



## FORESTCHECK: The effects of silviculture on the structure of jarrah forest stands

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### Background

Forest managers require information about tree size class distribution, growth rate and species composition in order to quantify the current structure and condition of forest stands and predict how this may change over time. Structural attributes directly affect the capacity of stands to provide commercially valuable products including wood and water, a broad range of ecosystem services including soil conservation and carbon sequestration, and to contribute to the conservation of biological diversity.

Jarrah forest is characteristically uneven-aged and a wide variety of growth stages from lignotuberous ground coppice to mature trees may be present at the patch scale of one to a few hectares. This structure reflects recruitment opportunities and the effects of past disturbance by bushfires, severe wind storms and occasional ex-tropical cyclones that are the predominant natural disturbance events in the forests of south-west Western Australia. Timber harvesting has also affected the structure of the jarrah forest throughout much of its range, with considerable variation according to the nature and condition of the original forest and the type of harvesting undertaken.

The FORESTCHECK project contributes to adaptive management of Western Australian forests by providing timely and relevant information about the implementation, effectiveness and biodiversity consequences of silvicultural practices in jarrah forest. FORESTCHECK monitoring takes place at five locations within four jarrah forest ecosystems at 48 sampling grids. Grids represented examples of reference forest (never harvested or forest that had not been harvested for at least 40 years) and forest subject to either gap release or shelterwood/selective cut silvicultural treatments during the period 1988-2002.

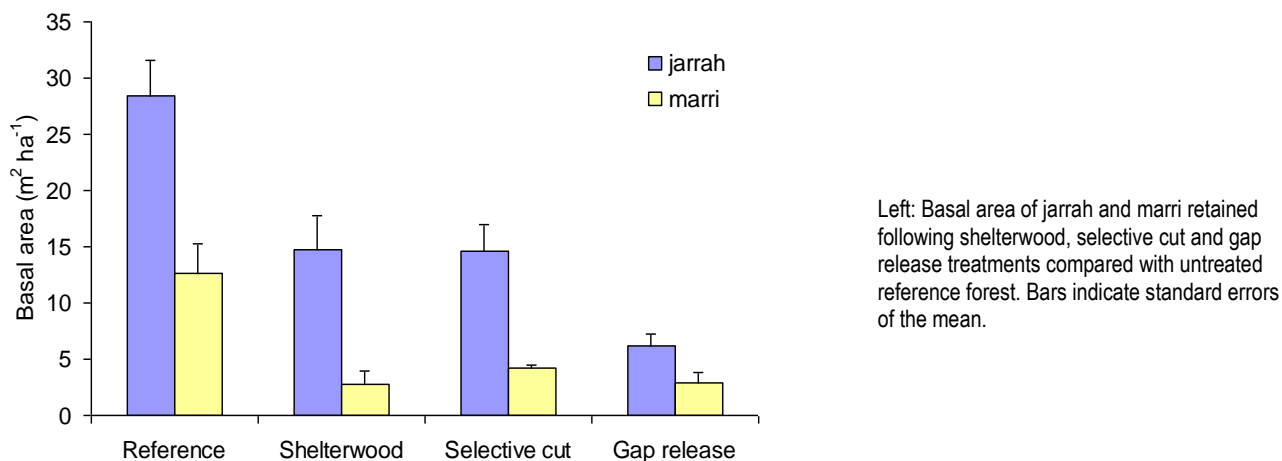


Above: Mature forest (left) and regrowth of jarrah and marri saplings in forest treated with shelterwood silviculture (right)

Grids at one of the five locations were sampled each year to measure stand structural attributes including basal area, species and size class distribution of overstorey trees. Surveys were also undertaken to determine the amount of regeneration present as seedling and advance growth.

## Findings

- Live eucalypt basal area in reference forest averaged  $41 \text{ m}^2 \text{ ha}^{-1}$  (range  $13\text{-}78 \text{ m}^2 \text{ ha}^{-1}$ ) with marri (*Corymbia calophylla*) contributing more than half the basal area on some grids in the Jarrah South and Jarrah Blackwood Plateau ecosystems.



- On average, basal area was reduced by 45% in shelterwood stands and by a similar amount in selectively cut stands. Basal area was reduced by 70% in areas cut to gap release.
- Mature trees greater than 70 cm diameter were retained at a rate of six to seven per hectare in shelterwood/selective cut and gap release treatments.
- Mature trees were more frequent on reference grids that had never been harvested than on reference grids that had been selectively cut before 1960 (means of 33 and 17 stems  $\text{ha}^{-1}$  respectively).
- Trees of diameter greater than 100 cm were recorded in seven reference grids, two shelterwood grids and one gap release grid at densities of 4.6, 3.1 and 0.9 stems  $\text{ha}^{-1}$  respectively.
- Gap release grids were generally well stocked with saplings and ground coppice comprised of approximately equal proportions of jarrah and marri, except in northern parts of the Jarrah North West ecosystem where jarrah dominated the regeneration cohort. Vigorous in-growth of saplings increased eucalypt basal area by up to  $16 \text{ m}^2 \text{ ha}^{-1}$  within five years of post-harvest burning in the most densely stocked grids cut to gap release.
- Shelterwood treatment outcomes were variable, both in terms of retained basal area and success in achieving regeneration stocking standards.

## Management Implications

Gap release treatment has resulted in fully stocked stands with a developing cohort of saplings.

Shelterwood treatment was applied conservatively with a tendency to retain more basal area than required by the silviculture guideline, and in areas that may already have had sufficient ground coppice to allow for satisfactory regeneration by gap release. Shelterwood treatment does not necessarily result in establishment of sufficient seedlings to satisfy regeneration stocking standards within 10 years of treatment, but further episodic recruitment following fire is expected to achieve this over the longer term.

### Reference:

McCaw, W.L. (2011) Characteristics of jarrah (*Eucalyptus marginata*) forest at FORESTCHECK monitoring sites in south-west Western Australia: stand structure, litter, woody debris, soil and foliar nutrients. *Australian Forestry* 74, 254-265