# "PROGRESS REPORT ON A FUEL ACCUMULATION STUDY IN BANKSIA WOODLANDS AROUND WANNEROO"

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1985.

## Summary

The rate of fuel accumulation is basic information for planning fire control operations and for assessing fire hazard. Such data are lacking for the Banksia woodlands.

Some 100 sample points were located in woodlands with a range of fire histories. Litter and scrub were collected in order to determine the rate of accumulation of these fuel types.

Litter fuels were very light, very patchy, very slow to accumulate and are probably insignificant as fuel in most areas. Vegetation (scrub up to 2m) forms the dominant fuel complex and accumulates at about 1 tonne/ha/annum. Not all vegetation is burnt, in fact only about 60% of the total biomatter becomes fuel.

The behaviour of fire in Banksia woodland fuel complexes is not well understood.

## Introduction

The Forest Fire Behaviour Tables for Western Australia provide guides for calculating the rate of fuel accumulation in the main forest types in the south west. These Tables do not extend to Banksia woodlands north of Perth. CALM staff at Wanneroo were interested to know the rate of accumulation of the various fuels in coastal Banksia woodlands in order to plan fire control operations including fuel reduction burning.

Manjimup Fire Research section carried out a survey of fuels in the region. The aim of the survey was to provide operations staff with a guide to the rate of fuel accumulation beneath Banksia woodlands. This study was not a detailed fuel dynamics study nor was it a fire behaviour study.

## Methods

A total of 9 forest blocks were sampled. The blocks were chosen to ensure a range of fuel ages. In each block, between 8 and 12 sample points were located.

Sampling consisted of;

i. Collecting ground litter from 10 quadrats (each $.04m^2$) randomly located within a 20m radius of the sample point.

ii. Taking a tree basal area sweep with a 2x wedge prism.

iii. Cutting out and bagging all scrub in a 3m x 1m plot at each point.

iv. Measuring the height and % cover of the scrub in a 20m radius of sample point.

In the laboratory;

i. Litter was dried and weighed and expressed in tonnes/ha.

ii. Scrub was separated into live and dead (trash) and each of these categories was further separated into <6mm diameter and ≥6mm diameter. Scrub samples were also dried, weighed and expressed in tonnes/ha.

## Results & Discussion

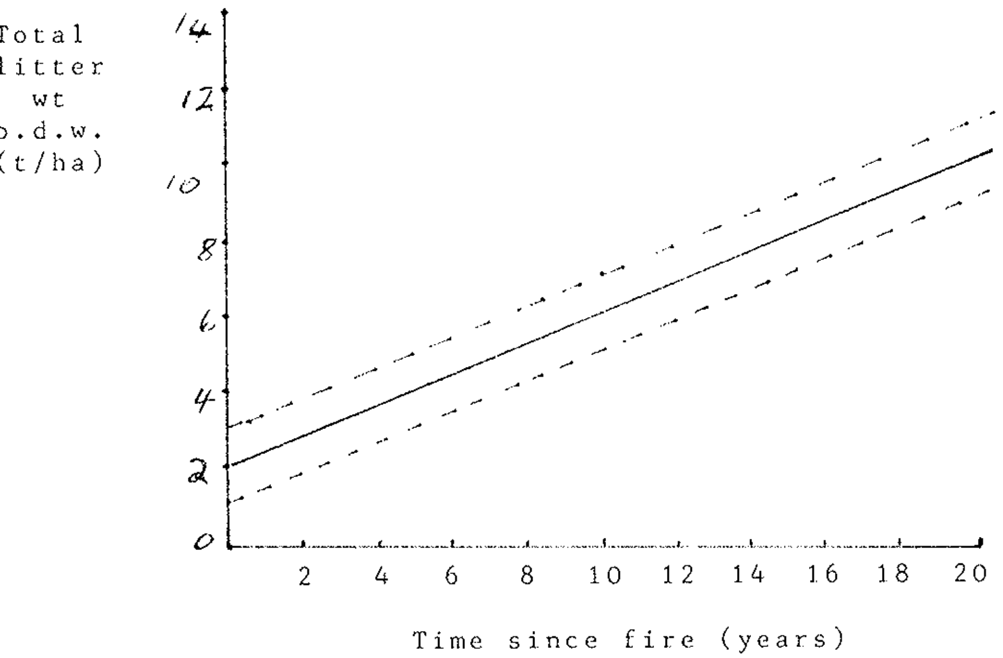
Ground litter (dead leaves, twigs etc.) was very light and patchy. The average rate of litter accumulation is shown in Figure 1 below. Ninety five percent (95%) confidence limits are also shown. The upper limits of fuel weight correspond to areas where the basal area of Banksias etc. was high ($\backsim 15m^2/ha$) and the lower limite corresponds to areas of very low stocking ($2 - 5m^2/ha$).

Normally, litter accumulation levels off with time, but the number of samples taken (100 in all) over the range of fuel ages (9 fuel ages) was not adequate to determine this. The relationships graphed in Figure 1 will suffice until more detailed studies can be carried out. In essence, ground litter is very much a minor component of fuels in Banksia woodlands. Even after 20 years and in the "worst" instance, there was only about 9 t/ha of leaf litter and more often about 6.0 t/ha.

## Scrub as Fuel

In all plots, scrub was by far the most significant fuel type. The quantity and arrangement of scrub fuel varied with site and vegetation type. Again, our sampling was not intense enough to cover all combinations. However, the following predictions are quite workable and should hold most situations.

FIGURE 1: Rate of litter accumulation (oven dry weight) in Banksia woodlands (from 100 samples) 95% C.L. are shown.

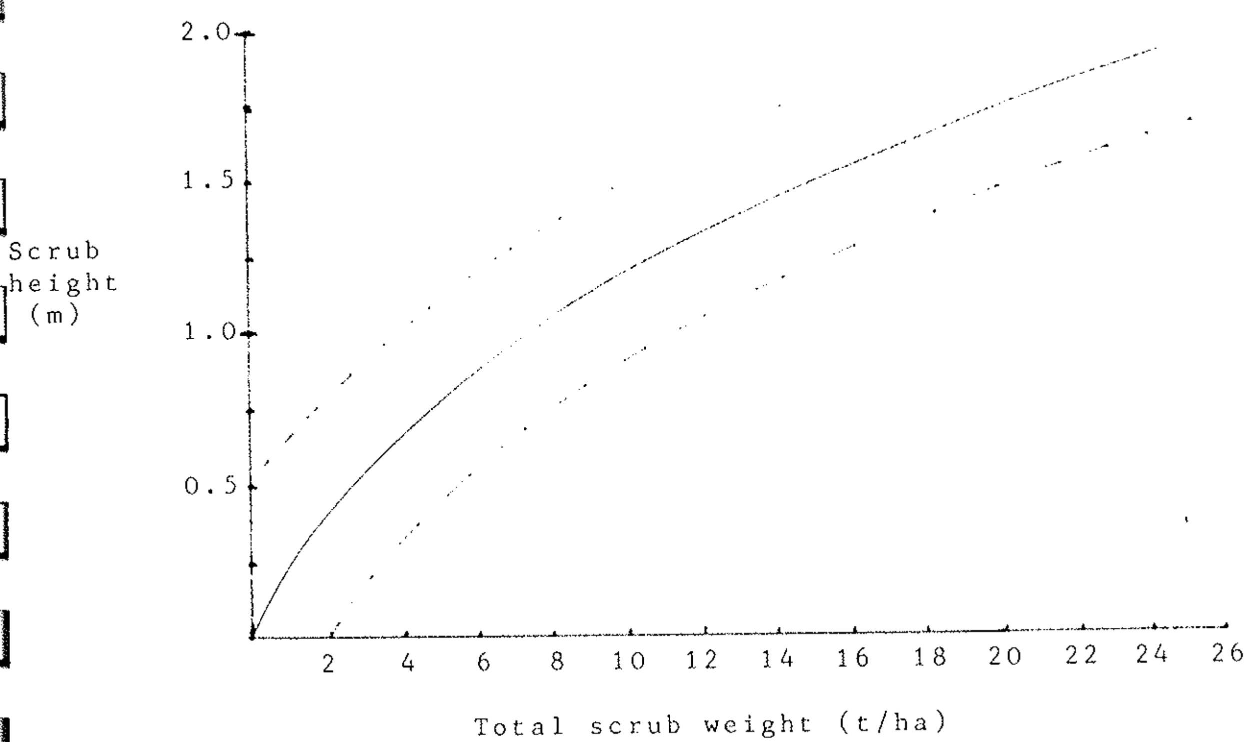



The quantity of scrub (t/ha) can be determined either by measuring scrub height (m) or by knowing the age of the scrub.

The relationship between scrub height (average height over an area of 1256$m^2$) and the total weight of scrub is shown in Figure 2 below.

Figure 2 assumes a scrub cover in the order of 60%. The total scrub weight (oven dry) will be more or less, depending on the scrub cover. The average scrub cover of all points sampled was 55%.

FIGURE 2: Relationship between scrub height and total scrub weight for scrub of about 60% cover.




Total scrub weight can also be predicted by knowing the time since the last fire (assuming the fire consumed the scrub). This is graphed in Figure 3. Figure 4 shows the relationship between scrub height and time since fire. This may be useful for predicting fuel age.

Total scrub weight includes all biomatter. However, not all will burn in a fire. The amount which does burn is largely a function of the fire intensity, with progressively more scrub being consumed with increasing fire intensity.

Here, we assumed that all scrub particles <6mm in diameter would be consumed in a fire which defoliates the scrub. This includes both living and dead vegetation. The total amount of living vegetation and dead vegetation with scrub age is graphed in Figure 5. The amount of live and dead fuel (<6mm in diameter) is graphed separately in Figure 6.

FIGURE 3: Total scrub weight verses time since fire (95% C.L. shown)

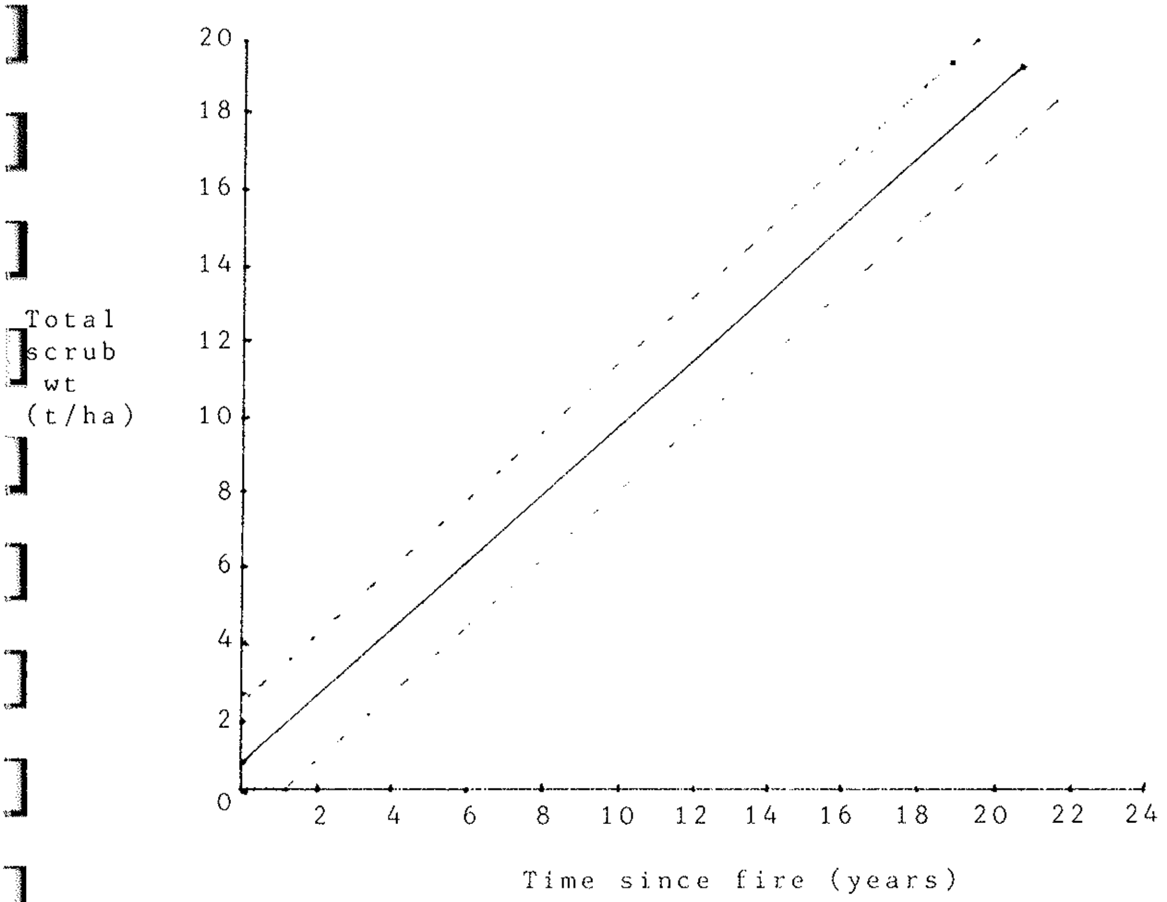



FIGURE 4: Scrub height verses time since fire.

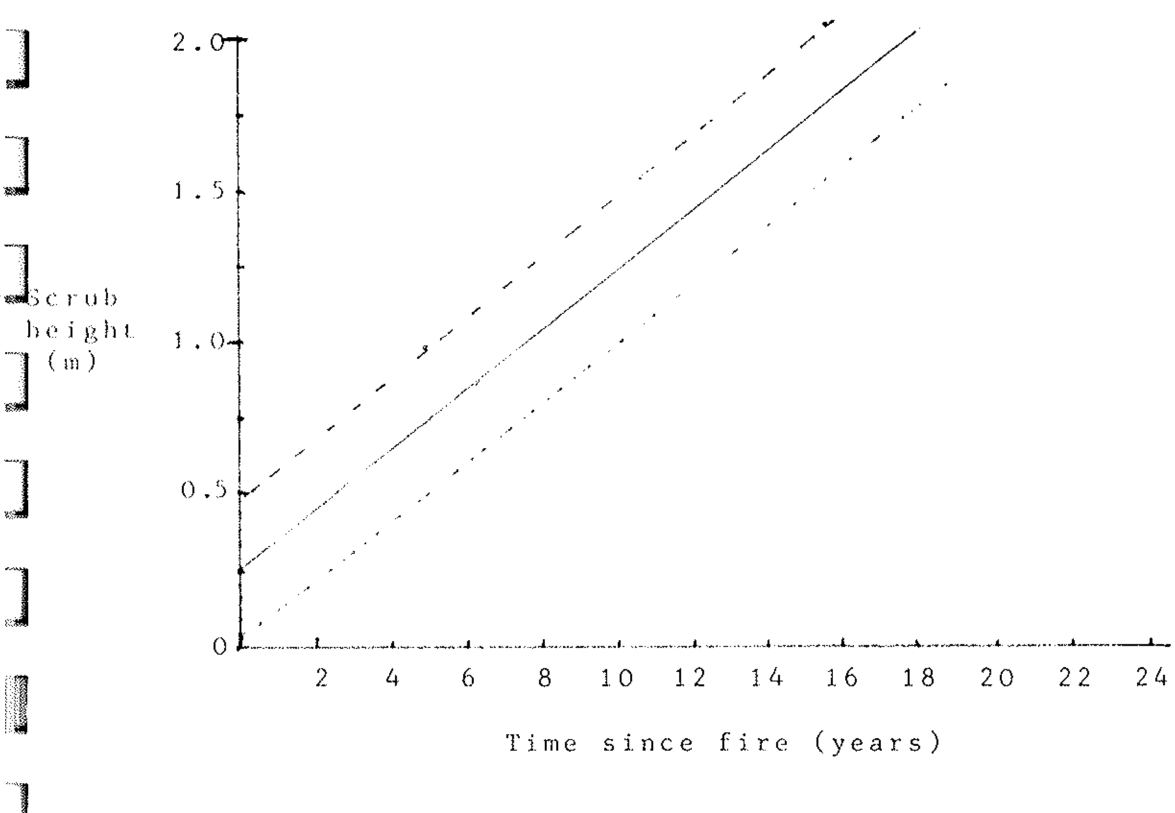


FIGURE 5: Breakdown of scrub into live and dead with time since fire and for a 60% scrub cover.

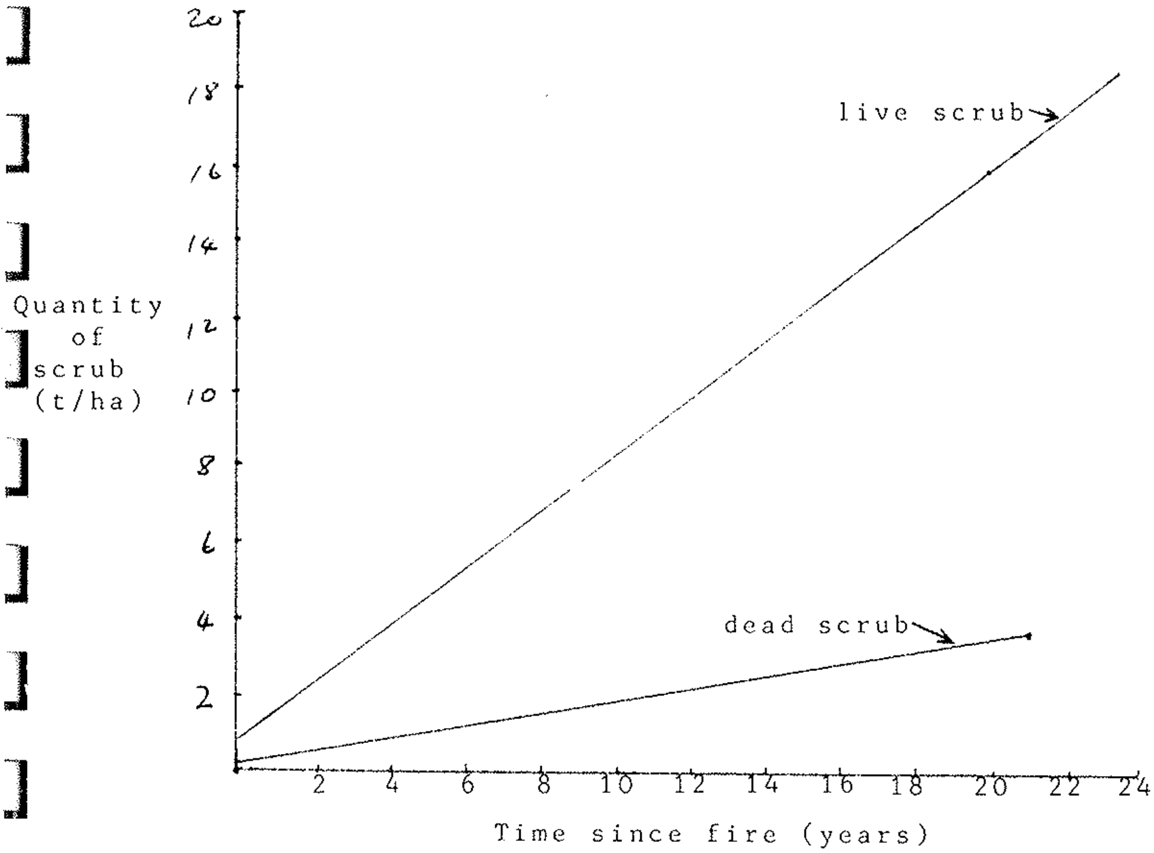
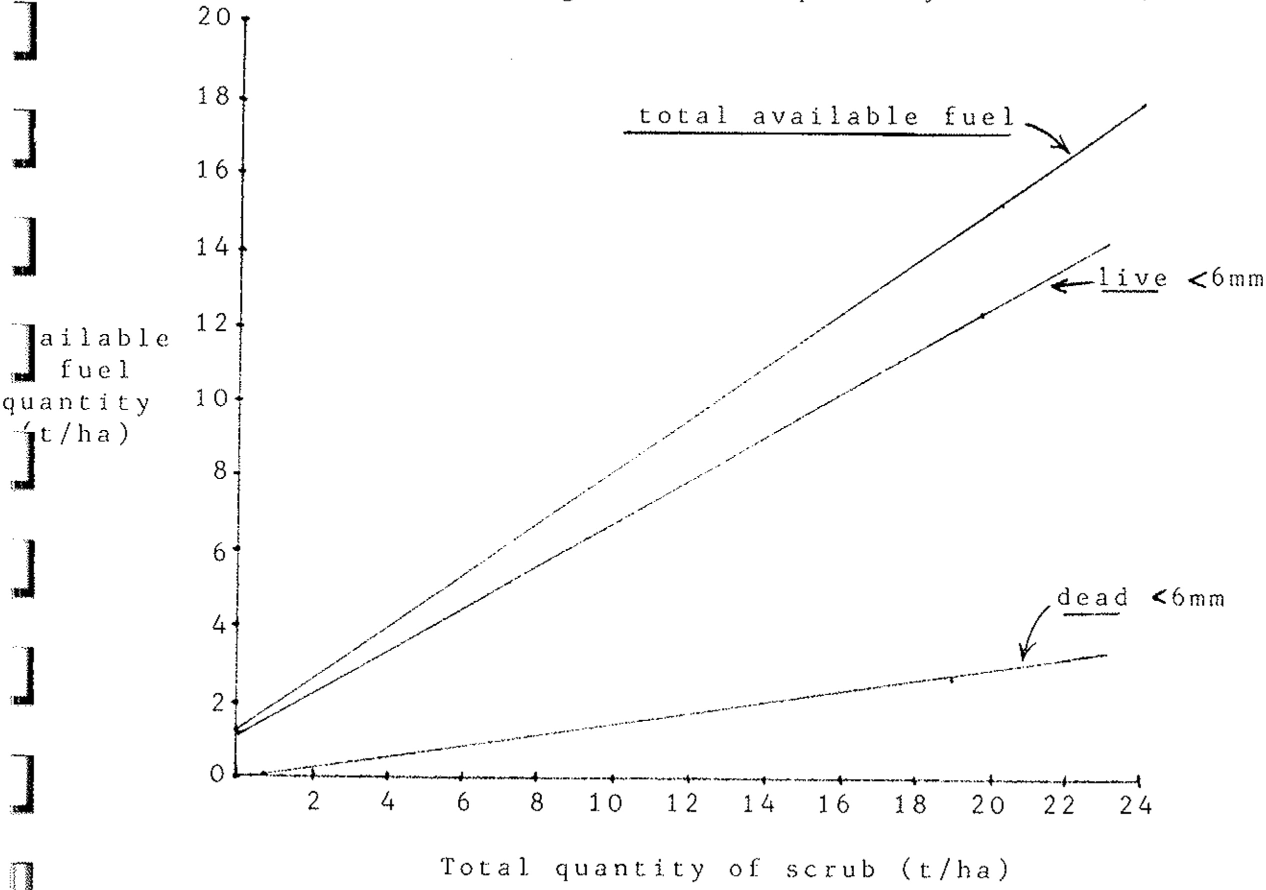



FIGURE 6: Quantity of live and dead scrub fuels less than 6mm in diameter and quantity of fuel available for a given total quantity of scrub (60% cover).



Where scrub was younger than 2 years (since last fire) then little or no trash was recorded, except for the dead stems of original plants killed by the fire. Generally, the quantity of dead material (trash) was about 20% of the total. We expected the proportion of dead material to increase with increasing scrub age, but this did not show in the data. It is possible that too few samples were taken over a limited range of fuel ages. With the exception of 8 samples taken in 20 year old fuels, all sampling was in fuels younger than 6 years (100 samples in all).

## Conclusions

Litter build-up in Banksia woodlands is very slow ($\sim$.3 t/ha/annum) and is very patchy. Therefore, litter plays a minor role in fire behaviour. There may be localized exceptions, where Banksia stocking is particularly high (20$m^2$/ha).

Scrub is the most important fuel component. While it is also patchy, reasonably good relationships were developed to enable the prediction of scrub fuel accumulation rate. However, there is a need to relate this to fire behaviour.

Generally, total scrub biomass increases at about 1 t/ha/annum. Of this, only about 60% is likely to be burnt.

Better fuel dynamic relationships could be developed by more intensive sampling and by sampling a wider range and number of fuel ages. In spite of this, the relationships expressed here are workable and should assist fire controllers in the Wanneroo District and areas with similar rainfall and vegetation types.

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