasses too are

evergreen perennials. Many of the herbaceous species are also perennials, but most of these lose some foliage seasonally, especially under lower and more erratic rainfall, where the proportion of annual or ephemeral species increases.

Introduced flora

The number of naturalised alien species in the present Australian flora stands at around 10% of the total of 20 000 species (Michael 1981). In terms of area occupied, the most important introduced plants are sown herbaceous species; namely winter or summer crops, especially cereals, and annual or perennial pasture grasses and legumes. The introduction of these plants has been accompanied by the introduction, both accidental and deliberate, of many species of herbaceous weeds.

There are more limited areas of a wide range of other introduced economic plants, such as horticultural areas, or plantations of sugar cane and of pine trees (chiefly *Pinus radiata*). Some introduced woody plants, both economic and ornamental, have escaped to become weeds in rural areas.

