

# Visual Fuel Load Guide for Denmark Shire



Bush Fire and Environmental Protection Branch



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Fire & Emergency Services Authority of Western Australia  
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This publication is intended to be a guide only and readers should obtain their own independent advice and make their own necessary enquiries.



## Introduction

Many factors influence fire behaviour but none is more significant than fuel. The availability, size, arrangement, moisture content and type of flammable material available all contribute to what can be considered as fuel. An appreciation of the range of variables affecting fuels assists with a prediction of the likelihood of fire and fire behaviour under certain conditions. This enables better management of risks and assessment of the best fire suppression options.

As a fuel load increases the potential bush fire run (rate of spread) and heat output (fire intensity) increases, thus increasing the risk to life, property, the environment and firefighter safety as well as diminishing suppression options.

### Purpose of this booklet

This booklet is a reference guide to enable fire managers and other stakeholders to visually estimate fuel loads in tonnes per hectare (t/ha) and provide an estimate of the potential fire risk. This booklet will also assist in fuel load management planning and the preparation of fire prescriptions.

### The Denmark Shire

The Denmark Shire is situated within the south west of Western Australia (Figure 1). It covers an area of 1843 km<sup>2</sup>.

Denmark Shire covers two biogeographic regions:

- Jarrah Forest; and
- Warren.

The area is characterised by jarrah-marri forest on the laterite gravel, marri-wandoo on the clay soils, *Agonis Spp* shrublands on the eluvial and alluvial deposits and *Melaleuca Spp*/sedge swamps on the leached sandy soils.

The rainfall, soil types and vegetation within Denmark Shire have a direct impact on the available fuel load and therefore the fire behaviour in the region.

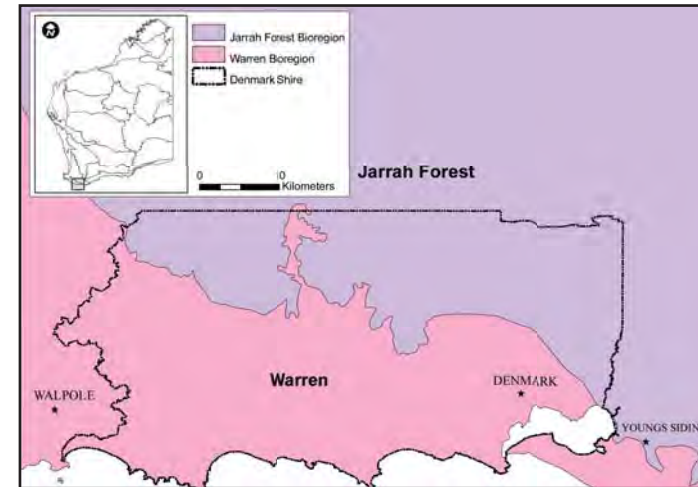


Figure 1. Denmark Shire

## Methods of fuel sampling

The method used by FESA to calculate fuel loads and develop the guide is based on a representative fuel load sample.

A 1 m<sup>2</sup> quadrat is placed over an area of vegetation that is representative of the broader sample area. All vegetation from within the quadrat, that is less than 10 mm in diameter, is collected and dried in an oven. The dried weight of the sample is then converted into tonnes per hectare (t/ha). The white square displayed in each of the photos represents the area that was sampled.

### Fuel load calculation

Dried weight (grams per metre<sup>2</sup>) / 100 = fuel load (t/ha)

## How to use this Guide

This guide is intended to assist the user in visually estimating fuel loads. It provides a non-destructive means of assessment, in that the user does not need to remove vegetation in order to gain an estimation of the fuel load for a particular area.

The guide is divided into two sections:

- 1 Scrub fuel assessment.
- 2 Leaf litter fuel assessment.

Use the photos in the book to visually assess the scrub fuel (t/ha). To assess the leaf litter fuel, measure the depth of the leaf litter using a ruler and convert your measurement into tonnes per hectare using Table 1 (page 22).

**If there is both scrub fuel and leaf litter fuel present, the two fuel assessments must be added together to determine the overall fuel load.**



## 0 –5 tonnes per hectare

<2 t/ha scrub fuel (also with 37 t/ha leaf litter)



<2 t/ha scrub fuel (also with 46 t/ha leaf litter)





3 t/ha scrub fuel (also with 21.1 t/ha leaf litter)



3 t/ha scrub fuel (also with 8.5 t/ha leaf litter)





**4 t/ha scrub fuel** (also with 34.6 t/ha leaf litter)



**4.5 t/ha scrub fuel** (also with 2.8 t/ha leaf litter)





## 5–10 tonnes per hectare

6.5 t/ha scrub fuel (also with 11 t/ha leaf litter)

7.5 t/ha scrub fuel (also with 6.9 t/ha leaf litter)

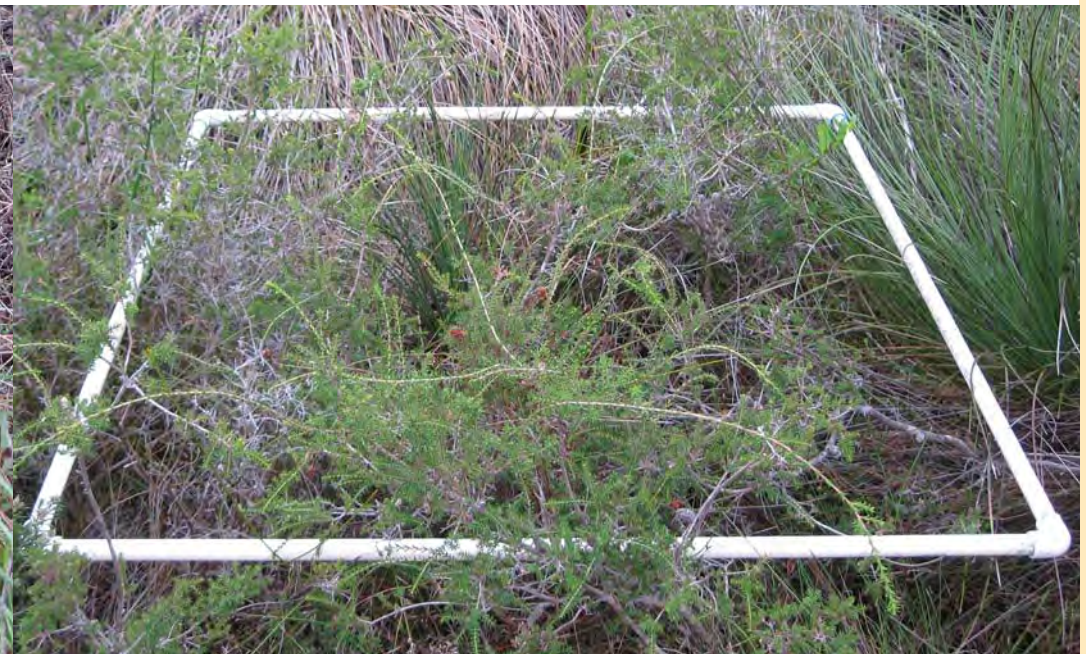
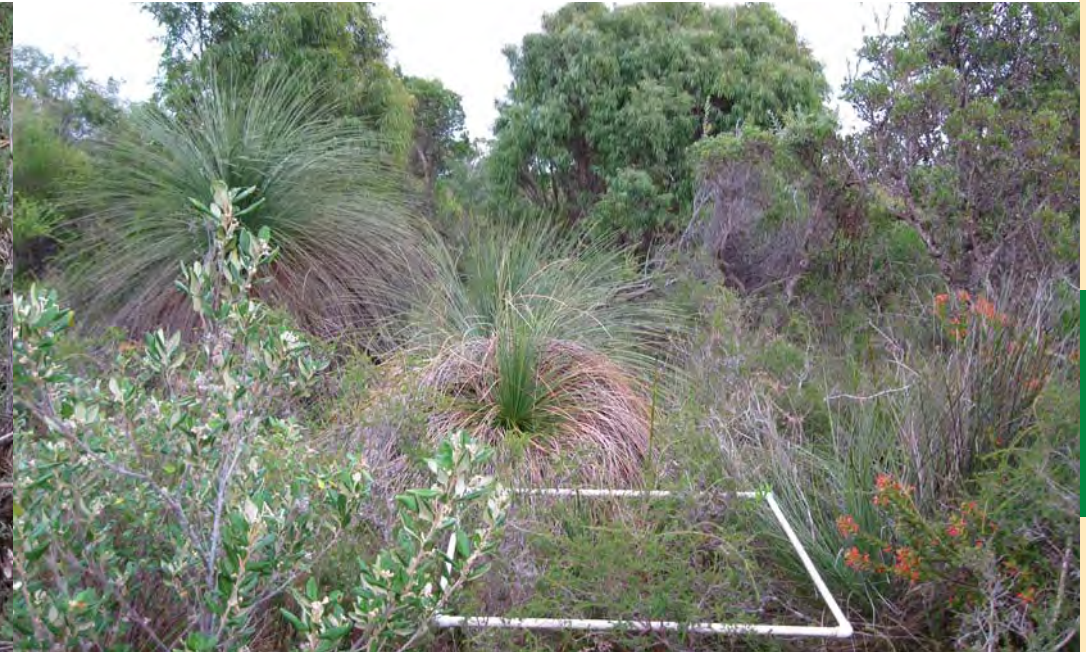




## 10–15 tonnes per hectare

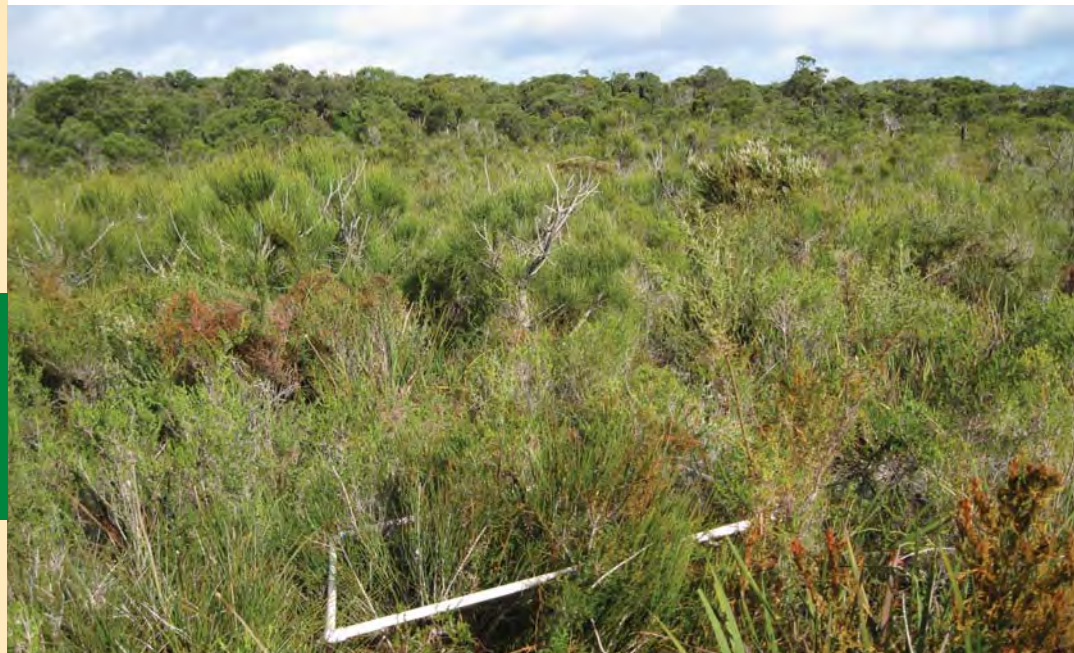
8 t/ha scrub fuel (also with 7.17 t/ha leaf litter)

10 t/ha scrub fuel (also with 5.4 t/ha leaf litter)





10.5 t/ha scrub fuel



11 t/ha scrub fuel





12 t/ha scrub fuel (also with 12 t/ha leaf litter)



15 t/ha scrub fuel





18.5 t/ha scrub fuel

20.5 t/ha scrub fuel

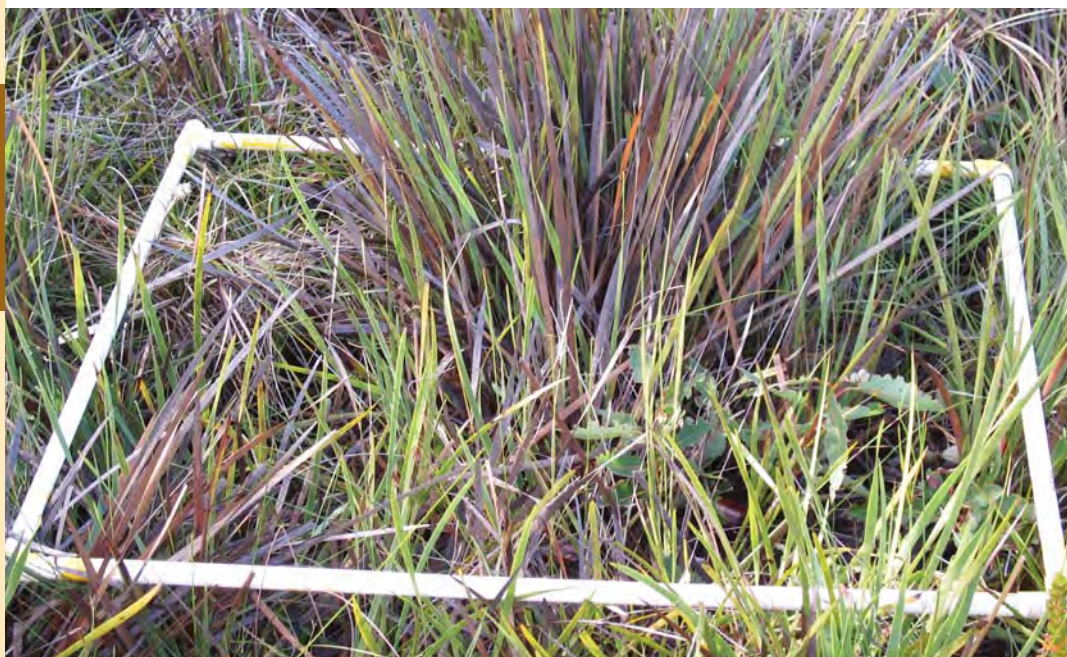




22t/ha scrub fuel



24.5t/ha scrub fuel





# Leaf litter

Leaf litter is an accumulated layer of leaves, twigs and bark on the ground. Leaf litter depth varies depending on the type and age of overstorey vegetation and the length of time between bush fires.

If there is leaf litter present, measure the leaf litter depth using a ruler.

Determine the forest type (based on the dominant tree species present) and then convert the leaf litter depth (mm) into tonnes per hectare (t/ha) using Table 1.

If there is also scrub fuel present, add the scrub fuel load (t/ha) and the leaf litter fuel load (t/ha) together to obtain the overall fuel load.

**Note:** Leaf litter includes twigs up to 10 mm in diameter.

Litter depth (mm)	Forest type					
	Karri dominant	Mixed M., J., K.	Jarrah dominant	P. pinaster needle	P. radiata needle	Wandoo
	Litter weight (tonnes/ha)					
5	3.2	2.6	2.7	2.5	2.8	4.4
10	6.4	5.1	5.3	4.9	5.2	8.8
15	9.6	7.7	8.0	7.4	7.2	13.2
20	13.0	10.3	11.0	10.0	9.0	17.6
25	16.0	13.0	13.0	12.4	10.7	22.0
30	19.0	15.0	16.0	15.0	12.0	26.4
35	23.0	17.0	19.0	17.0	14.0	30.0
40	26.0	19.0	21.0	20.0	16.0	
45	29.0	22.0	24.0	22.0	18.0	
50	32.0	25.0	27.0	25.0	20.0	
55	35.0	27.0	29.0	27.0	22.0	
60	39.0			29.0	24.0	
65	42.0			31.0	26.0	
70	45.0			33.0	28.0	
80	51.0			37.0	31.0	
90	58.0			41.0	34.0	
100	64.0			45.0	37.0	

Table 1. Relationship between litter depth and weight (Peet, G.B., Sneeuwjagt, R.J. (1998) *Forest Fire Behaviour tables for Western Australia*. Dept. of Conservation and Land Management).

# Glossary

<b>Biogeography</b>	Geographic patterns of species (plant and animal) distribution and the processes that combine in a location to produce areas of natural occurrence.
<b>Fuel load</b>	The dry weight of fine fuel (<10 mm in diameter) per unit area—commonly expressed as tonnes per hectare.
<b>IBRA</b>	Bioregions are large, geographically distinct areas of land with common characteristics such as climate, ecological features and plant and animal communities.  The Australian land mass is divided into 85 bioregions and 403 subregions.
<b>Leaf Litter</b>	The accumulated layer of leaves, twigs and bark on the ground.
<b>Spp.</b>	Plant species.



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