FUEL AND VEGETATION SAMPLING

Notes for a Workshop held at Woodvale 3rd November 1986.

ESTIMATING FUELS IN REGROWTH KARRI STANDS - L. McCAW

1. Introduction

Fuel studies in regrowth stands of karri have had 2 distinct aims;

1.1 to develop a rapid and reliable technique for estimating fuel quantity that could be used by operations staff. This would provide the fuel input (i.e. tonnes/ha) required for predicting fire behaviour using the existing model for karri forest (Sneeuwjagt and Peet 1976). This model appears to also operate successfully in regrowth stands, at least at lower levels of fire intensity.

1.2 to describe the structure and characteristics of the fuel in sufficient detail for input into semi physical models for predicting fire behaviour, e.g. Rothermel (1972).

Factors that influenced our choice of techniques included;

- the relatively complex and variable nature of the fuels in question,

- the rapid change in fuel characteristics of young regrowth associated with the collapse of the understorey layer between age 10 and 20 (approx.),
- the major influence of fuel characteristics on fire behaviour and possible tree damage,
- relatively large areas eventually requiring accurate fuel assessment (2000 ha/annum),
- need for simultaneous sampling of stand development to determine fire resistance of the trees,
- hostile nature of the sampling environment (bull ants, thick scrub, logs).

2. Sampling Techniques

2.1 Several alternative methods of fuel sampling were initially evaluated including Levy point sampling and Browns Planar Intersect method (1972). The latter method appeared promising as a research tool because it is non destructive, and thus theoretically repeatable, and also provides useful information about fuel particle characteristics. Unfortunately reality did not match expectation and we failed to establish reasonable agreement between predicted and observed values despite considerable effort. Problems we encountered included difficulties in accurately counting and measuring particle intercepts, and with orientation of sampling planes.

2.2 The approach we have now adopted is to establish correlations between fuel quantity (difficult to measure) and stand characteristics (relatively easy to measure). As expected there is a strong correlation between fuel quantity and age; much of the variation within stands of the same age is explained by basal area because suppression of the understorey is related to tree development and canopy closure.

Using this relationship it has been possibleto indirectly assess fuel quantities from large scale air photos, with obvious savings in time required for field sampling, and therefore cost. This technique is being promoted for use by operations staff (see attachment). Briefly, sparse eucalypt canopy above live scrub = low ground fuels while dense canopy = heavy ground fuels.

2.3 In developing these relationships we used the following sampling procedure -

a. sample points were selected in stands with a range of age and understorey composition (4 - 10 points/stand).

b. fuel was collected on 5 consecutive quadrats
   - litter, on quadrats of $0.04m^2$ with depth also measured,

- aerated trash on quadrats of $0.5m^2$ up to 0.60m high, (preliminary studies had shown that about 80% of fuel was below this height). Live and dead material up to 25mm was collected, and the number of scrub stems in each quadrat was counted.

c. measured all trees $\geq$5cm diameter in 5m radius around quadrat centre point to allow calculation of stocking and basal area.

d. fuel samples were returned to the lab, oven dried, sorted into live and dead and then weighed by sizes classes (0.6mm, 6 - 10mm, 11 - 25mm) that correspond with those used by main fire behaviour models.

e. subsamples were then taken for determination of particle density and surface area/volume ratio. Fuel bed bulk density was also calculated.

3. Discussion Points

3.1 Study has taken considerable amount of time both in field and in lab, probably 1 - 2 man years.

3.2 Predictions from Rothermel model are sensitive to variation in SA/volume ratio and bulk density. When dealing with a complex fuel type it is difficult to know how good our estimates really are, and so validation with field experiments will be necessary.

SOUTHERN FOREST REGION OPERATIONS MANUAL

Prescribing Fires in Regrowth Karri Forest

1. SCOPE

This note describes the procedure which should be undertaken when prescribing a fire in regrowth karri forest which has an understorey dominated by Hazel (Trymalium spathulatum), Netic (Bossiaea laidlawiana), K-Wattle (Acacia pentadenia), or Acacia urophylla, and has not been burnt since regeneration.

Recommendations are based on research and operations current in 1986.

2. OBJECTIVE

To prescribe a fire which will consume litter, and trash fuel up to 1 metre high (>75% of available fuel consumed on >75% of area) without causing stem damage or full crown scorch to the dominant and co-dominant trees in the stand.

3. FUEL ASSESSMENT

3.1 Large scale, vertical air photos should be used to map stand development and estimate fuel types. Prints should be in colour at 1:2,500 - 1:3,000 scale but stereo coverage is not required.

3.2 Identify the following features on the photograph and prepare an overlay showing:-

a) Burn boundaries.

b) Old snig tracks and landings.

c) Stags, veterans or groups or mature trees.

d) Swamps, creeks or gullies within the burn.

e) Regrowth forming a dense closed canopy.

f) Regrowth forming a 50-90% cover (by area) with patches of live scrub.

g) Areas where scrub is dominant and regrowth forms less than 50% canopy cover.

h) Any other features which may affect fire operations.

If more than a quarter of the area proposed for burning has a regrowth canopy cover less than 50% then it will be difficult to achieve a satisfactory burn; in this case reconsider your reasons for prescribing the fire.

3.3 a) Locate at least one, and perferably two, field sample lines in regrowth canopy types (e), (f), (g) listed above, and if necessary in (c) and (d) as well.

b) Sample five points at 20m intervals so that each line is 100m long. Sample lines should start no closer than 20m from a major road or boundary to minimise edge influences.

c) At each sample point record the following information on the sheet provided:-

- litter cover: incomplete or complete
- trash density: sparse, medium, dense
- basal area: determined using a 2x wedge prism
- diameter of each regrowth stem >15cm dbhob (within 5m radius of the point)
- estimated height of co-dominant trees
- any other relevant information eg: dense sword grass, old landing

3.4 Calculate the total fuel weight at each point according to the basal area and age of the stand using Table 1.

TABLE 1 TOTAL FUEL WEIGHT (TONNES/~~HA~~) IN RELATION TO STAND AGE AND BASAL AREA OF REGROWTH KARRI FOREST.
Preliminary Data Only

STAND AGE (YEARS)	BASAL AREA (M^2/HA) (TONNES/HA)			
	10	20	30	40
12	16.5	19.0	22.0	26.0
14	18.0	21.0	24.0	27.0
16	20.0	23.0	26.0	29.0
18	21.5	24.5	27.5	30.5
20	23.5	26.5	29.5	32.5

a) Research has demonstrated that fuel weight, particularly trash fuel, increases in proportion to stand basal area because of the effect of competition on the suppression of the understorey.

b) An available fuel factor of 0.8 - 1.0 will normally apply when fuels in regrowth are dry enough to burn.

c) Count the number of stems at each sample point (5m radius) that are:-

- 15-19cm dbhob
- ≥ 20cm dbhob

and multiply each number by 125 to determine the number of stems/ha in each category.

4. PRESCRIPTION GUIDELINES

4.1 Prescription details should be entered on the appropriate form (CLM 763).

4.2 Tree Size and Stocking

a) Determine the proportion of points sampled which meet the following criteria:

- basal area ≥20m^2/ha
- at least 250 stems/ha ≥20cm dbh
- co-dominant height ≥ 18m.

If more than a 30% of points do not meet these criteria (excluding non-forest types) then the stand may be difficult to burn and may not have sufficient undamaged trees remaining after the fire. More extensive field sampling may be required to determine whether the stand should be burnt in this case.

b) Stocking ≥20 dbh is used as an index of stand development but there is usually an additional number of stems 15-19cm dbh also capable of withstanding low intensity fire.

c) Bark thickness can be determined from overbark measurements using Figure 1. This relationship holds for unburnt trees on a wide range of sites.

d) Regrowth on average karri sites will generally take 15 years to attain this level of development, and poorer sites may take considerably longer.

4.3 Soil Dryness Index

Fuels in regrowth are not generally available for burning before the S.D.I. exceeds 800, however burning at the lowest practical S.D.I. will minimise ignition of logs and reduce the potential for stem damage.

4.4 Fuel Moisture

a) Fuel moisture contents in regrowth (age 10+) are similar to those in mature karri type 4+5. Tables should be updated weekly or after rain. It is most important that field samples are taken before the decision is made to go ahead with the burn.

FUEL AND STAND ASSESSMENT SHEET FOR KARRI REGROWTH FOREST

Area Location: ....

Sample Line No.: ....

Age of Regrowth: ....

Major Scrub Species:- Live: ....

Dead: ....

Canopy Density Class (from air photo): ....

POINT No.	FUEL (tick appropriate class) LITTER COVER INCOMPLETE	COMPLETE	TRASH DENSITY SPANE	MEDIUM	DENSE	BASAL AREA FACTOR=..... COUNT	M^2/HA	SIZE CLASS (CM)	TREES Diameter (to nearest cm)	TOTAL No.	STEMS/HA (Multiple total x 125)	COMMENTS eg: Sword grass
								15–19				
								≥20				
								15–19				
								≥20				
								15–19				
								≥20				
								15–19				
								≥20				
								15–19				
								≥20				
	TOTAL NUMBER					MEAN						

No. of points with ≥ 250 stems/ha ≥ 15cm dbh =

No. of points with ≥ 250 stems/ha ≥ 20cm dbh =