FIRE EFFECTS ON STAND STRUCTURE IN THE JARRAH FOREST.

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Introduction.

Recent Australian forestry literature and discussion has presented a diversity of opinion on forest damage and changes in stand structure introduced by periodic controlled burning. Opinions range from negligible damage, to forecasts of stand deterioration, but there appears to be little experimental evidence to support either contention.

To the author's knowledge the jarrah forest remains the only significant forest area in Australia, in which planned periodic area controlled burning has been implemented, and it is therefore pertinent to discuss possible changes in stand structure which may arise in this forest.

Harris and Wallace (1959) indicate that early settlers described the jarrah as an open forest with a generally sparse scrub cover. This paper concludes that it is probable that the jarrah forest received periodic light burning prior to European settlement. The advent of utilization resulted in dense accumulations of felling debris and accompanying damaging conflagrations, and these fires were of an intensity unusual in the earlier environment.

Admittedly there is only rudimentary information on stand structural changes resulting from fire, but some trends in current fire damage studies are likely to be indications of future developments.

If early observation was correct it could be expected that the dense pole stands in the prime jarrah forest will be noticeably thinned by repeated burning. It is also possible that the silvicultural benefits of repeated burning are greater than is now generally accepted.

Fire as a Thinning Mechanism

The concept of fire as a thinning mechanism was recognised by Lindemuth (1962), but his assessment indicated no benefit from a single large area burn under Ponderosa Pine.

The author is of the opinion that beneficial thinning may well accompany repeated burning in dense jarrah forest, and this opinion is based on trends in fire damage assessment of the Dwellingup fire area. The assessment is based on one acre randomly located plots, at an intensity defined by the accepted standard error of the mean.

Within the assessment results the recovery of the under 36" GBHOB class is of interest, because this size class represents the most fire susceptible trees considered in the study.

Within this class trees were divided into two groups.

a) Those considered to be potential future crop trees by their position in the stand.

b) Surplus trees of no significance to the fully stocked condition, being fully suppressed or surplus members of a coppice stool.

Within these groups trees were classed as those which had replaced their crowns after the fire, and those with fire killed crowns.

The results of assessment in the defoliated area of the Dwellingup Fire are shown in table 1 (forest damage stratum defined by Working Plans A.P.I. assessment).

Table 1. Number of trees per acre under 36" GBHOB

	Future Crop Trees	Surplus Trees
Crowns Replaced	44	24
Crowns Dead	58	167

The results show that 57% of the potential future crop trees, and 87% of the surplus trees, have failed to replace their crowns. The indications are that a potential crop tree has a higher fire resistance than a surplus tree, which could be expected as they have room to grow and are inherently more vigorous.

If this hypothesis is reasonable a lowering of fire intensity should result in a higher proportion of crop tree recovery than that which occurs in the surplus trees. To examine this contention the assessment figures for the fully browned area of the Dwellingup Fire are shown in Table 2.

Table 2. Number of trees per acre under 36" GBHOB.

	Future Crop Trees	Surplus Trees
Crowns Replaced	59	56
Crowns Dead	18	131

Comparing defoliation and fully browned it will be noted that the percentage of future crop trees which failed to replace a crown has dropped from 53% to 23%, a decrease of 60%. Similarly the surplus trees show a drop from 87% to 70% but the decrease is only 19%.

This difference in inherent fire resistance may produce marked benefits when extended to the fire intensities accepted for controlled burning. Providing reasonable height growth has been achieved properly planned controlled burning should result in minor damage to potential crop trees, while a significant proportion of the surplus trees are killed or damaged. With repeated burning the benefits should accrue and the stand gradually revert to a desirable spacing. In practise it is unlikely that the process will be entirely selective and a number of crop trees may be damaged, but the chances of surplus trees being damaged is much greater.

It was noted in the defoliation assessment that variation in fire resistance also appears in trees of merchantable size. Taking two utilization standards in large trees i.e. merchantable and cull or useless, trees were divided into those with crowns replaced and those completely fire killed. The results of this assessment are shown in Table 3.

Table 3. Volume per acre cubic ft.

	Merchantable	Cull
Crowns Replaced	645	69
Fire Killed	70	65

Merchantable trees have lost only 10% of the volume per acre by fire kill while cull trees have lost 48%.

It appears to the author that if fire intensity is lowered to an acceptable level, which is defined by the nature and type of stocking, then real benefits will accrue by removal of much of the stand rubbish. To have confidence in this contention it is necessary to know whether fire damage can be controlled by using the current controlled burning guide for the northern jarrah forest.

Control of Fire Damage.

As a check on the effectiveness of damage control by using the controlled burning guide three burns in 6 year old regeneration were carried out in the Gleneagle area. Trees had an average height of 10 ft., hence were susceptible to fire damage.

Three burns were conducted, using the normal strip method and at three different fire danger ratings. Within each area 150 saplings were selected as potential future crop trees. The scorch resulting on these trees is shown by the distribution on Graph 1.

From graph 1 it will be noted that Burn 1 carried out at a fire danger of Purple 0.8 ft./min., that 46 of the 150 saplings received no scorch while 32 were fully scorched. In Burn 2 (fire danger Green 1.2 ft./min.) the number of no scorch trees dropped to 12 while the number fully scorched rose to 100. In Burn 3 (fire danger Green 1.6) only 5 saplings escaped scorching while the number fully scorched was 112.

There seems little reason why effective damage control cannot be gained by attention to the correct fire danger rating, and when this is accepted the use of fire in silviculture has a far greater potential than is at present generally acknowledged.

References. Harris and Wallace. 1959. Controlled Burning in Western Australia.

Lindemuth. 1962. Effects on Fuels and Trees of a Large Intentional Burn in Ponderosa Pine. J.For. 60(11) 1962.

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Graph 1. Scorch distribution from burns under 6 y.o. jarrah regen. - Gleneagle
(150 trees assessed in each burn).