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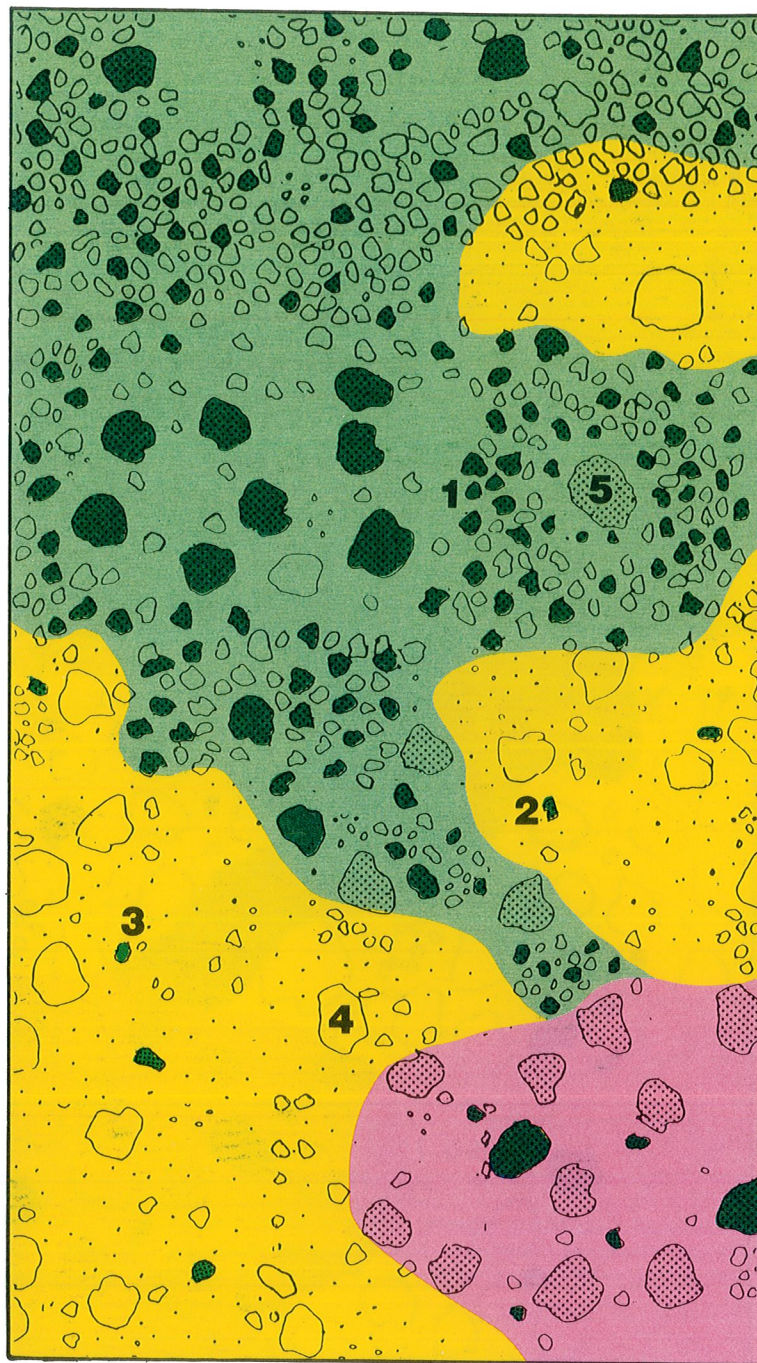


FIG 6. AFTER LOGGING

Note above:

1. Some potential crop trees surplus to stocking needs may remain after the commercial operation because they are below marketable size.
2. Occasional crop trees below marketable size may be retained in what is otherwise a gap. However, every opportunity should be taken to remove them commercially if possible.
3. Small groups of poles have little chance of surviving the felling of surrounding large trees.
4. Cull trees remain after commercial operations.
5. Some "non-crop trees" may be retained if their removal would cause excessive damage to crop trees.

**LEGEND**

TREES POLES SAPLINGS & GROUND COPPICE

POTENTIAL CROP TREE TREE TO BE RETAINED

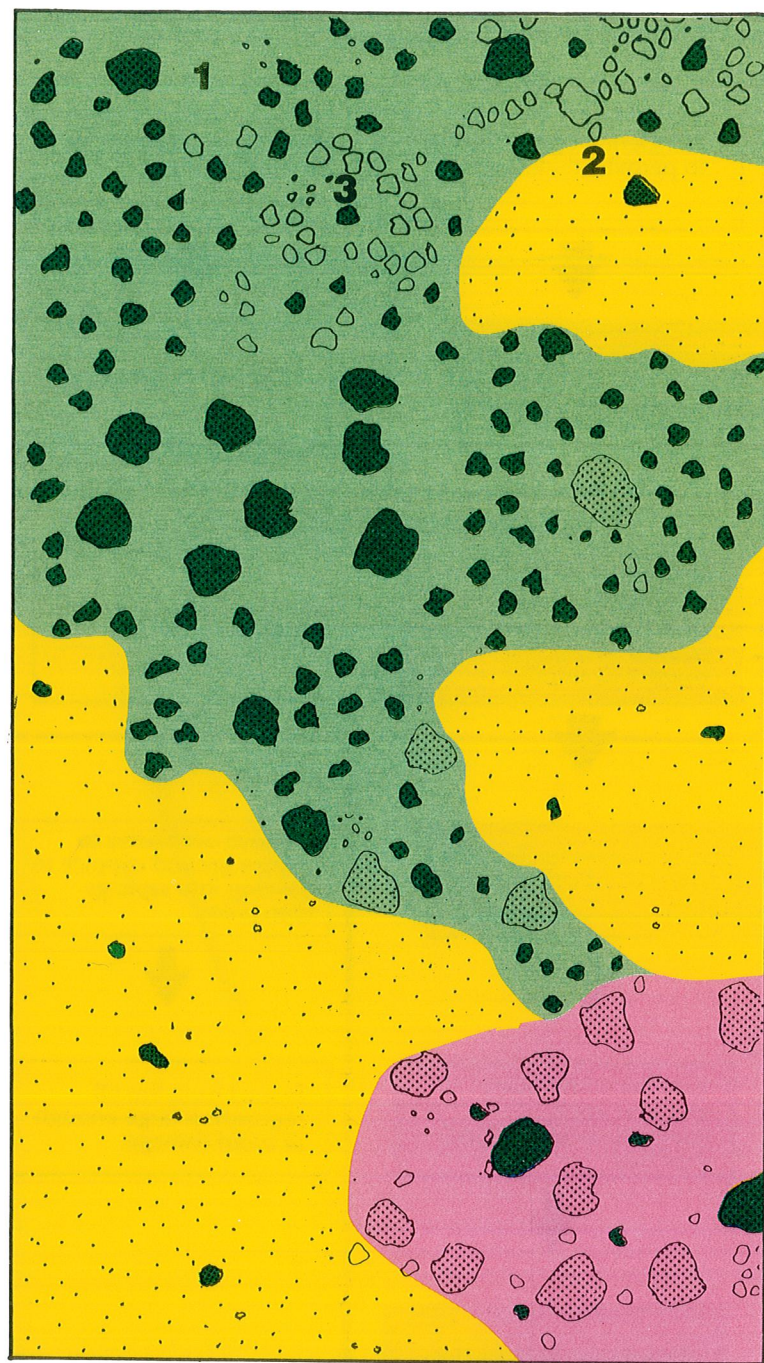


FIG 7. FOLLOW-UP SILVICULTURAL TREATMENT

Following logging, surplus stems are removed to produce a stand containing patches of:

- Partial cutting (or shelterwood) to promote the development of seedlings into ground coppice (Objective 1).
- Complete removal of the overstorey to release ground coppice to develop into saplings then poles (Objective 2).
- Thinning to concentrate the stand growth onto fewer stems (Objective 3).

Note above:

1. Some gaps which result are too small to be effective regeneration areas and larger than necessary for a thinning. This cannot always be avoided.
  2. This gap has been extended by the removal (or poisoning) of cull trees. It has not been extended far beyond the gap initiated by the commercial operation.
  3. Where insufficient crop trees exist for a complete thinning, individual crop trees are released from competition.
- Coppicing may be carried out in regeneration areas but coppice is discouraged in thinning areas where it will produce undesirable competition for the crop trees.



# Treemarking and Silviculture in the Jarrah Forest

A TRAINING BRIEF FOR OPERATIONAL STAFF  
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## SILVICULTURAL OBJECTIVES

The jarrah forest is a complex mosaic of stand structure, age and quality. This is due to natural variation and a number of logging and silvicultural treatments carried out in the last 100 years. Although discrete structures may be recognised (Fig. 1), changes occur continuously throughout the forest, often blending from one to another without distinct boundaries.

Given this complexity, what is the most appropriate silvicultural system to use? How should it be treemarked?

The objective of treemarking is to create the sort of stand structure most suited to the particular stage of development of that stand - whether it be for regrowth development or acceleration of tree growth. Because the forest is so variable, a fixed prescription will not work for every stand, but there are basic principles which apply to all stands.

If a tree is to be removed from a stand it should be done to achieve one of three silvicultural objectives:

1. **To reduce competition to allow seedlings to develop into ground coppice (large lignotubers)** (i.e. a partial removal of the overstorey to retain a forest cover while the regeneration develops).
2. **To allow ground coppice to develop unimpeded into saplings, poles and trees.** (i.e. a complete removal of the overstorey.)
3. **To promote growth on the remaining trees** (i.e. a thinning. Regeneration is not wanted at this stage.)

Only one of these objectives should be sought in any one patch of forest at one time. The desirable diameter of this patch is 4 x mature tree height (or more). If the patches are smaller than this, the felling of surrounding larger trees in the future will cause excessive damage to the regrowth in these patches. The existing stand structure will not always allow the 4 x tree height rule to be applied; nevertheless we should aim to push the stand in this direction whenever the opportunity arises.

When the emphasis is placed on selecting the trees to be retained as part of the next generation of forest a logical pattern begins to emerge. The trees available for cutting are those which are surplus to requirements as crop trees. When the commercial logging and the follow-up silvicultural treatment have been completed, the result should be a forest in a condition suitable for the optimum development of each particular stage of growth in each part of the stand.

## REGENERATION

Successful and rapid development of jarrah regeneration following its release depends on the stage of development of the advance growth. Except on very favourable sites, advance growth smaller than ground coppice will not develop immediately into saplings.

### Stages of jarrah regrowth development.

- Seedling**  
Less than 1 year old, usually with cotyledons still present, but with no obvious lignotuberous swelling.
- Lignotuberous Seedling**  
Original single shoot still present, but with a small lignotuberous swelling.
- Seedling Coppice**  
Lignotuber is obvious and multiple shoots have developed after the removal of the original shoot by fire or other causes.
- Ground Coppice**  
Shoot growth up to 1.5m. Lignotuber 10cm in diameter (may be as small as 5cm in southern forest). Capable of rapid development into a sapling.
- Incipient Ground coppice** - multiple shoots, no defined leader.
- Dynamic Ground coppice** - multiple shoots but with a dominant leader.
- Sapling**  
Stem taller than 1.5m, D.O.B. less than 15cm. Lignotuber large and ill-defined.

(Modified from Abbott & Loneragan 1984)



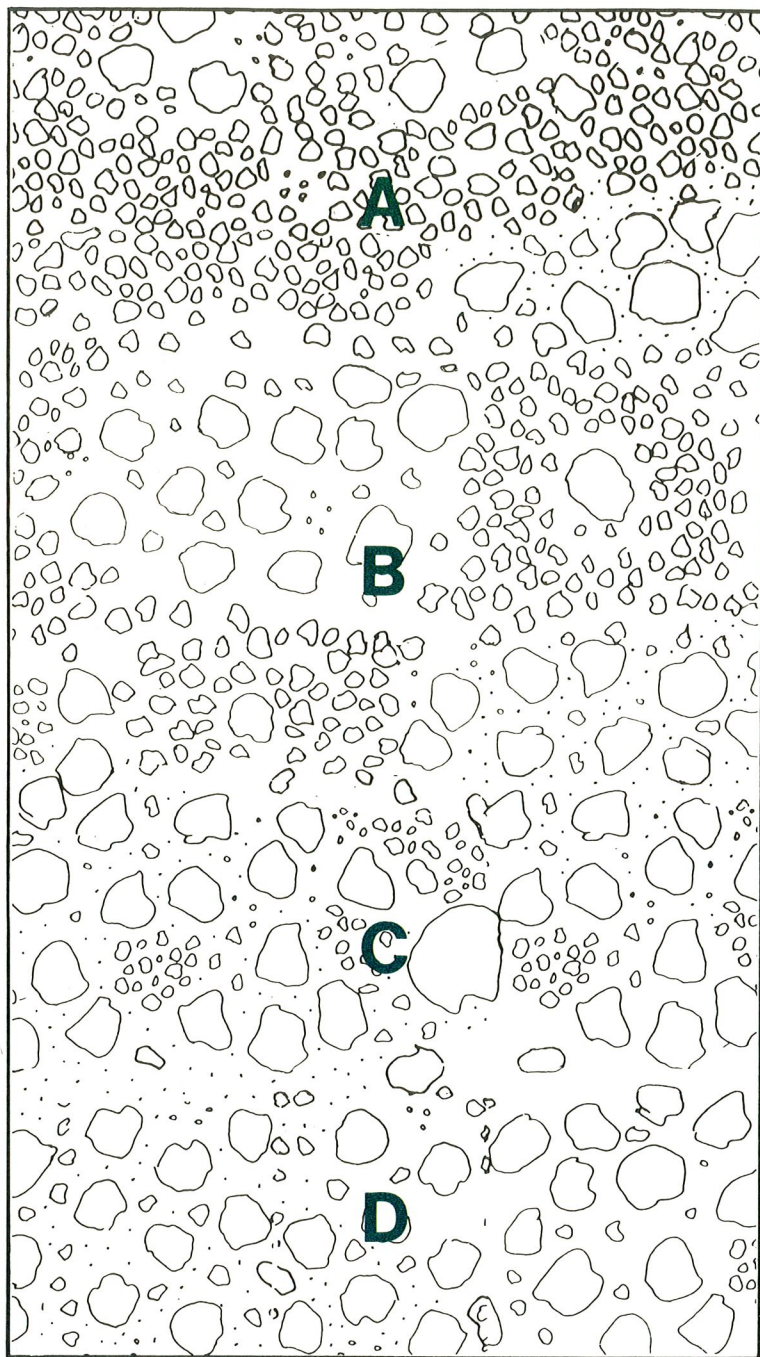


FIG 1. STAND STRUCTURE

The stands depicted here show a variety of structural types:

- A - Even-aged (from clear falling)
- B - Grouped (from group selection cutting and follow up removal of culls)
- C - Uniform (from single tree selection cutting or group selection cutting with no follow-up)
- D - Virgin (virgin forest may have a variety of structures but a preponderance of large sizes is common)

LEGEND

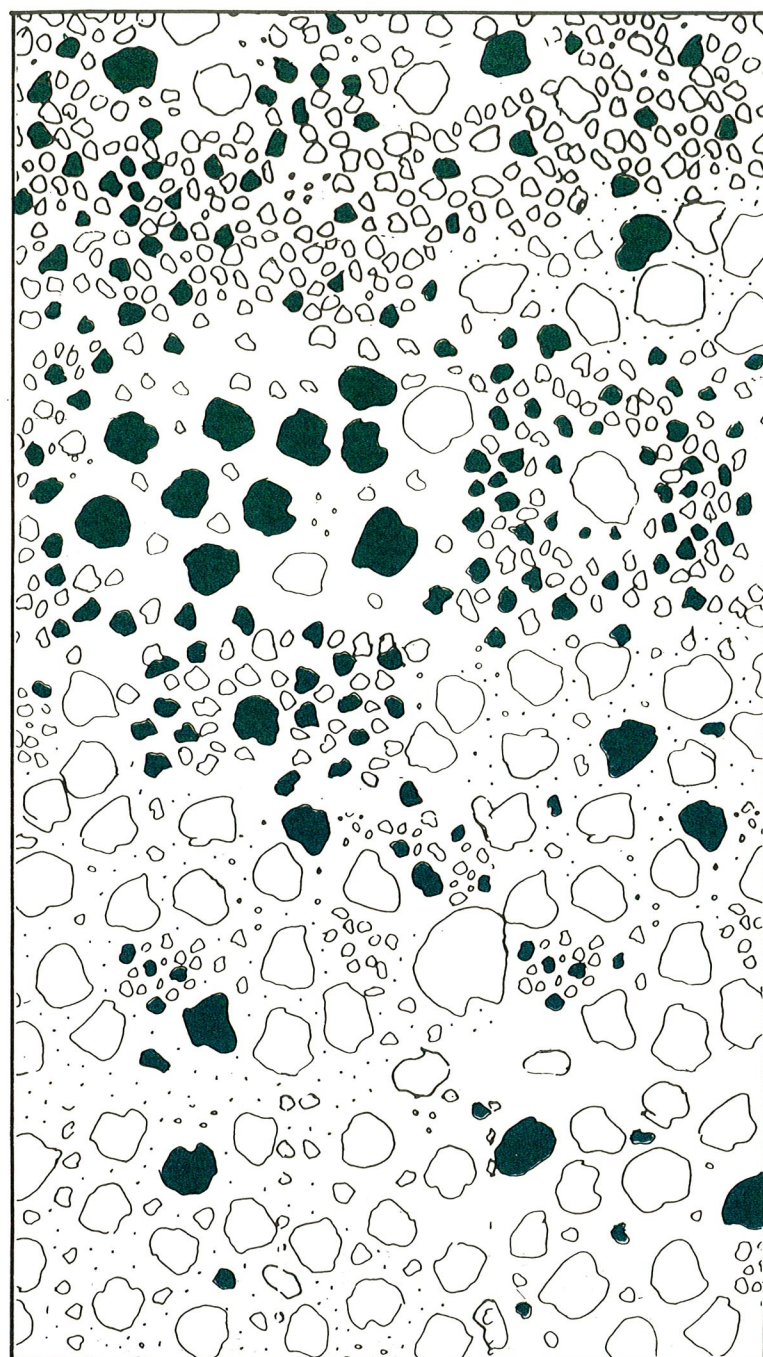


FIG 2. POTENTIAL CROP TREES

Regardless of the structural type, an initial identification of potential crop trees will show a pattern which will indicate whether a thinning or a regeneration cut is the most appropriate.

A crop tree should be in the codominant level, have a potentially useful bole (at least 3m free of any defect that would preclude its use as a sawlog) and have a good crown. Crown size is important since future growth will depend upon it. There is no size limit to crop trees and there is no obligation to remove a tree simply because it has reached a marketable size.

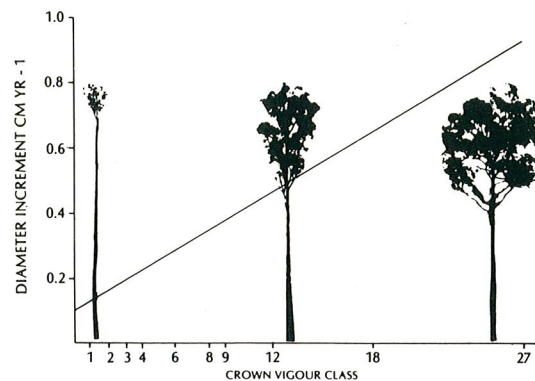


FIG 3. CROWN SIZE AND INCREMENT ARE CLOSELY CORRELATED. (LONERAGAN)

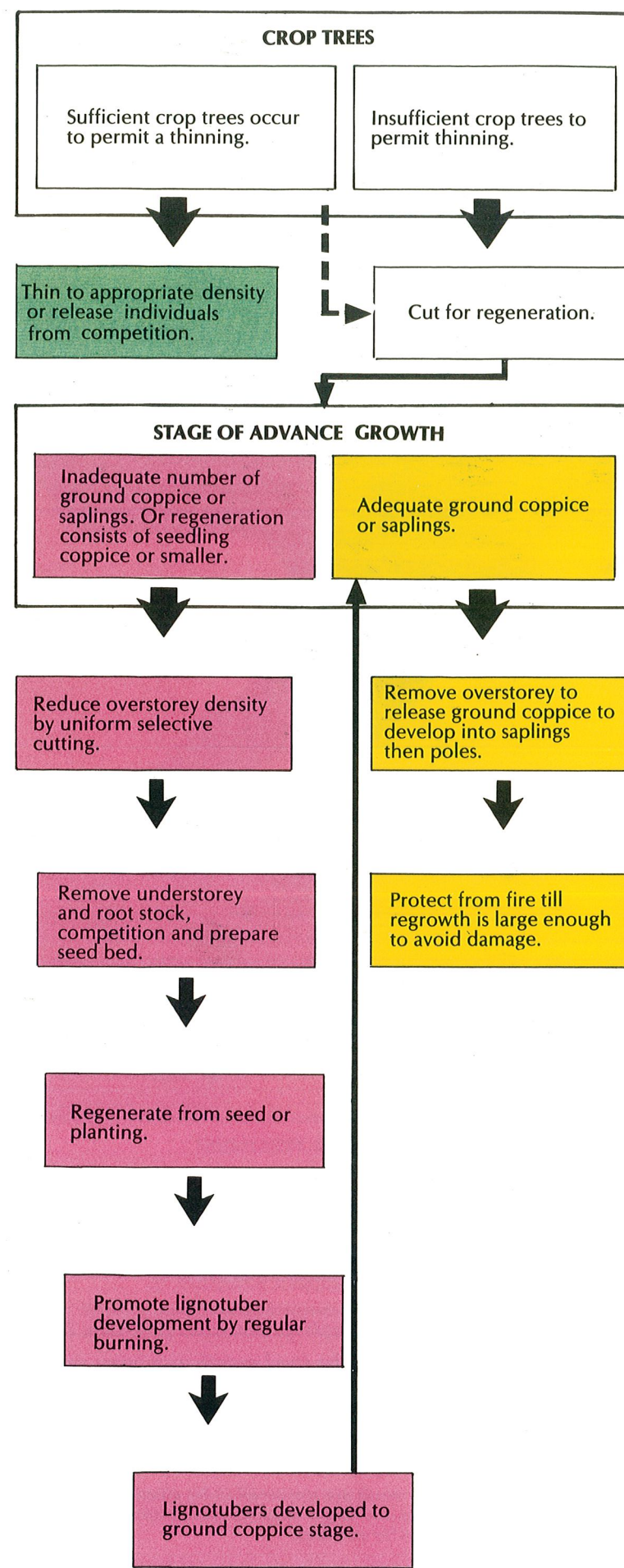


FIG 4. SUMMARY OF DECISION PROCESS AND STAND TREATMENT

This summary of the decision process illustrates how the number of crop trees and the stage of the regeneration development are used to determine the silvicultural treatments appropriate to different parts of the stand.



FIG 5. SELECTION OF CROP TREES AND STAND TREATMENT

In this patch there are few potential crop trees. Because there is inadequate ground coppice, a partial cut retaining some additional "non-crop trees" is carried out. The retained trees provide seed and a shelterwood while lignotubers develop to the ground coppice stage (Objective 1).

These patches contain few potential crop trees but have adequate stocking of ground coppice. All marketable stems (including potential crop trees) are removed to release the ground coppice, i.e. no marketable stems are marked for retention (Objective 2).

This patch contains sufficient potential crop trees to warrant a thinning (Objective 3). Thinning need not be restricted to pole sizes and is a valid option for all vigorous trees. Potential crop trees, surplus to those required for a specified density, are not marked for retention and may be removed.