FUEL QUANTITY ASSESSMENT IN PINUS PINASTER

by

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The Jarrah burning guide contains a table of fuel weights, the compilation of which involved the simple task of relating fuel weight to canopy cover and fuel age; however, fuel quantity values for Pinus pinaster cannot be obtained so readily since ground fuel weights depend largely on crown area and density. These are two parameters subject to a great extent by numerous factors, including site, strain, ground slope, thinning intensity, geographical location etc. In effect, ground fuel weights vary markedly within and between plantations containing the same conifer species. The position is further aggravated by the introduction of thinning slash.

Since a fuel quantity table appears to be out of the question for the time being at least, the alternative presented is a method of rapid fuel quantity assessment which can be applied by an inexperienced operator armed simply with a girth tape and a fuel depth gauge. The proposed system, its derivation and application will be explained in two sections; firstly, that in which the unthinned stand is considered and secondly, the thinned stand.

THE UNTHINNED STAND

Early investigations indicated a marked relationship between Pinus pinaster fuel depth and fuel weight which resulted in a 100 quadrat sampling trial being carried out in a fourteen year old unthinned stand. Where Y represented fuel quantity in tons per acre O.D.W. and X represented fuel depth in inches the resultant curve was $Y = 1.737 + 3.2468X$ which was significant at the 99% level with a coefficient of determination of .89 (Fig. I limits set at 95%).

The regression was tested against FQ/FD data taken from experimental spot fires run in sixteen year old fuel which had a maximum depth of three inches. The resultant curve, $Y = 2.12 + 2.91X$, significant at the 99% level with a C. of D. of .60 showed a remarkably good comparison.

A field test was carried out in McLarty plantation in which a twenty eight acre compartment (1A) was gridded at approximately 2 x 1 chains and 108 depth measurements taken which gave an average depth of 2.23 ± .1" with an average fuel quantity of 8.98 tons per acre. and a 95% significance range of 8.33 to 9.63 tons per acre. With a minimum of four depth measurements per acre, a thirty acre compartment can be sampled comfortably by one operator within half an hour. Precise gridding of the area is unnecessary but depth measurements should be taken at intervals of twenty two paces in lines roughly parallel to each other at approximately two chain intervals. A fuel depth-fuel quantity table has been drawn up (Table 1) which relates T.P.A. to half inch depth classes.

THE FUEL CONTOUR

It is obvious from what has gone before that the drawing up of a fuel contour plan for any compartment is a simple matter and this has been done for the compartment in question (fig. II). Contour strata can be set as desired. The plan illustrated has three strata – white represents area with less than eight tons per acre; hatching represents area with eight to fourteen tons per acre and the black area represents fourteen to twenty tons per acre. The latter would indicate pockets of heavy fuel which in the event of controlled burning would require careful attention, particularly in the unthinned stand.

THE THINNED STAND

The system devised for thinning-slash utilises the weight of flash fuel per tree top times thinning intensity, thus giving available flash fuel in tons per acre.

The task of finding the amount of needles and twigs per thinning crown by total crown sampling appeared cumbersome, therefore the parameter – O.D.W. of fuel per foot length of leading branch was devised for both needles and twigs less than half inch thick. Sampling was carried out until a variance ratio of less than 5% was reached for both needles and twigs. There was no relationship between the amount of fuel per foot branch length and the butt girth of the crowns sampled, therefore the parameters were considered acceptable.

The total leading branch length per thinning crown was related to crown butt girth for 100 measured crowns and gave the curve (fig. III) $Y = 18.11X - 79.6$ (sig.) 99%; C of D = .77 where the independent variable represented crown butt girth in inches. The table drawn up (Table II) represents oven dry weights for needles and twigs in tons per cent: therefore knowing the number of thinning tops per acre and their mean butt girth, the amount of available slash fuel is arrived at from the table in tons per acre O.D.W.

To arrive at the mean butt girth of tops in a thirty acre compartment it is suggested that a random sample of fifty girth measurements be taken. However, the operator with the statistical niceties at his finger tips will be able to arrive at a suitable sample number and thus relieve himself of unnecessary toil and trouble. Girth sampling is taken in conjunction with depth sampling. Where thinning intensity is unknown, the sample lines may be used in a line intersect method for assessing the number of tops per acre.

It is intended that information concerning the type of fuel depth gauge best suited for sampling P. pinaster fuel and instructions for its use will be included in a future issue of Forest Notes.

Table I. P. pinaster fuel depth (ins.) – Tons per acre (ODW)

Depth	T.P.A.	Depth	T.P.A.	Depth	T.P.A.
0.5	3.36	3.0	11.48	5.5	19.59
1.0	4.98	3.5	13.10	6.0	21.21
1.5	6.61	4.0	14.72	6.5	22.84
2.0	8.23	4.5	16.35	7.0	24.46
2.5	9.85	5.0	17.97	7.5	26.09

Table II. P. pinaster Crown butt girth (ins.) – Foliage and Twigs – Tons per acre (ODW).

Girth	Foliage	Twigs	Girth	Foliage	Twigs
6.0	.17	.04	13.5	.95	.23
6.5	.22	.05	14.0	1.00	.24
7.0	.27	.07	14.5	1.07	.26
7.5	.32	.08	15.0	1.11	.27
8.0	.38	.09	15.5	1.16	.28
8.5	.43	.10	16.0	1.21	.29
9.0	.48	.11	16.5	1.27	.30
9.5	.53	.13	17.0	1.31	.31
10.0	.59	.14	17.5	1.37	.33
10.5	.63	.15	18.0	1.42	.34
11.0	.69	.17	18.5	1.47	.36
11.5	.74	.18	19.0	1.53	.37
12.0	.79	.19	19.5	1.58	.38
12.5	.85	.20	20.0	1.63	.39
13.0	.90	.21			

Fig. I

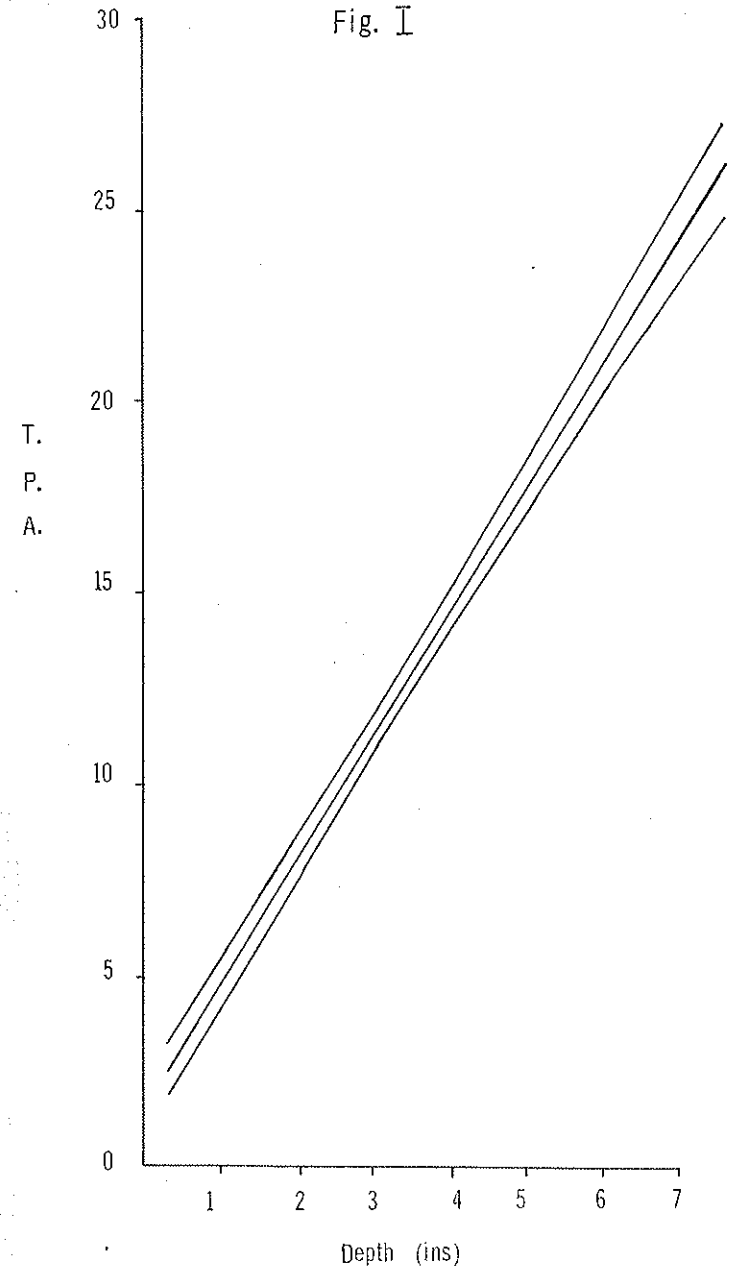
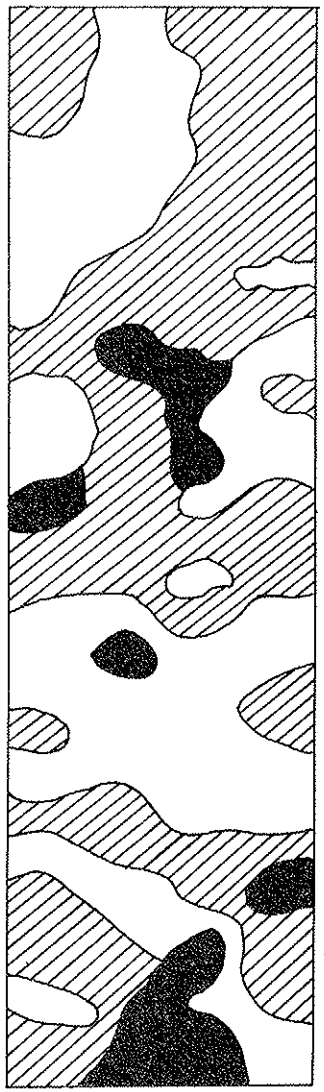


Fig. II



Mc Lartys IA 28 acres
Planted 1956
Assessed Sept. 1970

Fig. III