

# FORESTS DEPARTMENT

OF WESTERN AUSTRALIA

54 BARRACK ST. PERTH

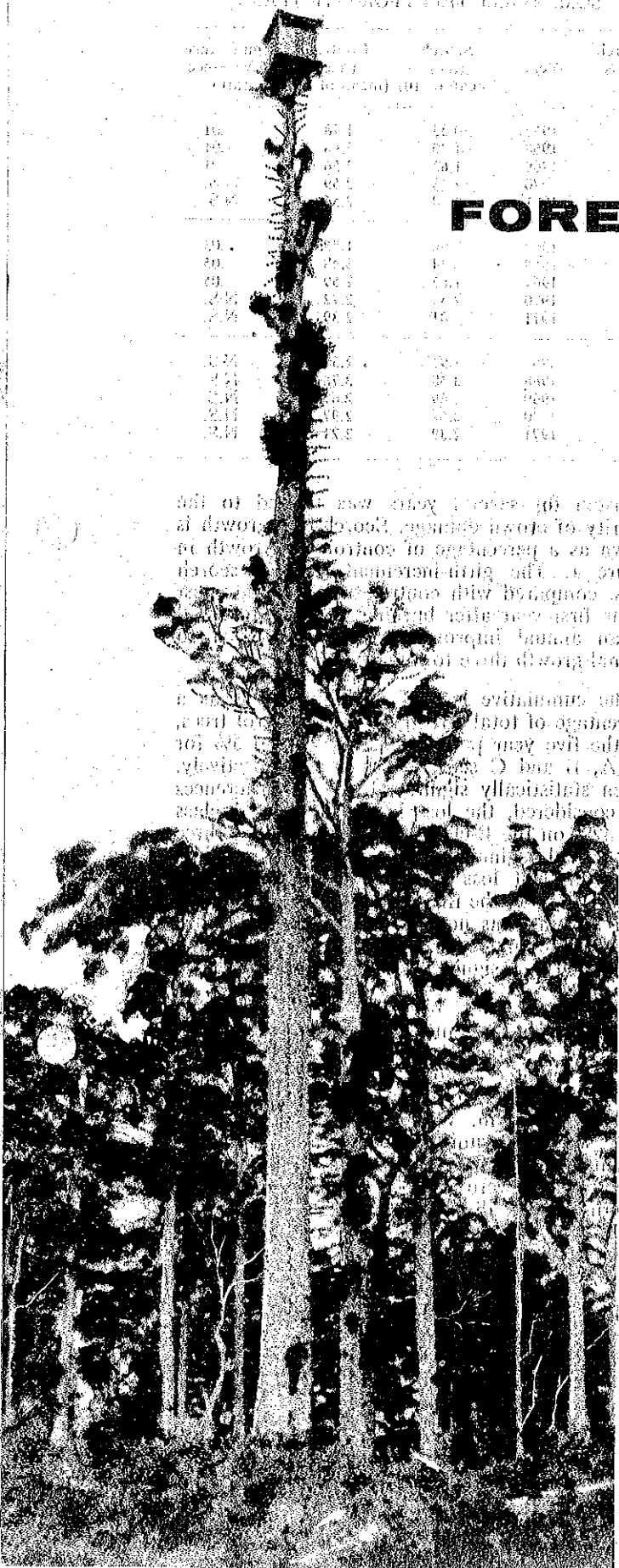
## RECOVERY OF MARITIME PINE (*Pinus pinaster*) AFTER SEVERE CROWN SCORCH

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### SUMMARY

During prescribed burning operations on maritime pine (*Pinus pinaster* Ait.), two types of crown scorch may occur: light crown scorch in which only the foliage is affected; severe crown scorch in which branch-kill takes place resulting in reduction of green-crown height with a corresponding loss in girth increment. Growth trials give a recovery time for severely scorched trees:



## INTRODUCTION

Thirty-eight and 19-year-old maritime pine were studied to find the effect of crown damage by fire on girth growth. Measurements of both size classes were maintained until the prolonged effect of crown damage on girth growth declined to an insignificant level.

## METHOD

### Somerville trial

Prescribed burning took place in 38-year-old 14 m high maritime pine in Somerville plantation during September 1966. In a stand which had been thinned to 6.4 m spacing prior to burning, a number of trees were severely scorched by the ignition of heaps of thinning slash 2.4 to 3 m high. Where the slash heaps lay almost directly beneath the standing-tree crowns, severe crown damage resulted. Although a number of tree crowns were considerably reduced in size, there was no visible sign of damage to the tree boles. The average bark thickness of the measured trees was 3.3 cm prior to burning.

From a 1.6 ha site on fairly level ground in the Somerville plantation 10 trees were selected in each of three scorch categories comprising trees with (A) 0.5 m, (B) 1.5 m and (C) 3.0 m green tip remaining. The damaged trees were matched by girth with burned but unscorched trees within the area. The average crown height of the control trees was 7.6 m. The 60 trees were fitted with aluminium girth growth bands at 1.30 m and measurements were taken at monthly intervals for five years commencing February 1967, six months after burning took place.

### Gnangara trial

In a post-thinning burn carried out in 17-year-old 12.8 m high maritime pine in Gnangara plantation during September 1968, a small number of trees had their crown heights reduced by half to three-quarters. There was again no visible sign of bole damage. The average bark thickness of the trees was 2.3 cm and the final tree spacing was 4.3 m.

In this trial, 30 scorched trees, whose crown heights had been reduced by over half, were matched with 30 unscorched trees and both classes were girth banded at 1.30 m, as for the Somerville trees. Girth measurements were taken monthly for three years.

## RESULTS

### Somerville trial

Growth for each of the scorch and control trees was analysed yearly, beginning in February 1967 and ending in March 1972 (Table 1). A marked deterioration in growth rate which

TABLE 1  
AVERAGE GIRTH INCREMENT (cm) FOR  
SOMERVILLE TREES FOR FIVE YEARS

Scorch class	Year	Scorch trees (mean of 10)	Control trees (mean of 10)	Significance of variance ratio
A 0.5 m green tip	1967	0.33	1.78	.01
	1968	1.30	3.48	.01
	1969	1.63	2.56	.01
	1970	2.13	2.59	N.S.
	1971	2.18	2.56	N.S.
B 1.5 m green tip	1967	0.96	1.85	.05
	1968	2.34	3.48	.05
	1969	1.85	2.59	.05
	1970	2.34	2.72	N.S.
	1971	2.01	2.39	N.S.
C 3.0 m green tip	1967	1.91	2.54	N.S.
	1968	3.68	3.78	N.S.
	1969	2.69	2.67	N.S.
	1970	2.62	2.97	N.S.
	1971	2.39	2.21	N.S.

persisted for several years was related to the severity of crown damage. Scorch-tree growth is shown as a percentage of control-tree growth in Figure 1. The girth-increment loss of scorch trees, compared with control trees, was greatest in the first year after burning and was followed by an annual improvement until a return to normal growth three to four years later.

The cumulative loss of girth increment as a percentage of total girth growth of control trees, for the five year period, was 42, 27 and 5% for the A, B and C scorch-class trees respectively. When statistically significant growth differences are considered, the loss is 65% on the A-class and 42% on the B-class trees for an initial three year period beginning six months after scorching. No significant loss took place on the C-class trees. However, the first six month growth period after burning was not accounted for, and, since the damage happened during the main annual growth surge, a significant if slight loss may have occurred.

Tree heights were measured at the start of the trial with a "Haga" altimeter and at the end, with a "Suunto" clinometer. The mean original tree height was 13.7 m and the mean final tree height was 15.2 m. With an expected 5% error from both instruments used and a height increment of barely 0.3 m per annum, the measurements were thought to be unreliable for detecting height differences between the damage classes but suitable for discriminating between green-crown height changes over a five year period.

The original green-crown height of the control trees was 7.6 m which increased to 8.2 m five years later. Crown heights for the damaged trees (Table 2) had not returned to normal even five and a half years after burning.

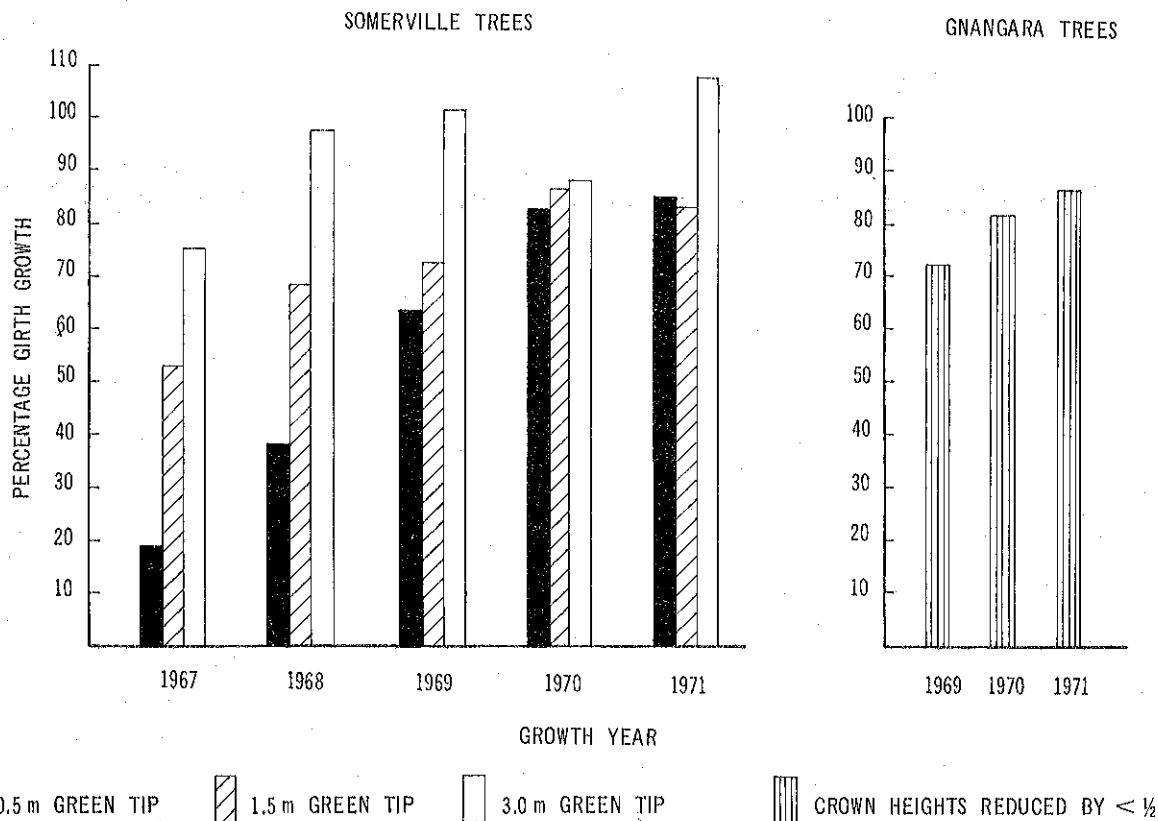


FIGURE 1: Scorch-tree growth as a percentage of control-tree growth

**TABLE 2**  
 RECOVERY OF GREEN-CROWN HEIGHT (m) FOR  
 SOMERVILLE TREES 1967 TO 1972

Scorch class	Original (mean of 10)	Final (mean of 10)
A	0.46	5.83
B	1.52	5.83
C	3.04	6.52
Control	7.53	8.38

**Gnanagara trial**

The girth increment loss due to depletion of the 17-year-old trees' crowns by burning (Table 3) resembled that of the 38-year-old Somerville trees in which the lower half of the crowns had

**TABLE 3**  
 AVERAGE GIRTH INCREMENT (cm) FOR  
 GNANGARA TREES FOR THREE YEARS

Scorch intensity	Year	Scorch trees (mean of 30)	Control trees (mean of 30)	Significance of variance ratio
50-70% crown scorch	1969	1.35	1.85	.01
	1970	1.88	2.31	.05
	1971	1.88	2.16	N.S.

been severely scorched. Measurement of the Gnanagara trees began soon after scorching and stopped in October 1971. The cumulative loss of girth increment as a percentage of total girth growth of control trees, for the three year period, was 19%. The significant girth-increment loss during the first two years after burning was 23%.

**CONCLUSION**

Green-crown height reduction by burning in maritime pine is followed by several years reduction in girth increment, but where branch-kill is limited to the lower crown, the detrimental effect appears to be negligible. It is doubtful, therefore, whether light crown scorch in which no branches are killed can result in loss of tree growth.

**REFERENCES**

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The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

In the second section, the author details the various methods used to collect and analyze the data. This includes both manual and automated processes, highlighting the challenges of data integration from multiple sources.

The third part of the document focuses on the results of the analysis. It shows a clear upward trend in the data over the period studied, which is attributed to several key factors discussed in the text.

**CONCLUSION**

The findings of this study indicate that the current system is effective in capturing and analyzing the data, but there are still areas for improvement.

The first recommendation is to improve the data collection process by implementing more robust validation checks. This will help to reduce the number of errors and ensure that the data is more reliable.

The second recommendation is to enhance the reporting capabilities of the system. This will allow users to generate more detailed and customizable reports, making it easier to identify trends and anomalies.

Finally, it is recommended that the system be regularly updated to incorporate new features and address any security vulnerabilities. This will ensure that the system remains current and secure.

In conclusion, the data analysis shows a positive overall performance, but the implementation of the recommended changes is crucial for long-term success. The system's ability to handle large volumes of data and provide timely insights is a significant advantage, provided that the data is accurate and the system is well-maintained.

The author would like to thank the management and staff for their support and cooperation throughout the project. Their input and feedback were invaluable in identifying the areas for improvement and ensuring that the final report meets the needs of the organization.

The data was collected over a period of six months, from January to June. The sample size was large enough to provide a statistically significant analysis of the trends. The results are presented in the following tables and charts.

The overall trend shows a steady increase in the number of transactions, with a slight dip in the middle of the period. This is likely due to seasonal variations in the market. The data also shows a high correlation between the variables studied, suggesting a strong relationship between them.