FALLER TRAINING MANUAL

FOR

WESTERN AUSTRALIAN HARDWOODS

FOREWORD

This manual was compiled by the Tree Fallers Training Committee at the direction of the Consultative Committee on Forestry & Timber.

It is primarily a reference for use by faller training instructors but may be used as a self teaching aid.

The manual makes known the basic guidelines for safe and efficient falling practices in the hardwood forests of W.A.

Much of the information presented has been derived from experts in the Timber Industry, the Forests Department and supplemented with ideas drawn from the New Zealand training manual.

In commending the manual I wish to acknowledge the efforts of the members of the Tree Fallers Training Committee, as a valuable contribution.

B. J. BEGGS,
CONSERVATOR OF FORESTS.

OCTOBERm 1975.

C O N T E N T S

INTRODUCTION

Tree felling is one of the most dangerous operations in the forest and accounts for many fatal accidents.
Cross cutting and log trimming also cause accidents of a serious nature.

It is therefore essential that chainsaw operators are made aware of the dangers inherent in each of these operations, and of the techniques which can minimise or eliminate them.

The information incorporated in the manual will not take the place of experience in the making of an expert faller, but the techniques discussed offer a sound basis for gaining that experience. Nevertheless, fallers must also seek to recognise potentially dangerous situations and obtain more expert advice on how to handle them.

Experienced fallers, no matter how well taught or how well versed in the skills of falling, can all recall a number of accidents or near misses. Tree felling is a hazardous occupation, characterised by a high level of fatal accidents, but the adoption of safe methods can do much to reduce the level of such risks.

No man should be allowed to commence tree felling until he has been thoroughly instructed in the techniques of falling, has been made fully aware of the hazards and dangers which may occur, and knows the safety precautions needed for each stage of log preparation.

The bush foreman has overall responsibility for conducting a safe and efficient bush operation. His advice should be sought whenever a particularly hazardous tree is to be cut down.

THE FALLER AND HIS ATTIRE

Fallers must be physically fit, able to move quickly and to communicate with other bush workers.

Alert observation, good hearing, fitness and concentration will help the faller develop the good judgement needed to work safely and effectively in a forest environment.

A faller must wear well-fitting clothes. Billowing sleeves and trouser cuffs, loose jumpers or flapping shirt tails can readily catch on obstructions causing a man to trip, stumble or misdirect a blow.

Safety helmets must be worn for all falling operations and should be worn squarely on the head with a correctly adjusted inner band.

Solid work boots which give maximum support to the feet and have sprigged (studded) soles and heels or a non-slip tread, are essential. Safety boots with steel toecaps are the best, but no matter what type of boots are used, they should not be used when soles and heels have worn smooth.

Fallers with long hair should either wear a hairnet or headband or tuck their hair under the safety helmet. A man whose hair has been caught in a sawchain and his face pulled down onto the cutters is not a pretty sight. Attention to this factor is an essential safety procedure.

A first aid kit should be carried in every vehicle.

This particular kit need not be elaborate but should contain items needed for treatment of minor injuries and for initial treatment of more serious ones.

First aid courses are available through the St. John's Ambulance organisation at most centres, and fallers should be encouraged to attend these. Knowledge gained in this way can save lives.

HAND TOOLS

Correct selection of tools and equipment is needed for safe, efficient felling.

1. Wedges :

   Two or more wedges are generally used, plastic and aluminium being the preferred materials for most purposes, but steel wedges are essential for large trees where lifting is required to direct a tree, or to lift a "bridging" log.

   When using steel wedges, extreme care must be taken to ensure that the chain does not contact them. Such contact will throw the saw and may result in serious injury or damage to the bar and chain.

   * Never wedge into heavy or thick bark but remove the bark and wedge into solid wood.
   * Never use "mushroom-top" wedges.

2. Sledgehammers :

   To lift large trees and logs by wedging, it will be necessary to use steel wedges and a steel sledgehammer with a mass of about 4 kilograms. This need is most common for fallers in the karri forest.

3. Axes :

   Axes are still needed for cutting, removing scrub and for driving the lightweight plastic or aluminium wedges.

   When trimming above shoulder height, for safety reasons an axe should always be used in preference to a chainsaw.

CARE OF HAND TOOLS AND SAFETY EQUIPMENT

* All tools --- hammer, wedge, axe --- should be kept in good condition and be used only for the purpose intended.

* Case hardened or "mushroomed" tools should not be used because of the risk of injury from slivers of material.

* The axe should be kept sharp, and have a tight fitting handle, free from splits and other damage.

* Keep safety helmet, eye protection, gloves, ear muffs and fire extinguisher in good condition and free from dirt.

* Clothing should be kept free of grease and should not be of synthetic materials.

* Keep the First Aid Kit clean and well stocked at all times.

* AT ALL TIMES seek to use the safe way to do the job, not the quickest way.

MACHINE TOOLS

1. Chainsaws:

A rugged chainsaw which is dependable, has assured service and parts back-up and adequate fuel/oil capacity is needed for hardwood falling.

Fallers should discuss suitability of various models of saw with experienced operators. Characteristics of noise, vibration and balance when using the saw are all worthy of investigation.

2. Cutter Bars:

Chainsaw cutter bars are available in a number of different lengths and the length chosen should be related to the average diameter of trees to be felled. For example, although a half metre bar and chain can fell a one metre tree, the ideal length would be about three-quarters of a metre. Cutter bar and chain should be matched with the motor unit to ensure correct fitting and balance.

If operating in bush where diameters vary over an extreme range, it is of value for the faller to have two bars complete with chains of different lengths, but the length most often used should be the one used to balance the saw.

3. Desirable features of Chainsaws:

The most important features to consider when purchasing a chainsaw are summarised :

* Light weight and good balance commensurate with power and cutter bar length required.
* Ease of starting, especially the presence of a decompression release on saws with high compression motors.

* Automatic and adjustable chain oiling system.
* Simple disassembly for maintenance.
* Grouped hand controls.
* Automatic clutch to stop the chain when the throttle is released or when the chain binds in a cut.
* Diaphragm carburettor for cutting in all planes.
* Anti-vibration handles to reduce the risk of the vibration injury, Raynaud's Syndrome.
* Effective exhaust muffler to reduce noise and carbon monoxide emission.
* An approved safety mitt for operator protection.
* Fuel and oil tanks sufficiently large to obviate the need for refuelling at short intervals.
* Assured supply of spare parts and a reliable maintenance and repair agency.
* Cutter bar and chain appropriate for work conditions.
* A suitable tool kit and spares e.g. starter ropes and spark plugs.
* Solid construction to withstand continuous hard usage.

CHAINSAW OPERATION

The purchase of the most suitable chainsaw for the job in hand is only part of the requirements for safe falling practice.

* A fire extinguisher or other fire fighting equipment should be maintained close to the work area at all times.
* Refuelling should be done before the saw tank is emptied to avoid the saw stopping in the cut, and probably in a difficult refuelling position.
* Fuel and oil must be handled with care. The saw should be placed away from flammable materials and preferably on flat bare ground.
* Carry fuel in a metal container only, use a funnel to avoid spillage, do not refuel a hot saw and do not smoke while refuelling.
* After refuelling, move the saw at least 3 metres and wipe off excess fuel or oil before attempting to restart it.
* "Drop" starting may look impressive but is a very unsafe act. A saw should be started on the ground or resting on a log, and not with the assistance of other people. Place the saw on clean, level ground, hold the wrap-around bar with one hand and the rear handle with the tip of one boot. Pull the starter cord till it engages the starter pawl, then start the saw with a short upward pull.
* Pull the cord in a direction which creates minimum pressure against the cord-hole in the machine framework, to prevent excessive wear of the frame and prolong the life of the rope.
* Where a clear area is not available for ground starting, the saw may be placed on a log or a stump. Keep the bar clear of other material and pull the starter cord in the usual manner.

* Always have the saw running at nearly maximum speed before starting the cut, thus preventing clutch slip and excessive wear.
* When cutting, hold the saw firmly with both hands, stand to one side of the cutting line with feet braced and body balanced. Be prepared for "kick-back" and never attempt to control the saw with only one hand.
* When cross-cutting always stand out of the line or direction of the cut.
* Travel no more than a few metres with the chain moving, and stop the motor when refuelling, adjusting chain tension or doing other maintenance on the saw. Stop the motor and carry the saw with the cutter bar to the rear.
* Use "anti-kick" saw chain wherever possible.
* Maintenance must include clean exhaust ports, tight ignition wires, clean filters and cooling fins, adjustment of cutter bar and chains for optimum cutting.
* If a chainsaw motor backfires or runs unevenly it should not be used.
* Empty fuel cans should not be left in the bush as they could explode and start a fire.
* Donot operate a saw with its muffler broken or removed.
* Never place a hot saw on dry litter or slash, but select a stump or bare mineral soil.
* Check sawdust or chips for smouldering material before moving to the next cut. No cutting should be done for at least 15 minutes before leaving the bush for the day.
* Fit a hand guard on the front grip to prevent injury from "kick-back".

SITE CONDITIONS AND TREE CHARACTERISTICS

Before felling commences, the operator must become familiar with the layout of the operation and some of the characteristics of trees and site conditions.

1. Wind :

   Extreme caution is required when a strong wind is blowing across or against the intended direction of fall. When in doubt the bush foreman should be consulted.

2. Public Warnings :

   When falling is being done near a road or track, prominent signs must be displayed each side of the danger zone. In busy places lookout men should be posted on the track.

3. Direction of Fall :

   Factors which control the direction of fall are :

Natural Factors	-	Crown Weight Distribution
		Bole Shape
		Wind.
Human Factors	-	Wedging
		Sawing Technique.

   The direction of fall can be assessed by use of an axe (or a weighted cord) as a "plumb-bob".

   Where toe-marks indicate the preferred direction of fall, the faller must also check the tree for lean and overhanging or interlocking branches. Trees without a toe-mark should be fallen towards an open space, if this is feasible.

4. Cutting Sequence :

   It is expected that the faller will work out a sequence of cutting, especially in dense forest. This factor is not so critical in open forest.

   To determine a felling sequence it is essential that the faller considers the following points :

* location of log landings, roads, other workers.
* delating work until work areas are declared safe by the bush foreman.
* interlocking crown which could cause a tree to "hang up" or swing out of control.
* dead limbs, "jockeys" or "widow makers" which could endanger the faller and other workers.
* fall to minimise soil disturbance.
* avoid the felling of tops into areas yet to be worked, which might make later felling dangerous.
* avoid felling into other trees and onto stumps, rocks or logs to prevent log damage and to reduce the chances of the tree kicking backwards or to the side of its stump.
* ensure that no persons or machines are within a distance of twice the tree height. This distance must be increased on steep slopes or in any other unusual circumstances.
* ensure debris is removed from the work area to provide space for safe working and to give a firm footing.

5. The Leaning Tree :

Few trees are truly vertical, and tree shape may be such that there are two apparent directions of lean. The most pronounced lean is called the head lean, while the least pronounced is called the side lean. Wedges may be necessary to overcome part of the lean in achieving the overall natural fall of the tree. Trees tend to lean down-slope but this cannot be assumed.

6. Escape Path :

Prepare a suitable escape path and clear it of obstructions for a distance of several metres into a safe area. The direction of the path should be at an angle of 45 degrees to the direction of fall, and no equipment should be left on the path.

7. Sounding :

An area of fungal rot may not be visible externally. A tree which gives a hollow sound when struck with the axe, or which shows discoloured sawdust, may have a rotten core. Particular care is needed when felling this type of tree.

8. Hollow Butts :

Trees with partially burnt-out butts must be cut with great care because they lack "holding" wood. Depth and position of the scarf must be carefully executed as both over-scarfing and under-scarfing can result in loss of control.

9. Hand Tools :

Lay out hand equipment behind the tree but not on the escape path.

FELLING TECHNIQUES

There are three basic steps involved in felling a tree :

1. Making the scarf.
2. Making the back cut.
3. Wedging - this may not be needed on every tree, although many fallers contend that it is always good practice to place a wedge in the back cut as insurance against a misjudged lean.

THE SCARF

Scarfing a tree has two main functions :

* it helps control the fall by allowing the tree to slip off the stump instead of jumping.

* it is the means of breaking the holding wood while at the same time preventing the tree from kicking back over the stump and splitting the log.

The four most commonly used scarfs are shown in Figure 1.

(a) The standard underscarf which reduces the risk of kickback and saves timber because the snipe is taken from the butt, not the log.

(b) The standard overscarf (commonly called the watermelon because of its shape).

(c) The standard overscarf with step cut, which assists to direct a tree and also helps to prevent kickback.

(d) The box scarf and step which is used on particularly large trees or where the cutter bar is too short.

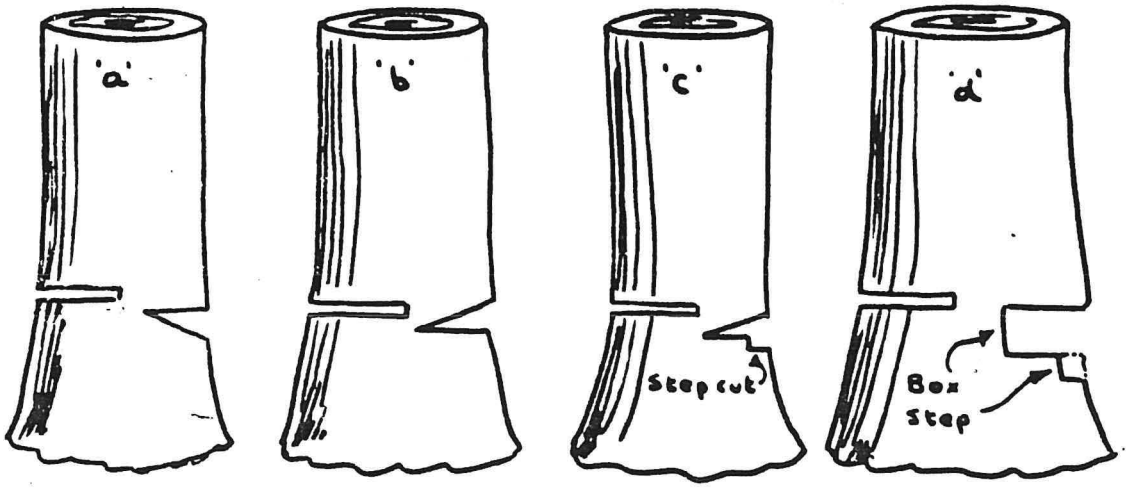

FIG 1. Standard Scarf Types.

To make a scarf, place the bar at the required height on a point directly in line with the desired direction of fall, and dig in the bucking spike.

* First cut is made with the cutter bar horizontal, cutting to a depth approximately one third the diameter of the tree.
* Second cut is the upper or over-cut so that a wedge-shaped piece of wood is removed.

Care must be taken to ensure that both cuts match up at point 'c' of Figure 2. Any continuation beyond that point destroys the hinge or holding wood with consequent loss of control.

Clean out the scarf by removing the cut wood and make any adjusting cuts deemed necessary.

The scarfs shown in Figure 2 demonstrate the right and wrong ways of making them.

Scarfs 1 and 2 demonstrate the horizontal cut to one third of tree diameter, the clean meeting of the second cut at point 'c' and the line of the proposed back cut 'd'.

Scarf 3 shows the overlap of both scarf cuts with consequent loss of holding wood which is needed to control the falling tree.

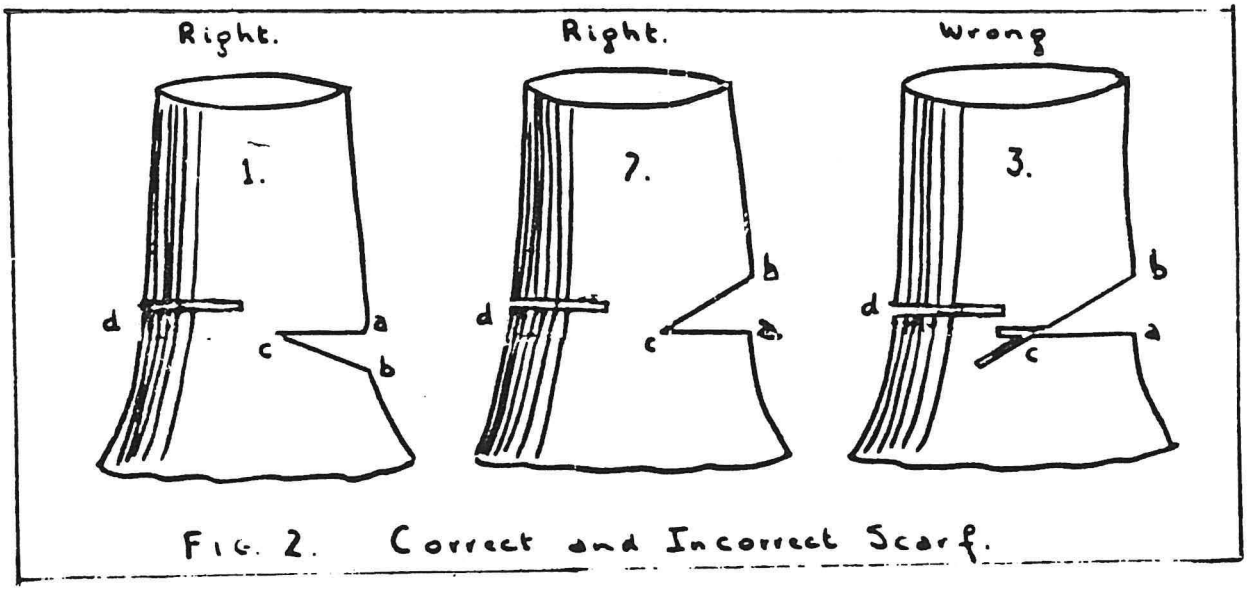

FIG. 2. Correct and Incorrect Scarf.

BACK CUTTING :

Back cutting, sometimes called "backing down", is the final cut which allows the tree to fall over the scarf cut.

The back-cut should start at the rear of the tree at least 50 millimetres above the horizontal cut of the scarf increasing to about 150mm as tree size increases.

Place the chainsaw bucking spike against the tree, and cut in an arc, pivoting the bar until cutting is parralel with the scarf. Before completing the back cut, the faller should ensure that he is away from the lean and on the same side as the escape route.

Do not cut through the scarf, but stop when the saw is some 50 millimetres from it, so leaving holding wood to act as a hinge which controls initial speed and direction of fall.

Frequent checking of the tree crown for movement and widening of the cut will indicate when the tree is ready to fall.

The faller must be alert and ready to move quickly as the tree begins to move.

He must watch for falling branches and, when the tree has fallen through the first quarter of its arc, he should switch off the saw, withdraw it from the tree, move out along the escape path and at the same time continue to watch for falling debris.

PROTECTION OF YOURSELF IS PARAMOUNT. SHOULD AN EMERGENCY ARISE, IT IS BETTER TO ABANDON THE SAW THAN RISK AN INJURY.

Back cutting/Wedging :

When wedges are used, they should be inserted in the back cut as soon as this can be done without fouling the saw chain and they must be driven into the wood, not the bark.

Figure 3 demonstrates right and wrong ways to back cut small trees and Figure 4 shows the cutting pattern for very large trees :

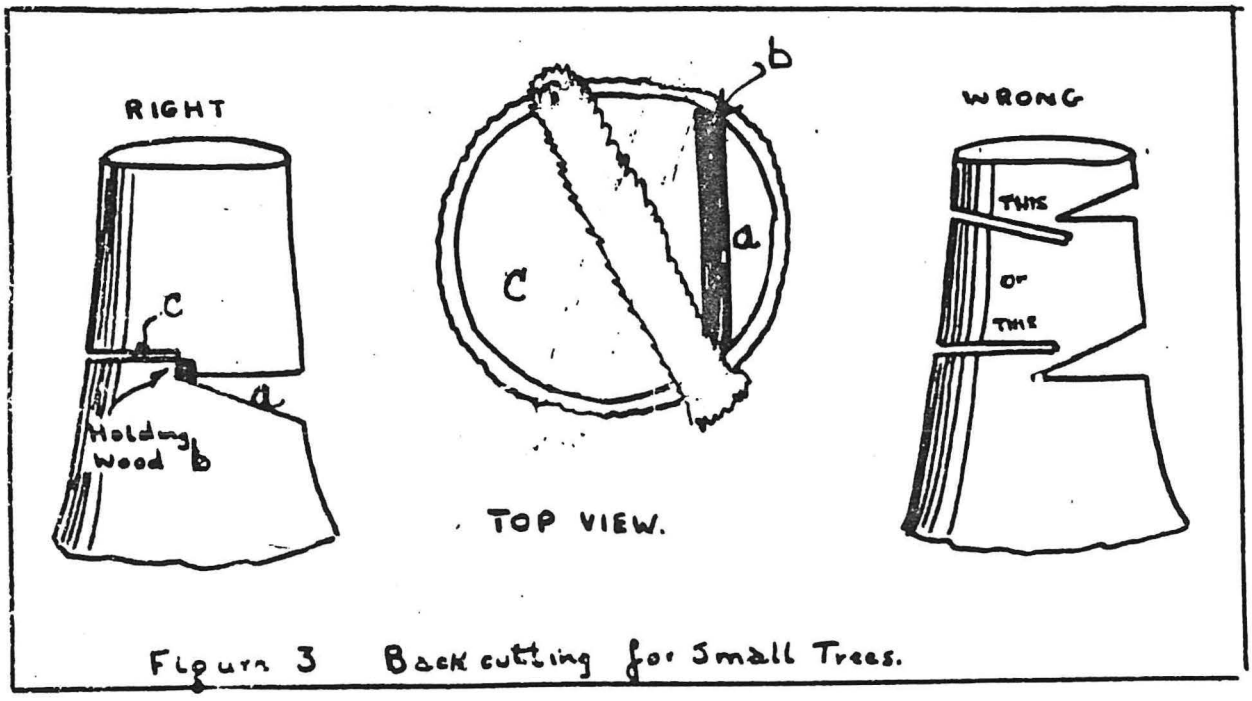

Figure 3 Back cutting for Small Trees.

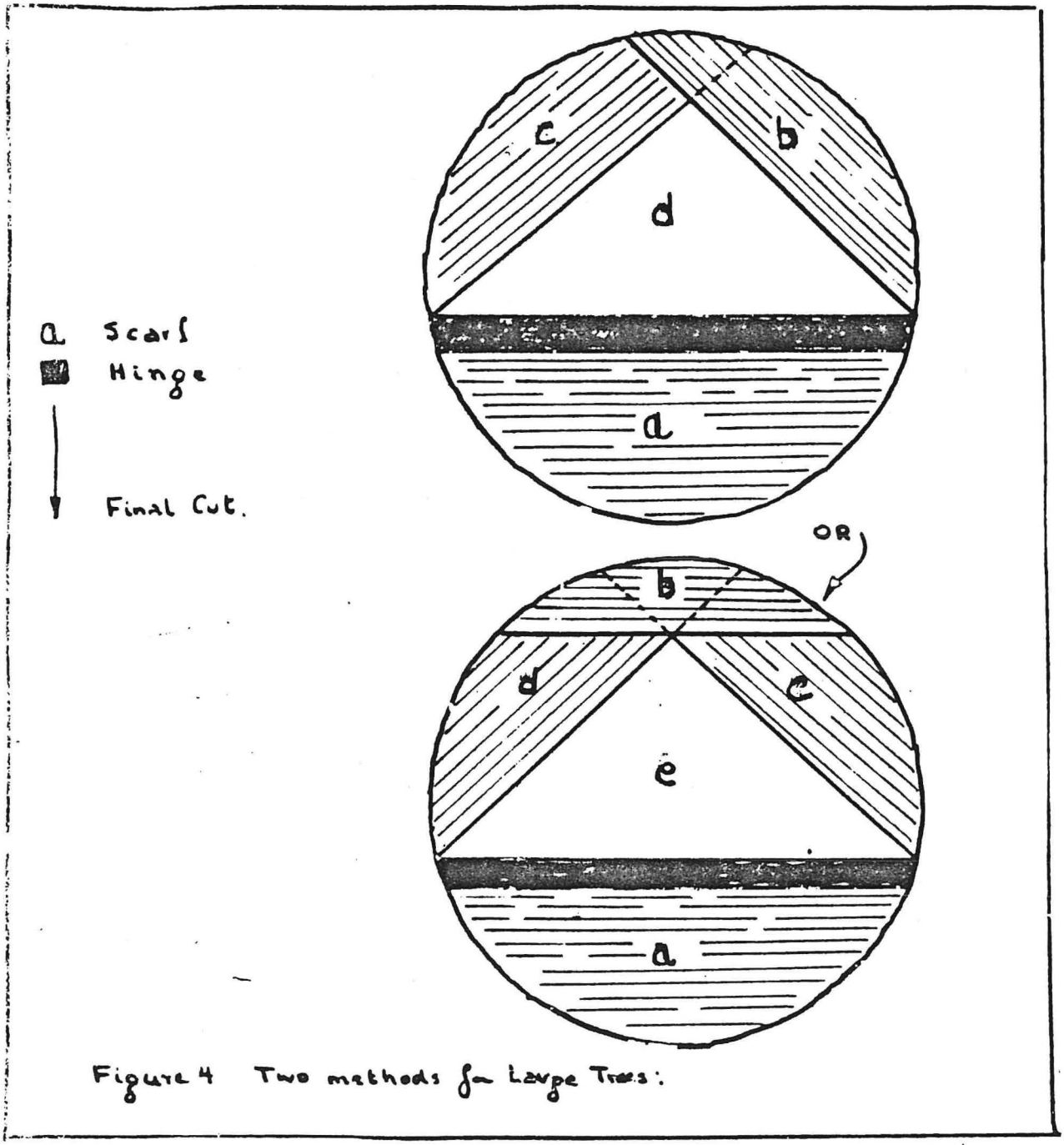

Figure 4 Two methods for Large Trees.

METHODS FOR DIFFICULT TREES

A faller will need to modify the standard methods in circumstances where his cutter bar is short, the tree has a heavy lean or where "boring" is necessary.

1. Short Cutter Bar :

When the cutter bar is too short for a single back cut, two backing cuts may be required, or even a side cut. Figure 5 shows the method which is recommended for this situation.

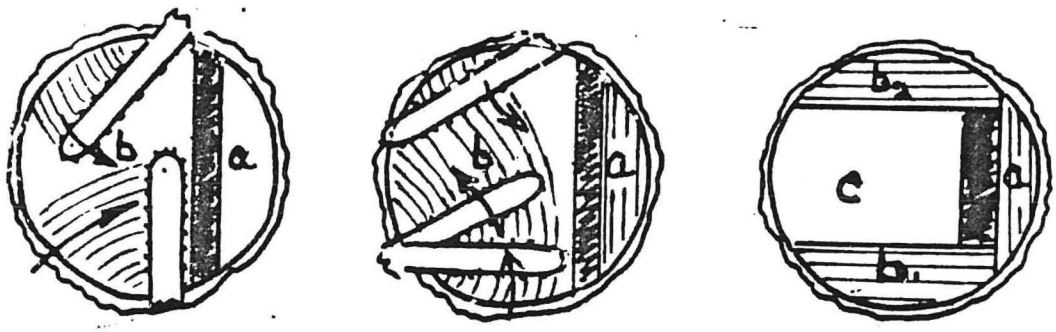

FIGURE 5 SHORT CUTTER BAR.

Cut from one side first, then move to the other side of the tree to start the second in the same manner but pivoting the latter cut.

Where tree diameters are more than twice bar length, the side scarf of Figure 5 should be used, in which two side scarfs are made at right angles to the original scarf. The side scarfs require sufficient space for the saw to reach beyond halfway during the final conventional back cut.

2. Heavy Side Lean :

A tree with pronounced side lean, or one that is out of balance through heavy limbs on one side, may need to be fallen away from the major lean. Three methods frequently used are illustrated in Figure 6.

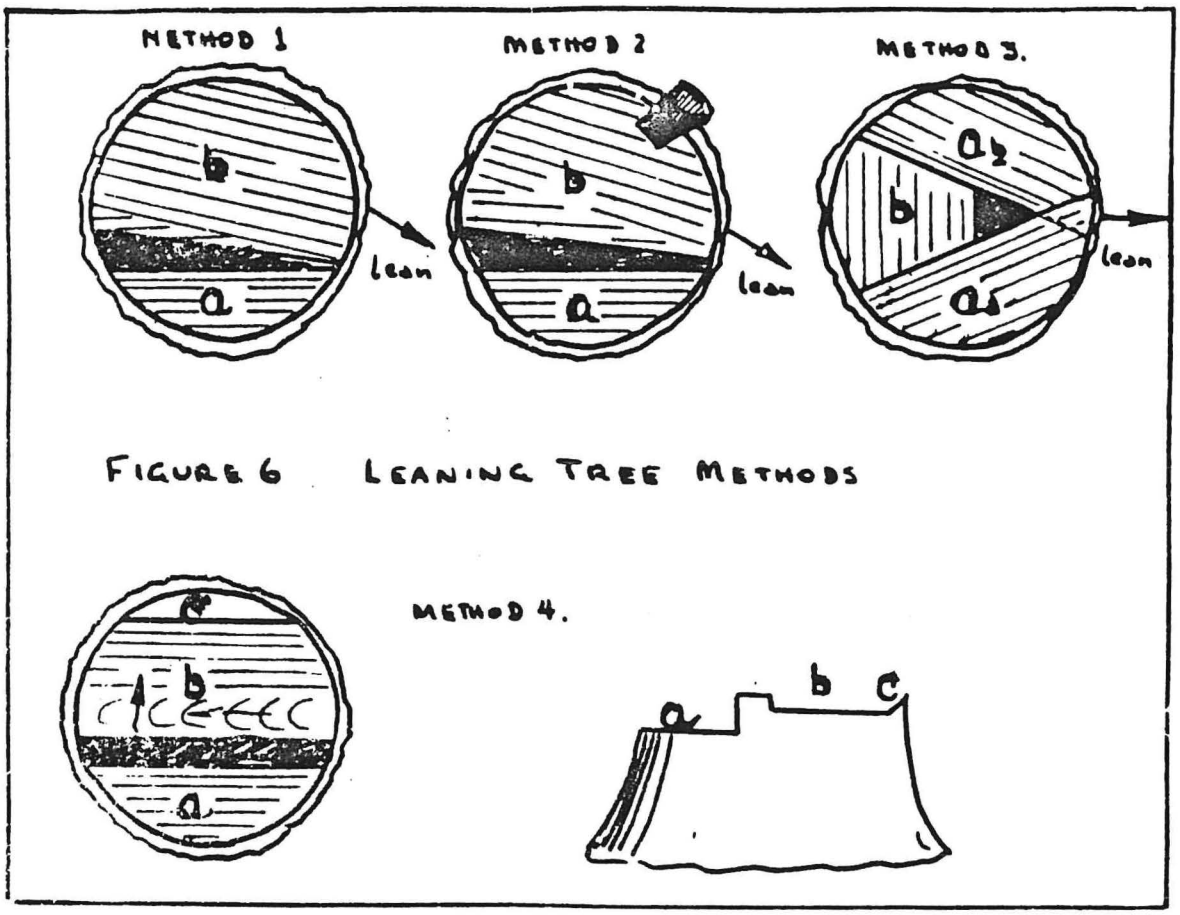

FIGURE 6 LEANING TREE METHODS

Method 1 : leaves more hinge or holding wood on the side away from the lean by cutting a conventional scarf but sloping the last part of the back cut by pivoting the saw towards the side of the lean.
This back cut must NOT cut into the scarf.

Method 2 : uses the same approach as Method 1, but enlists the aid of a steel wedge placed approximately at right angles to the direction of lean.

Method 3 : is achieved by cutting a double-sided or V-shaped scarf as shown in Figure 6.3, and then removing the triangular shaped backwood.

This method will prevent the tree splitting up "barber chairing" and endangering the faller.

NOTE : When trees with a pronounced lean are fallen in the same direction as the lean, severe stress may occur when the bole strikes the ground, resulting in fracture of part of the bole.

Method 4 : illustrates the technique of "boring" with a chainsaw to fell trees with a heavy forward lean. This technique requires skilled use of the chainsaw, and should only be attempted by fallers with high levels of proficiency in conventional methods.

The boring method uses a normal scarf and hinge, but the back cut is started by boring behind the hinge and working toward the back of the tree until about 150 millimetres of backwood remains - zone C of diagram. The zone C holding wood is back cut in the normal manner.

3. Starting the Boring Cut :

The boring cut can be dangerous for inexperienced operators. Attempts to bore directly into the tree can cause violent kick-back, either upward or downward, with a high risk of injury to the faller.

Figure 7 shows how the saw will react to contact with a log, the fourth diagram showing the minimum reaction of an oblique contact.

Place the cutter bar at an oblique angle as in diagrams 5 or 6, above or below the point required: start the cut gently, then pivot the saw up or down to the position of boring, and start to bore into the log.

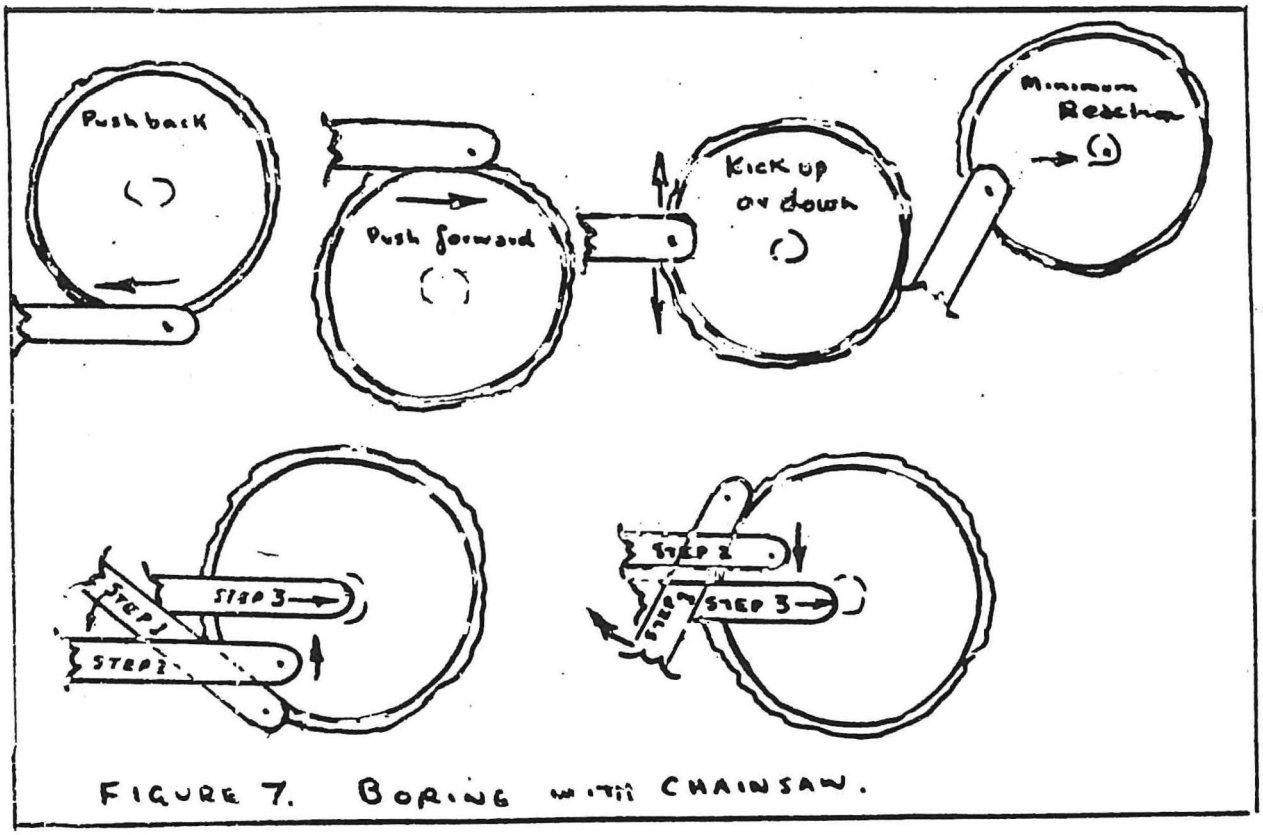

FIGURE 7. BORING WITH CHAINSAW.

TRIMMING

When trimming the branches, commence at the butt end of the trees and work towards the crown. Hanging branches should be cut from above, and branches in contact with the ground should be undercut. Limbs on small logs should be trimmed from the opposite side of the log, and the faller should always stand in such a position as to avoid injury should the saw or axe be deflected.

Branches which are or may be propping up the tree should not be trimmed until the tree is adequately chocked against rolling or dropping.

It is important to remember that any branch of a fallen tree may be under stress and may spring with considerable force when cut free.

CROWNING AND CROSSCUTTING TO LENGTH

Many accidents occur during log preparation due to logs falling or rolling, saw kickback and so on.

The faller should always work from the top or uphill side of the felled tree, making sure he has a clean, firm footing. Where there is any possibility that the felled tree will fall or roll, it must first be adequately chocked.

Ensure there are no overhead hazards, and that the work area is clear of obstacles, before commencing to crown—off.

Maintain a firm grip on both saw handles and endeavour to keep the arm holding the top handle straight. With the arm bent, the bar may ride out of the cut and be thrown back into the face or upper body, while a straight arm will help to thrust back the whole upper torso.

Adopt a firm stance but do not stand directly behind the saw.

Grip the saw firmly and exercise care to avoid kick-back if the cutter bar contacts other branches or if the cut tightens.

Let the log carry the weight of the saw wherever possible.

Avoid walking along the top of the log.

When limbs are under stress, they must be cut with caution - top cut first and undercut to finish.

Good safety practice demands that, when finishing a cut, the faller stands as far away from the log as possible and uses the tip of the saw to complete the cut. This helps eliminate jamming of the cutter bar or possible injury to the faller.

Crosscut Methods :

Method 1 : Logs suppprted full length.

The cut can be made from the top of the log. Place the backing spike on the log, and pivot the saw into the wood by light downward pressure on the top handle. Several pivot cuts may be needed on a large log, carried out by gradually lifting the nose of the cutter bar and lowering the whole saw in stages.

Do not allow the tip of the chain to hit the ground.

Method 2 : Logs which are supported at one end only.
Undercut the log for about a third of the diameter, then cut down from above to meet near the undercut as shown in Figure 8. For very large logs, climb onto the log to place side cuts 'a' and 'b', as in diagram 2 of Figure 8, to overlap under the log. Then, from the ground, finish by cutting down from above.

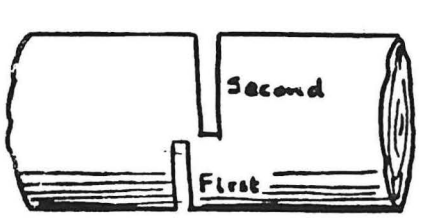

FIGURE 8 Supported one end only

Method 3 : Trees held on a slope with side-binding.

Work from the uphill side and cut the lower side first, cutting far enough underneath the log so that the remainder can be cut from a position on the ground and uphill from the log. Figure 9 shows the sequence of cutting required.

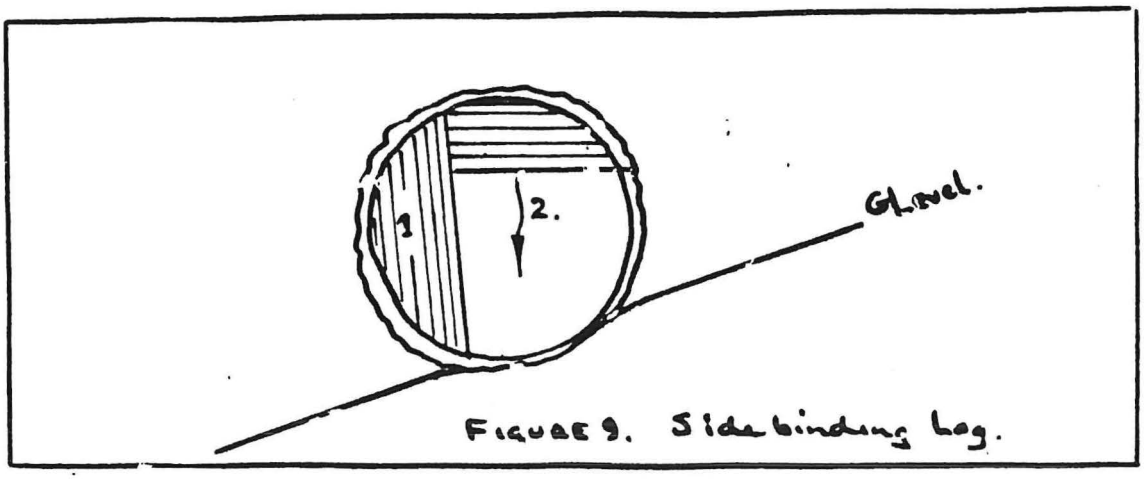

FIGURE 9. Side binding log.

Method 4 : Bridging cut where log is supported at both ends.

This type will usually bind at the top and open at the bottom with a tendency to split along the bottom. Figure 10 shows two ways for cutting a bridging log, the first being by a top cut of one third diameter followed by a bottom cut.

The second requires two side cuts overlapping at the top of the log and leaving a V-shaped section for the final cut.

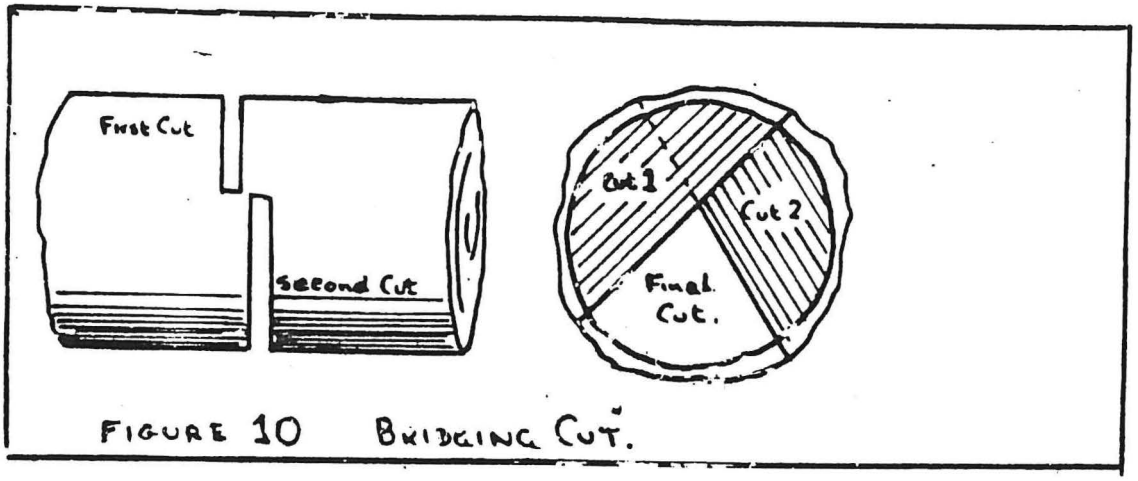

FIGURE 10 BRIDGING CUT.

Method 5 : Large bridging logs - use of steel lifting wedges.

Figure 11 shows the placement of saw and wedges needed. Begin cutting to the side of the top centre of the log then cut downwards for two thirds of diameter. Slowly work the saw back over the top section of the log until there are signs of the bar binding or pinching in the cut. When this happens, insert a steel lifting wedge in a position as shown in diagram, to keep the bar moving freely. Continue cutting until there is sufficient room between bar and log surface for a second steel wedge to be inserted. On very difficult logs, a third wedge may be needed, and this is usually placed in a corresponding position to the first wedge but on the opposite side of the log. Extreme caution is needed to ensure that the chain does not contact the wedges at any stage.

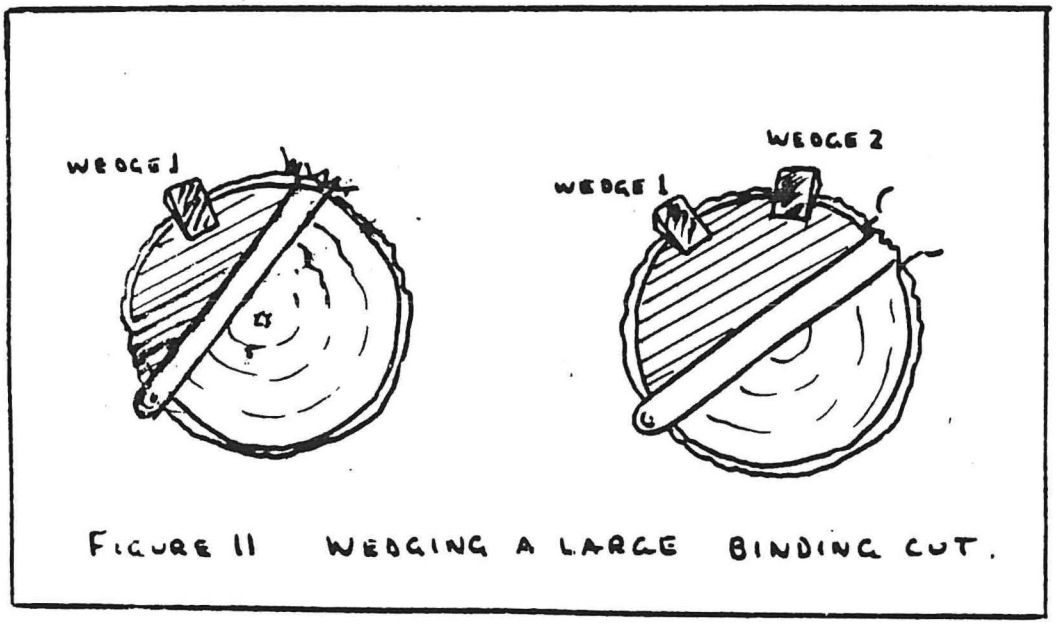

FIGURE 11 WEDGING A LARGE BINDING CUT.

Method 6 : Sloping the cross cut.

Before cutting through a log, check for any possible lateral movement which could occur on completion of cutting. It may be necessary to cut through the log at an angle, rather than vertically. If the cut is vertical or at the reverse angle, the bar and chain can be trapped. The method used is the same as for Method 1, except that the cut is a sloping one as shown in Figure 12.

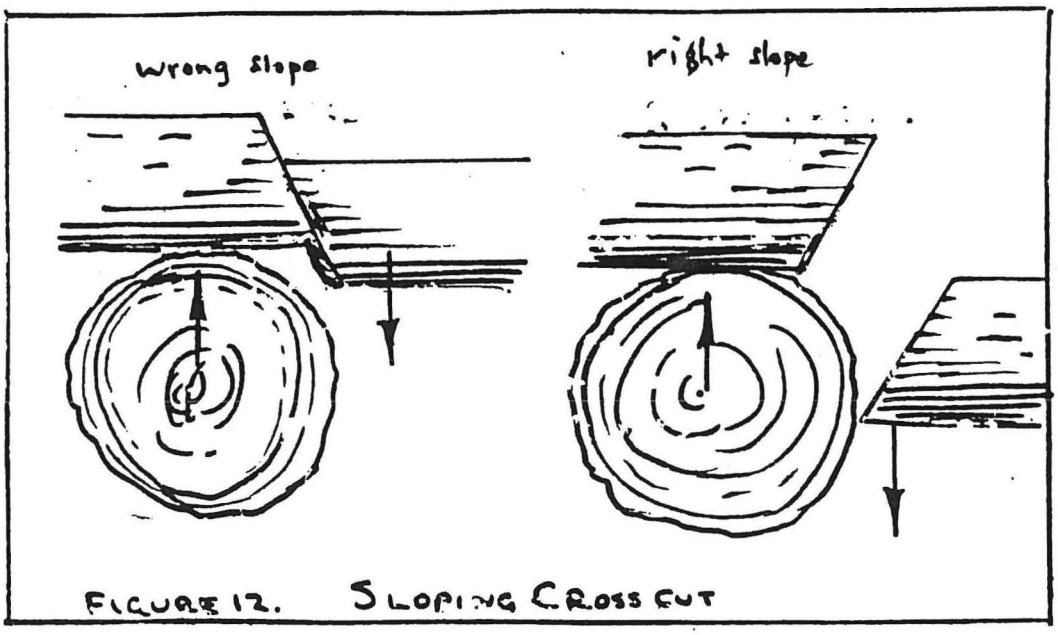

FIGURE 12. SLOPING CROSS CUT

FALLER TRAINING COURSE

DURATION - 10 DAYS

	0800 - 1200	1300 - 1630
MONDAY	Introduction - Timber Industry and Forests Dept. (a) the tutors (b) the students (c) aim and objectives (d) teaching methods	Motivation and Safety Induction (a) felling and sawmilling (b) safety code Aided by films and slides
TUESDAY	Physical Fitness Aspects (a) level of medical requirements (b) first aid treatment	Equipment - Selection and Maintenance Hand Tools :- (a) axe (b) hammer (c) wedges (d) fuel containers Power operated chain saws :- (a) selection of suitable type (b) principal parts (c) specific dangers
WEDNESDAY	Power Operated Chain Saw Maintenance (a) engine (b) cutter chain (c) cutter bar (d) sprocket (e) trouble shooting and remedies	(a) chain sharpening (b) chain repair (c) testing (practical)
THURSDAY	Safety Equipment and Its Use (a) hats (b) boots (c) ear muffs (d) eye shields (e) gloves (f) chain brake (g) hand protection	Felling and Cross Cutting (a) felling techniques (b) trimming (c) cross cutting with the aid of films and slides
FRIDAY	Chain Saw Operation in the Jarrah Forest (a) felling (b) trimming (c) cross cutting (d) safety	

WEEK TWO

	0800 - 1200	1300 - 1630
MONDAY	Felling Operations - As for Friday	Jarrah Forest Area
TUESDAY	Felling Operations - Felling, trimming and cross cutting in a Karri Forest Area	
WEDNESDAY	As above	Karri Forest Area
THURSDAY	As above	Karri Forest Area
FRIDAY	Course summarised and discussed in detail	Completion of Course @ 1200 hours