PAMPHLET No. 6
BULLETIN No. 58

The Foresters' Manual

* *

PART II

REFORESTATION
and
SYLVICULTURAL OPERATIONS
(Jarrah and Karri)

* *

CONTENTS

This Pamphlet Covers:—

INTRODUCTION

The attention of officers receiving this pamphlet is drawn to the introduction in Pamphlet No. 1 which is applicable to the Manual as a whole.

It is to be noted that each section as issued will override the instructions contained in circulars on subjects covered by the section and such circulars will automatically be cancelled.

Pamphlets Nos. 1 to 4 issued in 1950 covered Part 1—General District Work (South-West).

Pamphlet No. 5 issued in 1952 covered Part 4 of the Manual—Afforestation with Pines (South-West).

This Pamphlet No. 6, covers Part 2 Reforestation and Sylvicultural Operations (Jarrah and Karri).

T. N. STOATE,
Conservator of Forests.

1953.

REFORESTATION AND SYLVICULTURAL OPERATIONS

JARRAH AND KARRI

Problems and Methods of Regeneration.

The aim of Forestry.

618. Foresters need to keep before them at all times the fact that their work is primarily to increase the yield of the forests. Forest management, sylviculture and protection accompanied by efficient utilisation of the mature and overmature trees are necessary to contribute to this end. The general Working Plan governs the amount of mill log timber to be cut annually.

Foresters to study problems.

619. In Western Australia, we are fortunate in having as our two main species, Jarrah and Karri, which regenerate comparatively easily following trade cutting, but this very fact may frequently cause foresters to lose sight of the importance of studying carefully the effects of burning, treemarking for trade cutting, seed trees, seed years and other sylvicultural problems. The aim is that the regeneration shall be the result of the fellings themselves. Jarrah regeneration is obtained partly from advance growth resulting from seedling coppice. Subsequent establishment of seedlings in the blanks takes place for a few years until complete stocking is secured. Karri regrowth is from seed.

Methods of Regeneration.

Records of Regeneration.

620. Every Forest Officer, in charge of an area of forest, should have a knowledge of the stocking on his forest, and particularly, a record of areas where regeneration or growth appears unsatisfactory, and where patches of forest have been seriously damaged by fire. Such areas should be made the subject of discussion with senior officers and suggestions made for their improvement.

Treemarking the first step.

621. Natural regeneration of the forest follows the opening of the canopy resulting from trade cutting, and treemarking therefore, is the first step in regeneration operations, apart from precautionary measures such as advance burning.

Sequence of Operations.

Sequence of operations for regeneration.

622. The sequence of operations, according to existing practice in Western Australian forests to ensure regeneration of the forest is as follows:—

(a) Advance burn.
(b) Treemarking.
(c) Trade cutting of the older age classes.
(d) Top disposal.
(e) Regeneration operations if necessary.
(f) Permanent assessment lines.

The Working Plan.

623. The first general Working Plan was based upon assessments of State Forest carried out between 1920 and 1930. At each revision this original assessment was amended in the light of subsequent work by the Field Staff, and Working Plan records. Of recent years air photos are being used in conjunction with field work. The forest is divided into milling sections which after sale, form the permit areas under which mills operate. On each permit area annual cutting coupes are determined as the location of the cutting operations for the current year.

Permits and Coupes.

Advance Burn.

Advance burning before Trade Cutting.

624. Controlled burning, which must be carried out before trade cutting commences, is dealt with under Fire Control. The object of this operation is to reduce the severity of fire hazard both during felling operations and during the subsequent top disposal.

Treemarking.

Treemarking on the Selection System.

625. Treemarking in the Jarrah and Karri forest is carried out in accordance with the Group Selection System. It is the marking for removal for trade purposes of mature and over-mature trees, or groups of trees, which possess utilisation value.

Object of Treemarking.

626. Treemarking must be regarded primarily as a sylvicultural operation and is the marking of the mature trees which should be cut for sawmilling in trade operations. Better utilisation is secured through closer control of the falling instead of leaving the selection to the faller as was formerly the case. Better protection in the falling is afforded the immature trees which will provide the cut at the end of the next cutting cycle.

627. By cutting in accordance with the group selection system regeneration can be assured and conditions are provided for the satisfactory development of the regrowth.

Standards of Treemarking.

628. Standards, for the guidance of officers engaged in treemarking, will be detailed by a Regional Forest Officer and it is essential that officers doing treemarking should realise the important part their work plays in inducing a new crop. Vigorously growing immature trees, whether occurring in groups or isolated, must on no account be marked for cutting.

Immature trees to be held.

629. Officers must realise that it is obviously not good forest practice to remove an existing good immature tree or group of such trees to make room for a new crop which will take much longer to reach maturity. It will be realised that definite girth measurements are not an indication of maturity but girth standards are used as a guide to the treemarker.

Personal instructions of treemarkers.

Officers entrusted with the important work of treemarking will receive personal instructions from senior officers on the subject.

Methods of treemarking by branding axe.

630. The trees will be marked by branding in an axe-cut at the foot of the tree in such a position that the tree must be felled directly over the brand. The brand used is an insert in an axe head and is marked F.D. over a number; the number signifying the authorised officer using the brand. All branding axes are issued by Head Office and the name of the officer holding each number is registered. No branding axe may on any account be lent or transferred or allowed to fall into the hands of an unauthorised person.

Relations of the Treemarker to the Fallers and the Bush Boss.

Fallers blocks.

631. All treemarking is done by fallers' blocks which must be marked out on the landing by a representative of the sawmiller concerned, usually the "Bush Boss." No treemarking should be commenced until these blocks for individual fallers are set out to the satisfaction of the Forester or Assistant Forester in Charge. Regulation 37 covers the responsibility for the demarcation of the permit boundaries.

Permit boundaries.

Inspection of fallers blocks.

632. The Forester, or Assistant Forester in Charge, must make regular inspections of blocks claimed to be cut out before allowing fallers or cutters to move on to the next block.

Treemarker deals with Bush Boss.

633. In marking for mills employing a number of fallers, the treemarker shall deal only with the Bush Boss and not with individual fallers. In the event of any difference of opinion arising between the treemarker and Bush Boss, the question in dispute shall be referred to the Forester in charge and Mill Manager.

Bush Boss responsible for logs.

634. It is not in the best interests of either the Forests Department or the sawmiller that useless timber shall reach the mill landing. The responsibility for preventing this lies with the sawmiller concerned, and is among the duties of the Bush

Boss. Strict supervision of fallers is necessary to prevent avoidable damage due to careless falling causing split butts and broken crowns. The Bush Boss will find it necessary occasionally to condemn a log which is seen after falling to be valueless. He should also see that logs are long-butted when necessary and properly headed off.

635. Should it appear to any officer that neglect of these matters is likely to give rise to complaints by the mill management concerning quality of timber or recovery, a report should be made to the Forester in charge, who will take the matter up with the Mill Manager, and only report to Head Office or the Regional officer if he is unable to effect improvement by local action.

Forester to check work of Bush Boss.

Trade Cutting.

636. The main features of Departmental control under the Forests Act, 1918, and Forest Regulations are discussed in previous pamphlets of this Manual. It is necessary for the Forester in charge to know, at all times, which portion of the permit area will be worked over during the ensuing 12 months.

Annual cutting coupes must be known in advance.

637. It is necessary for the permit holder, when applying for renewal, to submit, each year, an application through the Forester in charge, setting out the area known as the annual cutting coupe over which he desires to operate for the ensuing 12 months and showing on a plan the tramlines it is proposed to maintain and construct. This application will be forwarded through the Divisional Forest officer to Head Office by the Forester in charge with his recommendation. Before such papers are sent to Head Office the officer concerned should make a copy of the information referred to above for his own guidance.

Tramline plans to be submitted and copies held by Foresters.

638. The attention of Foresters is drawn to Regulation 29, by virtue of which the Department is empowered to confine operations on a permit area to certain defined sections. Accordingly it is the duty of the local officer to see that operations are strictly confined to the sections agreed upon, and that no departure from this is allowed except by express permission in writing from the Conservator.

Falling operations to be confined to annual coupes.

Top Disposal.

639. This operation of vital importance to protection and regeneration is dealt with under "Fire Control." In most cases today, this operation completes the work necessary to ensure the establishment of the new crop.

Top Disposal.

Jarrah Regeneration.

640. In virgin bush this should be the result of the fellings themselves, and as stated above the complete stocking is secured after a few years. In former cut-over bush satisfactory regrowth is becoming established in most places. Earlier it was the practice to carry out ringbarking and minor cutting, known as regeneration cleaning. This is no longer done and the term regeneration cleaning has therefore fallen into disuse.

Jarrah Regeneration.

Karri Regeneration.

641. Karri regeneration is dependent on the fall of seed on the mineral soil after logging and top disposal operations. A burn, when the trees carry adequate seed, is followed by abundant regeneration. A burn when seed is deficient is followed only by a dense growth of scrub species which take possession of the site, and may effectively prevent Karri from re-establishing itself with future seed crops. Karri seeds

Karri Regeneration dependent on seed.

fairly heavily at irregular intervals of three, four or even five years, and the seed may stay on the tree for two summers, but will fall during the third. It is important therefore, to ensure that the trees carry adequate seed, before burning the tops from trade cutting. Thus, while top burning in two successive years may yield good regrowth, any burning in the following year or two, may result in only an unstocked area of scrub.

Effect of burning on Karri regeneration.

Importance of studying seed years for Karri.

642. Officers will therefore observe closely the development of buds, flowers, fruits and seeds on Karri in their area, and include notes on such development in their Quarterly Statement to the Divisional office.

643. The sequence of operations will be similar to that set out in paragraph 622 for the Jarrah forest, except that:—

Sequence of operations for Karri regeneration.

1. It is not always possible to get an advance burn of all the Karri cutting area. It is important to appreciate that a fierce advance burn may bring down the seed and thus start germination of seedlings which would later be killed in the top disposal burn.
2. For the first and second year after formation of a good seed crop, autumn top burning will be followed by abundant regeneration.
3. For the third year after seed formation, a spring burn may be followed by adequate regeneration, but as the remainder of the seed will fall during the summer, an autumn burn will destroy much of the seed on the ground, and inadequate regeneration will result.
4. If a fresh crop of seed is not produced after three years, it is desirable to hold the top burning for one or two years until abundant seed is again available. This will require careful planning in advance to ensure the area of "tops" is well protected by fire-breaks or advance burns.

Coppice Cleaning.

Coppice Cleaning.

644. The term "coppice cleaning" is used to describe the operation of reducing the number of stems per stump or per acre during the first 10 years. Experimental work to date has shown little or no economic gain from this operation. In addition, indications are that earlier forking of the tree results from such cleaning operations.

Thinning.

Purpose of Thinning.

645. The purposes of thinning are, where possible, to cut for sale those trees which will otherwise die in the struggle for existence in the growing stand, also to effect by selection, among the stems, some improvement in the constituent members of the crop and to provide increased growing space for those trees remaining. The Jarrah and Karri forests are comparatively open forests even for Eucalypts. Those trees which are desirable piles and poles for trade purposes, are the best trees in the forest and are therefore those which should be retained to form the future crop. Only a very limited thinning for some poles, chiefly from the sub-dominant trees, is therefore possible in the Jarrah and Karri forests. The problem is even more accentuated in the Wandoo forest.

Very little thinning necessary in Jarrah and Karri.

646. Near the metropolitan area however, there is from time to time a sale for scaffold poles, vine trellis poles, etc., rendering possible some thinning in comparatively young stands. In the Mallet plantations thinnings can be made to provide bark and lagging poles and firing sticks for the Murchison gold mines, while in some Jarrah stands of 40 years of age thinnings are made to yield firewood, and in some cases small case logs. Young Karri forest is being thinned today at Boranup for case logs.

Special cases where thinnings are possible.

647. Future markets, which will affect thinning operations in the Jarrah and Karri forests in the years to come, will be round fence posts creosoted before use, and pulp wood. Our Eucalypts yield a short fibred pulp, but there is no doubt this will be used in mixture with the longer fibred pine pulp resulting from the pine planations now being established.

Future thinning proposals.

Improvement Work.

648. This is a term applied to an operation designed to improve the forest by the removal, usually by ringbarking, of useless trees or trees of useless species, overtopping or interfering with good growing young trees. It has extremely limited application in our hardwood forests, and is not now generally practised. Trees today thought to be useless may, some day, prove profitable under different trade and price conditions.

Improvement work.

649. With limited annual funds available to the Department it is, of course, more important, at the present stage of Forestry in Western Australia, to use such funds for initial development of unprotected or partially protected forest than to expend them on the tending, thinning and improvement of areas of regrowth or poles; unless and until such tending operations can be shown to pay interest on money expended.

Funds available needed for protection work.

TEMPORARY ASSESSMENT LINES

(Quarterly Assessment)

650. All treemarkers, at the close of each quarter, are required to assess a portion of the area cut over and to forward the results of this work to the D.F.O., who summarises the work for various permits and forwards to Head Office with the Quarterly Report.

Quarterly Assessments.

651. The objects of these assessments are:—

(a) To inform the D.F.O. and the treemarker himself of the volume he is removing and the volume he is retaining per acre.

(b) To inform Head Office for management purposes and working plan calculations.

(c) To provide data for future use with air photo interpretation.

Objects of temporary assessments.

652. The treemarker should run a compass line, with either chaining or pacing of distances, through the area cut over during the quarter, preferably across the ridges, so as to obtain a representative sample of the area. On this line for a half chain each side he measures and records the girth of all trees over 60in. girth and calculates volumes removed and volumes remaining, using the same tree classification as set out in paragraph 682 covering permanent lines. Loadages are calculated for each 10 chains. About one mile of line, giving eight acres, is required for each permit.

Method of temporary assessments.

653. The Department requires to have on record for application to air photo interpretation, a number of heights of co-dominant trees throughout all parts of the forest.

Tree heights required.

654. All officers, therefore, running temporary assessment lines at the end of each quarter, should measure the total height of three co-dominant trees on each permit area on which they are running temporary lines. The measurements should be included on the page on which temporary assessment line figures are reported to Head Office.

Three trees to be measured.

655. The information required for each tree is:—

(a) Girth at stump height—state whether under bark or over bark.

(b) Total height of tree.

(c) Length of log recovered.

(d) Length from ground level to the fork, i.e., the total bole length.

656. In many cases of course, it will be possible for the treemarker to obtain this information by measuring the tree immediately after it is fallen. In other cases it may be necessary to make the measurements after the log has been removed.

657. Where permanent lines are being established under direction of the Regional Officer, within the quarters cutting, there is no need to do temporary line work, but figures must be supplied to Head Office with the Quarterly Summary.

PERMANENT ASSESSMENT LINES

SECTION 1—FIRST ASSESSMENT

(Paragraphs 658 to 722)

Objects of permanent assessment lines.

658. Following on trade cutting, it is necessary to establish permanent plots or assessment lines on which the remaining trees are measured periodically to provide data for growth studies and forest management. Permanent lines in lieu of plots have been adopted as standard practice in this State.

Uniformity necessary throughout the Department.

659. Uniformity in all details in all Divisions is important in this work in view of the long term nature of the studies depending on the first measurements.

Lines to be run.

660. The work of establishing and measuring permanent lines commenced in 1942 and there is, of course, a large area of forest which was cut over before that date, and in which lines have still to be run.

May's line

661. The first line selected for running is a continuous true N-S line known as May's line which traverses the main Jarrah forest belt. Other lines will be run parallel with May's line. They will be named as follows:—

W8 is a line eight miles west of May's line.

E8 is a line eight miles east of May's line.

662. Other lines not necessarily on the meridian are run as directed by a Regional Officer in compartments where a permanent line takes the place of a temporary line.

Selection of Starting Point.

663. Maps provided from Head Office show the position of the line. Select convenient starting points from these maps Lines may be run either northwards or southwards from the starting point to suit the convenience of the gang.

Starting the line.

664. When the line is broken by entering private property, it is resumed from zero chainage at the point of emergence from the private property. Every time the line is broken in this manner the actual "mileages" (starting and finishing) on the line must be noted in the field book. "Mileage" means the distance south from the north edge of Mundaring map sheet and is shown on the maps sent to the assessor.

Poling the Line.

665. Check for compass variation and local attraction at the starting point by foresighting and backsighting on azimuth pegs or Lands Department surveys. A true N. or S. bearing is then set off by the compass.

666. Officers in charge should check personally this important first step in locating the line.

667. The line is then extended by "sighting in" further pegs. A plumb bob must be used for this sighting. Pegs should be cut to length so that the operator can conveniently sight along the tops. The peg top is to be flattened on two sides and sharpened to a point to facilitate sighting. When the line is obstructed by a good pole or pile, large tree or other obstacle it will be necessary to offset the line. Every care should be taken to avoid unnecessary falling of good poles. The method of offsetting is as follows:— Running the line.

668. Firstly, decide the amount of offset required to clear the obstacle and then cut a light stick to approximately this length.

669. Pegs are then set up alongside the last two pegs in the line (which should be at least three chain apart) at the agreed offset distance by measuring with the stick which must be held horizontally and at right angles to the line. The top of offset peg should be at the same level as the top of the corresponding line peg so that measurement can be made between the actual points of the pegs. Offsetting the line.

670. Having set these two offset pegs, the line of these pegs is continued beyond the obstacle for two pegs when a reverse process is applied to bring the line on to its original position.

671. Check the position of the line on every theodolite Reference Tree and Lands Department survey. If more than three chain off the line in three miles, step back on to the correct line. Corrections need not be made more often than every three miles. If the error at three miles is less than three chain, continue the line to the next tie point provided it is not too far and the anticipated error at that point does not exceed five chain. Checking the line.

672. The above adjustments should always be made at five chain pegs.

Pegging the Line.

673. Once the line has been poled, the next step is to chain it with a five-chain band and then to set pegs at the commencing point and at five chain intervals. In the chainage of the line it is not proposed to make any adjustments for slope, but if steep slopes are encountered a note to that effect should be shown in field book. The peg is to be cut from mature durable wood with a flat sawn top and a cross section not less than 4in. x 4in. It will be found best to obtain sawn pegs or else to split them from logs at a central depot and then to distribute them along the line. Chaining the line.

674. Pegs will be set 12in. in ground and 12in. above ground except that the peg at the starting point should be 3ft. long so that it can be more readily located at a subsequent date. Pegging the line.

675. Trenches of spade width, 6in. deep, 3ft. long and 3ft. from the peg will be made to indicate direction of the line. Where possible a cairn of rocks 3ft. long to replace the trench is preferable. Soil from the trenches or rocks are to be packed around the peg to a height of 9in. Trenching from pegs.

676. Pegs will be branded on the top with ½in. steel dies to show by broad arrow the direction of line and below this, the chainage. Branding pegs.

677. After branding the top of the peg, the top and the sides down to the top of the spoil will be painted with white outdoor paint. Painting pegs.

678. Where lines are offset to correct their position, pegs will be put at the five chain positions and an arrow will indicate the direction of the step taken. Indicating offset.

The Assessment.

Width of assessment.

679. To enable the positions of trees and stumps to be recorded the five-chain band is run out (the forward end being anchored). Assess one chain on each side of the line. Hence five chain of line = one acre.

Fixing position of trees.

680. By recording the position along the line (lks.) and the distance offset (ft.) from the line, the position of any tree is permanently fixed for future reference. Offsets on the right are indicated in field notes by + sign, those on the left by the — sign.

Method of assessment.

681. Details of data to be recorded are set out hereunder:—

(1) **Standing Trees.**

(a) Trees over 60in. G.B.H. (all species).
Record position, G.B.H., height to top of merchantable log and classification according to size and quality.

(b) Trees under 60in. G.B.H. Pile and Pole Class.
N.B. All species.

Recording standing trees.

If over 20ft. utilisable length and 6in. crown diameter and up to standard specifications as set out in grading rules, record position, length of pole or pile obtainable and crown diameter.
For trees not up to specifications, a count of the number in each species is recorded.
In order to have samples of the stocking of the forest in the lower classes, it is required every four miles to book for five chain the G.B.H. and utilisable length of all piles and poles irrespective of quality down to 24in. G.B.H., and to record the number of stems between 24in. G.B.H. and 12in. G.B.H.

(2) **Removed Timber.**

Record position of stump, under bark girth to the nearest inch at top of stump, length of log and under bark girth at crown. If falling was by power saw, note stump height.

Where bark is present make a deduction of 1in. per foot of bark up to a maximum of 8in. for Jarrah and 6in. for Karri.

Recording removed timber.

Where either the stump or crown is missing or unmeasurable an estimate should be made for the volume of the log or the missing dimensions.

TREE CLASSIFICATION

682. **Standing Trees.**

A. **Over 90in. G.B.H.** (Karri over 108in.).

(i) Trees retained as growing stock (or will be retained where bush not previously tree-marked). Sometimes only fair trees are retained because there is nothing better.

(ii) Trees held for special reasons. In tree-marked bush this includes logs held—

(a) To prevent damage to immature growth.

(b) Trees held to allow a top log to reach millable size.

(iii) Marketable logs which should be taken to a mill in the district. This includes trees M.N.T. because of quality or because they would fall over a road.

(iv) Trees not at present exploitable. These may include some of the M.N.T.'s. (Volumes will be calculated.)

B. **Trees between 72in. and 90in. G.B.H.** (Karri 72in.-108in.). Tree classification to be used.

(i) Growing stock for the future.

(ii) Trees that could be removed—too defective for future growing stock.

(iii) Trees not at present exploitable because of defects (volumes will be calculated).

C. **Trees between 60in. and 72in. G.B.H.** (Karri likewise).

(i) Dealt with in same manner as B.

(ii) " " " "

(iii) " " " "

D. **Under 60in. G.B.H. Piles and Poles** (tree classes). When above 60in. G.B.H. engineers' piles and poles will be classified according to their girth class, but the letter "E" will be added in the class columns, e.g., BI (E).

Engineers' Piles and Poles.

Poles (all species)— Piles and poles.

Minimum length 20ft.
Minimum crown diameter 6in.
Maximum crown diameter 9in.

Piles (all species)—

Minimum length 20ft.
Minimum crown diameter 10in.
Maximum crown diameter 16in.

Record position, crown diameter and length of engineers' piles and poles. For others down to 24in. G.B.H. record number only, but not on a separate line—see specimen page of field book.

683. **Removed Trees.** Removed trees.

Jarrah.

Over 90in. over bark—R1.
Under 90in. over bark—R2.

Karri.

Over 108in. over bark—R1.
Under 108in. over bark—R2.

The removed trees should be encircled thus in the case of an old cutting (R1) (R2) to differentiate from a further or new cutting which are marked thus, R1, R2.

684. **Stand Height.**—The total height of a mature co-dominant tree should be taken every 20 chain or at any change of type.

685. Co-dominant trees in immature stands can be used in conjunction with the girth-height curve to determine stand heights, but trees below 40in. G.B.H. should be avoided. If the curve is used, the actual height of the tree should still be shown and a separate line used to show the stand height deduced. Stand height.

686. Changes of type of less width than 10 chain need not be recognised in this connection.

687. **Survey Ties.**

Ties to surveys required.

(a) Ties to Theodolite Reference Trees (indicated by double circle on plans) and Lands Department Surveys are recorded to accurately place the line.

(b) All Reference Trees, tracks, railways, creeks, swamps, and die-back areas, etc., should be recorded in the field book at correct distance. Reference Trees should be tied to the line, if not more than five chain away.

688. **Air Photo Interpretation (A.P.I.).**—To enable co-ordination between the assessment lines and aerial photography it is necessary wherever possible to "tie-in" control points (C.P.'s) to the line. These are points which are easily recognisable on the photos, e.g.—

Air photo control points required.

Corner of cleared paddock.
Cross-roads, building, bush landing, etc.
Ties to C.P.'s must be sketched.

Note.—If C.P. is also tied to a Lands Office survey it becomes of greater value for A.P.I.

Sylvicultural notes to be made.

689. **Sylvicultural Condition.**—At the end of each 20 chain give a brief summary of "sylvicultural condition," e.g.—

Dense saplings 30ft. high.
Dead tops.
Badly fire damaged.
Good poles.

690. **Understorey.**—At the end of each 20 chain give brief notes on understorey over 10ft. high, e.g., merchantable sheoak, dense banksia.

Field notes.

691. **General.**—Leave one line break in booking to indicate:—

(a) End of each five chain.
(b) Change of forest type.
(c) Change of site quality.
(d) Change from virgin cut-over bush.
(e) Block boundaries.

Field Book.

692. On the outside cover of the book must be shown the name of the line and the field book local number.

First page must carry an index if book contains more than one unbroken section of line.

On the inside cover of the book should be sketched the position of the line, name of line and location of ties and steps over. "Mileages" (starting and finishing) must also be shown, e.g., 120-123 ml. 20 ch.—120-118 ml. 40 ch. See paragraph on "Identifying lines" for explanation of mileages.

Field books to be marked.

On the second page the following should be given:—

(a) Division, e.g., Dwellingup.
(b) Name of Block or Blocks.
(c) Sawmill permit.
(d) Map reference.
(e) Month and year assessment commenced.
(f) Name of assessor in charge.

The date must be recorded at the top of every page. When lines are remeasured, accurate dates are required for calculating increment.

Specimen Page of Field Book. 15

693. This will explain some anomalies that may occur.

Ch.	Dist.	Sp.	Class.	G.B.H.	Merch. Log.	Pot. Log.	Centre Girth.	Top Girth.	Piles and Poles. Length.	Piles and Poles. Top Diam.	Total Height.	Crown Spread.	Lds. Rst.	Remarks.
320	+24	J	A1	9 1	32		J							
335	+65	J	B1 (E)	6 3			III		40	16				
370	—10	J	B (E)						20	6				Crown damaged.
400	—23	M	C2*	5 10	22		MII							Girth at 6ft. Hollow to 5ft.
460	—40	M	B3	7 5	20									Very poor form.
							J (3)	Top Log					1	Badly damaged. Kink at 20ft.
493	+24	J	C1	5 8	28	10 x 2·4	M (2)							
1500														
50	+30	J	(B1)	7 2	20			5 6						
79	+42	J	(B2)	6 1			JII						2	Cr. missing.
120	—55	J*	A2	9 10	38									Girth est.
	.....							Cr. Log					½	Badly overgrown.
145	—25	J	A4*	8 2	22									Dry side, no crown.
192	—32	M	A3*				MII						2½	Hollow butt to 10ft.
243	—53	J	A3	8 10	40						(105)			G.B.H. a mean—Niggerhead.
261	—27	K	B1	8 11	25									
372	+63	K	A1	11 0	47	Type change to pure Karri.		KIII						
				Control point at road junction.										
							J (2)							
441	+ 5	K	C1	5 5	32		M (3)							
487	—20	K	A3	9 3	64		K (3)				(200)			
				Badly damaged by fire about 2 years ago.										
				Jarrah type carrying dense sapling stand —40ft. epicormic crowns.										
2000				Banksia understorey, in moderate amount.										
				Note: * Denotes trees not suitable for increment calculations.										

Method of Measurement—Standing Trees.

694. G.B.H. to be measured at 4ft. 3in. from the ground surface and not from the top of the litter. The 4ft. 3in. measurement is taken on the high side of the tree. A 5ft. stick with a notch at 4ft. 3in. should be carried.

695. Measurement is made with a **steel tape only,** left to right around the tree, and taken to the nearest ¼in. Care must be taken to ensure that the tape is run around at right angles to the axis of the tree.

Method of measurement.

696. If the tree is unsuitable for measurement at this point and it can be measured elsewhere from the ground at a suitable point the actual height at which the measurement is made must be recorded in the field book.

697. If measurement from the ground is not possible, an estimate of volume should be made.

698. Girthing of trees which will be remeasured is of utmost importance and the greatest care is required.

Log Length.

699. Log lengths of trees with sound butts will be given from ground level. Estimates should be checked regularly with a hypsometer or Abney level. In Head Office an average stump height of 3ft. will be subtracted when volumes are calculated.

Measuring log length.

700. If a tree is burned or useless to say 5ft., book the length above 5ft. plus 3ft. (subtracted in H.O.). If possible, girth at 1ft. 3in. above the butt of log, i.e., in this case 6ft. 3in.

701. In the case of poles and piles, book the actual length that can be taken—there is no deduction in Head Office.

Total Height.

702. Firstly examine the selected codominant tree from several angles to decide the highest point.

Measuring tree heights.

703. To ensure reading to the highest point of a tree when measuring codominant heights it is necessary to plumb someone under this point from two directions at right angles. Find the spot where 45° reads to the highest point. Then if using a clinometer set to zero and measure the height from ground level to the point where this cuts the bole of the tree. This height is added to the distance between the two measurers to give the total height.

704. Where it is practicable to use them, more accurate results are obtained by using angles less than 45°. The only difference in the calculation is that the distance between the two measurers is multiplied by the tan of the angle, examples of tangents:—

27°	0.50
31°	0.60
35°	0.70

Painting.

705. Any free-growing tree which is worthy of remeasurement for increment purposes, will be marked by a paint line 3in. in length and 1in. in width at a point so that the top of the paint line will be 12in. above the level of the point of measurement, but facing the assessment line. Before the paint is applied the rough outer bark should be lightly removed. (This does not necessarily mean 5ft. 3in. from the ground on that particular side of the tree.) In the case of Karri and Wandoo, the paint line is replaced by a 4in. copper nail, or heavy gauge copper wire.

Marking the trees for remeasurement.

Marri and Blackbutt are painted in the same manner as Jarrah.

All A1, A2, B1, and C1 trees are painted.

706. **If one of these is unsuitable for remeasurement,** because of overgrowth or the possibility of unreliable measurement, place an **asterisk** between the class and G.B.H. columns.

Calculation of Volumes.

707. **In the Field.**—All assessors are required to calculate one acre per week in the field while running permanent lines. Standing tree volumes to be found by using the "Jarrah Volume Table," and removed volumes using the "Cubic Contents Table." By doing this the assessor will increase his knowledge of tree volumes and appreciation of area volumes. The figures obtained must be shown in the field book. It is desired that the acre should be the last acre done each Monday morning.

708. **In Head Office.**

Calculations of volumes.

(a) The volumes of removed trees calculated from butt and crown measurements will be subject to a deduction of 20%, due to butt swell, as compared with calculation of mid-girth.

(b) Mid-girth of standing trees will be calculated by the use of a volume table in Head Office.

(c) For trees below 60in. girth a pile and pole table is used based on crown diameter and log length.

Equipment Required.

709. Steel tapes with hook attached (G.B.H. measurements) according to number in the gang.

1 light axe (2¾ lb.) for removing bark and hammering nails.

1 cloth tape (66ft.).

5 ch. steel band.

Chain mending outfit.

Set of steel dies (0-9) and arrow.

Spade.

Tin of heavy bodied white paint and brush.

Clinometer or hypsometer.

Copper nails or wire.

Plumb bob (may be home made).

Field book, pencil and rubber.

Topo field bag.

Plan case.

Compass.

Board with straps will be found an advantage.

80 and 20 scale plans.

Slasher (may not be required).

Equipment required for the gang.

710. In all types of country it will be found a great advantage to use a booking board consisting of a sheet of masonite about 17in. x 13in. curved inwards at one 17in. edge to fit in front of the body and slotted to hold straps. One strap around the neck and another around the waist will hold the board in position. A clip on the front of the board will hold the field book in position and both hands are free.

Plans Identifying Sections of Line Run.

711. May's line starts from zero miles at the north end and the miles run consecutively from north to south unbroken by private property and divisional boundaries. The mileage at which May's line enters each division is shown on the 80 scale plan. The officer in charge of the work can then scale off the mileage of the points where he desires to commence and finish a section of the line.

Plans to identify lines.

712. By measuring on the plan at right angles from May's line it is possible to find the mileage at any point on the lines east or west. As these lines, unlike May's line, are broken, it is necessary to adopt the corresponding mileages from May's line.

713. As every field book and section of the work is completed, the mileages (starting and finishing) will be shown on the Progress Plans. In any later reference to the work these mileages will be quoted and even without reference to a plan they give a good lead regarding the locality of the work.

714. In Head Office a serial number is allotted to each field book and the section of line therein is plotted on a master plan.

Field Books and Head Office Work.

Despatch of field books.

715. Field books should, if posted, be sent under registered cover. If delivered personally to Head Office, field books should be handed in to Records Branch who forward all field books to the Drafting Branch.

716. Drafting Branch record the line on assessment plans and number the book in accordance with the numbering system held by Research Branch.

717. Completed field books should be sent promptly to Head Office.

718. If a field book is half completed and there is no prospect of completing it within a month, the book should be forwarded.

Assessors to keep journals.

Assessors' Journals.

719. All assessors who are working on permanent lines should submit a monthly journal on Form FD. 1 as is done by officers of the Department. So that costs of various operations may be computed, the distance and time spent on each operation should be shown in the journal.

720. When officers are doing assessment work they should note on the days concerned in their monthly journal the location and chainage of the work done. Example:—

11th June; Sawyer's Block, May's line, Permanent line; Poling 130 chains; 8 hours.

Information sent back from Head Office.

Information from Head Office.

721. Each field book will, after computation, be summarised normally in 50 chain sections, i.e., 10 acre units, unless distinct forest type changes occur when the summaries will be made to conform with types.

722. This information will be sent to the D.F.O. or District Forester concerned who should, as necessary, pass information to the assessor or other officers concerned.

SECTION 2.—RE-ASSESSMENT

(PARAGRAPHS 723 TO 743)

General.

723. In re-assessment, the main object is to ascertain the growth rate of the forest. Re-assessments will be made at intervals of not less than 10 years.

Increment Calculation.

724. Because there are so many possible sources of error if volume increment over an area is found directly, and because of its simplicity, girth increment will be used to find the increase in volume.

How increment is to be calculated.

725. The growth rate will be based on girth increment only of selected trees over 60in. G.B.H. It is assumed (subject to checking on remeasurement) that these trees have reached their ultimate bole length.

Example:—

72in.-90in. girth class—

Mean girth increments over 10 1/12 years .... = 5in.
Basal area of 81in girth tree 10 1/12 years ago = 3.63 sq. ft.
Basal area now .... = 4.09 sq. ft.
Mean Basal area over 10 1/12 year period .... = 3.86 sq. ft.
Basal area increment .... = 0.46 sq. ft.

$$C.A.I.\% = \frac{0.46 \times 100}{3.86} \times \frac{}{10\ 1/12}$$
$$= 1.19\%$$

Volume 72in.-90in. on 50 acres, at the first assessment = 10,000 cu. ft. (200 cu. ft. per ac.).

This volume (Co) increases in 10 1/12 years to (Cn).

Therefore Cn = Co x (1.Op)n.
10,000 cu. ft. at 1.19% compound interest equals 11,280 cu. ft. = 225.6 cu. ft. per ac. on the 50 acres.

Thus the increment per acre is 225.6 minus 200 = 25.6 cu. ft. per ac. over the period of $10\frac{1}{2}$ years.

Trees to be Remeasured.

Notes on remeasuring of trees.

726. If fire burns the bark at G.B.H. it reduces the actual girth over bark of the tree, but the volume of timber is not necessarily affected likewise. Hence if we measure the girth before the tree has had time to make up the loss of bark we obtain an erroneous picture of its growth. It is essential to wait until the bark is normal before remeasuring permanent lines.

727. If a tree which was painted for remeasurement has subsequently been badly calloused by fire do not hesitate to omit remeasuring it (enter appropriate remark) because it is not indicative of the true increment. If the previous assessors saw fit to paint a rough stemmed tree for remeasurement there is no reason why we should follow his example and obtain a doubtful result. See paragraph 705.

Booking During Remeasuring.

Special books for remeasuring.

728. In the past, much time has been lost in Head Office trying to find the same tree in the old and new assessments. It is much simpler for the assessor to do this in the field. Hence a re-assessment field book has been made which allows the old and new measurements to be entered on the same line.

729. The old field book **must also be taken out on the job.** If the old and new co-ordinates of a tree do not agree perfectly, the previous figures will be accepted. However, if gross errors have been made, the correct figures should be entered in the "ch" and "Dist" columns.

730. The top of every page must bear the date as shown on specimen page of field book.

731. (1) The correct re-assessment book should be used.
(2) The position of the line should be sketched on the inside cover of the book. This may be copied from the old book if it is found to be in order.
(3) The first page must carry an index.

Use of field book in remeasuring.

(4) On the second page the following should be given:—

(a) Division, e.g., Dwellingup.
(b) Name of block or blocks.
(c) Sawmill permit.
(d) Map reference, e.g., Dwellingup 80.
(e) Date assessment commenced.
(f) Name of assessor in charge.
(g) Old field book numbers.

(5) Break booking every 5 chain by leaving one blank line.

(6) Show ties to reference trees, location corners, etc., where available.

(7) Show ties to control points (see "Meridian Lines").

(8) As field books are completed they must be forwarded to Head Office accompanied by the old books.

Locating old lines.

Locating the Line to be Remeasured.

732. Many of the original assessment or "grid" lines prior to the commencement of May's line, were laid out from a base line.

733. The old field book will show a sketch of that base line and assessment lines running off it. Using the "Ties" indicated it will be possible to locate the base line. This has pegs (6in. x 6in.) put in at every 20 chains. These pegs are numbered with dies to correspond with the actual chainage they represent.

734. Assessment lines were offset from the baseline at regular intervals being either 40 chain or more often 80 chain. These assessment lines have pegs at every five chains. These are stamped with both the line number and the chainage, e.g., the 40 chain peg on the fifth line would be stamped $\frac{5}{40}$.

A broad arrow points in the direction the line was run. Assessment is to a width of two chain (5 ch. of line = 1 ac.), but in rare cases one chain has been used. The offset distance to trees in the old field book will give the answer if it is not recorded.

735. At all pegs, on both base line and assessment lines, trenches one spade width and 3ft. in length, were dug in the direction of the line. Stone cairns replaced these where possible. It is useful to bear in mind these points when searching for pegs which may be burned out or destroyed by termites.

736. When carrying out re-assessment replace any pegs which are in bad condition and for this purpose it is necessary to carry a set of steel dies.

Trees to be remeasured.

Field Assessment.

737. Trees to be remeasured include:—

Good free-growing trees, A1, B1, C1, D1, which should have been painted originally, providing they are free of such blemishes as overgrowth, etc. at G.B.H. and will give a reliable increment figure.

Measurement of Standing Timber (see Permanent Assessment of Meridian Lines for new classification).

(a) **G.B.H.**

738. In the case of trees which were previously painted for remeasurement, measure at a point 12in. below the top of the paint mark.

739. When the trees to be measured have not been painted, measure at 4ft. 3in. from the ground (not the top of the litter) on the high side of the tree. Measurement is to be made with a steel tape left to right around the tree and taken to the nearest quarter inch.

740. Care must be taken to see that the tape is placed at right angles to the axis of the tree.

741. To ensure uniform height a stick measured to length can be used.

742. If the tree is unsuitable for measurement at 4ft. 3in. but can be measured elsewhere, record the height of this point from the ground. Trees which are blemished at G.B.H. and unsuitable for remeasurement must be marked with an asterisk between the two class columns.

743. The girthing of trees is of utmost importance because it is from this alone that we determine the growth rate.

(b) **Log Length.**

There is no necessity to measure the log length in re-assessment. It should however be checked by eye against the old book as a check on gross error.

(c) **Painting.**

Trees to be painted consist of good free-growing trees over 60in. G.B.H. which have grown into the measured class since the last assessment and all trees which were painted previously, i.e., all A1, B1, and C1. When trees in these classes have not been previously painted, they should be remeasured and painted to conform with standard practice as set out in paragraph 705.

Date of Original Mea surement 10/12/1940
Date of Remeasurement 13/9/1951

Ch.	Dist. L — R +	Sp.	Class. Old.	Class. New.	G.B.H. Old.	G.B.H. New.	G.B.H. Increment.	Merch. Log. Old.	Merch. Log. New.	Remarks.
2500										
5	—12	J	C1	B1	5 9¾	6 2¾	—	—	—	
105	20	J	—	D	—	3 2	—	—	31	Kinky, not measured before.
110	—39	J	B1*	—	7 1	—	—	—	—	Overgrowth, measurement unreliable.
220	35	J	B1	B1	6 10½	7 3	—	—	—	
270	21	K	B1	B1	5 0½	5 6¼	—	—	—	
312	—32	J	A1	A1	8 2½	8 6½	—	50	40	Gross error, original height.
322	65	J	—	C1	—	5 0½	—	—	35	Missed previously.
370	—27	K	B1	A2	8 11	9 7	—	—	—	Would fall on dense poles.
391	5	J	—	C1	—	5 0½	—	—	35	Not D(e) at last measurement.
407	37	J	C1*	B1	5 0	6 8	—	—	—	Rough at G.B.H.
3000	Area	burned	3 years	ago but	only ground fire.					
7	5	J	A1	Dead	8 7	—	—	—	—	Wind thrown.
96	—16	J	B1	B2	6 2	6 7	—	34	—	Crown gone back badly.
183	—41	J	C1	C1	5 3	5 8½	—	32	32	
205	36	J	A1	Dead	9 2	—	—	—	—	Wind thrown.
224	0	J	D1	D1	3 9	4 1	—	20	20	
276	—10	J	B1	Dead	6 6½	—	—	—	—	Crown broken off, dead.
305	—37	J	A1	A1	10 10	10 2	—	36	36	Girth checked. First measurement wrong.
386	3	K	B1	B1	8 10	8 11	—	40	40	
436	—46	J	B1*	—	6 0	—	—	30	—	Removed for nearby bridge.
458	54	J	C1	C1	5 3	5 8	—	23	23	
490	—10	J	—	D1	—	3 1	—	—	18	Too short for measurement before.
3500										

* Measurements should not be used for increment purposes.