BURNING THINNING SLASH IN YOUNG KARRI (Eucalyptus diversicolor) STANDS

Progress report on Research Project 153/91
Boorara 2 compartment, Pemberton District

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1. BACKGROUND

Even-aged regrowth stands of karri (Eucalyptus diversicolor) regenerated following clearfelling will play a central role in future wood production from the Southern Forest Region. The 1987 Timber Strategy for Western Australia proposed a major program of thinning in young (20-25 year age-class) stands in order to concentrate growth potential onto selected crop trees, and salvage usable wood products that would otherwise be lost to mortality. Thinning operations will produce commercial quantities of chipwood, and a lesser proportion of small diameter sawlogs.

Fire is routinely excluded from young stands for a period of at least fifteen years after regeneration, by which stage the potential crop trees have developed sufficient height and bark thickness to tolerate fires of low intensity (< 500kW/m).

Such stands carry heavy loadings of fine fuel, typically about 30t/ha, resulting from accumulated litterfall and dead understorey shrubs, and have the potential to sustain intense fires during the dry summer months from December to March (McCaw et al. 1988). Prescribed burning has been demonstrated to be technically feasible in unthinned stands older than fifteen years, although the requirement for specific weather conditions and ignition patterns has limited the opportunity for widespread application of this technique (McCaw 1986).

Thinning alters the situation considerably by creating additional fine and woody fuel from the crowns of felled trees, and altering the fuel drying regime and wind flow characteristics in the thinned stand. While the fuel hazard is temporarily increased following thinning, there is also an expanded opportunity to ameliorate this hazard by the use of prescribed fire.

The need to avoid damage to retained trees is an important constraint on any burning operations in young regrowth.

In August 1991 an experimental burning project was commenced in a 22 year-old stand at Boorara 2 compartment near Northcliffe with the following aims:

(1) to quantify fire behaviour and fuel consumption in a thinned stand over a range of burning conditions,

(2) to quantify impacts of fire on tree growth and stem quality,

(3) to evaluate operational aspects of prescribed burning including preparation, lighting technique, mop-up requirements and cost,

(4) to provide the opportunity for additional research into nutrient dynamics following thinning and fire.

2. STUDY METHODS

A series of twelve plots ranging in size from 0.2 to 3 ha were demarcated with bulldozed mineral earth tracks. Within each plot, stand characteristics, fuel conditions and fire behaviour were studied in a 30m x 30m sub-plot.

Stand characteristics assessed include tree height and diameter, stocking, basal area and diameter increment. Stem damage caused by the thinning operation was recorded prior to burning, and any further damage caused by fire will be recorded as it becomes evident over the coming year.

Fuels up to 100mm in diameter were harvested from five $1m^2$ quadrats within each sub-plot before burning, and from a further 5 matched quadrats following burning. Sub-samples of this material are being analysed for nutrient content by Dr Tony O'Connell from CSIRO Division of Forestry and will form the basis for development of a nutrient budget for thinned and burnt stands.

Plots were burnt under mild conditions in the period from October to early December 1991. Hand-held drip torches were used to ignite spots at about 20m spacing along lines 50m apart, with the overall pattern of lighting designed to maximise the area burnt by backfires; lighting pattern was varied to account for changing weather conditions and local factors of fuel and slope.

Fire behaviour characteristics including flame height, forward rate of spread and burn-out time were monitored. Fuel consumption, crown scorch, and monthly diameter increment have been assessed following burning.

3. RESULTS

Following thinning the retained stand consisited of:

- stocking 359stems/ha retained
- basal area $19.3m^2/ha$
- mean tree dbhob 25cm

The loading of 0-25mm diameter fuel in the thinned stand averaged 42t/ha, which is about 12t/ha more than in an adjacent unthinned area (Table 1). Additional woody fuel present in the thinned stand comprised 19t/ha in the 26-50mm diameter class and 16t/ha in the 50-100mm diameter class.

Of the eight plots burnt so far:

- three could be regarded as resulting in good fuel removal with minimum crown scorch (Fig. 1);

- a further two plots had good fuel removal but experienced unacceptably high levels of crown scorch due to flare-ups associated with dry (10% moisture content) surface and elevated

fuels, or wind changes which resulted in substantial headfire development;

- one plot showed very good fuel removal, including a substantial proportion of the 25-50mm diameter wood, but this may lead to stem damage;

- one plot showed moderate fuel removal with no crown scorch;

- one fire failed to sustain because of damp fuels.

A provisional burning prescription has been developed on the basis of the information presently available (Table 3).

4. FURTHER WORK

Further fires will be undertaken this autumn to examine fuel removal during conditions of high drought index.

Seasonal trends in the dryness of woody fuels are being monitored, and will be analysed in relation to a range of moisture indices.

The impact of coppice and scrub regrowth on the fuel situation will be monitored over time.

The response of crop trees to burning (ie. stem damage, increment) will be monitored for at least two years.

5. MANAGEMENT IMPLICATIONS

Thinning slash fuels are highly flammable and will remain so for at least three years after thinning operations; the woody component of the slash is slow to decompose and may persist for up to ten years.

The study has confirmed that there is a window of fuel and weather conditions suitable for undertaking prescribed burning in thinned stands.

For prescribed fires to remain within acceptable limits of intensity, the ignition pattern must accomodate local variations in fuel and terrain, and take careful account of weather conditions, particularly wind.

The window of suitable burning conditions is relatively narrow, and therefore unlikely to favour broadscale operational application with current technology.

REFERENCES

McCaw W L (1986) Behaviour and short term effects of two fires in regenerated karri (Eucalyptus diversicolor) forest. CALM Technical Report No. 9.

McCaw L, Smith R & Neal J (1988) Intense fire behaviour in a 16 year old stand of karri (Eucalyptus diversicolor) and yellow stringybark (Eucalyptus muellerana). CALM Landnote 3/88.

Comparison of fuel load (litterbed and roundwood 0-25mm diameter) in thinned and unthinned karri regrowth at Boorara 2.

	Fuel load (t/ha)	
Fuel component	Unthinned	Thinned
Litter	18.8	21.7
0 - 25mm	10.6	20.2
Total	29.4	41.9

Provisional prescription for burning thinning slash in young stands of karri (ie. 20 - 25 years old)

Variable	Unit	Range
Season		spring
Soil Dryness Index	(mm x 10)	200 - 400
Air temperature	(°C)	< 26
Relative humidity	(%)	> 40
Wind speed (10m open)	(km/h)	< 15
Fuel moisture content	(% ODW)	
– elevated fine fuel		13 - 18
– surface litter		13 - 18
– profile litter		80 - 140
Karri rate spread of index		15 - 24
Light ing		– spots at 20m spacing – ignition lines 50m apart – special attention required for slopes >5° and in heaps along the edge of tracks
Mean flame height		< 1m

Analysis of fuel consumption and crown scorch for 8 experimental fires in karri thinning slash, spring 1991.