HMSO £1 net

Forestry Commission
Leaflet 75

Harvesting Windthrown Trees

A T Jones R O Smith

CONTENTS

PLATE 1 (front cover) — An aerial view of the harvesting of windthrown trees at Knapdale Forest, following the severe gales of January 1968 *(17491)*

HARVESTING WINDTHROWN TREES

by A. T. Jones, and R. O. Smith

Forestry Commission

INTRODUCTION

Wind is a major climatic hazard to tree crops, but foresters generally have adapted their silvicultural and management practices to accommodate it. Experience of harvesting windthrown timber has also been built up over the past few years and the purpose here is to present a digest of this knowledge. It is based on the work and recommendations of the Forestry Commission's Work Study, and Education and Training Branches, and it is intended mainly as a practical guide for foresters and forest craftsmen directly involved with such work. The emphasis is placed on harvesting windthrown coniferous timber: the associated problems of silviculture, forest protection, management and marketing are not considered in depth.

The information is supported and supplemented by the Forest Industry Safety Guides (in particular FSC 10 – 15 and 21, 22 and 25) issued by the Forestry Safety Council.

Two broad categories of windthrow may be identified:

a. Catastrophic windthrow. This is caused by exceptional climatic conditions, and it is probably these occurrences which are most easily recalled, as in east Scotland in 1953, west and central Scotland in 1968, and Wales, central and eastern England in January 1976.
b. Endemic windthrow. This is the localised but progressive damage suffered by stands of trees, due not necessarily to freak weather conditions but to the inherent weakness of the crops to withstand ordinary high winds. It is therefore regarded as somewhat inevitable, and in that sense it is not wholly unpredictable. Vast areas of forest are classified as being susceptible to it but when it occurs on any scale, or accumulates, it presents the same range of harvesting problems as catastrophic windthrow.

Windthrow is notoriously variable and the harvesting problems must be considered in relation to each individual site. Scattered windthrow or snapped trees occur in many parcels of timber and it can be reasonably assumed that properly trained and experienced operators will take these in their stride. More complex harvesting problems arise when the trees are windthrown in groups, sometimes extending to cover whole compartments, and it is in this context that the guidance given here is intended to be of most use.

JOB ORGANISATION

General

Experience has shown that harvesting windthrown timber is different from normal clearfelling or thinning, in that a greater degree of organisation and control is required. The choice of methods, manpower and machinery requirements is determined according to local factors such as:

Crop type - species, spacing, size of trees.
Terrain type - largely affecting choice of extraction system.
Distribution and type of windthrow - trees scattered or in groups, number thrown per hectare, total area affected.
Proportion of partially thrown, hung-up or snapped trees.
Degree of tangle - possibly the result of several successive windthrows in different directions.
Marketing possibilities - what can be recovered, what is subject to degrade if not harvested quickly.
Forest protection - likely incidence of beetle attack etc.

Depending upon the scale of the windthrow

and the time available in which to clear it, major re-deployment of resources may be necessary. Specific training on the special problems of working windthrow must be given to all operators, and they should all be briefed about the hazards and dangers likely to be encountered on each windthrow area. Operators must also realise that it may not be possible to harvest all the timber as in clear fall situations. Greater emphasis should be given to eliminating hazards as work progresses, as by so doing the operators will avoid placing themselves in unsafe working positions.

On the ground itself, the first task should be to clear all access routes to and within the windthrow area, and then to establish the sequence and direction of work. If possible one should follow the direction of the windthrow, that is approach the thrown trees from the butt ends, but to facilitate this, and later extraction, one may have to remove standing and apparently windfirm trees. Ideally one should establish as wide a working face as possible to reduce the risk of a chainsaw operator being unnecessarily interrupted by extraction work, and so maintain the greatest flexibility in the work programme.

Primary extraction

It is virtually impossible to sned all group - thrown trees in situ without endangering the chainsaw operators involved. Some form of mechanical assistance is normally required to move the trees from the tangle, after they have been severed from their roots, to a position where they can be safely and conveniently snedded. This is known as primary extraction. The removal of some trees will isolate others (previously lying very close to, or underneath, the trees removed) sufficiently for snedding to be completed safely *in situ.* After snedding, all the trees may be extracted to roadside in the usual way.

It is suggested that there are three main alternative courses of action for harvesting windthrow. The first involves no primary extraction, the second involves the primary extraction of whole trees and the third involves the partial conversion of the tree with extraction of the timber length(s) directly to roadside and primary extraction of the remaining pole. These are shown in algorithmic form in Figure 1 on page 5, and apply equally to tractor and cable crane systems.

Where there is an identifiable need for primary extraction the progress of the chainsaw operators will be dependent on the effectiveness of the primary extraction. It should therefore be given priority over main extraction so that the chainsaw operators can continue to work safely and effectively. Very few areas would be large enough to justify the use of two machines on primary extraction, even if they were available, and for them to work together safely.

The choice of extraction machine is important, and experience has shown that modified agricultural tractors usually have insufficient power and ground clearance to be fully effective where tree sizes exceed about 0.25 cu m. The power of their winches is sometimes inadequate, as greater force is required to pull whole trees (including their branches) from a typical windthrow tangle than is needed where poles are completely snedded and, generally speaking, lying in a fairly orderly arrangement. Large (about 100 b.h.p.) purpose-built, forest tractors are to be preferred, but smaller machines may be used successfully if trees are partially converted *in situ* before extraction, although this does make the job more costly overall.

Workforce balance and outputs

Compared with normal clear felling, harvesting windthrow is inherently more difficult and slower in several ways. Not only is moving about difficult because of obstacles and limited access but the work is often fragmented. Trees may be severed and partly snedded, then left because further progress is impossible until they have been primary-extracted, or other trees have been moved first. There may be several such trees at any one time. The ancillary operations also may take longer, and occupy a greater proportion of the working

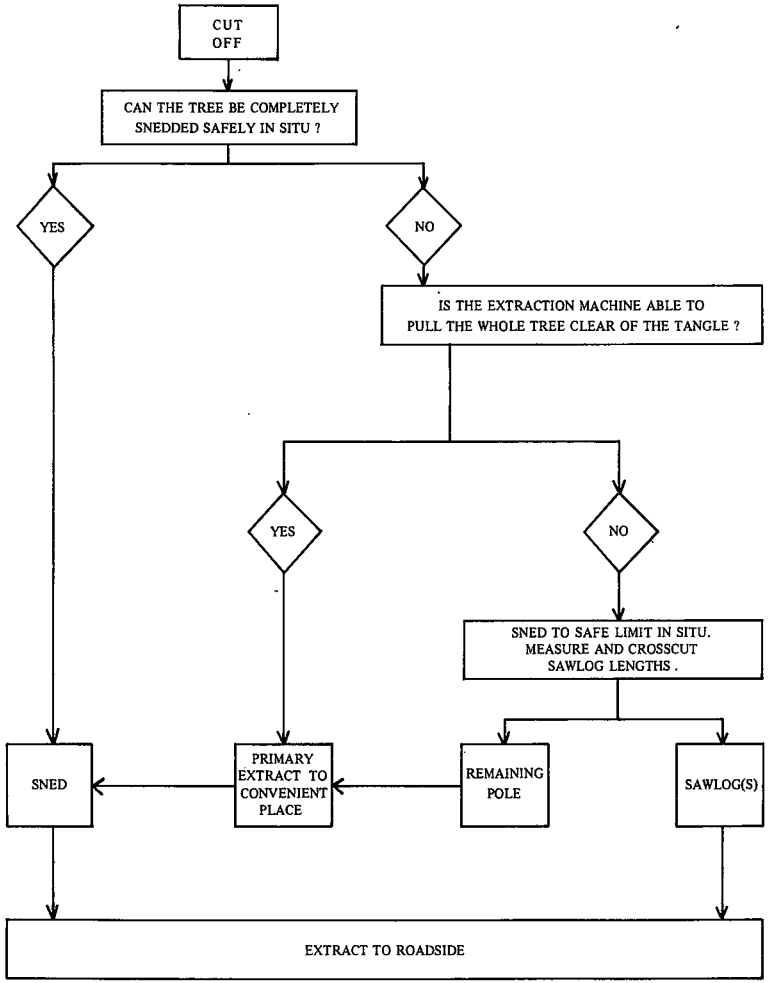

FIGURE 1. Arrangement of operations for the harvesting of windthrown trees.

day. Chainsaw operators may be delayed by having to leave the work position while primary extraction is taking place nearby.

Extraction is also slower than in clear felling because of the obstacles present, difficult presentation and the need to carry out primary extraction. Fewer chainsaw operators are usually required per extraction machine and experience suggests that in windthrow a reasonable balance is obtained where two to three chainsaw operators per extraction machine are employed to sever and sned trees as opposed to four or five men who would normally have been required for clear felling on that site.

In practice workforce balance will be optim-

ised only after some experience of the overall system working. A broad working face maximises the opportunities for continued work but may involve a high degree of movement between potential work locations on the face. Overmanning, if present, will manifest itself by high proportions of operator waiting-time and the inability of the operators to work effectively.

WORKING TECHNIQUES

Before starting any work it is essential that all the workers concerned must have been trained fully in the use, fuelling and maintenance of their respective machines and aid tools, and in the correct, working techniques. They must also be fully equipped with appropriate protective clothing.

Further details on these aspects are given in FSC 10-15 (covering the chainsaw and its use), FSC 21 and 22 (covering forest tractors and their use for ground skidding) and FSC 25 (covering cable cranes). The following notes contain guidance on the working techniques.

Chainsaw work

General

a. Each operator should work alone - never nearer than two tree lengths of another worker. Visible and audible contact must be maintained and the operators must agree the method and sequence of working prior to commencing.
b. Operators must stand well clear of the extraction machine and the trees being primary extracted.
c. Operators should fell trees, part sned *in situ* or complete the snedding after primary extraction or crosscut as required - in other words maintain a flexible approach as to what operation is done and when it is carried out.
d. Operators should always stand on the ground while working and never attempt to work balanced on fallen poles or logs.

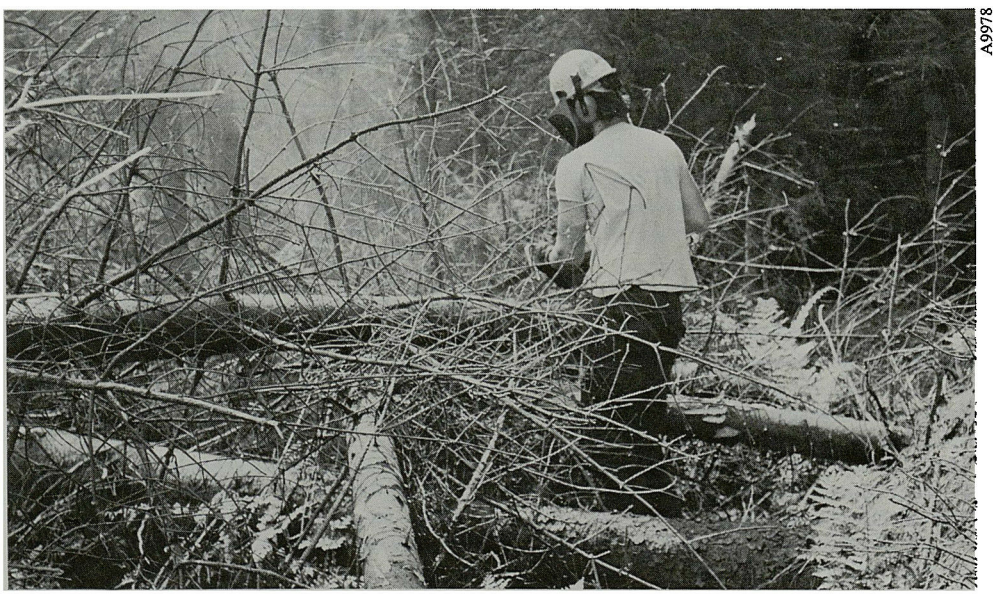

PLATE 2. The criss-crossing of trees and branches creates difficult working conditions and great care is needed when snedding windthrown trees.

HARVESTING WINDTHROWN TREES

by A. T. Jones, and R. O. Smith

Forestry Commission

INTRODUCTION

Wind is a major climatic hazard to tree crops, but foresters generally have adapted their silvicultural and management practices to accommodate it. Experience of harvesting windthrown timber has also been built up over the past few years and the purpose here is to present a digest of this knowledge. It is based on the work and recommendations of the Forestry Commission's Work Study, and Education and Training Branches, and it is intended mainly as a practical guide for foresters and forest craftsmen directly involved with such work. The emphasis is placed on harvesting windthrown coniferous timber: the associated problems of silviculture, forest protection, management and marketing are not considered in depth.

The information is supported and supplemented by the Forest Industry Safety Guides (in particular FSC 10 – 15 and 21, 22 and 25) issued by the Forestry Safety Council.

Two broad categories of windthrow may be identified:

a. Catastrophic windthrow. This is caused by exceptional climatic conditions, and it is probably these occurrences which are most easily recalled, as in east Scotland in 1953, west and central Scotland in 1968, and Wales, central and eastern England in January 1976.
b. Endemic windthrow. This is the localised but progressive damage suffered by stands of trees, due not necessarily to freak weather conditions but to the inherent weakness of the crops to withstand ordinary high winds. It is therefore regarded as somewhat inevitable, and in that sense it is not wholly unpredictable. Vast areas of forest are classified as being susceptible to it but when it occurs on any scale, or accumulates, it presents the same range of harvesting problems as catastrophic windthrow.

Windthrow is notoriously variable and the harvesting problems must be considered in relation to each individual site. Scattered windthrow or snapped trees occur in many parcels of timber and it can be reasonably assumed that properly trained and experienced operators will take these in their stride. More complex harvesting problems arise when the trees are windthrown in groups, sometimes extending to cover whole compartments, and it is in this context that the guidance given here is intended to be of most use.

JOB ORGANISATION

General

Experience has shown that harvesting windthrown timber is different from normal clearfelling or thinning, in that a greater degree of organisation and control is required. The choice of methods, manpower and machinery requirements is determined according to local factors such as:

Crop type - species, spacing, size of trees.
Terrain type - largely affecting choice of extraction system.
Distribution and type of windthrow - trees scattered or in groups, number thrown per hectare, total area affected.
Proportion of partially thrown, hung-up or snapped trees.
Degree of tangle - possibly the result of several successive windthrows in different directions.
Marketing possibilities - what can be recovered, what is subject to degrade if not harvested quickly.
Forest protection - likely incidence of beetle attack etc.

Depending upon the scale of the windthrow

and the time available in which to clear it, major re-deployment of resources may be necessary. Specific training on the special problems of working windthrow must be given to all operators, and they should all be briefed about the hazards and dangers likely to be encountered on each windthrow area. Operators must also realise that it may not be possible to harvest all the timber as in clear fall situations. Greater emphasis should be given to eliminating hazards as work progresses, as by so doing the operators will avoid placing themselves in unsafe working positions.

On the ground itself, the first task should be to clear all access routes to and within the windthrow area, and then to establish the sequence and direction of work. If possible one should follow the direction of the windthrow, that is approach the thrown trees from the butt ends, but to facilitate this, and later extraction, one may have to remove standing and apparently windfirm trees. Ideally one should establish as wide a working face as possible to reduce the risk of a chainsaw operator being unnecessarily interrupted by extraction work, and so maintain the greatest flexibility in the work programme.

Primary extraction

It is virtually impossible to sned all group - thrown trees in situ without endangering the chainsaw operators involved. Some form of mechanical assistance is normally required to move the trees from the tangle, after they have been severed from their roots, to a position where they can be safely and conveniently snedded. This is known as primary extraction. The removal of some trees will isolate others (previously lying very close to, or underneath, the trees removed) sufficiently for snedding to be completed safely *in situ*. After snedding, all the trees may be extracted to roadside in the usual way.

It is suggested that there are three main alternative courses of action for harvesting windthrow. The first involves no primary extraction, the second involves the primary extraction of whole trees and the third involves the partial conversion of the tree with extraction of the timber length(s) directly to roadside and primary extraction of the remaining pole. These are shown in algorithmic form in Figure 1 on page 5, and apply equally to tractor and cable crane systems.

Where there is an identifiable need for primary extraction the progress of the chainsaw operators will be dependent on the effectiveness of the primary extraction. It should therefore be given priority over main extraction so that the chainsaw operators can continue to work safely and effectively. Very few areas would be large enough to justify the use of two machines on primary extraction, even if they were available, and for them to work together safely.

The choice of extraction machine is important, and experience has shown that modified agricultural tractors usually have insufficient power and ground clearance to be fully effective where tree sizes exceed about 0.25 cu m. The power of their winches is sometimes inadequate, as greater force is required to pull whole trees (including their branches) from a typical windthrow tangle than is needed where poles are completely snedded and, generally speaking, lying in a fairly orderly arrangement. Large (about 100 b.h.p.) purpose-built, forest tractors are to be preferred, but smaller machines may be used successfully if trees are partially converted *in situ* before extraction, although this does make the job more costly overall.

Workforce balance and outputs

Compared with normal clear felling, harvesting windthrow is inherently more difficult and slower in several ways. Not only is moving about difficult because of obstacles and limited access but the work is often fragmented. Trees may be severed and partly snedded, then left because further progress is impossible until they have been primary-extracted, or other trees have been moved first. There may be several such trees at any one time. The ancillary operations also may take longer, and occupy a greater proportion of the working

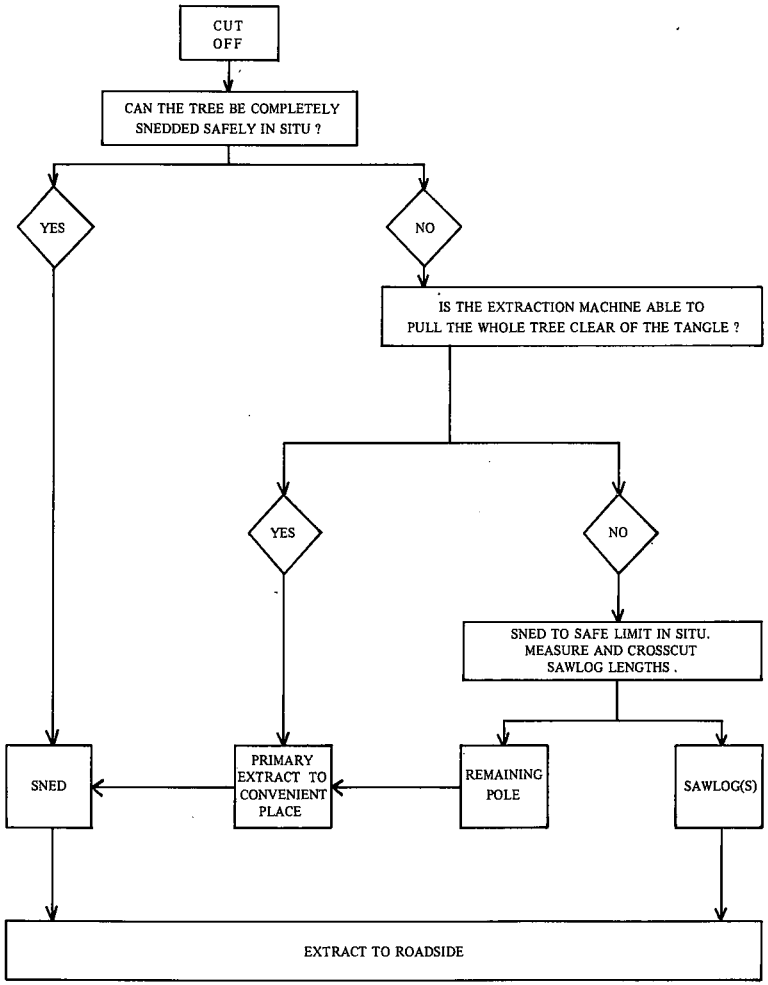

FIGURE 1. Arrangement of operations for the harvesting of windthrown trees.

day. Chainsaw operators may be delayed by having to leave the work position while primary extraction is taking place nearby.

Extraction is also slower than in clear felling because of the obstacles present, difficult presentation and the need to carry out primary extraction. Fewer chainsaw operators are usually required per extraction machine and experience suggests that in windthrow a reasonable balance is obtained where two to three chainsaw operators per extraction machine are employed to sever and sned trees as opposed to four or five men who would normally have been required for clear felling on that site.

In practice workforce balance will be optim-

ised only after some experience of the overall system working. A broad working face maximises the opportunities for continued work but may involve a high degree of movement between potential work locations on the face. Overmanning, if present, will manifest itself by high proportions of operator waiting-time and the inability of the operators to work effectively.

WORKING TECHNIQUES

Before starting any work it is essential that all the workers concerned must have been trained fully in the use, fuelling and maintenance of their respective machines and aid tools, and in the correct, working techniques. They must also be fully equipped with appropriate protective clothing.

Further details on these aspects are given in FSC 10-15 (covering the chainsaw and its use), FSC 21 and 22 (covering forest tractors and their use for ground skidding) and FSC 25 (covering cable cranes). The following notes contain guidance on the working techniques.

Chainsaw work

General

a. Each operator should work alone - never nearer than two tree lengths of another worker. Visible and audible contact must be maintained and the operators must agree the method and sequence of working prior to commencing.
b. Operators must stand well clear of the extraction machine and the trees being primary extracted.
c. Operators should fell trees, part sned *in situ* or complete the snedding after primary extraction or crosscut as required - in other words maintain a flexible approach as to what operation is done and when it is carried out.
d. Operators should always stand on the ground while working and never attempt to work balanced on fallen poles or logs.

PLATE 2. The criss-crossing of trees and branches creates difficult working conditions and great care is needed when snedding windthrown trees.

e. Under no circumstances should an operator work underneath a leaning, or partly-thrown tree.
f. The chainsaw should never be lifted above shoulder level for cutting off the tree or for snedding, although under windthrow conditions there will be a temptation to do so.
g. Greatest care must be taken when working amongst tangled trees, as freedom of movement is greatly restricted (Plate 2). No operator should work where his escape routes are likely to become blocked and he should be prepared to move to an alternative position on the workface where safe working is possible until the hazard has been removed.
h. A chainsaw operator must secure the root plate of the tree he is working on if it is likely to fall towards him after the severing cut is made or if there is any possibility of it rolling away. (Similarly, no one should work at the base of an upturned root plate (of another tree) without ensuring that it is secure in that position).
i. Chainsaws should always be switched off when being carried over difficult ground.

Cutting off the tree

All situations cannot be described here but the following principles apply in most cases.

a. Before starting to cut the chainsaw operator should:-
   (i) prepare the cutting position by removing branches and other debris, and clear escape routes;
   (ii) assess carefully the direction of tension in the tree and decide on the sequence of cuts to be made. The sequence of cuts is determined by the position of the tree, direction of tension and the diameter to be cut through in relation to chainsaw guide - bar length. The sequence should be chosen so that tension is progressively reduced and the tree does not pinch the saw. (Plate 3).

PLATE 3. Severing the tree from the upturned root plate.

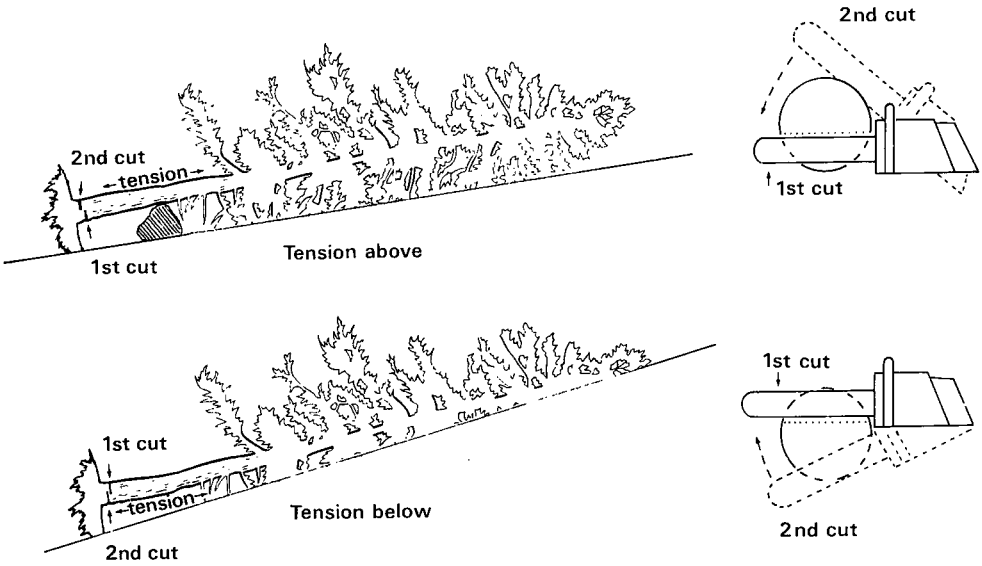

FIGURE 2. Sequence of chainsaw cuts when guide bar is greater than butt diameter of the windthrown tree and where stem tension is present.

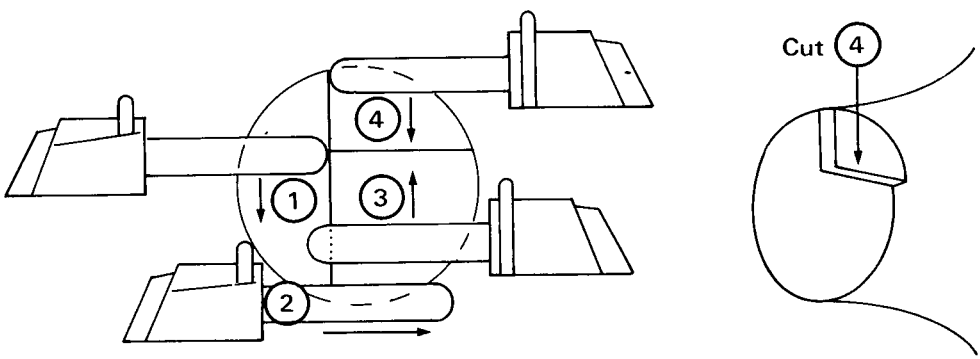

FIGURE 3. A sequence of cuts when butt diameter of windthrown tree is greater than guide bar length.

1. Reducing cut leaves bole width below guide bar length.
2. Undercut to mark position for next cut.
3. Undercut, with top of bar, until cut starts to close.
4. Final cut, staggered towards stump about 2 cm. Bar nose must not overlap cut (1).

b. The first severing cut should be made on the compression side (see Figure 2).
c. Where the tree diameter exceeds guide-bar length a reducing cut should be made first on one side of the stem and extended to the other side underneath the stem to mark the position of the reducing cut, thus allowing the correct positioning of subsequent cuts (see Figure 3).
d. If excessive tension is present some form of restraining equipment should be applied (e.g. hand-operated winch).
e. As many root plates as possible should be allowed to fall (or be pushed) back into place to create safer working conditions for subsequent operations. The operator should check the root plate is stable before leaving it.
f. Where stumps are partly buried or obstructed the second cut, on the tension side of the tree, should be staggered away from the root plate to allow the butt length to lift up.
g. For partially snapped trees, where the top is resting on the ground but still appears to be attached to the vertical butt end, the chainsaw operator must check to see if snap is complete. With the aid of a hand winch or the extraction machine he should try first to pull down the snapped top. If it is still firmly attached the felling sequence is:
(i) cut off the crown where it rests on the ground and
(ii) fell the standing part of the stem at right angles to the direction of throw.
h. Trees which are only partly thrown or hung-up are very awkward to deal with, and they should be dislodged or pulled down by winch or tractor before work is commenced.

Stump treatment

To be effective, stumps should be treated against *Fomes annosus* within 20 minutes of felling or, in the case of windthrow, cutting off the tree.

If extraction does not follow almost immediately then access to the stump surfaces may be obstructed and treatment delayed. In pine crops, where the usual stump treatment is by a suspension of spores of *Peniophora gigantea,* take care not to contaminate the butt ends of the trees as this may lead to degrade of the timber.

Snedding

a. The method and sequence of snedding is the same in windthrow as in normal felling operations. If it is possible to sned the tree completely *in situ* using safe techniques, this should be done. Sometimes, however, there is a point beyond which it is not possible to sned completely in safety, and for convenience this point is called the *Safe Limit* of snedding. The safe limit will vary from tree to tree depending upon the conditions. (The rules given should be observed and will determine how far it is possible to proceed with any tree safely).
b. Where it is neither possible to sned the tree completely *in situ* nor primary-extract it as a whole tree the chainsaw operator should sned the tree to the safe limit, and measure and crosscut a timber length or multiples of timber length. The timber length(s) should then be extracted in the normal way and the remaining pole primary – extracted. In shortwood harvesting systems this would be the method for all trees, with pieces stacked as necessary.
c. If the safe limit is reached, either before the tree is completely snedded or before timber length(s) is reached, work on that tree should be temporarily abandoned and resumed later when adjacent trees have been removed to render conditions safe.
d. Snedding after primary extraction is as normal.

Primary extraction

Ground Skidding

a. Using a ground skidding tractor fitted with a powered winch is most suitable where a large proportion of the windthrown trees need primary extraction over a distance of at least two or three tree lengths (say 20-70 metres), or further if desirable, to a safe area for snedding (Plate 4).

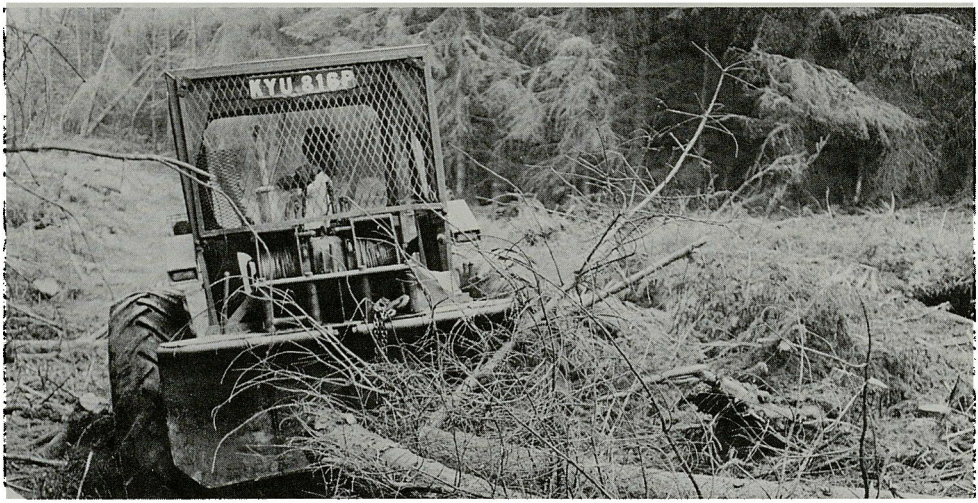

PLATE 4. Primary extraction using County 754 (Falstone) tractor. Partially snedded trees will be trimmed in the clearance area ahead.

(i) The tractor should be driven towards the trees to be removed and positioned close to the tree butts, (if they are lying fairly flat) or a safe distance away (if they are still hung up or leaning in excess of 30° to the horizontal).

(ii) One to four trees should be chokered at a time, attached to the winch rope and winched in to the butt plate of the tractor, maintaining a safe distance between the trees and tractor until the leaning trees in particular have been brought down.

(iii) If subsequent main extraction is to be done butt-first using a winch skidder, it is advisable to use detachable chokers as they can be left on the tree and used later.

(iv) When double-drum winch skidders are used the loads on the two ropes can be separated after reaching the snedding area by allowing one rope to run free and lining up its load behind the load on the other.

(v) If possible the trees should be left in such a position as to facilitate the chokering or gathering of an optimum load for the main extraction.

b. Using a ground skidding tractor fitted with a grapple is similar to the use of winch skidders, but as movement over the area is difficult, access to each tree butt may not be possible. The method is therefore more suitable for small groups of windthrow where only a small proportion of the trees need primary extraction, and is limited to extracting one tree or piece at a time. Such a technique has been successfully used on larger scale windthrows where good ground/site conditions permitted easy all-round access to the windthrown trees. One can improve the effectiveness of grapple skidders by fitting small winches to draw inaccessible poles into the grapple. Even the provision of a hand winch is often an advantage.

c. Using a powered winch (e.g. the winch of a static extraction tractor) may be preferred if the windthrown trees are more scattered, or not so entangled, and winching only over a distance of up to 30 metres will isolate every tree.

(i) The winch should be set up about 20 – 30 metres from the butt-ends of most of the trees to be removed.
(ii) The trees should be chokered at the butts as for ground skidding extraction, preferably using detachable chokers which may be left on and used later.

Cable cranes

The use of cable cranes is very similar in principle to the third method of ground skidding mentioned above, but it requires more formal organisation.

a. On the windward side of the windthrown trees a rackway should be felled, preferably at a slight angle to the direction of throw and having a width equivalent to one tree length. The rackway should be mainly in standing trees to ensure relatively safe working conditions initially, though a suitable ride could be used if available.
b. The cable crane should be set up along the rackway using artificial supports where necessary.
c. The poles from the rack should be extracted to roadside in the usual way.
d. The next line of trees should be cut off (if windthrown) or felled (if still standing): the latter should be felled parallel to, or into, the rack to permit their extraction tip - first.
e. The windthrown trees should be chokered at their butt-ends, attached to the main haul-in rope of the cable crane and winched into the now clear rackway: they would then lie roughly at right angles to the rack.
f. Snedding should be completed in the rack (while the cable crane is at rest), and the trees then extracted to roadside, thus clearing the rack area.
g. Stages d-f should be repeated until a drift 25-30 metres wide has been cleared. The cable crane is then moved to within one tree length of the next line of uncut trees and the procedure is repeated.
h. Trees which are too large for primary extraction in one piece should be snedded and partially converted at stump if possible.
i. In areas accustomed to shortwood working, a near normal operation will be possible.

Main extraction

After completion of snedding, extraction to roadside is direct, butt-first or tip-first as convenient, depending upon the equipment being used and the conditions. It should be possible to optimise load sizes, especially if primary extraction has been done effectively and the poles are fairly concentrated.

Where a sawlog length is cut off at stump and extracted directly to roadside some extra snedding may be needed to remove any branches or snags which could not be cut in the wood. This work should be done by the person doing the crosscutting (at roadside) so as not to hinder the return of the extraction machine into the wood. In tractor operations, it is strongly recommended that the log-rolling blade on the tractor is used to push upturned root plates back into position. Any stumps which are still too high should be reduced by cutting to allow improved access and easier subsequent operations.

OUTPUT DATA

Output Guides prepared by Forestry Commission Work Study staff provide guidance for foresters dealing with windthrow situations are set out in the Appendices which follow in the next pages.

APPENDIX A

OUTPUT GUIDE

Clearing Windthrown Scots and Corsican Pine

---

1 Conditions

The Output Guide applies to windthrown trees cleared under the following conditions:

a. Trees thrown singly, in groups or snapped.
b. Tree volume determined by a locally agreed method.
c. Forest floor conditions are average, i.e. generally flat or with a slope of not more than 10% (6°) and with some decayed brash and light undergrowth.
d. The brashing percentage is at least 90%.

2 Job specification

The Output Guide is for the following work:

a. Stumps to be cut as low as safely possible.
b. Branches to be cut off flush with the stem and tops to be cut off at a diameter specified by the supervisor.
c. Primary conversion into sawlog(s) and remaining pole to be carried out at the time of clearing.
d. All cuts to be made square across the stem.
e. Butts to be squared off where necessary.
f. Rides and roads to be kept clear of lop and top.
g. Stumps to be treated against *Fomes annosus* as soon as possible after cutting. Care should be taken not to taint sawlogs when the root does not fall away from the butt. (Extra time is required for stump treatment—see paragraph 7.)

3 Tools and equipment

a. Lightweight anti-vibration chainsaw, of an approved pattern and suitable for chainsaw snedding, together with spares and maintenance tools.
b. Fuel and oil cans.
c. Breaking bar where required.
d. Logger's harness, spring loaded logger's tape (when primary conversion or measurement at stump is required).
e. Stump treatment equipment.

f. Safety equipment is as follows:–
   (i) Safety helmet, complying with BS5240
   (ii) Mesh visor.
   (iii) Ear defenders.
   (iv) Gloves, incorporating ballistic nylon lining on back of left-hand.
   (v) Nylon leg guard (left leg only).
   (vi) Safety boots, incorporating inner ballistic nylon guard.

4 Allowances

The following allowances are included in the Output Guide:

a. For contingencies and work other than that actually performed on individual trees, e.g. refuelling saws, walking to and from work site, clearing tops from rides, supervisory visits, etc, 22% of the time spent on felling and snedding. This has been increased to 40% to take account of the extra saw sharpening entailed in windthrown areas and for unavoidable delays caused by having tangled trees pulled apart by the tractor.

b. For personal needs and rest, 22% of the total working time.

5 Method of using the Output Guide

The average tree volume, number of whorls to be snedded per tree and the number of pieces to be cut per tree should be determined by an agreed method. The time per tree is then taken from the tables in paragraph 6 according to species.

Example 1

CP.
0·50m³ per tree.
22 whorls per tree.
2·50 pieces cut per tree.

Fell and sned	= 8·92 SMs per tree (from table 6B col II).
Treat stump	= 8·92 SMs × 5% (from paragraph 7)
	= 0·45 SM per tree.
Measure and crosscut	= 1·01 SMs per tree (from table 6B col V).
Total time per tree	= 8·92 + 0·45 + 1·01 SMs
	= 10·38 SMs.

Example 2

CP.
0·50m³ per tree.
23 whorls per tree.
2.·30 pieces cut per tree.

Fell and sned	= 8·92 + 0·14 − (0·18 × 2) SMs per tree (from table 6B col II with addition for extra whorl and deduction for fewer pieces cut)
	= 8·70 SMs per tree.
Treat Stump	= 8·92 × 5% (from paragraph 7)
	= 0·45 SM per tree.
Measure and crosscut	= 1·01 − (0·06 × 2) SMs per tree (from table 6B col V with deduction for fewer pieces cut)
	= 0·89 SM per tree.
Total time per tree	= 8·70 + 0·45 + 0·89 SMs
	= 10·04 SMs.

6A Scots pine—time in standard minutes per tree

Volume in m^3 per tree	*Time to fell and sned in SMs per tree*	*Mean number of pieces cut per tree*	*Mean number of whorls per tree*	*Time to measure and crosscut in SMs per tree*
I	*II*	*III*	*IV*	*V*
0·20	5·09	2·1	18	0·51
0·25	5·50	2·2	18	0·63
0·30	5·98	2·3	19	0·73
0·35	6·54	2·4	19	0·82
0·40	7·10	2·5	20	0·90
0·45	7·69	2·6	20	0·97
0·50	8·25	2·7	20	1·04

(i) *Add/subtract* 0·14 SM per whorl to the time shown in col II if the mean number of whorls per tree is different to that shown in col IV.

(ii) *Add/subtract* 0·06 SM for each tenth piece to the time shown in coll II if the mean number of pieces per tree is different to that shown in col III.

(iii) *Add/subtract* 0·02 SM for each tenth piece to the time shown in col V if the mean number of pieces is different to that shown in col III.

6B Corsican pine—time in standard minutes per tree

Volume in m^3 per tree	*Time to fell and sned in SMs per tree*	*Mean number of pieces cut per tree*	*Mean number of whorls per tree*	*Time to measure and crosscut in SMs per tree*
I	*II*	*III*	*IV*	*V*
0·25	6·59	2·2	20	0·67
0·30	7·21	2·3	20	0·73
0·35	7·75	2·3	21	0·80
0·40	8·20	2·4	21	0·87
0·45	8·59	2·5	22	0·94
0·50	8·92	2·5	22	1·01
0·55	9·17	2·5	23	1·06
0·60	9·38	2·6	23	1·11
0·65	9·55	2·6	23	1·16
0·70	9·67	2·6	24	1·21
0·75	9·75	2·6	24	1·25
0·80	9·80	2·6	24	1·30
0·85	9·85	2·6	24	1·33
0·90	9·87	2·5	24	1·37
0·95	9·89	2·5	24	1·38
1·00	9·91	2·5	25	1·42

(i) *Add/subtract* 0·14 SM per whorl to the time shown in col II if the mean number of whorls per tree is different to that shown in col IV.

(ii) *Add/subtract* 0·18 SM for each tenth piece to the time shown in col II if the mean number of pieces per tree is different to that shown in col III.

(iii) *Add/subtract* 0·06 SM for each tenth piece to the time shown in col V if the mean number of pieces is different to that shown in col III.

7 Modifications and variations to the Output Guide

N.B. These modifications and variations are only to be applied when the prevailing conditions or job specification differ from those listed in paragraphs 1 and 2.

a. *Stump treatment*

For treatment of stumps at the time of severance

Add 5% to the time shown in col II.

N.B. The method of making this addition is shown in the examples in paragraph 5.

APPENDIX B

OUTPUT GUIDE

Clearing Windthrown Sitka Spruce, Norway Spruce and Douglas Fir

---

1 Conditions

The Output Guide applies to windthrown trees cleared under the following conditions:

a. Trees are thrown singly, in small or large groups, or snapped.

b. Tree volumes are determined by a recognised and locally agreed method.

c. Brashing percentage is at least 90%, but see paragraph 7b.

d. Forest floor conditions are average for the species, i.e. normal amounts of lop and top from thinnings, little ground vegetation, few rocks, normal drainage patterns, slopes up to 20% (11°), but see paragraph 7a.

e. Trees are snedded to safe limits *in situ*. Any tree not snedded, or not completely snedded *in situ*, is primary – extracted on to cleared ground where snedding can be completed.

f. One-man working.

N.B. It is assumed that an extraction machine with operator(s) is available for the primary extraction of trees which are difficult or unsafe to work *in situ*. Approximate gang balance – one extraction machine per two or three fellers.

2 Job specification

The Output Guide is for the following work:

a. Pole length working where possible in safety. For marking and measuring sawlogs see paragraph 7c. Large trees may require primary conversion at stump. For marking, measuring and cross-cutting sawlogs during snedding see paragraph 7d. (Each sawlog is completely snedded.)

b. Stumps to be cut as low as possible in safety and root plates left in a safe condition (i.e. ensuring they will not fall back at an inconvenient moment).

c. Branches to be cut off flush with the stem. Smaller trees will be turned from the tip for snedding the undersides. Larger trees (above 0·25m^3) will normally only be snedded as thoroughly as is possible without turning them.

d. Tops to be cut off at about 7 cm diameter and cut up into lengths not exceeding 1·2 m as required by the supervisor.

e. Trees standing within or bordering on the windthrown area to be felled as directed by the supervisor.

f. All cuts to be made squarely across the stem and butts to be squared off where necessary.

g. Roads and rides to be kept clear of lop and top, as directed by the supervisor.

h. Stumps to be treated against *Fomes annosus* as soon as possible after cutting. (Extra time is required for stump treatment - see paragraph 7e.)

3 Tools and equipment

a. Lightweight anti-vibration chainsaw, of an approved pattern and suitable for chainsaw snedding, together with spares and maintenance tools.

b. Fuel and oil cans.

c. Breaking bar where required.

d. Logger's harness, spring loaded logger's tape (when primary conversion or measurement at stump is required).

e. Stump treatment equipment.

f. Protective clothing viz:
Safety helmet BS5240.
Mesh visor.
Ear defenders.
Gloves, incorporating ballistic nylon lining on back of left hand.
Nylon leg guard (left leg only).
Safety boots, incorporating inner ballistic nylon guard.

4 Allowances

The following allowances are included in the Output Guide:

a. For contingencies and work other than that actually performed on individual trees, e.g. refuelling and day-to-day maintenance of the saw, clearing lop and top from roads and rides, fetching tools and supplies etc 31% of the time actually spent on felling and snedding (table 6A).
Where the use of an extraction machine, carrying out primary extraction, causes unavoidable delays to the fellers, the 'other work' allowance is 45% of the time actually spent on felling and snedding (table 6B).

b. For personal needs and rest, 25% of the total working time (table 6A).
When the 'other work' allowance increases to 45%, personal needs and rest allowance is decreased to 23%.
N.B. (i) Any delays in excess of 11 minutes duration caused by the use of an extraction machine are not included and should be allowed for separately.
(ii) Mechanical breakdowns of the saw in excess of 15 minutes are not included and should be allowed for separately.
(iii) Times for primary or complete extraction are *excluded.*

5 Method of using the Output Guide

a. Select the appropriate table for the working method used (paragraph 8 below)
Use table 6A—Where complete snedding *in situ* is possible in safety (Working Method 1) or where the use of an extraction machine (Working Methods 2 and 3) does *not* cause delays in the felling and snedding operation.
Use table 6B—Where the use of an extraction machine (Working Methods 2 and 3) causes *unavoidable* delays in the felling and snedding operation.

b. Obtain mean tree volume by a recognised and locally agreed method.

c. Read the standard time per tree for the correct species from the appropriate table and modify as necessary with reference to paragraph 7.

Example 1

Sitka spruce. Mean tree volume 0·29m³.
Workng Method 2. Extraction causing unavoidable delays in felling and snedding operation.
Brashing percentage 70%. Moderately difficult terrain.
Felling and snedding time (from table 6B).

Interpolated: $11{\cdot}02 + \left[\frac{11{\cdot}77 - 11{\cdot}02}{4} \times 1\right]$ = 11·21 SMs per tree

Allowance for moderately difficult terrain (5%) (from paragraph 7a) = 0·56 SM per tree

Allowance for brashing (from paragraph 7b) 90% − 70% = 20% of 0·75 SM = 0·15 SM per tree

Allowance for stump treatment (from paragraph 7e) = 0·60 SM per tree

Total time = 12·52 SMs per tree

Example 2

Douglas fir. Mean tree volume 0·84m³.
Working Method 3. Machine extraction does not cause delays in felling and snedding operation.
One multiple length sawlog measured, marked and crosscut from each tree.
Mean top diameter of sawlogs = 24 cm.
Conditions as shown in paragraph 1.
Felling and snedding time (from table 6A) = 14·68 SMs per tree

Allowance for measure, mark and crosscut sawlog (from paragraph 7d).

Interpolated: $0{\cdot}70 + \left[\frac{0{\cdot}79 - 0{\cdot}70}{5} \times 4\right]$ = 0·77 SM per tree

Allowance for stump treatment (From paragraph 7e) = 0·80 SM per tree

Total time = 16·25 SMs per tree

6A Standard times for clearing windthrown trees

Trees completely snedded *in situ* where possible in safety, or if primary – extracted no unavoidable delay occurring.

Volume of average tree in m³	*Standard time per tree in standard minutes*		
	Sitka spruce	*Norway spruce*	*Douglas fir*
0·08	6·55	6·42	7·19
0·12	7·29	7·06	7·46
0·16	8·01	7·71	7·75
0·20	8·73	8·33	8·09
0·24	9·43	8·95	8·47
0·28	10·12	9·56	8·89
0·32	10·81	10·15	9·32
0·36	11·48	10·73	9·75
0·40	12·13	11·29	10·20
0·44	12·79	11·84	10·65
0·48	13·41	12·36	11·10
0·52	14·03	12·88	11·54

Volume of average tree in m^3	*Standard time per tree in standard minutes*		
	Sitka spruce	*Norway spruce*	*Douglas fir*
0·56	14·64	13·38	11·97
0·60	15·23	13·86	12·42
0·64	15·80	14·32	12·82
0·68	16·34	14·74	13·22
0·72	16·88	15·15	13·60
0·76	17·41	15·55	13·98
0·80	17·91	15·92	14·36
0·84	18·39	16·26	14·68
0·88	18·86	16·60	15·02
0·92	19·31	16·90	15·34
0·96	19·72	17·17	15·63
1·00	20·12	17·44	15·95
1·04	20·50	17·66	16·26
1·08	20·86	17·88	16·57
1·12	21·19	18·06	16·86
1·16	21·50	18·21	17·13
1·20	21·80	18·36	17·41

Interpolate as necessary.

6B Standard times for clearing windthrown trees

Trees primary – extracted whole or in part before snedding completed. The use of the extraction machine causing unavoidable delays to the felling and snedding operation.

Volume of average tree in m^3	*Standard time per tree in standard minutes*		
	Sitka spruce	*Norway spruce*	*Douglas fir*
0·08	7·13	6·99	7·83
0·12	7·94	7·69	8·13
0·16	8·72	8·40	8·44
0·20	9·51	9·07	8·81
0·24	10·27	9·75	9·23
0·28	11·02	10·41	9·69
0·32	11·77	11·05	10·15
0·36	12·50	11·69	10·62
0·40	13·22	12·30	11·11
0·44	13·93	12·90	11·60
0·48	14·61	13·46	12·09
0·52	15·28	14·03	12·57
0·56	15·94	14·57	13·04
0·60	16·59	15·10	13·53
0·64	17·21	15·60	13·96
0·68	17·80	16·05	14·40
0·72	18·39	16·50	14·81
0·76	18·96	16·94	15·23
0·80	19·51	17·34	15·64
0·84	20·03	17·71	15·99

Volume of average tree in m^3	*Standard time per tree in standard minutes*		
	Sitka spruce	*Norway spruce*	*Douglas fir*
0·88	20·55	18·08	16·36
0·92	21·03	18·41	16·71
0·96	21·47	18·70	17·02
1·00	21·92	18·99	17·37
1·04	22·33	19·23	17·71
1·08	22·72	19·47	18·05
1·12	23·08	19·67	18·36
1·16	23·42	19·83	18·66
1·20	23·74	20·00	18·96

Interpolate as necessary.
N.B. Where trees are partially converted at stump, extra time should be allowed for marking, measuring and crosscutting the sawlogs — see paragraph 7d.

7 Modifications and variations to the Output Guide

N.B. These modifications and variations are only to be applied when the prevailing conditions or job specification differ from those listed in paragraphs 1 and 2.

a. *Ground conditions*
Where ground conditions are difficult because of rocks, deep drains or excessive steepness
Add up to 10% in 5% steps.
For extremely difficult conditions
Add 15%.

b. *Brashing percentage*
If the percentage of trees brashed is less than 90% the brashing of all measurable unbrashed trees should be allowed for. The time for chainsaw brashing (or minimal brashing and extra snedding) is 0·75 SM per tree.

c. *Measure and mark sawlog lengths*
When sawlog lengths are measured and marked (but *not* crosscut), during snedding using a logger's tape for measuring and the chainsaw for marking the trees
Add 0·45 SM for each timber length measured and marked.

d. *Measure, mark and crosscut sawlog length*
When a single or multiple sawlog length is measured, marked and crosscut during snedding make an addition from the following table:

Mean top diameter sawlogs (cm)	*Time per sawlog (SM)*
15	0·64
20	0·70
25	0·79
30	0·94
35	1·16

e. *Stump treatment*
For applying fungicide to the stump immediately after felling (including fetching chemicals, filling cans, etc)
Add 0·40 SM per tree for trees up to 0·18 m^3
Add 0·60 SM per tree for trees from 0·18 m^3 to 0·72 m^3
Add 0·80 SM per tree for trees over 0·72 m^3.

8 Recommended methods of working

Methods

1 (i) Cut off tree at stump ensuring stump is made safe.
(ii) Sned tree completely *in situ.*
(iii) Treat stump, trim butt, cut off top, etc as in normal clear felling.

2 (i) Cut off tree at stump ensuring stump is made safe.
(ii) Sned tree to safe limit *in situ.*
(iii) Primary extract tree clear of windthrown tangle (about one tree length at least).
(iv) Complete snedding.
(v) Treat stump, trim butt, cut off top, etc as in normal clear felling.

3 (i) Cut off tree at stump, ensuring stump is made safe.
(ii) Sned tree to safe limit *in situ.*
(iii) Measure and crosscut sawlog length(s) *in situ.*
(iv) Extract sawlog(s) to roadside and extract remaining part of tree clear of windthrown tangle (about one tree length at least).
(v) Complete snedding.
(vi) Treat stump, trim butt, cut off top, etc as in normal clear felling.

Notes:

(a) Safe limit for snedding varies from tree to tree.

(b) Methods 2 and 3 apply in principle to both tractor and skyline extraction though the organisation of the latter is more complex.

(c) Methods 2 and 3 may involve some unavoidable delay to the feller in so far as he may have to wait for the extraction machine to remove the tree or part tree from the tangle, or the removal of a second tree may interfere with him as he works on a first tree. Delays are *not* inevitable when using these methods. They will depend on the nature of the windthrow, the type of tree, extraction method, etc.

APPENDIX C

OUTPUT GUIDE

Primary Extraction of Windthrown Trees

METHODS OF WORKING

Using Ground Skidding Tractors

TWO methods are possible

(a) *Method 1*
The technique is very similar to butt-first extraction, taking from 1–4 trees per load, and extracting over distances of 20–70 metres in the wood.

(b) *Method 2*
Tractor static, using winch only. In this method the tractor is parked 20–30 metres away from the butts of the trees to be primary extracted. One or both ropes are used to pull the trees over a distance of up to 20 metres.

Using Cable Cranes

Method 3
This is similar to Method 2 above where the trees are chokered to the haul-in rope of the cable crane, and pulled towards the main rack.

It may not be necessary to primary extract every tree, because following the removal of some trees, the remaining trees (originally lying underneath those now removed) would be sufficiently isolated, and rendered safe for snedding *in situ*.

With larger trees, necessitating partial conversion *in situ* into single or multiple sawlog length(s) and top, the sawlog(s) would be extracted in the normal way and only the top would need to be primary-extracted. If further snedding of the sawlog(s) is needed this can be done on roadside (by the crosscutter) as it is likely to be fairly limited.

Working windthrow — Primary Extraction Method 1 (Ground Skidding)

Method

a. Reverse tractor to a position close to the butt(s) of the tree(s) to be removed.

b. Choker 1–4 trees to the winch rope(s).

c. Winch in the trees to the butt plate of tractor, and extract to a safe snedding area.

d. Where two winch ropes are used, separate the loads on the two ropes in the snedding area by allowing one rope to run free so that the load on one rope is lined up behind the load on the other. If possible, leave the poles in such a position that the main extraction to roadside will be tip-first.

Guidance times

a. Conditions:
   (i) Tree volumes, or tops (if sawlog(s) removed at stump) within the range 0·1 m^3 — 0·5 m^3.
   (ii) Ground conditions — easy to moderate for ground skidding.
   (iii) One man working.

b. Job Specification:
   (i) The method as described above, including unchokering.
   (ii) Normal daily maintenance of the tractor.

c. Tools and Equipment:
   (i) Ground skidding tractors, e.g. Timberjack 225D, Ford 4000 4 × 4, County 754, fitted with winches (double drum).
   (ii) Maintenance tools
   (iii) Safety clothing
   } as specified for normal extraction

d. Allowances (included in the times): 20% for Other Work
   20% for Personal Needs and Rest

e. Method of Selecting the Time:
   Primary extraction times in standard minutes per pole are obtained by reference to the average primary extraction distance, and average load size. (The primary extraction distance is from the point where a load is picked up to the point where it is dropped for further conversion).

f. Primary Extraction Times in Standard Minutes per Pole:

Average Primary Extraction Distance (m)	SM	
	2 trees (average load)	3 trees
25	3·73	3·04
28	3·87	3·18
32	4·07	3·38
36	4·27	3·57
40	4·46	3·77
44	4·66	3·97
48	4·85	4·16
52	5·05	4·36
56	5·25	4·56
60	5·44	4·75
64	5·64	4·95
68	5·84	5·14

g. For difficult conditions e.g. steep slopes, frequent obstructions, including high stumps or root plates, additional time may be required.

Working windthrow — Primary Extraction Method 2 (Ground Skidding)

Method

a. Park the tractor 20–30 metres from the butts of the trees to be primary-extracted.

b. Choker the trees to one or to both winch ropes.

c. Winch in the trees until clear of the tangle, i.e. until they are sufficiently isolated for snedding to be done safely.

d. Repeat operation along felling face extracting from up to 20 metres either side of the tractor.

Guidance times

a. Conditions:
   (i) Tree volumes or tops (if sawlog(s) removed at stump) up to 0·2 m^3.
   (ii) Tractor static during winching in.
   (iii) Ground conditions (for access) easy to moderate for ground skidding.
   (iv) One man working.

b. Job Specification:
   (i) The method as described above, including unchokering.
   (ii) Normal daily maintenance of the tractor.

c. Tools and Equipment:
   (i) Ground skidding tractors e.g. Timberjack 225D, Ford 4000 4 × 4, County 754, fitted with winches (double drum).
   (ii) Maintenance tools
   (iii) Safety clothing
   } as specified for normal extraction

d. Allowances (included in the times): 20% for Other Work
   20% for Personal Needs and Rest

e. Method of Selecting the Time:
   Primary extraction times in standard minutes per pole are obtained by reference to the average haul-in distance, namely, the average distance from where the butts of the trees are lying prior to primary extraction to the point where they are lying after primary extraction.

f. Primary Extraction Times in Standard Minutes per Pole:

Average Haul-in Distance (m)	*Time per Tree (SM)*
6	2·63
8	2·90
10	3·18
12	3·45
14	3·73
16	4·01
17	4·14

Working windthrow — Primary Extraction Method 3 (Cable Cranes)

Method

a. On the windward side of the windthrown area fell a rackway with a width equivalent to one tree length, preferably at an angle to the direction of throw. If possible the rackway should be

mainly in standing trees to ensure safe working, though a suitable ride could be used if available.

b. Set up the cable crane along the rackway, with artifical supports if necessary.

c. Extract poles from the rackway to roadside in the normal manner.

d. Cut off or fell the next 'line' of rackside trees.

e. Primary extract these trees by chokering the butts of the trees to the haul-in cable, and extracting sideways into the cleared ground of the rackway.

f. Following snedding and main extraction to roadside cut off the next 'line' of trees and primary-extract into the rack area.

g. Repeat the above procedures (c) — (f) until a drift 25–30 metres wide has been cleared, then move the cable crane to within one tree length of the next 'line' of trees. Continue to primary-extract as described.

h. Trees which are too large for primary – extraction in one piece should be partially converted at stump and extracted in two or more pieces.

Guidance times

a. Conditions:
   (i) Tree volumes or tops (if sawlog(s) removed at stump) up to 0·2 m^3.
   (ii) Average loads 1–3 trees.
   (iii) Even ground conditions.
   (iv) Average side haul distance 18–20 metres.
   (v) Two man working.

b. Job Specification:
   (i) The method as described above, including unchokering.
   (ii) Daily maintenance of tractor and winch.

c. Tools and Equipment:
   (i) Standard cable crane.
   (ii) Radios and other equipment
   (iii) Safety equipment
   } as specified for normal extraction

d. Allowance (included in the times): 20% for Other work
   20% for Personal Needs and Rest

e. Method of Selecting the Time:
   Primary extraction times in standard minutes per pole are obtained by reference to the average number of trees per load.

f. Primary Extraction Times in Standard Minutes per Pole:

Average Number of Trees per load	*Time per Tree (SM)*
1	4·84
2	3·69
3	2·56

ACKNOWLEDGEMENTS

The aerial view on the front cover was taken by I A Anderson, the Forestry Commission's Chief Photographer and, with the remaining photographs taken by A T Jones, is in the Commission's collection. Line drawings were prepared by J Williams, Graphics Officer.

Enquiries relating to this publication should be addressed to the Publications Officer, Forestry Commission Research Station, Alice Holt Lodge, Wrecclesham, Farnham, Surrey, GU10 4LH.

Printed in England for Her Majesty's Stationery Office by Linneys of Mansfield Dd 599414 K40 3/80

Guidance times

a. Conditions:
   (i) Tree volumes, or tops (if sawlog(s) removed at stump) within the range 0·1 m^3 — 0·5 m^3.
   (ii) Ground conditions — easy to moderate for ground skidding.
   (iii) One man working.

b. Job Specification:
   (i) The method as described above, including unchokering.
   (ii) Normal daily maintenance of the tractor.

c. Tools and Equipment:
   (i) Ground skidding tractors, e.g. Timberjack 225D, Ford 4000 4 × 4, County 754, fitted with winches (double drum).
   (ii) Maintenance tools
   (iii) Safety clothing
   } as specified for normal extraction

d. Allowances (included in the times): 20% for Other Work
   20% for Personal Needs and Rest

e. Method of Selecting the Time:
   Primary extraction times in standard minutes per pole are obtained by reference to the average primary extraction distance, and average load size. (The primary extraction distance is from the point where a load is picked up to the point where it is dropped for further conversion).

f. Primary Extraction Times in Standard Minutes per Pole:

Average Primary Extraction Distance (m)	SM	
	2 trees (average load)	3 trees
25	3·73	3·04
28	3·87	3·18
32	4·07	3·38
36	4·27	3·57
40	4·46	3·77
44	4·66	3·97
48	4·85	4·16
52	5·05	4·36
56	5·25	4·56
60	5·44	4·75
64	5·64	4·95
68	5·84	5·14

g. For difficult conditions e.g. steep slopes, frequent obstructions, including high stumps or root plates, additional time may be required.

Working windthrow — Primary Extraction Method 2 (Ground Skidding)

Method

a. Park the tractor 20–30 metres from the butts of the trees to be primary-extracted.

b. Choker the trees to one or to both winch ropes.

c. Winch in the trees until clear of the tangle, i.e. until they are sufficiently isolated for snedding to be done safely.

d. Repeat operation along felling face extracting from up to 20 metres either side of the tractor.

Guidance times

a. Conditions:
   (i) Tree volumes or tops (if sawlog(s) removed at stump) up to 0·2 m^3.
   (ii) Tractor static during winching in.
   (iii) Ground conditions (for access) easy to moderate for ground skidding.
   (iv) One man working.

b. Job Specification:
   (i) The method as described above, including unchokering.
   (ii) Normal daily maintenance of the tractor.

c. Tools and Equipment:
   (i) Ground skidding tractors e.g. Timberjack 225D, Ford 4000 4 × 4, County 754, fitted with winches (double drum).
   (ii) Maintenance tools
   (iii) Safety clothing
   } as specified for normal extraction

d. Allowances (included in the times): 20% for Other Work
   20% for Personal Needs and Rest

e. Method of Selecting the Time:
   Primary extraction times in standard minutes per pole are obtained by reference to the average haul-in distance, namely, the average distance from where the butts of the trees are lying prior to primary extraction to the point where they are lying after primary extraction.

f. Primary Extraction Times in Standard Minutes per Pole:

Average Haul-in Distance (m)	*Time per Tree (SM)*
6	2·63
8	2·90
10	3·18
12	3·45
14	3·73
16	4·01
17	4·14

Working windthrow — Primary Extraction Method 3 (Cable Cranes)

Method

a. On the windward side of the windthrown area fell a rackway with a width equivalent to one tree length, preferably at an angle to the direction of throw. If possible the rackway should be

mainly in standing trees to ensure safe working, though a suitable ride could be used if available.

b. Set up the cable crane along the rackway, with artifical supports if necessary.

c. Extract poles from the rackway to roadside in the normal manner.

d. Cut off or fell the next 'line' of rackside trees.

e. Primary extract these trees by chokering the butts of the trees to the haul-in cable, and extracting sideways into the cleared ground of the rackway.

f. Following snedding and main extraction to roadside cut off the next 'line' of trees and primary-extract into the rack area.

g. Repeat the above procedures (c) — (f) until a drift 25–30 metres wide has been cleared, then move the cable crane to within one tree length of the next 'line' of trees. Continue to primary-extract as described.

h. Trees which are too large for primary – extraction in one piece should be partially converted at stump and extracted in two or more pieces.

Guidance times

a. Conditions:
   (i) Tree volumes or tops (if sawlog(s) removed at stump) up to 0·2 m^3.
   (ii) Average loads 1–3 trees.
   (iii) Even ground conditions.
   (iv) Average side haul distance 18–20 metres.
   (v) Two man working.

b. Job Specification:
   (i) The method as described above, including unchokering.
   (ii) Daily maintenance of tractor and winch.

c. Tools and Equipment:
   (i) Standard cable crane.
   (ii) Radios and other equipment } as specified for normal extraction
   (iii) Safety equipment }

d. Allowance (included in the times): 20% for Other work
   20% for Personal Needs and Rest

e. Method of Selecting the Time:
   Primary extraction times in standard minutes per pole are obtained by reference to the average number of trees per load.

f. Primary Extraction Times in Standard Minutes per Pole:

Average Number of Trees per load	*Time per Tree (SM)*
1	4·84
2	3·69
3	2·56

ACKNOWLEDGEMENTS

The aerial view on the front cover was taken by I A Anderson, the Forestry Commission's Chief Photographer and, with the remaining photographs taken by A T Jones, is in the Commission's collection. Line drawings were prepared by J Williams, Graphics Officer.

Enquiries relating to this publication should be addressed to the Publications Officer, Forestry Commission Research Station, Alice Holt Lodge, Wrecclesham, Farnham, Surrey, GU10 4LH.

Printed in England for Her Majesty's Stationery Office by Linneys of Mansfield Dd 599414 K40 3/80

First published 1980

HER MAJESTY'S STATIONERY OFFICE

Government Bookshops

49 High Holborn, London WC1V 6HB
13a Castle Street, Edinburgh EH2 3AR
41The Hayes, Cardiff CF1 1JW
Brazennose Street, Manchester M60 8AS
Southey House, Wine Street, Bristol BS1 2BQ
258 Broad Street, Birmingham B1 2HE
80 Chichester Street, Belfast BT1 4JY

Government Publications are also available through booksellers

ODC Number 312 : 421

ISBN 0 11 710231 8