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THANKS TO ROGER J. UNDERWOOD

by P.N. HEWETT

After many years of battling with slow writers, inert writers, printing problems and so on, Roger Underwood has hung up his blue pencil. During the time since Roger first assumed the responsibility for production of forest notes there has been a number of changes and many improvements. The inclusion of safety news, regional notes and the production of some special issues have all helped to make this publication an important part of Departmental output.

Forest Notes has served to improve communications between Divisions, an outlet for an increasing amount of research data, and a forum for officers to indulge to some extent in their allied interests of botany, bird watching, anthropology and so on.

This and future editions will be edited at Como by Ian Lennon who is technical editor for the Department. We would appreciate everybody's continued help in the provision of material for publication, and will continue Roger's policy of minimal editorial change.

26 Egham Road
VICTORIA PARK W.A.6100

24th December, 1973.

The Editor
"FOREST NOTES"

Dear Roger

Congratulations to L. Talbot on his carefully researched article "Karri Thickets Before Settlement" (Forest Notes Vol. 11, No. 2), which I read with great interest. I have always felt a strong element of doubt on this old and often repeated assertion that the Karri forest was much more open in the old days. In considering this statement one should I suppose eliminate the disturbed cut over forest from consideration. In 1919 and 1920 I was working in the first assessment camps ever to examine the Karri forest, the extent of which was then unknown. The camp that I was assigned to worked almost exclusively in virgin forest and there was no shadow of doubt that at that time the major part of it was covered with exceedingly dense Karri Wattle and Hazel thickets. Penetration of some of them was extremely difficult and almost impossible to haul a five chain band through. True there were areas of more open and park like forest but these were few and far between, and my impression was that the bulk of the virgin Karri forest had a dense ground cover of wattle and hazel. It can be said that I was looking at this forest some forty or fifty years after white people had come into the fringes of it but the fact remains that access into it was very limited and we had to cut most of our own access tracks. I find it very hard to accept the view that in a space of fifty years the white man's habits had turned an open park like forest in to one in which the ground was covered with very dense thickets. There is no doubt that Mr Talbot's researches support this view.

In looking through some old Forestry Journals recently I came across the enclosed "Lament from a Lookout Tower", which might be of interest to some readers. I spent some time on lookout duty on Mt. Gungin in the summer of 1921-22 which included Christmas day of 1921 and I have no difficulty in recalling the lovely fried, half-rotten sausages I had for dinner on that day. We spent week and week about, relieving each other by saddle and pack horse.

Bedding and stores for the week were carried on the pack horse by the relief, and were returned to H.Q. by the man going off duty. With regard to the use of helios with which we were all required to be proficient, I well remember the occasion a woodcutter rode a lathered and knocked up horse into Sawyers Valley and raced into the hotel to tell his listeners that Mt. Dale was in full eruption and he had seen a number of brilliant flashes on the top to prove it. If one happens to be directly in line with a transmitting heliograph one would certainly see a brilliant flash at a distance of many miles. I expect it took him a good while to live that one down.

Sincerely,

D.H. PERRY.

Extract from "The Australian Forestry Journal" January, 1925.

A LAMENT FROM A LOOKOUT TOWER.

The following interesting document has been received from one of the employees of the Western Australian Forest Service, Mr J. Perry, after a week's sojourn on fire look-out duty in the heart of the jarrah forest. It may be of interest to readers as giving a description of the daily life of a lookout man, as well as showing the attitude of the fire-fighter towards his job :

"My thoughts grow hazy. Here I am, like Alexander Selkirk, monarch of all I survey; and I'd give it all for a bath and a cool drink. But there! such luxuries are not for forestry employees on watch-tower duty.

"Ah! there - a flickering dot of light in the distance, that steadies and becomes motionless as I look. My own helio is already set up and sighted on the spot where the dot of light shines. xx I tap out, dash, dot, dot, dash, xx flickers the tiny pin-point of light in acknowledgment. Alert and watchful once more - even that wee dot of light reminds me there are other humans in the world, even though they be 12 miles distant at Greystones. 'Tis true it is not I they are personally interested in - all alone on Mount Dale though I be. No! what they signal for is not to inquire if little Sammy is well and fit, or if he'd like a cool drink. No, indeed! their request is 'Hows things?. Is their area clear of fire? Life! just everybody for themselves.

"Once more I relapse into thoughts, and am just spending riotously a portion of the Tatt's ticket which one always hopes to win, when - a wisp of smoke rises. A bearing taken on it with the theodolite, in conjunction with one taken simultaneously from Mount Gunjin lookout tower, places it outside the area. I have just located the fire on the map when the telephone rings. 'Hullo, hullo! Dale, this is Barton's speaking. Howdy? 'All clear on the area' I reply. 'It's pretty warm. Say, Bill, when you're on Dale, did you see any butterflies? 'Sure thing, Sam, you can always see them when you've been there four days - you can't see them yet. You've only been up two days.' 'Well, I can anyway, big black and white ones.' 'Oh, my lad, they are there all the time. It's the coloured ones that turn up after four days. Well, so long, Sam. Good luck.'

"Having entered up the calls, helio, and telephone, in the time message book, and taken another survey of the country spread out for miles below the lookout tower, I pick up the only book on the tower I have not read, and try again to get up an interest in the impossible characters. Jessie, the simple country maiden, rejects with scorn the Lord of the Manor, in favour of the noble-hearted ploughman, etc. etc. Oh, drivel, and I've five more days to put in. I'll be reading the ads of pink pills ere those five days are gone. Oh, well, it's all in a lifetime, and a rest cure at that. Next week some other poor blighter will take my place. There's the view, that's worth a good deal; from Mount Bakewell in the east, far past Chidlow's in the north, away over Rottnest in the west, and bound by the Jarrahdale Range to the south. It is a fine panorama.

"The State forest over which we keep a lookout for fires is quite a small part of the view, occupying only one of the four sides of the tower, which consists of a small open-sided hut mounted on a 25-foot tower. It is equipped with a theodolite and map for finding and locating fires; a heliograph for communicating with any of the Forests Department employees in the State forest, and a telephone connection to Mount Gunjin Lookout Tower, to Barton's Forest Station, and to Forest Headquarters at Mundaring Weir itself. Thus communication can be established any time between Forest Headquarters and any employee in the bush.

"To date, it has been ideal weather for prevention of fires - late rains and cool nights, quite the reverse of last season, when the hot dry weather and gales of wind made it almost impossible to cope with the miles of country that had been so maliciously set alight.

"I have often though (and Dale is a rare place for one to find time to think) that an enforced term of fire-fighting would perhaps have more effect as a deterrent on an incendiary than imprisonment. Consideration, then, for those who have to fight the fire might sway them more than the fact that it is their own wealth they are burning when they light the country for miles.

"The afternoon draws in. A final 'all clear' has been flashed to the helio. sub-station at Greystones, Barton's Forest Station, and headquarters have been given the same message by telephone, a final 'So long' to Gunjin, and down I go to the hut below the tower for tea. Quickly the sun sinks; it is dark now, and the wind that ever blows on Dale murmurs in the trees around the hut, a brush rustles by. Away on the western horizon Rottnest Lighthouse is blinking, the only sign of civilisation - about 40 miles away, I think.

"The hard-hit hero of some of our modern best-sellers, who retires to an obscure spot to 'find himself,' should assuredly come to Dale. No one will ever interrupt him and there are many thousands of large stones in the granite ridge that forms the backbone of the hill, under which he could prosecute his search."

Australian Forestry Journal
15th January, 1925.

Forests Department
HARVEY

November 23rd, 1973.

The Editor
"FOREST NOTES"

Dear Sir

Attached is an extract from a Harvey Division file which would be of interest to readers of Forest Notes. It concerns a prescription for regeneration burning in the jarrah forest and was written by S.L. Kessell in 1931.

Rather risky, but the results were excellent regeneration!

Yours

P.N. SHEDLEY.

FINAL BURNING - JARRAH REGENERATION OPERATIONS

The final burn is one of the more important operations associated with regeneration work in the jarrah forest which has not received the careful study it deserves in all districts. No detailed rules can be held to apply to all classes of jarrah forest, but there are certain guiding principles which should be followed, and a satisfactory technique built up to meet local conditions. These may be considered under the following headings:-

1. TIME TO BURN

With few exceptions, it will be found that most satisfactory results will be secured in the latter half of February. To hold over the work until March is risky, as changes in weather may render it impossible to secure the necessary conditions.

2. WEATHER CONDITIONS

High temperatures associated with steady winds which can be relied upon to continue from the one quarter while the burn is being carried out are essential. The periods during which steady winds can be relied upon from one quarter, when high temperatures prevail, are of infrequent occurrence and, in consequence, a gang of 4 or 5 men is necessary so as to complete the burning of the compartment on lines set out hereunder within a few hours from the time the first fire is started.

3. PERIOD OF TIME BETWEEN TREATMENT AND BURNING.

This is a local problem which must be studied separately for each compartment, but there are two principal considerations which must be constantly borne in mind -

a. The floor of the compartment must be cleaned up so that it will not carry a fire for several years after the burn, and banksia logs and smaller marri and jarrah saplings should be burnt up to an extent that will render controlled burning after the first thinning possible without damaging the regrowth.

b. It is hopeless trying to save coppice which has developed since treatment and odd small saplings at the time of the final burn. The coppice should be completely burnt off, so that a new crop will start from the stool, while the odd small saplings should have been cut down at the time of treatment. Small poles which have been cleared around can be saved if the instructions hereunder with reference to burning in strips are followed.

It is false economy to try to save coppice or saplings a few years old and sacrifice a clean burn on this account. A clean floor with a minimum of damage to the poles, piles, and bigger trees remaining should be the object aimed at.

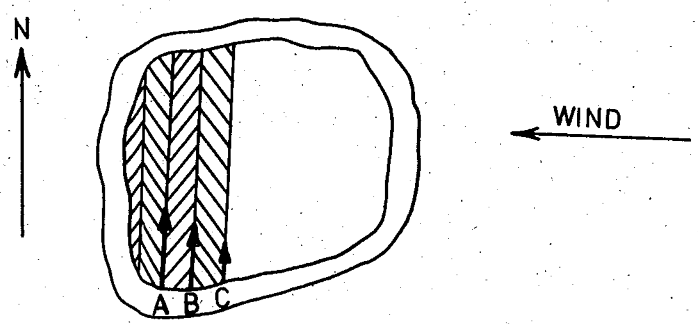
4. ORGANIZATION AND EQUIPMENT NECESSARY FOR FINAL BURN.

It is desirable to have at least four men, if possible, to handle an average compartment on which there is a fairly heavy accumulation of debris. Each man should be supplied with a kerosene torch, axe, rake and water-bag.

5. METHOD OF BURNING

In the majority of cases, it will be advisable to see that the fire belt is burnt when treatment begins or earlier to protect the compartment against an accidental fire while the debris is drying out. The scraper track or plough line round the compartment should be freshened up immediately prior to the burn.

The actual burning should be carried out by setting fires along narrow strips at right angles to the direction of the wind, which should be strong and steady. This is illustrated by the diagram hereunder :-



The first country lit is a narrow strip averaging half to 1 chain in width to allow the fire to burn with the wind to the break on the leeward side of the compartment. When this strip is burnt and the man in charge is satisfied that the fire is safe on the leeward face of the compartment, a man starts the next strip from A, a point 1-2 chains to the east, and when he has advanced a chain or two, a second man starts from the point B, a similar distance from A. This echelon formation is continued until all the men are on the opposite side of the compartment, when the same procedure in an opposite direction is repeated until the compartment has been burnt. It will be found that the strips can be widened to three chains as the work progresses.

The narrow strip method outlined above is important and essential. It prevents whirling and also insures that the whole compartment shall be thoroughly burnt on a hot day without a scorching fire being allowed to develop which will wither off the leaves of the green trees remaining on the compartment. The greater the number of growing trees remaining, particularly in the pole stage, the more important it becomes to keep the strips as narrow as possible.

6. EXCEPTIONS TO THE ABOVE PRACTICE.

There are compartments met with in certain districts which are more or less fully stocked with good regrowth. The major operation on these compartments is therefore in the nature of a thinning and regeneration cleaning is of secondary importance. In such cases, it may be necessary to stack and burn the tops in the small openings made, for the purpose of securing additional regeneration, but care must be taken that unnecessary work is not done in this way, as very often there are sufficient trees to make a final crop.

Perth
28/5/31.
SLK/MD

CONSERVATOR OF FORESTS.

FIRE DETECTION USING AIRCRAFT

A Note on a Trial at Pemberton During the 1973/74 Season.

R.J. UNDERWOOD

Fire detection in W.A. State Forests has traditionally been built around the use of Lookout Towers and over the years a comprehensive system of towers has been installed and manned. Most of us have "grown up" with the tower lookout system and have learnt to work with its inherent weaknesses, some of which are:

(i) Relatively high cost of installation and maintenance of the towers themselves and their communication systems;

(ii) high cost of manning towers, especially with the overhead component allowed for;

(iii) inflexibility in hours of manning related to fire danger index, due to isolation of most towers and the method of payment of towermen by the half-day;

(iv) the indirect view, which even the most perfectly sited towers have over large areas of forest; and

(v) the basic inaccuracies in the "triangulation" method of plotting smokes, particularly as the angles from towers to smoke approach reciprocal bearings.

Despite these difficulties, the tower detection system has always seemed to work quite well and all of us are familiar with examples of brilliant detection work by certain towermen. For these reasons there is a degree of resistance to any change in the system and a conservatism of outlook has developed which is inimical to progress and development in the fire control scene.

Recent trials of aircraft detection at Pemberton, however, may lead to a revolution in this field.

THE PEMBERTON EXERCISE

A decision to conduct a full-scale aircraft detection trial at Pemberton in the 1973/74 fire season was undertaken following a brief exercise at Nannup in the previous summer. The Nannup exercise, lasting only a few days, indicated the potential of the technique and provision was therefore made in the 1973/74 estimates for a full summer's trial in the Pemberton Division. After a number of preliminary discussions, tenders were called and a contract let; a Cessna 150 aircraft being selected by the successful tenderer. The price was $18.00 per hour.

Preliminary work then commenced. This included:

1. Compilation of special plans, mounted in sections on plywood, and showing clearly those ground features readily seen from the air and not usually marked on F.D. 80 maps - e.g. private property areas cleared or uncleared, plots, karri regeneration areas and areas cut to seed trees, repurchased farmlands etc.

2. Training of aircrew in navigation, plotting, smoke descriptions, general features of the area, basic fire control and communications.

3. Calculation of flight patterns and flight times in relation to F.D.I.

The flights proper commenced on 26th November, 1973 when all the Pemberton Towers were also manned. Towers were manned continuously until mid-January so that a detailed comparison with the detection work of the "spotter" aircraft could be made.

FLYING SCHEDULES AND PATTERNS

A flying schedule based on daily forecasts was developed. This is discussed with the pilot at 0800 hours each morning and is basically as follows:

F.D.I. (5 year old karri)	Schedule
White	One circuit at DFO discretion
Purple-Green	Two circuits (a.m.) from 0900 Two circuits (p.m.) from 1300 or 1400
Blue-Brown	Three circuits (a.m.) from 0900 Three circuits (p.m.) from 1300
Yellow plus	Continuous operation 0900-1700 with ½ hour refuelling stop at midday.

The daily schedules are upgraded or down-graded when changes in condition warrant, by DFO or Duty Officer.

The "circuits" referred to involve a pre-determined flight pattern covering the Division and can be "broad" (1 hour turn-around) or "narrow" (30 minute turn-around) as required.

RESULTS

For the trial period December–January when both tower and spotter systems operated simultaneously, an analysis has been made of smoke reports on a number of selected days (wet days were excluded).

During this period, the aircraft reported 379 smokes and of these the towers reported only 181. Only 22 smokes were reported by towers which were not seen by the aircraft. Of these 22, 20 occurred when the spotter was grounded with communications problems which initially bugged the system (a new multi-channel aircraft VHF set was installed just after New Year and since then no communication problems have occurred).

All aircraft plots were very accurate six-figure references accompanied by a description of the origin of the smoke (e.g., "log smouldering in old C/B", or "running fire in grass paddock 50 metres from State Forest, no-one in attendance!") and any other relevant information. A large number of the tower plots were one-tower efforts when cross-bearings from other towers could not be obtained.

In addition, the aircraft was responsible for a number of significant "saves," including the early detection of a private property fire only 50 metres from a pine plantation, the location of a spot fire 800 metres outside the edge of a previous days aerial burn and the "catching" of an incendiarist setting fire to State Forest. In the latter instance, the fire had only burnt a few square metres before a nearby officer arrived on the scene, directed from the air, and the culprit was caught at the scene. None of these fires was picked up at all by the lookout towers.

PROBLEMS

Certain problems have emerged and these are:

1. In nearly every case where the towers and the spotter report the same smoke, the towers make the sighting first. In some instances a time interval of 2 hours occurred between a tower and aircraft siting of a particular smoke. The reasons for this are:

   (i) With a circuit turn-around time of about 1 hour, the pilot only has a certain area of the division in view at any given moment. The tower system, of course, was deliberately designed to provide continuous surveillance over the entire area all the time.

   (ii) On days of white to green fire danger the aircraft is not continuously in the air. The towermen were not "stood-down" while the aircraft was down for obvious administrative, and, in the case of towers 70 metres or so in height, sheer physical reasons.

   It must be noted, however, that time intervals decreased with increasing fire danger and with time of the year - at the end of the Restricted Burning period, they became insignificant. Balanced against the time interval is the fact that the aircraft is not only the <u>detector</u> of a smoke, he is also the first investigator. A smoke from a tower which takes an hour to plot, seek cross-bearings for, find on the ground and appreciate by an officer or overseer on foot, is quickly covered by the same smoke plotted accurately from the air and described in detail at the same time, even if the plane saw it an hour after the tower.

2. On very bad days in spring and early summer (and probably autumn, too) when there are large numbers of smokes to investigate and plot, circuit turn-around time can extend up to two hours. On such days the dual use of the aircraft and the towers is essential.

3. The aircraft cannot accurately measure wind speed and direction. When this information is required, for example during aircraft burns or wildfires, towers must be manned to provide it.

4. Pilot boredom is a problem when, as often happens, day after day goes by with nothing to report. This is the well-known "towerman's syndrome" and can only be overcome by crew changes, by lighting a few fires or by spending a bit of time with the pilot or towerman to bolster his morale and listen sympathetically to his personal troubles.

CONCLUSIONS

There is no doubt in the minds of those officers at Pemberton who have worked with the spotter this summer that the system is a "goer" for southern hardwood forest fire detection.

Speaking generally it is likely that the use of towers will decrease and the use of aircraft will increase. However the degree of reliance on one or other technique will depend on many factors such as location of towers, detection requirements, forest types and relative costs in each locality.

PLANTING KARRI NURSERY STOCK

by

P. Skinner and P. Richmond

Previous trials have shown that Karriwildings can be successfully planted on failed regeneration burn areas, and that a lightly trimmed root pruned 46 to 76 cm wilding is the best size to plant. With a good karri seedfall only every 3 or 4 years however, and the difficulty of obtaining suitable wildings when required, wilding planting will have to be supplemented with nursery plants. If the right type of plant can be raised in the nursery this could give an easier and cheaper supply of planting stock than wildings, and ensure that burning in karri clear felled areas can be done, if desirable, even when there is little or no seed available on the remaining trees.

Wildings have the great advantage of no initial establishment costs - i.e. seed collection, storage, sowing and nursery tending. Their disadvantages are that there may not be an adequate supply when required, or what there are may be so far from the planting site that transport costs are prohibitive. Pulling and trimming will cost more than the equivalent operations for nursery stock. And wildings are necessarily of one type, no root or top pruning can be done until the plants are actually lifted just prior to planting.

The main problem of raising nursery stock would appear to be the provision of a sturdy 46 to 76 cm plant at the optimum planting time. Spring sown seed usually gives a much larger plant than this by the following planting season, but if sowing is left until early or mid-summer, germination is much poorer and the seedlings require more treatment and care in their early stages.

There are 2 ways of overcoming this problem:

(i) Retarding the growth of plants from spring sown seed.

(ii) Increasing the germination percentage and survival of summer sown seed.

The object of this experiment was to test ways of achieving the former - i.e. retardation of plants from spring sown seed, and to compare the survival and growth of such plants after planting in the field.

A trial plot was planted on 9 June 1970 at Pine Creek Road, Grey Block, using plants raised in Nannup nursery.

In the nursery, seed was sown on 17 September 1969 and the pre-emergent weedicide, GESATOP, applied at the rate of 1.12 kg/ha.

After germination, the nursery plants were divided into 4 approximately equal sections, and the following treatment applied:

(i) Control, no treatment other than the normal rate of watering received by all treatments.

(ii) Root-pruned, i.e. under-cut about 15 to 20 cm below soil level. Commenced 6 February 1970 and continued at monthly intervals.

(iii) Topped, at about 15 cm above soil level on 6 February 1970 and continued at monthly intervals.

(iv) Root-pruned and topped on 6 February 1970 and continued at monthly intervals.

When the plants were lifted, the control was divided into two, half being left and half stumped to 15 cm above the root collar.

There were thus five treatments planted in the field.

a. Control 0.3 to 1.5 m high plants.

b. Stumps. Cut back to 15 to 23 cm above root collar, no foliage left.

c. Root-pruned - Average slightly smaller than control, but no extensive tap root.

d. Topped. Topping had reduced these to squat scrubby looking plants with multiple leaders.

e. Topped and root-pruned - similar in appearance to (d).

Because of the variation in size of the Control plants they were divided into small (up to 0.9 m high) and large (0.9 to 1.5 m high). Stumped plants were treated likewise, being divided into small and large before stumping was done. Though small and large were planted and assessed separately, they still comprise one treatment and must therefore be analysed as one.

The number of plants in each treatment varied, but all plants received were divided equally between a hill site and a valley site. Normal spade planting methods were used, and 57 g of Nutrifert were applied to each tree soon after planting.

It was necessary to root prune most of the stock on planting, as the control and topped plants had developed both tap and fibrous roots, and nursery root-pruned plants had extensive side roots.

A survival count taken at the end of winter, on 18 November 1970, gave the following results:

Treatment	Total Number of plants on two sites	Percentage survivals		
		Hillside	Valley	Combined
Control - large	100	50*	28	39
Control - small	40	30	20	25
Stumps - large	100	0	6	3
Stumps - small	40	5	20	12.5
Topped	175	90	82	86
Root-pruned	140	96	97	96.5
Topped & root-pruned	175	97	93	95

* A further 32% had lost all foliage and looked like dying.

Remaining trees were vigorous in all cases, those on the hillside plot had put on more height growth than those in the valley plot.

A further assessment of the plots in July 1972 showed considerable height growth, though little change in percentage survival. On the hillside site it was impossible to locate all survivors in the control and stumped plots, as there was so much wilding regrowth. It appeared that the 32% doubtful survivors in the 1970 count of large control trees had died, and additional casualties in the other treatments had also shown signs of dying at the 1970 count.

Results were as under.

Treatment	Total Number of plants on two sites	Percentage survivals		
		Hillside	Valley	Combined
Control - large	100	?	18	?
Control - small	40	?	5	?
Stumps - large	100	0	2	1
Stumps - small	40	?	20	?
Topped	175	90	75	82.5
Root-pruned	140	96	94	95.0
Topped & root-pruned	712	92	93	92.5

Remaining trees were vigorous in all cases, those on the hillside plots had put on more height growth than those in the valley plots.

No clear comparison of percentage increment can be made, considering the variety and types of treatment of planting stock, but total heights in July 1972 were as follows:

Treatment	Hillside			Valley		
	No. of survivors	Top Ht in m	Av. Ht in m	No. of survivors	Top Ht in m	Av. Ht in m
Control - large	-	-	-	9	2.99	1.89
Control - small	-	-	-	1	1.71	1.71
Stumps - large	-	-	-	1	0.91	0.91
Stumps - small	-	-	-	4	1.92	1.58
Topped	81	4.85	2.71	64	3.60	1.89
Root pruned	68	5.55	3.72	66	3.41	1.98
Topped & root pruned	83	4.60	2.83	79	3.23	1.83

It will be seen that root pruned plants give the best survival percentage, and topped plants also give good results, but combination of root pruning and topping gives no advantage over straight root pruning. Stumping at time of planting, particularly of the larger plants, is disastrous. The untreated control trees, both large and small, show poor survival, and these have to be planted with great care. Many may be loosened by wind and the consequent drying out of the roots undoubtedly contributes to the death rate.

Untreated plants from September sowings obviously grow too large, and have too much variation in size to be suitable for field planting. They cannot be left to be stumped at planting time, and some form of nursery treatment is essential. Root-pruning would appear to be the most beneficial treatment both for survival and subsequent increment.

The survival figures for root pruned plants might be improved further if some method of side pruning could be carried out in the nursery, though the already high rate of 96.5% would hardly justify too much extra nursery cost. However, the large side roots that develop when undercutting alone is done make pre-planting handling and transport more difficult and necessitates rather drastic side pruning at planting time. Side pruning could be done at the same time as the monthly tap root pruning, by incorporating a set of small discs, keeping the entire pruning to one operation. This would increase costs hardly at all.

Topping is a fairly quick and easy nursery operation being done by a motor mower set at 15 cm above soil level, and driven along the beds. Though topping gives no advantage over root-pruned plants in survival after planting it does give a smaller overall plant, and could reduce transport costs, though it does make handling during planting more difficult. The main disadvantage of using topped plants is their tendency to multiple leaders.

An inspection of the planting site was made in December 1973. While the majority of the topped plant survivors showed little sign of their early multiple leader stage, on the hillside site 7%, and in the valley site 8% of survivors still retained two or more co-dominant leaders.

It appears therefore that some form of nursery treatment is essential, and the most successful is tap-root pruning. Side-root pruning would probably be economically justifiable to reduce handling and transport costs and could give better field results - though this would have to be tested. Topping gives no advantage on survival or increment and a definite disadvantage in tendency to multiple leaders, so should not be done in preference to root pruning.

THE CORRECT METHOD OF PREPARING AND FITTING DENDROMETER BANDS TO RECORD TREE GIRTH INCREMENT

by: J.C. GILCHRIST

1. FITTING BANDS TO A PLOT FOR THE FIRST TIME

1.1 Field Measurements

Measure all trees to be banded and mark at 4'3" from the ground, numbering each tree clearly in sequence.

1.2 Smooth the bark around each tree at the 4'3" mark using a sub-former or rasp to ensure the band fits tightly and no loose bark remains.

1.3 Measure and book against each tree number the exact girth at the 4'3" mark to the nearest 1/10th of an inch.

When the field measurements are completed the dendrometer bands can be prepared at headquarters using the following method.

2. PREPARATION OF BANDS

2.1 Measure a piece of band (Aluminium tape ½" wide) approximately 12" longer than the girth of the tree to be fitted. (i.e. Girth 24" cut band 36").

2.2 Starting at the left hand end of the measured band make the loop through which the band must be threaded when fitting takes place. (See figure 1).

2.3 Fit the band into the template approximately 2" from the loop and mark with a stylus the 3" or 6" scale, making sure the lower edge of the scale corresponds with the lower edge of the tape (see figure 2). Care should be taken to see that the stylus or knife used is only sharp enough to score the band and does not cut through the metal.

2.4 Measure the girth of the tree to be fitted from the last mark of the scale along the band from left to right (i.e. from the right hand end of the scale) and mark the top edge of the band at this point. Insert this mark into the template to coincide with the right edge of the vernier and mark the vernier scale along the top edge of the band from right to left of the point selected. The base of the vernier should then appear along the top edge of the band (see figure 2).

2.5 Cut out piece along the top side of the vernier scale with scissors (see figure 2) taking care not to remove too much of the vernier yet enough to enable the scale below to be easily read (see figure 3).

2.6 Tailor the end of the band approximately 2" beyond the vernier scale and punch a hole for the spring (see figure 2) (use leather punch).

2.7 Allowing approximately 6" to 7" from the right edge of the scale punch the second hole to enable the spring to be fixed with enough tension to hold the band tight against the hole. Finally tag the prepared band with its field number.

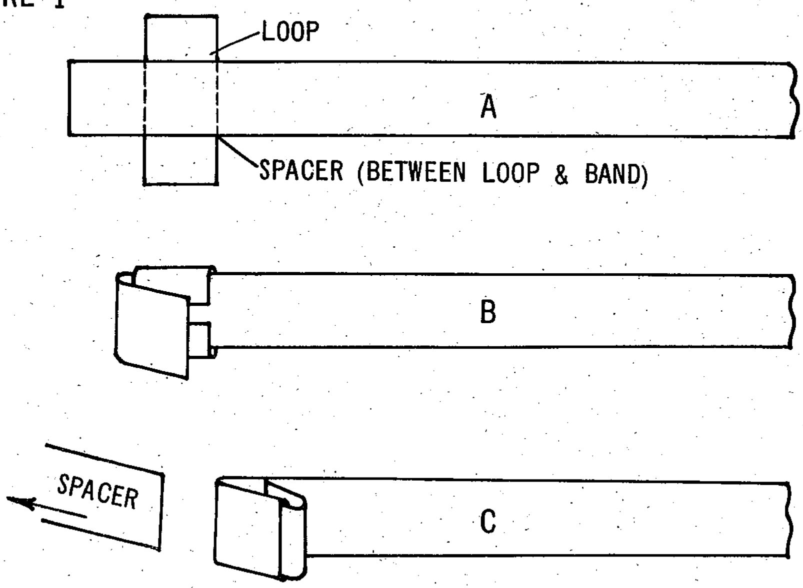
2.8 The Dendrometer bands can then be fitted to plot quickly and the fitted readings taken and recorded. (See figure 3 and note).

3. REPLACING BANDS IN THE FIELD IN ESTABLISHED PLOTS.

3.1 The old band after reading is removed and a new band is prepared from instructions 2.1, 2.2 and 2.3. The band is then fitted to the tree and the vernier scale position marked so that the right hand edge of the vernier coincides with the right edge of the 1/10th inch scale. The band is then removed and completed following instructions 2.4 to 2.8. The measurements quoted are imperial as all templates at present in use are of this scale, however the same instruction would apply if metric measurements are used.

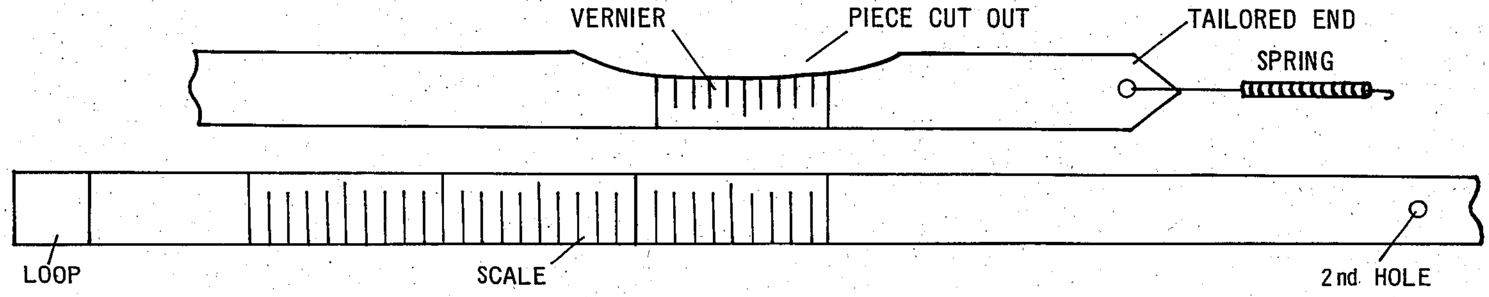
When the preparation and fitting is mastered it takes approximately fifteen minutes to prepare, fit and record each band.

FIGURE 1



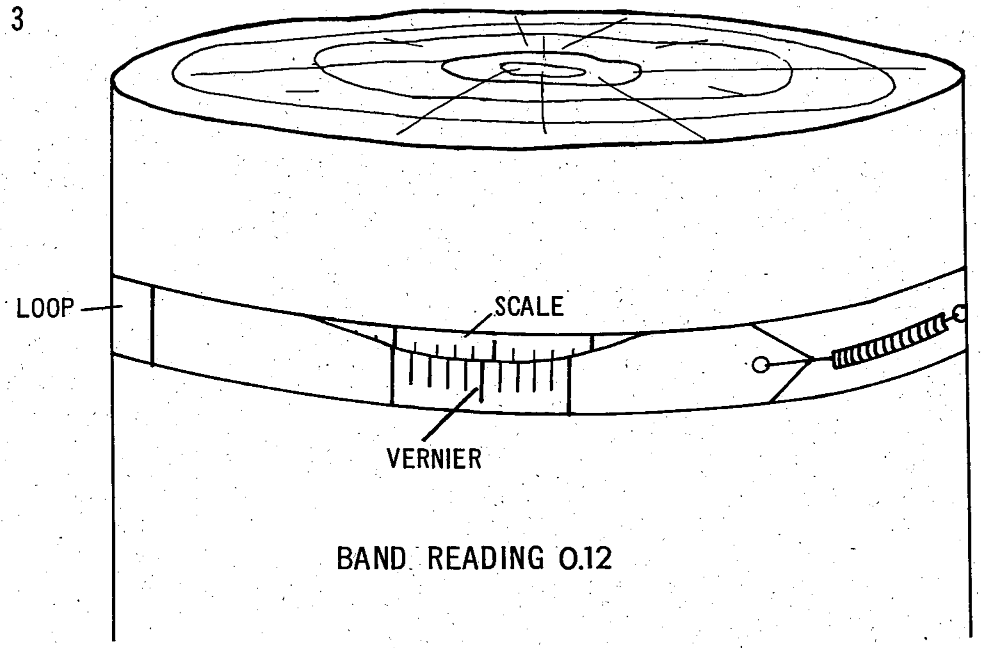
REMOVE SPACER AND PRESS LOOP ALONGSIDE BAND

FIGURE 2



BAND THREADED THROUGH LOOP TO OVERLAP SCALE

FIGURE 3



BAND READING 0.12

NOTE:

The Vernier moves along the scale away from the end fixed by the spring. If the instructions in the notes are correctly carried out the Vernier will always move along the scale in a clockwise direction and the correct fitting enables the reading of the band to be carried out quickly without fear of error from wrongly marked scales.

THE JUNE-1974 TOTAL SOLAR ECLIPSE

by G. Styles

The November 1973 issue of "Sky and Telescope" contained an article on the 1974 Total Solar eclipse. A photocopy was sent to my parents from the London University. Although this subject may appear to be in no way connected with forestry the article does make mention of our department on several occasions. Unfortunately space would not allow publication of the whole article.

On June 20th, 1974 the moon's umbral shadow will pass a quarter of the way around the earth, but will only cross land on two occasions. The first place is Amsterdam Island in the Indian Ocean and the second the extreme south west of Western Australia. The central line of totality passes about 50 miles south of the coast and places like Augusta and Windy Harbour will have a total eclipse for 4.2 minutes which is only 40 seconds shorter than at the centre line.

The article describes at some length the unfavourable winter weather and heavy June rainfall in the SW of W.A. and the same paragraph goes on to say:

"With the air masses originating mostly over the ocean, if the sky is clear it should be free of haze or dust. Local air pollution from sawmills and <u>forest burn offs</u> can be avoided by prudent selection of site."

O.I.C. Pemberton please do not prescribe any burns for 20th June, 1974! However it is claimed that there is a 50-50 chance of a clear sky on the day.

The general land area covered by the eclipse is described as follows:

"Most of the coastline between Augusta and Walpole is covered with sand and marshes extending inland for 10 miles. Farther from the coast heavily forested pine plantations alternate with stands of very tall eucalyptus hardwood trees, three of which are used for forest fire-lookouts. Many areas have been cleared for farmland."

Apparently they expect many overseas eclipsegoers to visit the area, as group air travel, accommodation, costs and supplies etc are given in detail, with a warning that power failures are common in country areas and forestry department roads are unpaved.

All in all, the article is quite good and it is nice to know that people on the other side of the earth know a little about us, even if only to create air pollution.

EDITOR'S NOTE

Further to Gordon Styles' notes above, Ron Kitson at Northcliffe reports a frenzy of preparation in the area as the eclipse approaches. All accommodation at Northcliffe and Pemberton is booked solid, and visitors include a party of 20 astronomers from the U.S.A. who are travelling over specifically for the event. The Northcliffe P & C Association is cashing in, as is their wont, with the establishment of hot-dog and coffee stands on the cliffs at Windy Harbour.

FOOD FOR THOUGHT

The <u>forest scientist</u> lives in a world all to himself, concentrating, studying and diligently working in an ever narrowing field until he is an accepted expert knowing everything there is to know about nothing.

The <u>forest manager</u> is given a broad background on a wide variety of subjects. As he develops in his profession he spreads his talents in ever expanding spheres until he knows nothing about everything.

The <u>forest technician</u> starts off with a reasonable understanding of all fields of forestry and, left to his own devices, could carry out assignments in any of these fields quite competently. However, after severe exposure to <u>forest scientists</u> and <u>forest managers</u>, he evolves to the stage of knowing nothing about anything.

(Forestry Chronicle, June 1973).

THE U.S. FOREST SMOKE POLLUTION PROBLEMS RELATED TO WESTERN AUSTRALIA

Rick J. Sneeuwjagt

INTRODUCTION

The intent of this report is to make West Australian foresters more aware of the problems associated with forest fire smoke. This report was prompted by my growing conviction that the problems faced today by the forest industries and the public over air quality legislation in North America might soon become a reality in Western Australia.

Over the last ten years, public pressure for clean air has led to the establishment of restrictive smoke management legislation in the U.S. These forbid industry and forest management groups from conducting burning practices during days of possible air pollution accumulation. Unfortunately, many of these regulations were set up on the basis of emotional reaction rather than true scientific inquiry. In the past, forest burning was carried out with little regard for public inconvenience or opinion. Even less was done to investigate the ever-increasing chances of health endangerment and atmospheric fouling by wood smoke. As a result, forest industries are today forced to accept restrictive prescribed burning regulations which, in the present light of knowledge, many feel are unjustified.

In this report I have gathered togather some of the latest findings on the measured effects of wood smoke components on human health and the atmosphere. I have taken the liberty to present my ideas on a future course that Western Australian forest managers might follow in order for the Forests Department to prepare itself against future criticism of the prescribed burning policy.

THE PROBLEM

Wood smoke has always been an inevitable and natural part of man's environment since he learned to use fire. However, in recent decades, smoke from forest wildfires and prescribed burns has been considered on a par with any other emission that might effect air quality. The present crusade to reduce air pollution points an accusing finger at all burning that utilizes forest fuels. The general public believes that anything in the air except air is dangerous pollution that must be prevented. The more visible it is, the more dangerous, and the smoke from the burning of forest fuels is certainly visible, especially to the vocal 'city man' who is driving through forested country.

The criticism that smoke from prescribed burning practices is a visual nuisance might be acceptable, but it is questionable that this smoke is a public health hazard. From the several reports I have read on the topic, there is little medical evidence to support the notion that wood smoke is dangerous to public health, although it seems that the current amount of knowledge on the products of wood combustion is less than the ignorance on this topic.

COMPONENTS OF WOOD COMBUSTION

There is general agreement that, in burning forest fuels, the hottest fires with ample oxygen and longest possible residence time of combustion lead to the most complete combustion. The products of complete combustion of wood are mostly water vapor and carbon dioxide. However, this reaction rarely occurs, even in the fiercest wildfire. More commonly, the combustion is incomplete, and the products, which are dependent on the fire temperature and the chemical make-up of the fuels, are mostly complex organic molecules. These result from the thermal decomposition of wood which occurs in several ill-defined stages. Each thermal stage results in the emission of varied gaseous products such as formic and acetic acids, methane, ethane, formaldehyde, carbon monoxide, and various hydrocarbons. All of these products are greatly diluted by the major emissions of carbon dioxide and water vapor. A normal fire will burn at a very wide range of temperatures and will emit some of all the possible mixtures. Although the emissions are many and varied, there are only a few that need concern us in this discussion. These include carbon monoxide, particulates, nitric oxides and both simple and poly-nuclear hydrocarbons (PNH). These have received a great deal of attention because of their well-known toxic qualities or nuisance effects.

Carbon Monoxide (CO)

Aside from carbon dioxide, not considered a pollutant, CO constitutes, in tonnage, by far the largest percentage of air pollution components. Since its toxic nature has long been recognized, an enormous amount of reference literature has been written on it. However, very few actual measurements of CO production per ton of forest fuel have been carried out. Countrymen, in 1964, working on large fires in piles of heavy fuels arranged in systematic patterns, found, as expected, lethal concentrations of CO in the active part of the fires studied. However, these CO concentrations were very much lower towards the edge of the fire. He reported that "no significant concentrations were found in the 'streets' of the test fire." Several other reports confirm this finding, so it seems that increased concentrations of CO do not persist for more than a short distance from the going fire.

Interestingly enough, the concentration of CO does not seem to be increasing in the atmosphere despite the great amounts produced in modern times mainly by the incomplete combustion of petroleum fuels in motors. Several theories have been offered as to the disappearance of the newly produced CO, the most convincing of which suggests that micro-flora (fungi and bacteria) in the soil may be the major CO sink.

In any case, the impression in the public mind that highly toxic quantities of CO accumulate in the atmosphere should be allayed. And furthermore, it appears that the contributions of CO by forest fire smoke are at the most insignificant, especially when compared to those made by car engines and industries.

Particulates

The visible smoke from a fire is actually water vapor made visible by its condensation on to fine particulate matter. Particulates are formed by the combining of hydrocarbons emitted from wood fire with each other or with molecules of oxygen or formaldehyde. The fine particulates appear to aggregate rapidly into larger particles, contributing to the bluish smoke from a fire after most of the water has been driven off. Such material does not remain suspended indefinitely in the atmosphere, for the smaller particles combine further to form even larger particles which fall out in a relatively short time. In a moist air mass, the particulates act as condensation nuclei forming droplets of moisture. If the smoke column is within existing clouds, the droplets will grow along with the cloud drops and will fall out with the first rain. Under dry atmospheric conditions the moisture vapor in the smoke column will evaporate leaving the particulates visible. Thus, particulates will remain suspended in a dry air mass longer than in moist conditions.

Of all the properties of particles in the air, none dominate the behaviour of a particle more than its size. Research on this aspect indicates that smoke particulates are of two major size groups. In general, sub-micron particles are dominated by Brownian motion and remain suspended for many days. Larger particles will settle out of still air.

The effect on visibility in a particulate emission depends more on the size of the particles than on the concentration of them. Sub-micron particles have a much greater ability to scatter light than do the larger particles, and are therefore more visible to the eye.

The fate of the particulates in lung tissues is not well known although there is some evidence that coarse particles are well taken care of by the mucociliary system in the respiratory tract, while finer particles probably enter the alveolar tissues of the lungs. Medical experts at several air quality conferences are of the opinion that such materials are rendered soluble by enzymic action, and are able to enter the blood stream where they are eliminated.

Obviously, any conclusion as to the impact of fine particulates on human health is premature, as a great deal of research still needs to be done. However, present signs are promising, and if proven correct, will help to alleviate that source of public concern.

<u>Hydrocarbons</u>

Unsaturated hydrocarbons are produced by the incomplete combustion of organic fuels, especially petroleum fuels and coal. These compounds, due to the absence of a hydrogen atom in the molecule from adjacent carbon atoms, have a very high affinity for oxygen or other oxidation elements. If such a reaction occurs in their presence, there is a photo-chemical oxidation. The result is photochemical pollution, as is found in Los Angeles. This can be quite dangerous to health. There is strong evidence that the hydrocarbons produced from forest burning are for the large part not photochemically reactive. Nor have they been shown to be a health hazard. The worst that can be said of them is that they may condense to form visible aerosols of particulates.

In 1966, Darley and others measured the yields of hydrocarbons during the burning of such woody fuels as natural brush, wood chips, and fruit tree prunings. By comparing these with average hydrocarbon emissions from petroleum exhausts, he found that for the San Francisco Bay area the annual yield from agricultural burning practices approximated the daily yield from automobiles in that area. Measurements on forest fuels by Fritschen and others (1971) confirmed the findings that the wood smoke contributions of hydrocarbons were insignificant beside those from automobiles and large industries.

Polynuclear Hydrocarbons (PNH)

The PNH compounds have been shown to produce cancer in susceptible strains of experimental animals and are therefore suspected of causing human cancer. In general, PNH result from combustion of fossil fuels such as coal and petroleum although they are probably released in relatively small amounts in the combustion of forest fuels (Hall, 1972). Urban communities have more PNH in the atmosphere than rural areas, with the highest figures reported from coal burning cities. However, all this information is not meant to frighten anybody since we are, have been, and always will be exposed to PNH. These compounds occur widely in the plant world, including many items of the human diet. Researchers find it indeed difficult to envision any significant increase in urban exposure to PNH attributable to the burning of forest fuels.

Nitric Oxides

The infamous photochemical smog of Los Angeles is a highly specialized smog, the ingredients of which are certain petroleum-based hydrocarbons, lots of sunlight and nitric oxide. In order for Nitric Oxide (NO) to form, temperatures are needed well above the probable maximum temperature of forest fires. In fact, the NO component in photochemical smog is derived from petroleum combustion. Hall (1972) in his summary on the nature of combustion products of forest fuels, stated that "it is inconceivable that the slight amounts, if any, of NO from combustion of forest fuels could have any measurable effects on the creation of photochemical smog or toxic effects on vegetation or humans."

SMOKE MANAGEMENT GUIDELINES

Education

During the last eight years there has been an accelerated research and development program in the U.S. to deal with the potential of air pollution problems from forest burning. The result of much of this work provided the few facts I have summarized above. Armed with these facts, foresters and forest researchers are trying to explain to a sceptical public the reasons for forest burning and what is known about its effects on the ecosystem. However, progress is extremely slow because of the lateness of these restoration efforts. The public is already convinced that fire and smoke are evil and harmful, and are unwilling to accept explanations from a defensive forest industry.

Fortunately for Western Australian foresters, this situation has not been reached as yet, and there is still time to develop a public education program on the role of fire in the environment. This must be done before legislation is created imposing restrictive burning limitations, which are now a way of life in many states of the U.S.A.

Education is the most powerful force available to shape opinion towards acceptance of fire and smoke in the environment. The success of the 'Smokey Bear' fire prevention campaign is a remarkable example of this. Forest authorities in W.A. would do well to follow this course of public education. However, education alone will not be enough to allay public concerns, and unless smoke management practices are followed diligently, all the prescribed burning promotion campaigns in the world will not succeed.

Meteorological Management of Smoke

When known and practical procedures are followed in prescribed burning of forest lands, troublesome pollution in large population centres, for example, can be reduced to a minimum that will not be objectionable. Such procedures involve proper integration of burning schedules with weather reports and close co-operation between meteorologists and forest managers.

Prescribed burning can be scheduled so that wind direction will take smoke away from 'smoke-sensitive' areas. Such areas would be defined by a smoke management plan, and would include heavily used recreation areas and major airports, besides dense population centres. Burning should be minimized when smoke could tend to accumulate, as in calm winds, under deep inversion layers, or when the air already carries a load of pollutants from other sources. Loading of the atmosphere can be minimized by burning into moist air that would remove particulates from the air through condensation and rain. With logging slash, it is of benefit to produce as hot and fast a combustion as is practical, as this not only leads to better site preparation and reduction in fuel hazards, but aids in the quick dispersion of smoke. Piled and dry fuels, atmospheric instability and moderate winds all ensure more complete combustion and rapid smoke dispersion; but, obviously, the advantages of good dispersion must be weighed against fire control and safety needs and the attainment of burning objectives.

Fuel Management Alternatives

There are many significant developments of techniques for ignition and burning of slash fuels which as yet are untried in W.A. Some of these are experimental and costly, but have helped solve some problems in the U.S. For example, electrical ignition systems, using wired circuits with prelocated ignition points have proved quite effective for quick ignition and fire establishment, and for achieving some measure of control over fire behaviour and smoke production. Napalm grenades have been tested with some success in difficult access areas as an incendiary device, and research is continuing on the development of other efficient ignition techniques.

Finally, there are developments related to alternative methods of slash disposal. Mechanical crushers, portable chippers, portable burners and burying equipment have all been developed as a result of severe burning restrictions in many logging areas. All these mechanical devices are extremely expensive and possess many limitations. However, they may conceivably be Western Australia's lot if events are allowed to parallel those of the U.S.A.

CONCLUSION

From my search of the literature I have found no evidence that links the combustive products of forest fuels with permanent injury to human health. In general, the only penalty inflicted upon the environment by prescribed burning is a temporary decrease in visibility. This is a slight cost for the rewards obtained in avoiding wildfires through the practice of prescribed burning techniques. This penalty can be decreased largely by the forest manager through the observation of smoke management guidelines and the close co-operation with meteorologists. The importance of public attitudes is stressed, and it is proposed that a public information campaign on the effects of fire and smoke on the environment be instigated as soon as is practical.

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International Symposium on Air Quality and Smoke from Urban and Forest Fires - October 24-26, 1973 in Fort Collins, Colorado. Summary papers presented at this conference were the major source of information in this report.

RUBIS FRUTICOSUS L.

(BLACKBERRY) INFESTATION IN STATE FOREST

by D.A. HASWELL

INTRODUCTION

The blackberry infestation problem in the Manjimup Shire is probably greater than any other area in the south-west. This is largely related to intensive human activity over many years in the forest, especially in the Pemberton area, the absence of extremes of climate and the high annual rainfall which ensure permanent and rapid growth of the blackberry plant.

The significance of blackberry depends to a large extent on the viewpoint. There obviously exists conflicting interests between those who pick the edible fruits for consumption, and foresters and farmers, who realise a loss in nett productive area when the species becomes established on their land.

The blackberry is capable of dominating land, especially moist fertile soils, to the exclusion of all other growth. Although remaining relatively dormant during the winter, rapid growth in spring and summer eventually result in extensive and impenetrable thickets. For example, thickets greater than three metres in height, and covering many hectares are not uncommon in the prime karri belt in the Pemberton area.

BLACKBERRY ERADICATION FROM STATE FOREST

Because of the potential threat of blackberry infestations to production forestry, especially during periods of regeneration, proposals have been put forward outlining possible measures for its control. It was envisaged that complete control would require two phases, viz.,

(i) Survey of blackberry infestation in State Forest.

(ii) Subsequent eradication, by chemical and physical means.

To date, the Blackberry survey has been completed, and the eradication programme will begin in 1974.

HOW THE SURVEY WAS ORGANIZED

The Manjimup Shire, covering some 681 472 ha., extends over the Forests Department Divisions of Manjimup, Pemberton and Walpole. A Blackberry Survey Officer was nominated at Pemberton, where the problem was considered to be the greatest. To assist his investigations, two liaison officers were nominated, one each in Manjimup and Walpole. The responsibilities of the Blackberry Survey Officer were to carry out a blackberry Survey in the Pemberton Division, and to co-ordinate the activities of the two liaison officers. Information collected was recorded on a centrally held Blackberry Distribution Plan of the Manjimup Shire, and in addition on plans held at Divisional Office.

METHOD OF SURVEY

The order of activity was as follows:

1. A review of the most recent and relevant literature was carried out.

2. Upon suitable base plans, information was recorded from reports by F.D. officer and employee sightings, local farmers, and outside bodies such as the Manjimup Shire Office and the Agricultural Protection Board.

3. Systematic Survey of State Forest. Because of the magnitude of blackberry infestation, the survey was based on a system of priority. Forest areas with a high liklihood of occurrence were divided, according to their existing blocks. Within each block a survey was carried out:

   3.1 Along rivers and streams, especially at road and track crossings.

   3.2 Along old logging tramways.

   3.3 Around old millsites and homesteads.

   3.4 At other places of human activity, e.g. boundaries of private property and State Forest.

These areas probably represent the majority of infestations. Other areas of State Forest given a lower priority have yet to be surveyed.

4. All information collected was recorded on a Blackberry Distribution Plan of the Manjimup Shire.

BLACKBERRY CONTROL

Blackberry eradication measures undertaken by the Forests Department in the past have been largely ineffective because of:

1. The Scale of the Problem. Within the limits set by available funds, eradication has tended to be fragmentary, rather than the more desirable method, where infestations are attacked on a face.

2. Incorrect Method of Eradication. Recent indications have shown that in many cases, deviation from the accepted method has occurred, thus reducing the overall impact of the spraying programme.

   The method of spraying is vitally important, and only mediocre results, or even failure will result if not observed. Although a variety of inorganic and organic chemicals have been used, best control is achieved with the ester of 2,4,5-T as the active component. As 2,4,5-T is a systematic weedicide, and is absorbed through the leaves when applied, concentrations above a maximum level results in rapid burning of the leaves, thus removing the medium of entry. The recommended rates for foliar application are as follows:

   2.1 Broadleaf Type - 1 kg acid equivalent in 3-4 kl.

   2.2 Narrowleaf Type - 1 kg acid equivalent in 5.8 kl.

Spraying is carried out when the plant reaches its maximum rate of metabolism. Best results are therefore associated with mid-summer spraying, coincident with flowering and fruit formation. However, it is recognised that variations in the optimum spraying time will depend upon geographic location.

Subsequent burning of the dried canes is carried out in the following spring. It is emphasized that burning before this time often negates the effect of previous spraying.

Follow-up treatment for another two growing seasons is normally required, however with diminishing rates of 2,4,5-T application.

CONCLUSIONS

Blackberry infestation in State Forest may appear a large problem at first, but closer examination reveals that it can be eradicated with a direct and co-ordinated attack.

Although the primary source of infestations are areas of past human activity, the blackberry has rapidly spread, mediated by rivers and streams, and is now largely localized in these areas. The dissemination of blackberry seed by water transport appears to be a very efficient mechanism, and it is recommended that these areas form the first priority of attack. Areas where seed dispersal depends upon forest fauna, and other agents, represents a low rate of blackberry spread, and are accordingly given a lower priority for eradication.

ECOLOGY OF A HOT KARRI FIRE

by

G.L. LIDDELOW

The aim of the experiment was to study the effects of a fire of wildfire intensity on the plant and animal communities of a karri forest area.

By recording the numbers and species of plants before the burn, any changes after the burn can be seen by further sampling. The same procedure can be used on the birds and animals. Through this it may be possible to relate changes in the fauna of the area to the changes in the plant community.

The area chosen for the experiment was in the Pemberton district at Warren Block. It comprised approximately 40 ha and had been unburnt for 20 years or more.

Due to the large number of Bush Rats (Rattus fuscipes) in the area, this was the animal selected to be studied. Others to be caught were the Mardo (Antechinus flavipes), Dunnart (Sminthopsis murina) and the introduced European rat (Rattus rattus). Three different sites are being studied, Sword Grass Plot (wet site); Open Forest Plot (ridge site) and the Control Plot (similar to Open Forest).

Trapping is carried out in each plot once a month on a grid system wherein 25 traps are rotated on a daily basis, giving a total of 100 trapping nights over 4 days. This gives us information on the movement as well as the numbers of rats in the area.

Trapping started on the 6th October, 1971. All animals caught are marked with ear tags and released after being weighed, measured and their sex and breeding condition noted. Total trapping numbers up till 23rd November, 1973 can be seen in Table 1.

The area was burnt to wildfire intensity on 17th January, 1972, with scorch height in places over 70 metres. The Control plot was left unburnt. Before the fire trapping results were similar in all areas (see Figs 1, 2 and 3). However after the fire over a period of six to eight weeks rats disappeared from the Sword Grass and Open Forest Plots. The numbers of adults gradually decreased, possibly due to predation in the open burnt habitat. Also the years crop of young which made the numbers in the Control Plot rise (Fig. 3) failed to establish themselves in the burnt plots.

The introduced or European mouse (<u>Mus musculus</u>) started to appear in the Sword Grass and Open Forest Plots in May and June 1972. They replaced the Bush rat over the next season. The Bush rat started to reappear in the Sword Grass Plot again in December 1972 after the next breeding season. However it was not until November 1973, the second breeding season after the fire, that the first rat was once again caught in the Open Forest Block.

The sampling of the bird population of the area was restricted to visual counts because at the beginning the calls of the birds were not known. The sampling procedure is to record species and numbers along five transect lines at 65 metre intervals using an "Audubon Bird Caller" to attract them. The birds are recorded in 4 vegetation strata as follows:

Ground cover to	1 metre
Scrub layer	1.3m to 3.3m
Lower tree canopy	5m to 25m
Upper tree canopy	26m to 65m

Before the fire there were a total of 24 species and 369 sightings on the transect lines whereas in the Control Plot there were 17 species and 113 sightings. Since the burn the species have increased to 46 in the burnt area and to 24 in the unburnt Control. The increase in species in the Control Plot is due mainly to the seasonal influx of Honeyeaters. The number of sightings have also increased to 2117 in the burn and 681 in the Control. The number of sightings which are high in both areas may be partly due to more surveys being done since the fire.

As can be seen from Figs. 4 and 5 there was a decrease in total numbers of birds and also numbers of species immediately after the burn along the transect lines. Also noticable is that the unburnt Control numbers of species and total numbers have not changed greatly. However since

February 1972 there was a steady increase for the next 18 months to where the species have steadied in number and the total number of sightings is again starting to fall.

After the fire species favouring the dense undergrowth, e.g. Splended Wren (Malurus splendens) and Spotted Scrub Wren (Sericornis maculatus) disappeared. Other species favouring the open understorey or ground for feeding, e.g. Western Shrike-Thrush (Colluricincla rufiventris) and the Scarlet Robin (Petroica multicolor) have increased. There has also been an increase in the number of birds who feed at scrub height or lower tree level, e.g. Broad-tailed Thornbill (Acanthiza apicalis) and the Grey Fantail (Phipidura fuliginosa).

Two species which have come into the burnt area that are uncommon are the Weebill (Smicrornis breverostus), and the Western Shrike-Tit (Falcunculus frontatus).

The vegetation of the area is also sampled along the same transect lines as the birds. The same four vegetation strata are used here also.

In the Upper Tree Strata which includes Karri (Eucalyptus diversicolor) and Marri (E. calophylla) there have been no changes, as could be expected. Moving down into the lower tree strata the Marri and Karri regrowth at the top of this division is unaffected. However the Peppermint (Agonis flexuosa) and Casuarina (C. decussata) were killed by fire, but they are now starting to come back mainly from root stock.

In the scrub strata the Hazel (Trymalium spathulatum), Netic (Bossiaea laidlawiana) and Chorilaena (C. quercifolia) have been killed by the burn but all three species are regenerating from seed and are at present ranging in height from 0.6 m to 1.5 m.

The ground strata species of grasses, herbs, Sword Grass etc. have also returned and it is noticable that the Sword Grass has come back thicker in the wet areas than before the fire. All through the burn the numbers of species of plants has increased since the burn. One section of the burn saw an increase of 100% in species (7-14); the average increase in all areas was 25%. Nearly all of the new species in this area have come from seed held in abeyance in the soil for many years. The majority of these new species are Acacias, Bossiae and some herbs and grasses.

Since the vegetation is a long-term study to show any marked changes, more surveys will have to be done before any changes in density and abundance can be noted.

TABLE I

TOTAL TRAPPING DETAILS TO NOVEMBER 1973

	CONTROL	OPEN FOREST	SWORD GRASS
No. of TRAP NIGHTS	2225	2050	2050
No. of BUSH RATS CAUGHT	106	18	59
Total No. of CAPTURES	452	95	208
No. of MUS MUSCULUS CAUGHT	-	24	43
Total No. of CAPTURES	-	73	100
Other Species CAUGHT A. flavipes (Mardo)	1		
Sminthopsis murina (Dunnart)		1	

AVERAGE DAILY CATCH OF *Rattus fuscipes* AND *Mus musculus* TO NOVEMBER 1973.

FIG. 1 SWORD GRASS

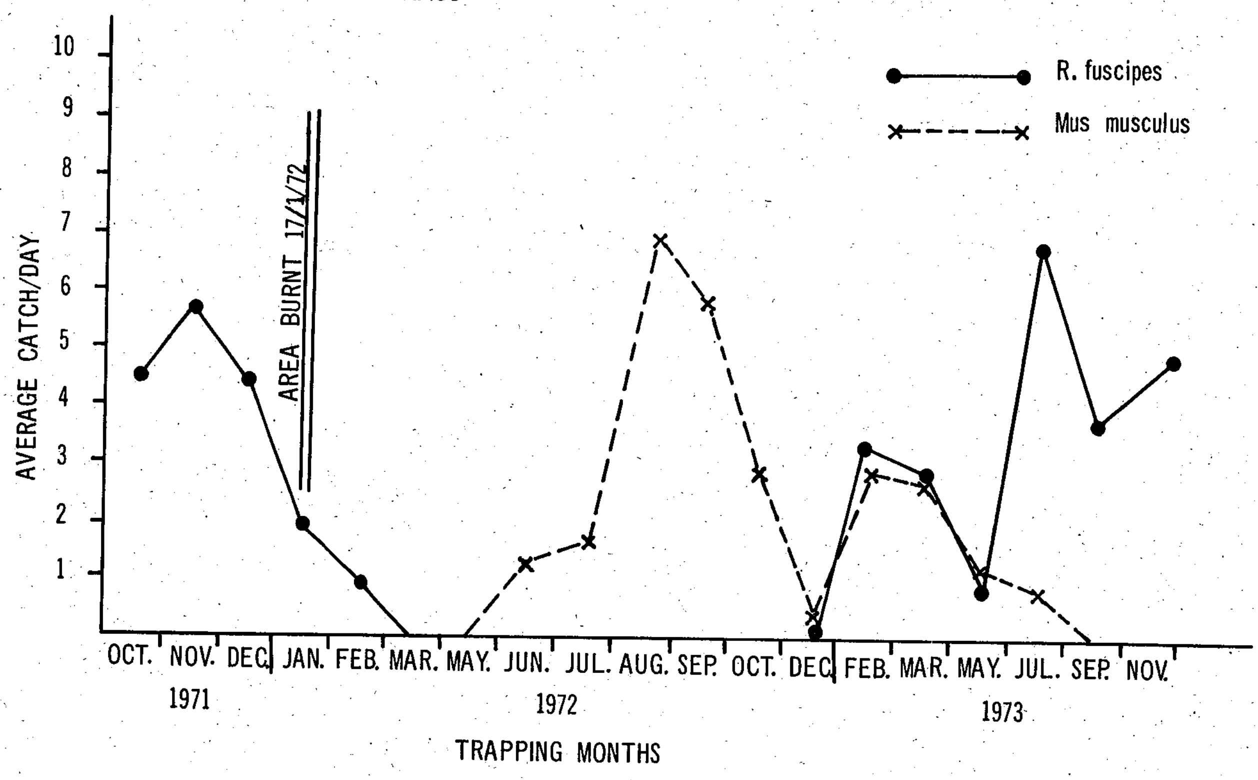


FIG. 2 OPEN FOREST

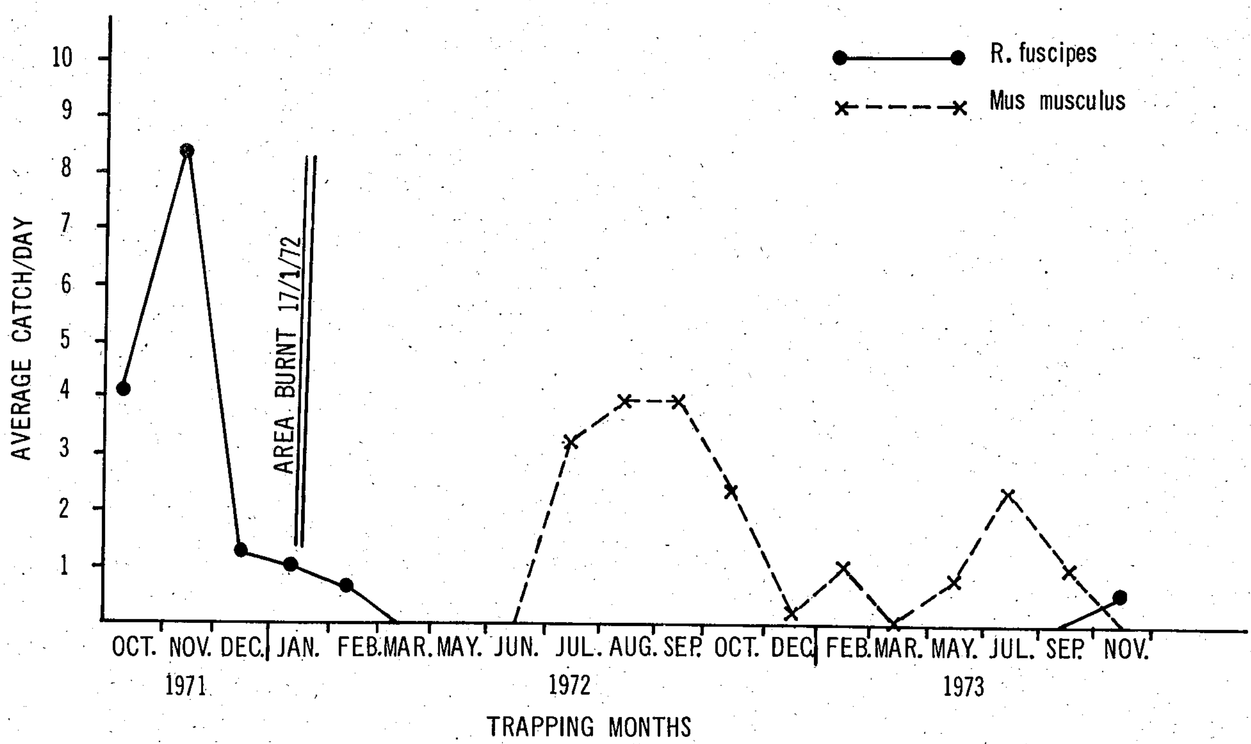


FIG. 3 CONTROL

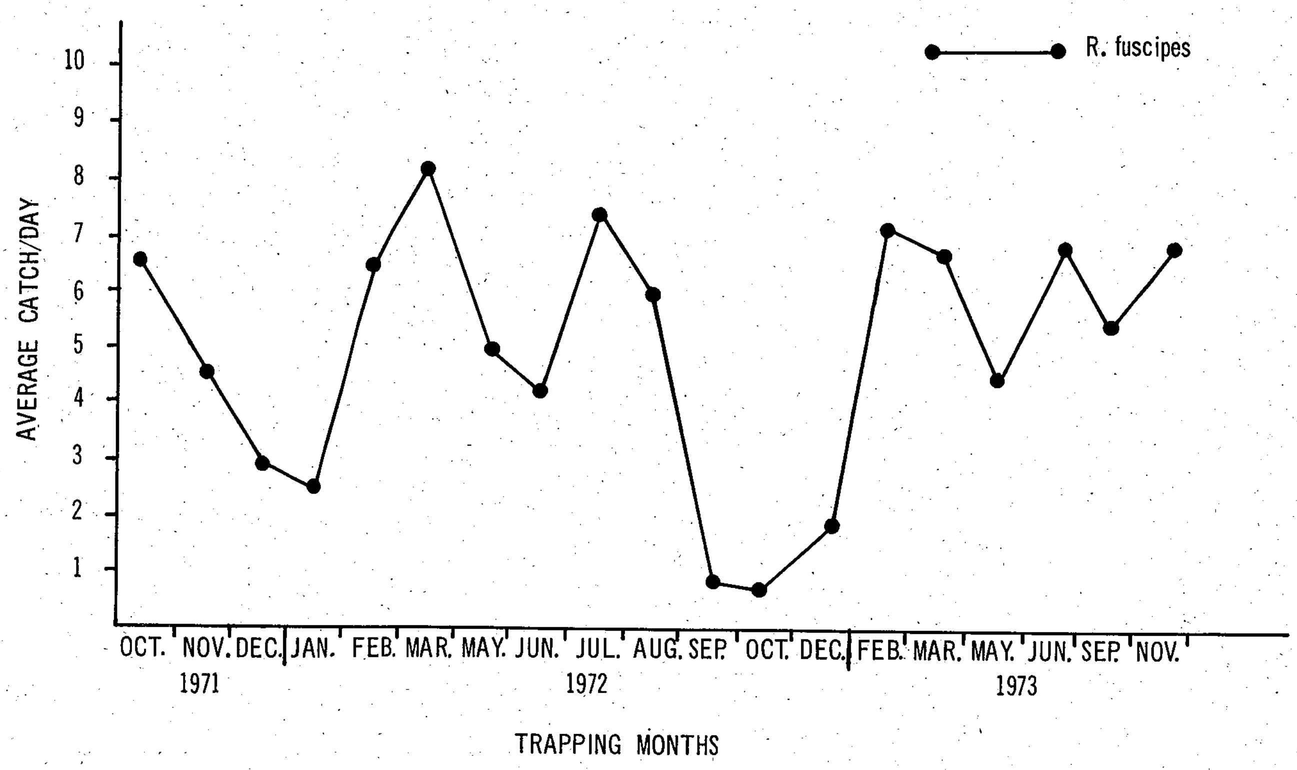


FIG. 4 TOTAL NUMBER OF BIRDS ON EACH SURVEY.

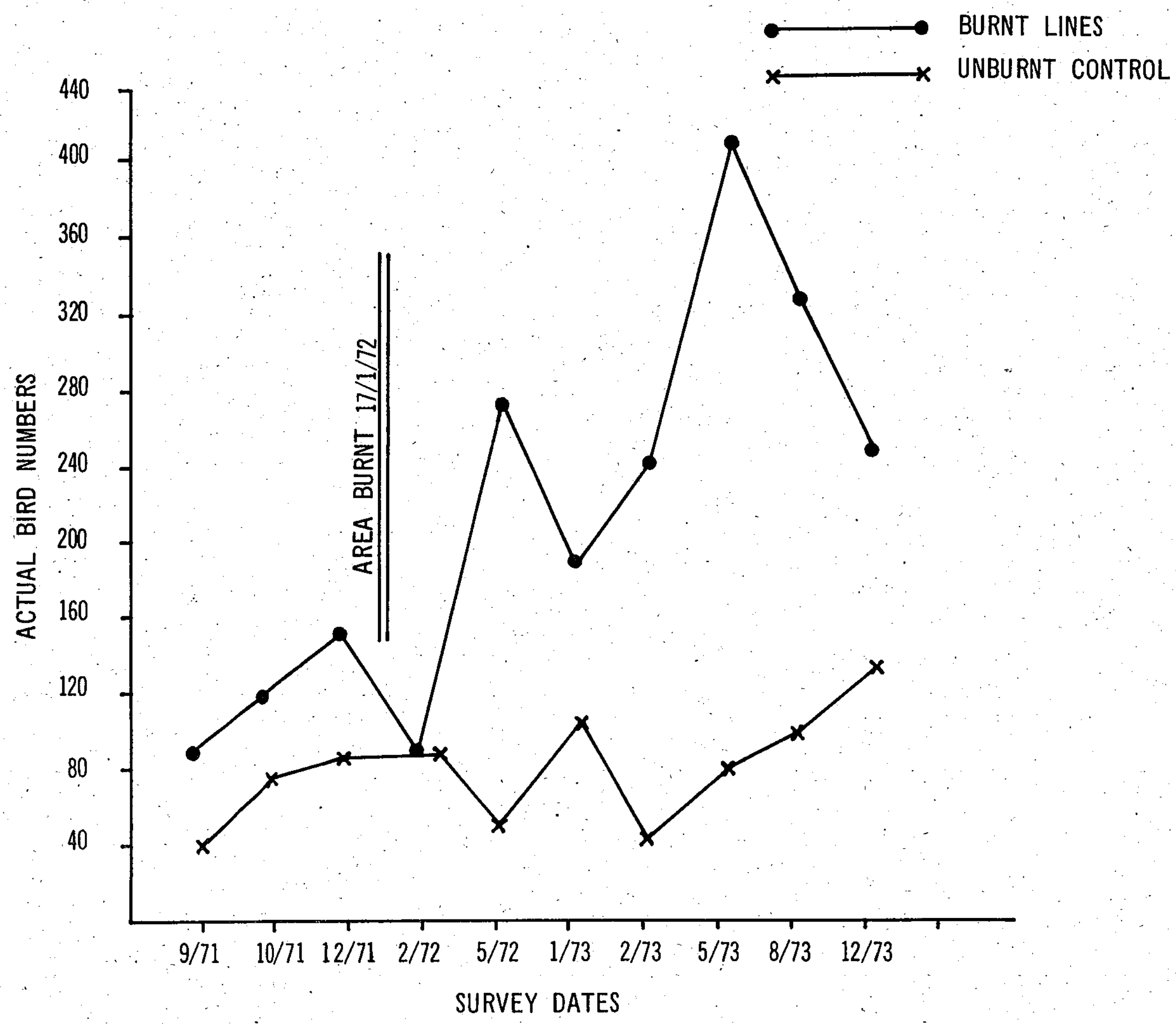
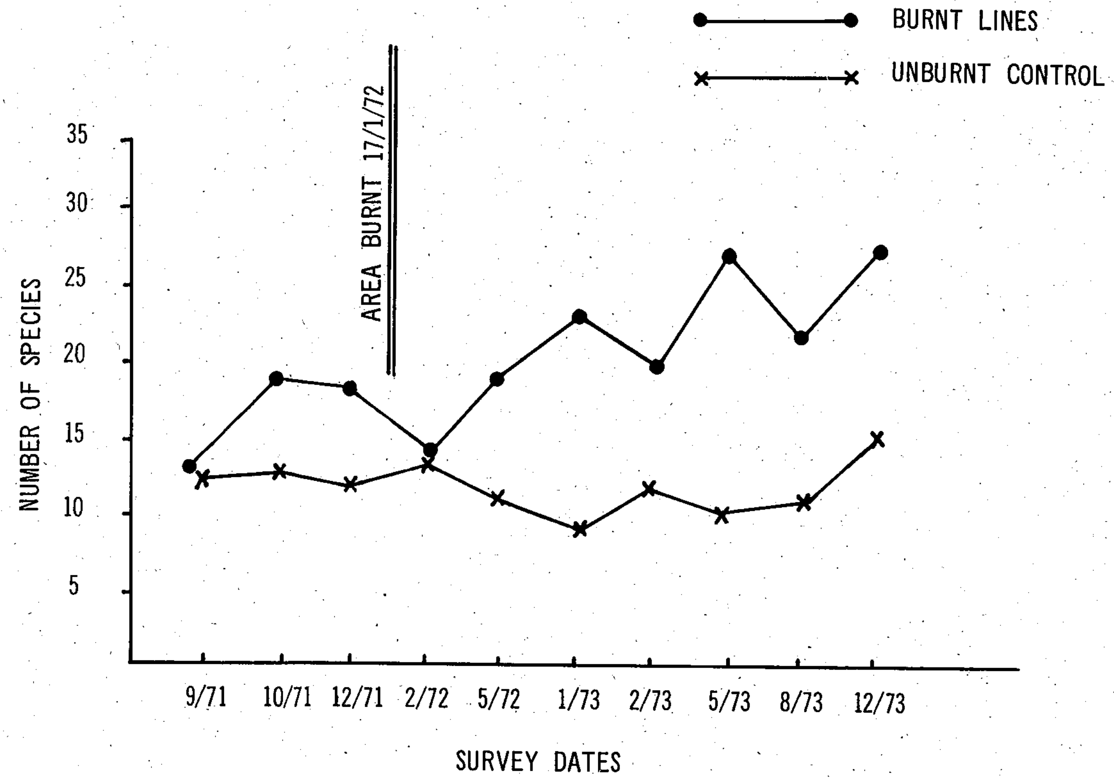


FIG. 5 TOTAL NUMBER OF SPECIES OF BIRDS ON EACH SURVEY.



THE USE OF "FIRETROL" IN MOPPING UP

by R.A. Kitson

Mopping up hot edges is a tedious and time-consuming job, particularly in the karri forest where logs and woody ground material are more numerous and larger than elsewhere. A typical example of the problem is the "rule-of-thumb" for control burning in the late spring or autumn; one day's burning means two days mopping up.

Therefore any means of making mopping-up easier and quicker would be a great advantage and result in safer edges, cheaper control burning and more efficient fire suppression.

The use of the water-soluble retardant "Firetrol" in heavy duties appears to be a break-through in this direction. A number of trials have been carried out at Northcliffe this summer.

THE TRIALS

In a number of tests, different ratios of Firetrol and water were used. The ratios were:

(8 parts water to 1 part Firetrol
(16 " " " 1 " Firetrol
(25 " " " 1 " Firetrol
(40 " " " 1 " Firetrol

Naturally it was found that the 8 to 1 mixture was the most effective, but even the 25 to 1 mixture did an outstanding job.

Excellent results were achieved using the 8 to 1 mixture. Five logs were sprayed with the mixture and only one log required 2 applications. This one log was dealt with in a matter of seconds. All the other logs were completely extinguished with the first treatment.

These burning logs were very hot before treatment and it appears that the hotter the material the quicker and better the result.

One particular log was surrounded by an area of extremely hot coals, and had been rolled out of its hot bed in the ground by a dozer. The area was $2m^2$ and was sprayed for 1 minute (approx 4 gallons of mixture) and the log was blacked out.

Using the 16 to 1 ratio very good results were also achieved. A tank of 160 gal. capacity lasted 2-3 hours of normal mopping up. Very seldom was a second spraying of hot material necessary. With straight water under these conditions, the tank would have only lasted about ½ hour.

A mixture of 40-1 was used in the same pumper unit as the 8-1 and 16-1 trials and it was found to be less effective, but still much better than a mixture of comprox and water.

The 8-1 mixture was given a short test on running fire suppression and the results were really amazing.

A H/D tank containing 300 gals of water with Firetrol added at a ratio of 25-1 was then used. Results were very good and the mixture lasted for 4 hours with only 1 log needing a second application. This was on standard mopping up of the edge of a January control burn at "The Thousand Acres."

A casuarina tree which had been scorched and pushed over was ignited and flames from the needles had reached a height of 1 - 1.5 metres when the 8-1 mixture was applied. The flames were extinguished almost instantly and the material was completely out.

About one week later this tree was inspected and it was found that some of the mixture was still visible on the needles. Tests were carried out by igniting small heaps of Firetrol treated and untreated needles. It was found that the treated needles did not ignite or burn as readily as the untreated needles and left a heavier black ash when compared to the very light, grey ash of the untreated material.

CONCLUSIONS

These tests were the first tried in the Southern Divisions and further trials with Firetrol using 16 and 20-1 mixtures in H/D's and a pack spray test using 4-1 ratio are planned for the autumn.

We plan to arrange a field day in the Autumn season and invite members of local brigades to attend.

Surely it would be of interest to all persons involved in fire control.

Fire Research Manjimup intend carrying out trials with Firetrol in the near future. Perhaps when these trials are complete more valuable information will be available.

It certainly appears that the use of Firetrol will revolutionize mopping up fire edges in heavy fuels. Although the Firetrol costs about 50c per gallon, if it makes a heavy duty load last five times as long, costs will soon break even.

SAFETY NEWSLETTER

Compiled by J. Marshall

At the end of the six month period July 1973 - December 1973 considerable success has been achieved in further reducing the incidence of accidents which necessitate medical attention. During this period 17 Disabling Injury Accidents were recorded, as compared with 27 for the same period last year, resulting in a reduction of D.I.A. Frequency rate from 26 at the end of June 1973 to 21.

Serious Injury Accidents sustained totalled 50 as against 48 recorded last year, but although this is an increase of 2 the overall total of compensable accidents show a reduction of 8 which is resulting in a continuing reduction in the total accident frequency rate from 86 to 82. This outstanding safety performance is due to those divisions who, by maintaining excellent safety records, must be congratulated for their continuing contribution to the overall success of the safety programme.

A number of divisions have achieved spectacular success, which is revealed in the divisional safety summary appearing on pages 55 and 56.

Although the progress we have made during the past 6½ years is something for which the entire work force can be justly proud, a study of the causes of accidents that are still occurring proves that we cannot afford to become complacent.

Accident prevention is not a positive or negative thing. It is a positive outlook requiring constant alertness and vigilance.

We all agree that not one of us likes to be hurt, yet there are still those of us who continue to unnecessarily expose ourselves to hazards - a practice which for sure will result in an accident sooner or later.

Remember! Safety is no accident.

Our own experience has proved that accidents DO NOT "Just Happen". They are caused and can be prevented.

Just as accidents do not happen, but are caused, so improved safety records do not just happen but are caused. They are caused by attention to work hazards in work areas, by elimination of unsafe acts in the work method and by training the worker in his job.

Remember there is a degree of risk in everything we do, on the job or at home, and our freedom from injury depends on our awareness of the risk and what steps we take to minimise the chance of an accident.

This is safety awareness which makes the unexpected happening the expected happening.

An authentic example of how an unexpected happening could have caused an accident is that told by an overseer about a near miss accident to an officer.

The officer concerned visited the gang who were engaged on low pine pruning. He stood on the fire-break awaiting the gang to move out of the plantation. At this particular time of the year the black cockatoos were present in large flocks feeding on the pine cones.

As the men moved out they disturbed a flock of 'cockies' who flew out directly above the officer, who got the shock of his life when a pine cone "whooshed" down within inches of his unhelmeted head. Dropped no doubt by one of the birds carrying it in his beak. Can anyone beat that?

In conclusion it is sincerely hoped that those people who are still of the opinion that "It Can't Happen to Me" and choose to disregard the common sense attitude to accident free working will change this attitude to that of the safe worker who does everything possible to keep himself and his workmates free from accident.

DIVISIONAL SUMMARY

SERIOUS INJURY ACCIDENTS

DIVISION	1973-1974 JUL	AUG	SEPT	OCT	NOV	DEC	TOT	1972-1973 JUL	AUG	SEP	OCT	NOV	DEC	TOT
WALPOLE	–	–	–	–	–	–	NIL	–	–	–	–	1	–	1
KALGOORLIE	–	–	–	1	–	–	1	–	–	–	–	–	–	NIL
HEAD OFFICE	–	–	–	–	1	–	1	–	1	–	–	–	–	1
COLLIER SOMERVILLE	–	–	–	–	–	1	1	–	–	–	–	–	1	1
NANNUP	2	–	–	–	–	–	2	–	2	–	–	–	–	2
KELMSCOTT	–	–	2	–	–	–	2	–	–	–	–	–	–	NIL
WANNEROO	2	–	1	–	–	–	3	–	1	1	1	2	1	6
RESEARCH	–	–	–	1	–	–	1	–	–	–	–	–	–	NIL
W/PLANS	–	–	1	–	–	–	1	–	–	–	–	–	–	NIL
COLLIE	–	1	1	1	–	–	3	1	2	1	1	3	3	11
MANJIMUP	1	2	–	–	1	–	4	1	1	–	–	–	–	2
KIRUP	2	1	–	1	–	–	4	–	–	2	1	–	–	3
DWELLINGUP	2	1	–	2	–	1	6	–	1	–	–	1	1	3
HARVEY	2	1	–	4	1	3	11	1	1	1	2	3	–	8
BUSSELTON	2	–	2	–	–	4	8	–	–	–	–	–	–	NIL
MUNDARING	–	1	–	1	–	–	2	–	–	–	–	–	–	NIL
NARROGIN	–	–	–	–	–	–	NIL	–	–	2	–	2	–	4
PEMBERTON	–	–	–	–	–	–	NIL	1	–	–	1	3	1	6

1973-1974			1972-1973		
MANHOURS WORKED	=	808,736	MANHOURS WORKED	=	864,541
S.I.A.	=	50	S.I.A.	=	48
F.R.		61.8	F.R.		55.5

TOTAL ACCIDENT. D.I. + S.I. F.R. = 82.8 > 86.7

DIVISIONAL SUMMARY

DISABLING INJURY ACCIDENTS

DIVISION	1973-1974							1972-1973							CURRENT ACCIDENT FREE MONTHS
	JLY	AUG	SPT	OCT	NOV	DEC	TOT	JLY	AUG	SPT	OCT	NOV	DEC	TOT	
COLLIE	–	–	–	–	–	–	NIL	–	–	–	–	–	–	NIL	37
WALPOLE	–	–	–	–	–	–	NIL	–	–	–	–	–	–	NIL	31
RESEARCH	–	–	–	–	–	–	NIL	–	–	–	–	–	–	NIL	26
W/PLANS	–	–	–	–	–	–	NIL	–	–	–	–	–	–	NIL	21
DWELLINGP	–	–	–	–	–	–	NIL	–	–	1	–	1	–	2	11
MANJIMUP	–	–	–	–	–	–	NIL	1	–	–	1	1	–	3	9
KELMSCOTT	–	–	–	–	–	–	NIL	–	–	–	–	2	–	2	11
COLLIER-SOMERVILLE	–	–	–	–	–	–	NIL	–	–	1	–	1	–	2	6
HARVEY	–	–	–	–	–	–	NIL	–	–	–	1	1	2	4	7
PEMBERTON	–	–	–	–	–	–	NIL	–	1	1	–	–	–	2	15
KALGOORLIE	–	–	–	–	–	–	NIL	–	–	–	–	–	–	NIL	49
NARROGIN	1	–	–	–	–	–	1	–	–	–	–	2	–	2	5
KIRUP	–	–	1	–	1	–	2	–	–	–	–	1	–	1	1
NANNUP	–	–	–	–	2	–	2	1	–	–	–	–	1	2	1
MUNDARING	1	–	1	–	–	–	2	–	–	–	–	–	1	1	2
BUSSELTON	1	–	1	1	1	1	5	–	1	1	1	3	–	6	NIL
WANNEROO	3	–	2	–	–	–	5	–	–	–	–	–	–	NIL	3
	6	NIL	5	1	4	1	17	2	2	4	3	12	4	27	

MANHOURS WORKED = 808,736 MANHOURS WORKED = 864,541

F.R. = 21 F.R. 31

CURRENT DEPARTMENTAL F.R. CALCULATED ON ACCUMULATED M.H.W. = 21

The response to requests for Safety articles for inclusion in the Safety Newsletter has been disappointingly poor. I feel sure that numerous officers and employees must be able to contribute with articles such as the "Cockatoo" episode or the following two submitted by Gordon Hampel of Mundaring.

Articles may be submitted direct to the editor at Como or to the Departmental Safety Officer.

THE TALE OF RECKLESS ROY

This is the tale of Reckless Roy
Who wouldn't wear his yellow boy

He went to fall a tree one day
But it didn't work out quite that way:
The tree looked down and said with a grin,
"This is where the games begin."

"This laddie wears no lid and so -
He gives to me an open go;
I'll drop a limb that's not too thin,
But big enough to clobber HIM."

We buried him the following day
We bought a wreath along the way,
We raised a cross and on it wrote
"He wasn't such a bad old bloke."

We also wrote "Remains of Roy
HE SHOULD HAVE WORN HIS YELLOW BOY."

UN SAFETY

A truck driver in the F.D.
With bulldust was rather too free;
When he turned round to skite
He swerved to the right,
And is now in hospital ward C.

A young Forest Guard drove too fast
Declaring he would never be passed;
He failed to see
A wandoo tree
And now he's a thing of the past.

A young forest worker was lax
While using his fine new axe;
As the tale goes
He cut off his toes;
Worse still - he gapped his new axe.

An old bloke who was poisoning a tree
Was spraying against the wind do you see;
The returning spray
Put him into sick bay;
The Tree? its as green as can be.

A well known firefighter named Bert
Attended a fire in a nice nylon shirt;
Now he's putting it round
That the idea's unsound;
"The ---- ---- ----- melted" said Bert.

There was a dumb fellow named Wright
Who mucked round with dynamite;
When the smoke and dust cleared,
It was just as we feared,
There wasn't much left of friend Wright.

An axeman who drank with great zest
In a grog fog was 'doing his best';
When a commotion arose
They counted his toes;
One two three - and farewell to the rest.

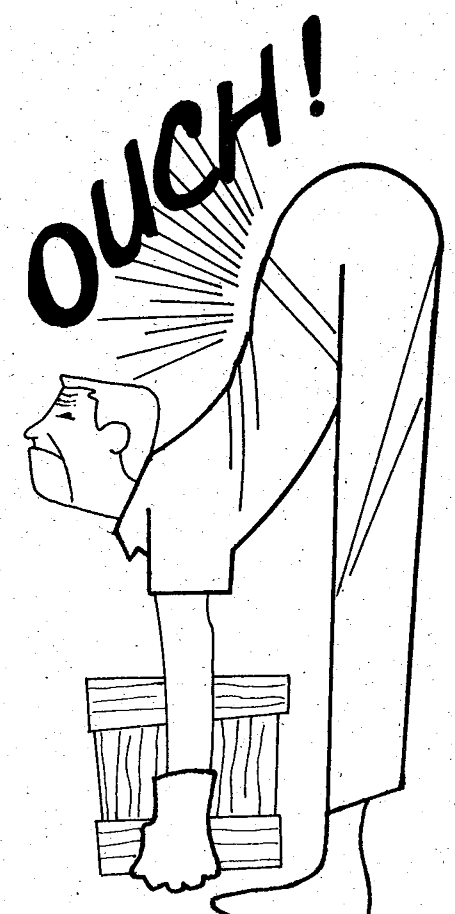
LIFT RIGHT

AND MIND YOUR BACK

The best way is the easy way. "Lift with your legs instead of your back."

That's the golden safety rule for "Lift Right."

But still people of all ages suffer back injuries as a result of improper lifting methods.



HERE ARE THE BASIC PRINCIPLES FOR

"LIFT RIGHT"

1. BEND YOUR KNEES, get down by the load and get a good grip on it.

2. Now let your legs do the work as you rise up.

3. Lift steadily, no jerking. Keep the feet and body in good position. DON'T TWIST.

4. Keep your back straight by lifting your head.

That should do it - a safe lift.

Of course all these good habits won't do you one bit of good if you do not follow another rule -

If the load is too heavy get help.

REYNAUDS SYNDROME

(WHITE FINGERS)

With the increased use of chain-saws throughout the department a number of suspected cases of the above condition have been reported and over the past 5 or 6 years several cases have been verified.

For some time the medical profession has considered that the risk of contacting this malady can be considerably reduced if chain-saw users were to adhere to a few simple safety rules, which are contained in the following report.

PROPER CHAIN SAW USE LESSENS 'WHITE FINGER'

There is sufficient evidence that most chain-saw operators begin to notice a form of vibration effect known as "white fingers" after regularly using a fixed handle chain-saw for 2-5 years, and continued use of a fixed handle chain-saw leads to worsening effects of white fingers. Occasional users, however, have not noticed the effect.

Experts in medicine, ergonomics, engineering, sound and vibration have investigated this for some time, as well as studied reports and spoken with experts from other countries. During this time, some chain-saw manufacterers have re-designed their saws, incorporating anti-vibration rubber or spring bushes between the handles and the saw engine and cutting unit to achieve much lower vibration levels than the fixed handle saws. Criteria for safe levels for vibration have been produced for chain-saws with allowance for variation in duration of usage per day and for interruptions in the working day. Most of the new anti-vibration chain-saws meet these criteria.

It is believed that spread of vibration effects can be halted (or prevented among those who have not noticed white finger effects to date) if suitable anti-vibration saws are used by regular operators, provided these operators also follow certain techniques and personal disciplines while working.

Anti-vibration saws are within safe vibration levels, provided that these five aspects of saw usage are followed:

1. Good techniques for felling, cross-cutting and de-branching with lightweight saws include resting the saw as much as possible on the tree (or occasionally on your thigh) so that some of the vibration is absorbed by the tree or your thigh muscles. Holding the saw lightly when it is at full throttle, without, of course, reducing effective control, will also reduce vibration absorbed by your hands.

2. Wearing chain-saw gloves spreads the grip over a larger area of your hand. (Four pairs per man should be provided so a dry pair is available after each break).

3. Good blood circulation to the arms and hands protects the flesh, nerves and bones in the hands, and is achieved by warming up <u>before</u> starting the saw, and by wearing suitable clothing and gloves. This applies to extra clothing during breaks.

4. Sprockets, guide bars, and chains should be well maintained and chains should be correctly sharpened with the recommended clearance for the depth gauge. Poor maintenance increases vibration by as much as one-third the normal level.

5. Every time the saw is idling or stopped, your hands and arms have a chance to recover from the effects of vibration. The more evenly breaks in usage are spread throughout the day, the less the risk of discomfort in your hands. Try to organize breaks for fuel, sharpening, meals, piling of timber or other work so that the saw is switched off for at least ten minutes, frequently, instead of a few, longer stoppages.

Research will continue to verify safe vibration levels criteria, to further reduce vibration levels of saws and to find ways of alleviating white finger effects.

CHAIN SAW SAFETY

Considerable concern is expressed at the continuing high percentage of accidents being sustained by chain saw operators in the timber industry throughout the world.

No Australian figures are available but recent statistics made public by Sweden and Canada reveal that there has been an alarming increase in chain saw accidents during the past five or six years.

These reports state that of the total injuries and deaths recorded in bush operations (Forestry and private) 52% of all accidents occurred while a chain saw was being used.

Of the total chain saw accidents 54% was the result of "Kick Back". These figures are of particular interest because a summary of accidents occurring in Western Australian bush operations reveal a similar trend.

Of the 116 accidents occurring in W.A. over the past five years 37% resulted from chain saw "Kick Back" - 19% in the actual tree felling operation and 18% in crowning off and trimming.

During the past twelve months 10 accidents - 5 Disabling and 5 serious have been sustained by departmental chain saw operators.

All ten accidents occurred in pine plantation operations. Of the D.I.A., 3 were the result of kick back whilst docking log lengths, 1 from kick back whilst trimming and the remaining accident was sustained by a piece work pine pruner who suffered a cut leg when the saw kicked back on striking limb debris.

The 5 S.I.A. were the result of two kick back incidents - 1 whilst felling and the other when docking. The remaining 3 resulted from trips and falls, in each case the operator tripped and fell on to the saw.

So it can be seen from our own experience and that gained world wide that the chain saw is a particularly serious source of accidents and warrants far more attention than it has received in the past.

Unfortunately far too many of us treat this machine as a toy. We feel that all that is required is to be able to start it and it will do the rest. Nothing could be further from the truth. It can be described as a lethal beast with a bite when in the hands of the inexperienced that can rip and main or even kill.

Even the experienced chain saw operator - the man with 15 years accident free working can tell of the numerous near-misses that he has had through not observing the few simple safety rules that are essential in the safe operation of this machine. As chain saw "Kick-Back" is by far the highest accident agency in its operation perhaps the following explanation of it could be of interest.

WHAT IS KICK-BACK?

Chain travels around the guide bar at about 42 m.p.h. Under certain conditions, the chain hits an object which stops it instantly. This makes the saw rear up and back towards the operator abruptly. This is kick-back, as distinct from the hazard resulting when the log pinches and disperses the power as the saw slows down.

CAUSES OF KICK-BACK

Kick-back results when material enters the space between two cutters and strikes the depth gauge. It can also result when the depth gauge hits wood before the cutting edge.

REDUCING THE RISK OF KICK-BACK

Stamp out bad maintenance - avoid incorrect depth gauge shape, where the front corner of the gauge is not rounded, allowing the corner to hit wood first, particularly on upper cutting - loose chain should also be rectified.

Avoid bars with a small nose radius - the dangerous part of the guide bar is the quadrant at the nose, and a bar with a small nose radius exposes the depth gauge more than a full radius nose, particularly if the chain is loose - the shape of a sprocket nose bar as well as the increased chain tension it allows, considerably reduces the hazards.

<u>Use Safety Chain</u> - bar design and chain tension reduce the hazards, but even under good conditions, a normal chain will kick when the bar nose strikes another log whilst the operator is cutting wood to length - or when the nose snags in brush while limbing. The new safety drive-link chains go a long way towards eliminating this. The safety link fills the space between cutters, providing a ramp which slides the chain smoothly over an obstruction, or effectively deflects the brush. The safety drive-link has been so designed that speed and efficiency do not suffer.