



One of the many interesting features of the jarrah forest is the variety of tree sizes present. Some trees are tall and have thick trunks, whereas others are short and thin. Several years ago we became interested in the size of trees throughout the jarrah forest, and wondered about the size of the biggest trees and how common they were.

People usually express the size of a tree as its total height. The height of individual trees, however, is often difficult to measure accurately and quickly, so foresters prefer to measure the diameter (over the bark at breast height) 1.3m above ground.

Before 1956, thousands of trees and stumps were measured throughout the jarrah forest to provide an inventory of how much timber was available and how much had already been extracted by logging. The trees and stumps measured were not selected at random, but were instead located along many narrow (20m or 40m wide) belt transects, totalling some 900km in length. This statistical information is held in the archives at the Institute of Forest Research, Como.

Most transects were confined to the jarrah forest that yielded most timber per hectare, so called high quality jarrah forest (Fig. 1). The occurrence of high and low quality jarrah forest is closely related to rainfall and fertility of the topsoil. High quality forest occurs on more fertile land where average yearly rainfall exceeds 1000mm, whereas low quality forest is present on soils of lower fertility, in a lower rainfall zone east of the high quality forest (Fig. 1).

### What sizes are big trees?

In 1934 members of the Forests Department measured all live trees of diameter 20cm or more, in two 4.05 ha plots, in jarrah forest that was then unlogged. One plot was near Tallanalla (Fig. 1), in high quality forest, and the other was near Beraking (Fig. 1), in low quality forest. The proportion of

# KING JARRAH

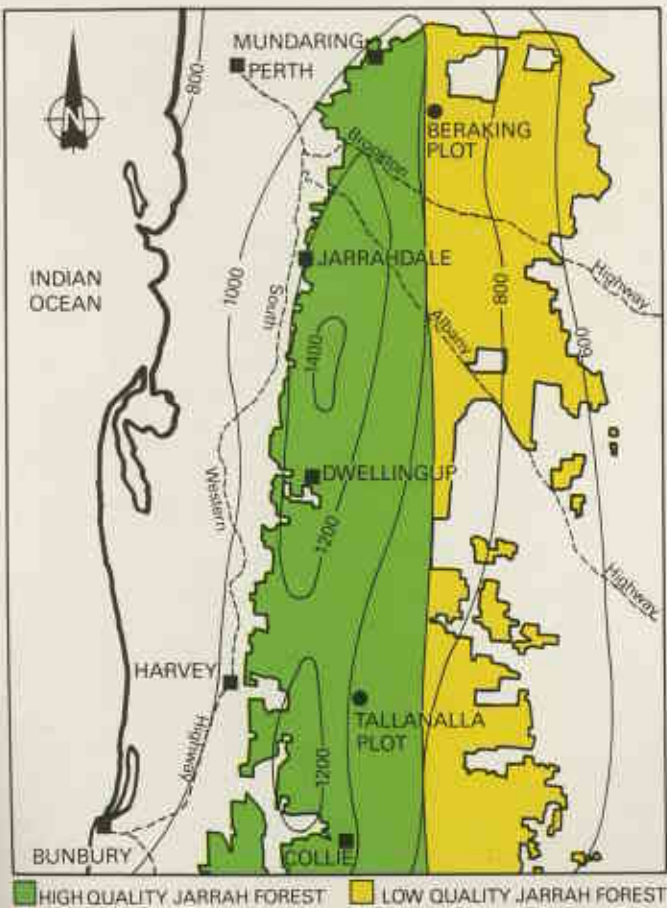
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Forest mensuration — measuring the diameter over bark at breast height — to ▲ calculate timber volume and annual tree growth.

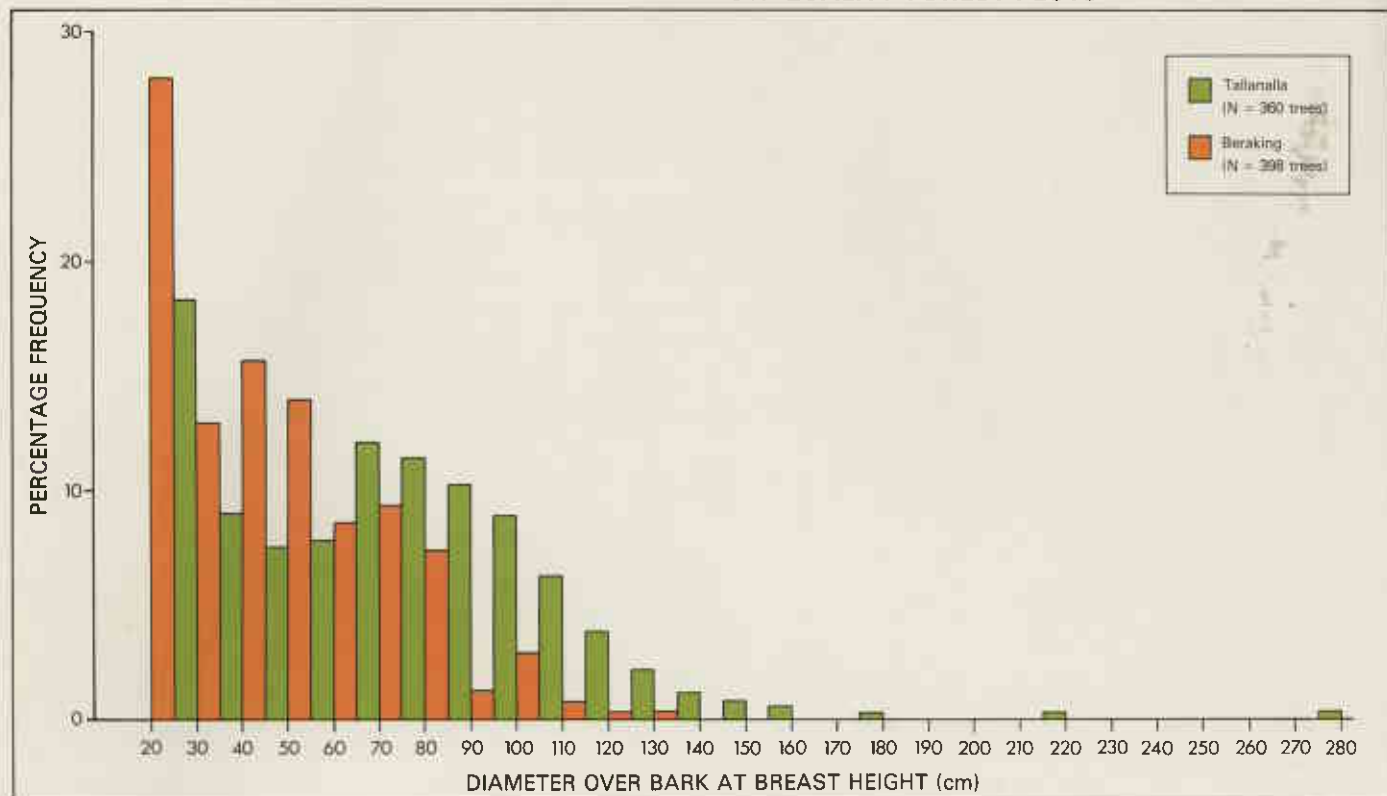
▼ Felling and utilizing large jarrah posed a real challenge for the early pioneers.



◀ **Figure 1**  
Extent of high and low quality jarrah forest north of Collie, annual rainfall, and plot locations.

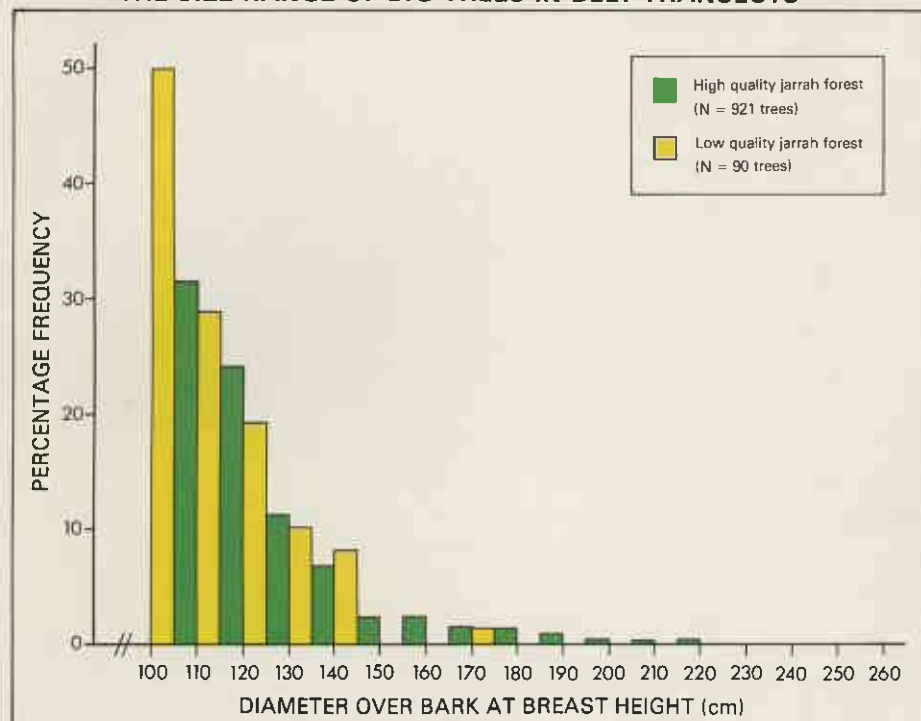


**JARRAH FOREST**  
**THE SIZE RANGE IN HIGH AND LOW QUALITY FOREST PLOTS**



**Figure 2** Diameters of jarrah trees in two plots in the jarrah forest; Tallanalla plot (based on 360 trees) and Beraking plot (based on 398 trees).

**JARRAH FOREST**  
**THE SIZE RANGE OF BIG TREES IN BELT TRANSECTS**



**Figure 3** Diameters of big jarrah trees in high and low quality forest; based on 921 trees for high quality forest and 90 trees for low quality forest.

trees in each 10cm diameter class (that is, 20-30cm, 30-40cm, etc) is displayed graphically (Fig. 2). There were many more small trees than large trees in each plot.

We refer to trees with diameters of 100cm or more as big trees, and there is a striking difference in the representation of big trees between the plots — 15.3% at Tallanalla compared with 4% at Beraking.

Particularly large trees in Western Australian forests are popularly known as king trees. To be more precise, we decided to call those jarrah trees with a diameter of at least 200cm, King Jarrahs.

The belt transects already referred to are helpful in assessing generally the range of sizes attained by big trees in high and low quality forest (Fig. 3). In high quality forest about 80% of big trees are of diameter 100-140cm, whereas in low quality forest the same proportion is in the diameter range 100-120cm.



The largest tree recorded from these transects in low quality forest was about 180cm, in contrast to 260cm in high quality forest. Only 0.5% of all big trees in high quality forest can be classed as King Jarrahs, and none have been recorded in low quality forest areas.

### Population of big trees in high and low quality forest

In high quality forest there are about three to four times as many big trees per hectare as there are in low quality forest (Table 1). The average population density of King Jarrahs in high quality forest is 4.2 per 100ha.

### Why do only some trees grow into big trees?

It can be seen from Fig. 2 that most jarrah trees in the forest are of small diameter. This is typical of the bulk of the jarrah forest. The main reason so few trees grow to reach the status of a big tree in the jarrah forest is because individual trees compete for both crown space and root space, and hence for light, water and nutrients. As a result of this competition the forest thins itself out, with some trees gaining dominance. Only the fastest growing individuals achieve a position of dominance over nearby trees.

**TABLE 1**  
**Density of Big Trees in high and low quality Jarrah forest.**

Site Quality	Density of big trees (Diameter ≥ 100cm) per ha	
	Mean	Range
High	7.6	6.0 - 10.6
Low	2.1	1.6 - 3.0

Another important factor is the occurrence of hazards. Before the jarrah forest was logged last century, the main hazard to the tree was fire started by aborigines or lightning. A fast growing dominant tree might be injured or even killed by fire before it reached the status of a big tree.

### How long does it take a jarrah to become a big tree?

Jarrah, as has long been recognized, grows very slowly. In high quality forest the average increase in diameter each year is only 0.17cm. In low quality forest this increment is even lower, 0.10cm. Simple calculations show that a diameter of 100cm would be attained in high and low quality forest in 600 years and 1000 years respectively. At that rate, in high quality forest it would take 1200

years for jarrah to become a King Jarrah.

However, it is most likely that only fastest growing individuals attain the status of big trees. In jarrah forest we have found that about 25% of the trees increase in diameter 0.31cm each year in high quality forest and 0.26cm each year in low quality forest. Simple calculations show that the fastest growing trees in high quality forest would attain 100cm diameter in about 300 years and 200cm in 600 years. In low quality forest a diameter of 100cm would be reached in 400 years. Occasionally, some jarrah trees in high quality forest have been recorded growing at the exceptionally fast rate of 0.60cm per year. It would take such trees less than 200 years to reach 100cm diameter and less than 350 years to become King Jarrahs.

Scenic drive through jarrah forest. ▼





▲ The stump of a King Jarrah at Mundlimup — felled in 1872.

Unfortunately the crowns and butts of many big jarrah have suffered fire damage over the years.



## King Jarrahs

We sawed a cross section of wood from the stump of a King Jarrah in Mundlimup Block, 5km east of Jarrahdale. The diameter of the tree at breast height was 200cm. We prepared this section for a count of the annual growth rings, by planing it. There were 397 rings, indicating that the tree was about 400 years old when felled in 1954.

As a check, we then submitted a sample of heartwood to the Sydney University radiocarbon laboratory. The date found by this method was 300 years. This is satisfactory agreement between the two methods. We concluded that this tree began life in the late sixteenth century or early seventeenth century and grew with an average annual increase in diameter of 0.5cm.

Unfortunately most King Jarrahs left in the forest are either dead, or nearly dead, through extensive damage by wild fire to the lower trunk and branches. Few carry vigorous crowns.

Some fine examples of King Jarrahs in the northern jarrah forest may be found in Sawyers forest block near Mundaring, in Lowden block near Collie, in Hadfield block near Harvey, and in the Nanga, Holmes and Amphion blocks near Dwellingup. The tree in Hadfield is, in fact, the biggest jarrah tree yet found, with a diameter of 319.3cm. Enquiries about the location of these trees should be directed to the Forests Department offices in the above towns.

### FURTHER READING

Abbott, I. and O. Loneragan. Growth rate of jarrah (*Eucalyptus marginata*) in relation to site quality in cut-over forest; Western Australia. **Australian Forestry**, 46(2):91-102, 1983.