Chapter 5 Management of land around Veteran Trees

5.1 Introduction

Trees do not exist in isolation; the environment around them can be crucial to their welfare and the landscape they are part of can be just as or even more important. The previous section has dealt with the management of veteran trees themselves. In many situations though, it is not the trees that need work done on them as much as the land surrounding them.Conditions in the soil will affect their roots and growth. What is growing on the surrounding land can compete with the tree for water, light and nutrients or present a fire hazard. Outside influences can affect the health of the trees and the organisms found on them.

Ancient trees are part of a landscape, either formal and designed or informal and evolved. It is important to consider what role the trees play within such landscapes as this will have implications for how the land around the trees and the trees themselves are managed.

5.2 Open land

5.2.1 Grassland

5.2.1.1 Grassland management (for full details see Crofts & Jefferson 1999)

The most sympathetic type of grassland to surround veteran trees (though not commonly found) is unimproved. Unimproved grassland should be managed with great care following the guidelines in Crofts & Jefferson 1999; this management will also be favourable to veteran trees. In general, the 'improvement' of grassland through reseeding or the application of fertilisers can be detrimental both to veteran trees and to grassland. For example, fertilisers and herbicides have had an adverse effect on the lichens and fungi at Moccas Park, Herefordshire, and the application of lime can cause problems for the fungal communities. If the grassland has already been improved and lime must be applied, it is better as coarse-ground limestone than agricultural lime as there is less drift.The ideal management is not to apply any substances although light applications of farmyard manure to improved grassland are acceptable in some situations. No inorganic fertilisers should be applied and no ploughing or reseeding carried out. Note that trees in fertilised pastures may look healthy but in times of stress they may decline quickly. The 'improvement' of pasture leads to a loss in variety and abundance of plants and invertebrates and therefore a loss of food for bats, birds, etc that may depend on the veteran trees for their resting sites. Hay cutting (the traditional management of grassland under pollards in other European countries) can be compatible with veteran trees though it is better if the grassland is not improved.

The control of problem species, such as ragwort, thistles and docks, within grazed systems needs to be considered carefully. There are methods that are sympathetic to ancient trees. For example, cutting of thistles, spot spraying, and use of some modern weed wipes that are relatively specific (see Bacon 1994). There are also suitable mechanical weed pullers available now (Bacon & Overbury 1998).

Effects of grassland improvement on veteran trees themselves

- **Inorganic fertilisers disrupt mycorrhizal fungi, and the trees are then more susceptible to stress.**
- **Lime may reduce the species diversity of fungi (including mycorrhizal species).**
- **Farmyard manure, slurry, fertilisers and lime may be sprayed onto the trunks of the trees; an excess is toxic to fungi.**

- **Ploughing damages the roots of the trees and mycorrhizal fungi.**
- **Rolling compacts the roots (see also section 5.2.2).**

5.2.1.2 Grazing

In many situations where veteran trees exist, grazing was an essential part of the management system. There are two quite different types of grazing that can be considered, extensive and intensive.

The benefits of grazing in wood-pasture are that:

- **It prevents mass regeneration of trees and shrubs, thereby reducing competition between trees for light and creating more varied growth forms of trees and a greater variety of woodland structures. This results in:**
  - A greater diversity of habitat structures, allowing other groups of organisms to survive.
  - Increased light levels that are beneficial to epiphytic lichens.
  - Many insects are sun-lovers as adults and will be lost under shady conditions.
  - Densely shaded trunks have cooler interiors and are less good for larval development.
  - Many wood-decaying fungi appear to fruit less frequently when the trunk is shaded.
- **It is the traditional form of management on many sites and, from an historic point of view, is an essential part of the system.**

Extensive grazing

Animals are able to roam over large areas to forage and the stocking density is relatively low. This type of grazing must have existed in the wildwoods, which naturally contained high densities of veteran trees. The grazing would have been by indigenous cattle, deer, bison and boar. Such grazing restricted, but did not stop, tree regeneration and had the effect of creating structural diversity in the ground flora and shrub layer (Figure 23). Today, woodlands with veteran trees benefit from light grazing, which increases the structural diversity and benefits a range of organisms (Mitchell & Kirby, 1990).

Figure 23. *See colour plate page 86.*

Intensive grazing

This type of grazing involves a higher stocking density and the land under the trees is dominated by plants that are not woodland species (Figure 24). The animals are often given supplementary feed, which is detrimental, to the ground flora and in many cases the grassland has been, or is under pressure to be, improved. Often the areas the animals range over are relatively small. Intensive grazing occurs in some types of wood-pasture (where the old trees were usually pollards), especially in parks where deer (or in some instances cattle) were grazed.

If a wood pasture or parkland has been grazed more or less without a break, it is likely that the most suitable management in both historic and biological terms is to continue with this. Changing the management regime in such circumstances should be carefully thought out before implementing. If there has been a long lapse in grazing, the situation should also be looked at more carefully, especially from a biological point of view, before deciding on what form of management to reinstate. (See also section 5.3 for a discussion of the consequences of opening up woodland from around veteran trees).

Figure 24. *See colour plate page 86.*

Disadvantages of grazing

There are disadvantages of grazing too, especially where it is intensive or the land is overgrazed:

- **Lack of tree regeneration. On sites where grazing has been continuous there is often a generation of old trees with few, if any, younger ones to form the ancient trees of the future. This situation needs addressing to prevent the loss of biological interest on the site and loss of landscape appeal and historic value. There are several ways to overcome this (see chapter 8).**
- **Activities relating to the grazing of animals that damage the veteran trees . Trees in grazed areas will always develop a browse line, the height of which depends on the animals present. In a healthy mature tree this does not cause too much damage, although the trees are unable to grow branches that reach the ground. This prevents layering and may make the branches more prone to snapping as they cannot be supported from below (Lonsdale 1999a). The grazing of animals may be directly detrimental to the trees in the following ways:**
  - Animals may chew the bark of the trees. In extreme situations they may ring bark them.
  - Animals may use the tree for shelter, causing trampling round it and damage to the roots. Where the animals dung and urinate, the nutrient levels rise and the high nitrogen levels are detrimental to the mycorrhizal fungi.
  - Vehicles used to feed and water animals may pass too close to old trees, causing the ground to be churned up.
  - Fodder, watering and mineral lick sites placed too close to the trees attract greater attention.
- **Where the animals are fed supplementary feeds the dung enriches the grassland/heathland/trees. It may also introduce new species and genetic variability via seeds, which may confuse the true distribution and status of species.**
- **Animals bring other chemicals into the wood-pasture system. Domestic stock are treated, particularly for intestinal worms, using a variety of chemicals. Some of the substances used are not specific to internal parasites and may be long lasting. An example is the widely used wormer with Avermectin as the active ingredient. The action of this has been shown to have an effect on a range of invertebrates including those that break down animal dung. Insectivorous species, especially bats and birds, may consequently suffer from lack of prey. The situation is of special concern with regard to cattle because a bolus system is often used which releases the wormer over long periods of time. As a general principle Avermectins should not be used on any site with conservation interest. Other types of wormers may be just as detrimental. For more information see JNCC (undated), Cooke (1997) and English Nature (1994). See also later in this section.**
- **Overgrazing, especially in the winter months, can cause poaching and this leads to infestations of tall weeds such as thistles, nettles, ragwort and docks.**

Solutions to problems caused by grazing

There are several solutions to these problems. The best one will depend largely on the situation and the money available for additional management work. They include:

- **Reduce the stocking density or alter the grazing regime so that the animals do not bark the trees (but for husbandry reasons avoid single animals in an area). Bark stripping is more prevalent in the winter but can be due to boredom as well as a nutritional need for the bark.**
- **Experiment with mineral supplements (eg Uniblock produced by Dodson and Horrell) to provide the minerals that horses might otherwise obtain from tree bark; other supplements have been shown to change the diets of animals such as sheep. Be sure to place them well away from the trees.**

- Fence off the veteran trees so that the animals do not have access to them. The fence should keep the animals beyond the extent of the canopy. This solution is usually practicable only if there is a small number of trees involved, and it can lead to the growth of competing vegetation.
- Ensure that there is nothing to attract the animals to stand under the trees. Feed and water them in a different place.
- Provide alternative shelter, with watering, etc to attract them preferentially.
- Ensure that vehicles do not use routes under veteran trees. If necessary move gateways.
- Try out other ideas to deter the animals, eg pile rocks round the bases of the trees to stop them from getting too close or chestnut paling wrapped round the tree (not as a fence). Be sure to check that they work (sheep can climb rocks and continue chewing the bark higher up!) and that they do not create other problems such as compaction or creating a humid day time resting place for slugs that then browse epiphytic lichens at night!

Solutions to the problems caused by wormers

- Don't use any wormer on site (ideal solution). Worm animals when they are grazing or housed elsewhere. Ensure that they are kept off the site for long enough for all traces of Avermectin, and other products, to have passed through (this will vary with the type of application). Avoid broad spectrum wormers and slow release bolus applications.
- Use wormers that are more specific to internal parasites. English Nature, JNCC and FWAG can provide advice on suitable alternatives.
- Be careful with new products, ensure that they are compatible with any nature conservation interest and seek independent advice.
- Consider carefully the use of other chemicals on the site. This does not mean that the health of the animals should be compromised. However, some chemical treatments for fly strike in sheep, for example, are 'better' environmentally than others.
- It may be worthwhile considering the guidelines of the Soil Association with regard to animal husbandry and the use of chemicals and medication, even if the aim is not to produce organic products.

Tree regeneration in grazed areas

In the New Forest, Sanderson (1996a) has shown that even palatable tree species can regenerate in grazed areas and this is also true in Hatfield Forest. Even in periods of heavy grazing thorny bushes, including holly, and dense bracken provide enough cover to allow young trees to become established. Regeneration requires extensive grazing systems that allow a full range of natural processes to occur, including shelter or respite from grazing.

Reintroducing grazing

The reintroduction of grazing on veteran tree sites that have not been grazed for a long period is starting to gain momentum. In these situations a site specific feasibility study is probably the best way forward. The choice of grazing regimes is likely to depend to a large degree on the wildlife interest of the site. In the majority of situations, however, a low density grazing regime is probably the most suitable. Achieving the right stock type and level at the right time is very difficult and may vary widely according to the type of land and also from year to year. When considering reintroducing grazing to a site it is important to consider the welfare of the animals, the work involved and financial implications. When considering reintroducing grazing to a site with an ancient monument make sure that the fencing and type of animals used are appropriate to the site and acceptable to the archaeologists.

Further reading: Bacon (1994), Crofts & Jefferson (1999), Lewis *et al*. (1997), Mitchell & Kirby (1990).

5.2.2 Bracken and heathland

The commons and wood pasture on which many veteran trees stand were not normally prime grazing or arable land. One of the contributing factors to the survival of many veteran trees was that the land around them was too poor (eg too low in nutrients, steep or rocky) for growing crops. In some areas heathland developed on the poor soils and where today, through lack of grazing and trampling, they have become dominated by bracken this can cause problems. Bracken has also become dominant in other vegetation types. The effect of the bracken fronds is very similar to dense summer woodland cover with few other plant species, including tree seedlings, able to get enough light. Bracken is also allelopathic, producing its own substance that inhibits the growth of other plants. The result is areas lacking in other tree species around the veterans. The dried fronds in bracken-dominated areas build up into a deep litter layer or thatch that early in the year can be a severe fire hazard. Fires can travel under the ground in the leaf litter and when this happens the old hollow trees act as excellent chimneys, fuelling the fire with air, which destroys the trees. For areas of heather-dominated land under veteran trees fire can be a problem too.

On sites with ancient trees and abundant bracken, some form of fire protection should be seriously considered. Ideally fire breaks should be made and kept open so that blocks of woodland are isolated from each other in case of fire and an area round each tree should also be kept bracken free, at least as far out as the canopy. In order to create such areas effectively, fallen dead wood may need to the moved (see the section 5.4 for details). However, this is not as easy as it sounds as bracken is a difficult plant to control. Health and safety considerations need be taken into account with some of the following treatments and an added problem is that bracken spores are carcinogenic.

5.2.2.1 Methods to consider for controlling bracken to create fire breaks or to reduce the fire risk on the site

- **Spray or weed wipe with Asulam.** When used properly this herbicide is very effective against bracken, but rarely eradicates with one application. Spot treatment of any regrowth is necessary in subsequent years. Prior to spraying, the ground vegetation should be surveyed because Asulam does kill *all* ferns and some other plants, eg sheep sorrel and some bryophytes. Surfactants, if added to the spray, may affect invertebrates. On many sites it is preferable not to use chemicals; however, using more modern methods of application the bracken can be targeted with minimal amounts of herbicide reaching other plants. Spraying is the best form of application, weed wiping should be carefully considered before use. The best time of year to spray is when the fronds are fully unfurled but have not begun to die back, usually between mid - July and the end of August.

Bracken control at Ashtead Common

Fires present a significant risk to the veteran oak pollards at Ashtead Common. In 1990 there were over 100 standing charred pollards as a result of a large fire (Figure 24a,see page 86). The risk has been reduced in recent years by creating fire breaks, primarily by chemical control of the bracken. Initially, all dead wood was removed from the fire breaks, into large piles nearby. Although not an ideal situation, it was necessary to allow the safe access of machinery and ensure that the fire breaks would be effective. Bracken is then sprayed annually with ASULOX by one person on foot, using a high pressure lance with a flood jet and a tractor-mounted spray tank driven by a second person. Small areas are sprayed using a knapsack sprayer. The herbicide provides an effective control rate of around 95% which is enhanced by mixing ASULOX with an oil derived from oil seed rape known as CODACIDE. This ensures that the chemical is water-resistant and improves adhesion to the fronds. Thereafter fire breaks are maintained by an annual mechanical grass cutting programme.

Figure 24a. *See colour plate page 86.*

- **Cut.** Cutting two to three times per year will reduce bracken cover but this will need to be repeated in subsequent years as bracken re-establishes itself quickly. The first cut should be made when the fronds have just started to unroll (usually late April/early May). The second cut should be made about a month later when the fronds reach a similar height again. In this way the plant puts maximum energy into growing and loses it all when the fronds are cut. If a third cut is possible this can be done at any time when the fronds are uncurled, but cutting for the first time in a year after July is not worth doing.One drawback of cutting is that the ideal time to cut is also when ground-nesting birds will be most vulnerable. Cut, dried and baled fronds can be used as livestock bedding.
- **Bruising.** Small rollers that crush the fronds are available. Rolling twice, the second pass at right angles to the first, improves the effect. When rolled in July on a hot day the bracken bleeds, which helps to exhaust it. A special 'bracken breaker' has been developed that is especially good at breaking the frond stipes and encouraging 'bleeding'. Rolling seems to reduce the vigour of the bracken by at least 50% and it is possible that continued rolling may result in eradication. Since rolling is best carried out later in the year than cutting fewer ground-nesting birds are likely to be affected but the later breeding nightjar may be vulnerable. Rolling may also be detrimental to anthills, reptiles and rare or solitary plants, and can break up any dead wood on the ground. The rollers designed for bracken may also adversely affect wavy hair-grass but ericaceous species seem to be able to withstand the treatment as long as they are not old or straggly. Heavier rollers may affect plants such as gorse and broom and also trees and shrubs. The compaction of the vegetation produced by rolling can be an advantage in helping to reduce the fire risk and encouraging decomposition, although the small specialist 'bracken breakers' cause bruising with negligible compaction.
- **Pigs .** Pigs in the autumn months dig for and eat bracken rhizomes and this can help to control the growth of the plant. Pigs should not be fed solely on bracken as this causes them to develop thiamine deficiencies. The results of pigs digging can be quite devastating, if not carefully controlled, so this method is most often used on recently cleared land. A low density of pigs can also help in the control of bracken if used in association with cutting, or rolling. Rooting by pigs is beneficial in promoting the germination of some seeds but 'mob stocking' can cause similar problems to that of overstocking with other grazing animals (see section 5.2.1.2).
- **Remo val of bracken litter .** If the bracken litter, or thatch, is very deep it can be removed and this may also be desirable if cutting or rolling are being carried out. Removing the build up of thatch can also help weaken the plant allowing possible frost damage but it may also suppress the growth of other plants. Litter can be removed by 'blowing' using strong leaf blowers, which causes less root damage to trees than scraping. It may be possible to sell bracken litter to the horticultural industry, as a mulch, and this has been successful in the Netherlands.
- **Grazing.** Livestock, especially large animals such as ponies or cattle, may trample the young bracken fronds, which can help to keep it in check once major control has been done physically or chemically.
- **Woodland.** Encouraging closed canopy woodland also helps to reduce bracken cover, though this may not be a desirable option if the veteran trees are unduly shaded by the surrounding woodland.

5.2.2.2 Disadvantages of controlling bracken

Bracken is an important plant for some organisms. For example, it can provide suitable conditions under the fronds for the growth of violets, which in turn can provide an ideal habitat for some threatened fritillary butterfly species. Other species that may benefit are bluebells, an endemic weevil (beetle) and some fly species. If there are such species of conservation value on a site with ancient trees then the management should take this into account. Bracken can also provide valuable shade (and frost protection) for piles of dead wood but fire breaks may be needed round these if they are large. In any case, bracken should not be viewed as a species to eradicate, since it is native. It may just need to be kept in check.

Further reading: Burgess & Evans (1989), Butterfly Conservation (1998), Crofts & Jefferson (1999), Forbes & Warnock (1996), Lewis & Shepherd (1996).

5.2.3 Cultiv ated ground

Ancient trees are also found within land that is cultivated. Many of those in the middle of arable fields have died or been felled but some manage to survive. In addition, those on the boundaries of fields are affected by cultivated land. Much parkland has also been ploughed and converted to arable farmland. Ideally, arable farming should not be carried out in areas with veteran trees. However, where it is unavoidable, steps should be taken to provide the best possible conditions for the trees.

A vital part of the tree, the roots, is out of sight, under the ground. Deep ploughing can be extremely detrimental as it destroys tree roots. Work nearer the surface, especially that leading to compaction can be equally damaging as some trees have abundant roots at quite shallow depths (Figure 25). Even harrowing and rolling can cause problems in compacting the roots and causing mechanical damage, this is especially true of modern power harrows.

Ideally, no work should be done closer to the tree than 5 m outside the extent of the canopy, or a distance from the centre of the tree of 15 times the diameter of the trunk at breast height, whichever is the greater. This establishes a 'separation distance' or exclusion zone round the tree and gives it the best chance of long-term survival. It can be quite surprising how far away the roots of some of these trees extend, eg up to 50 m.

Figure 25. *See colour plate page 87.*

Intense cultivation brings more potential problems. Spraying can be very damaging to the tree and its fauna and flora. Fertilisers have a detrimental effect on the tree, the lichens and the mycorrhizal fungi. Fungicides also affect the vital mycorrhizal species that the tree needs in order to survive and they also affect the lichen flora. Insecticides may kill the specialist dead wood species and are most damaging when used between May and July in the vicinity of the tree or on any plants in flower. These chemicals should not be used anywhere near old trees to avoid drift affecting them; the minimum distance is 15 times the diameter of the tree (as for cultivation). **Ideally there should be an island of uncultiv ated land surrounding the tree** but it is important that this is of sufficient size and is not 'eroded'each year. Ploughing and spraying right up to the trunk is extremely harmful. Veteran trees on the edges of fields are vulnerable to cultivation too. Remember that the roots will extend into the field, even if the trunk is in a hedge.

5.2.4 Amenity land

Veteran trees are also found in amenity areas. These range from private golf courses to school playgrounds and public parks. The same principles apply here as in other grassland or cultivated areas. Grassland tends to be very intensely managed in some of these situations, but the use of chemicals should be avoided close to the trees. An additional threat is the regular mowing and strimming, which if not carefully done round the bases of veteran trees can easily cause damage to the bark, exposing vital tissue. Wherever possible, try to create a 'nature area' of rough grass around the trees to alleviate these problems.

Trees in prominent positions are frequently used as locations for notice boards and signs. It is far better to use purpose-made posts but if trees must be used in this way, tie notices on, do not nail them. Make sure that they are removed before the tree grows into them. Old, neglected fences that are attached to trees cause a similar problem. Attaching fences to veteran trees should be avoided.

A frequent threat to veteran trees in amenity areas is compaction. Car parks, picnic sites and building development may reduce the amount of water a tree can obtain and lead to its rapid decline and eventual death. If a veteran tree is a valuable source of shade, consider providing alternative facilities nearby and relocate car parks, picnic benches, etc. Wherever people or property are in close proximity to a veteran tree the tree becomes a potential threat so the situation is best avoided.

5.3 Surrounding woodland

5.3.1 Veteran trees in woodland

There are three broad types of woodland which are found surrounding veteran trees:

- **high forest woodland that has developed naturally (usually ancient woodland) which contains old trees, eg a particularly old specimen of an oak within oak woodland;**
- **naturally regenerated woodland (usually broadleaved) which has developed around veteran trees, for example on commons or wood pasture, in which the ancient trees are found;**
- **planted woodland (usually coniferous) where a commercial crop has been grown, the ancient trees being left at the time of planting.**

The first of these three categories is the nearest to a wildwood but since British woodlands have been so actively managed in the past, all three situations potentially create problems for veteran trees. In the second and third categories especially, if the young trees start to grow over the top of the veteran, not enough light will reach the veteran tree. The natural ageing process and effects of any tree surgery are likely to reduce the crown of the veteran such that shading by younger trees has an even greater impact. Understorey bushes, such as holly or rhododendron, may compete with the veteran trees for water and nutrients (though in terms of competition for water, woodland may be less of a problem than grassland or bracken).

5.3.2 Remo val of competing woody vegetation

As a consequence of these factors, on sites where previously open grown trees are now surrounded by others, some opening up may be necessary (releasing the trees). However, even this is not as straight forward as it might appear. The sudden exposure of a tree that has been shaded for many years can cause problems, for example:

- **The leaves may be vulnerable to sun scorch.**
- **The tree itself may suffer increased transpiration rates and, with a root system that developed in a woodland situation, it becomes more susceptible to drought.**
- **Desiccation of the bark may stress the tree and cause cracking of hollow trunks through drying out in different places.**
- **General drying out of tree and increased exposure may be detrimental to the organisms associated with it, eg mosses and invertebrates.**

These problems are inherent in any veteran tree canopy reduction but are considerably more pronounced when surrounding woodland is cleared away. The sudden opening up of old trees may also be more of a problem where conifers are involved because they cast dense year-round shade and create a cooler moister microclimate.

If you do need to open up around veteran trees, make sure that the species of interest associated with the site (and old trees) are known, and assess the impact that opening up of the woodland will have on them.

Some points to take account of are:

- **Clear around the trees a year (or more) before doing any remedial cutting on the veteran trees (but be careful that the veteran tree is not exposed to greater winds).**
- **Clear round the trees in stages over a period of years. These stages may take five years or even ten. Be particularly careful if the veterans are in commercial forests in case all the surrounding trees are felled in one go.**
- **Consider clearing from the 'outside' in, ie leave trees closest to the veterans until last.**

Clearing conifers from around veteran trees

Birklands is a woodland within Sherwood Forest (Nottinghamshire) containing some 500 veteran oak trees. The woodland has been planted up with commercial pines since 1935. In recent years work has started to restore 50 ha to oak woodland. Clear - felling of the plantation pines has been carried out on half of this area and crown thinning of the conifers on the other. Seven years or more later the result indicated that more veteran trees survived in the crown thinned area than the clear - fell and some of them showed stronger crown regeneration than in the felled area. The clear - felling was considered to involve a greater risk of desiccation to the trees and the dead wood (Barwick 1996).

Similar conifer clearance work is being carried out at Windsor Forest (Berkshire) (Searle 1996), Castle Hill (Yorkshire), Croft Castle (Herefordshire) and Ethy Park (Cornwall). As at Birklands, the indications are that thinning of woodland surrounding the veterans is more successful than clear - felling (Figure 26).

Figure 26. *See colour plate page 87.*

- **Selectively fell, leaving some shade trees, especially if species such as birch, which cast a dappled shade, are present.**
- **Leave shade trees on the south (or most exposed) side.**
- **Pollard surrounding trees (if appropriate) to bring down the height of the surrounding canopy.**
- **Consider ring barking (or other equivalent methods) on surrounding trees to decrease the shade over a period. Note that some species take a long time to die when ring barked.**
- **Be careful not to expose the trees to other problems such as spray drift and air pollution.**
- **Avoid substantial clearance work in drought periods.**
- **When selecting which trees to fell and which to leave, remember that damaged ones (in terms of commercial silviculture) are more valuable for nature conservation.**
- **Fortunately, this means that the higher value trees commercially can be removed.**

Obtaining the correct balance of light and shade round old trees is a challenge.Achieving it will depend largely on the species of tree and site concerned.

Rhododendron and holly

These evergreen species can be detrimental to veteran trees when the bushes become large enough. Being shade tolerant they can grow very close to the trunk of the veteran and compete for water in dry years. They are also serious competitors for light when tall. As they cast a deep shade all year round, be careful that their sudden removal does not cause excess desiccation of the trunk.

Some additional points apply to veteran trees in commercial forests:

- According to the UK Forestry Standard (Forestry Authority 1998) individuals or groups of over mature, veteran or pollarded trees should be retained in both broadleaved and coniferous forests where it is reasonably safe to do so. Also, some (number unspecified) dead or dying trees should be retained in regeneration areas.
- The risk of pests damaging trees or timber when ancient broadleaf trees or dead wood is retained in commercial plantations is extremely small.
- Standard forestry practices carried out on commercial conifer crops in areas of ancient trees may have a detrimental impact on the saproxylic fauna. Under conifers there is a cool climate and restricted light levels. The nectar sources are reduced and dispersal may be inhibited.
- Selective felling should also aim to leave an uneven age structure of retained trees and some trees to form veterans of the future (especially in deciduous forests).

The management of land surrounding veteran pine trees in, for example, Scotland is not considered here.

Retaining trees within harvested forests to become veterans of the future

Ideally:

- Aim for 5 - 10 trees per hectare.
- Keep trees that will not be in the way or become hazards to the public in the future, will not become overtopped by crop trees and are close to areas with conservation interest, eg plentiful dead wood, glades.
- Encourage them to develop a full crown.
- Consider making pollards, if a full crown is not appropriate, but remember that they will need to be managed in the future.
- Select native, longer-lived species such as oak, ash and beech. Keep some others such as, willow, wild service and other fruit trees, which are valuable as nectar sources or have a distinct invertebrate fauna.

Bear in mind that the harvesting of the crop trees will have a large impact on retained trees, especially if the crop is coniferous.

Further reading: Alexander, Green & Key (1996), Barwick (1996), Crofts & Jefferson (1999), English Nature (1994), Forestry Authority (1998), Forestry Commission (1990), FWAG (1997), JNCC (undated), Key & Ball (1993), P. Kirby (1992), Lonsdale (1999), Sanderson (in prep.), Searle (1996), Wall (1996),Winter (1993).

5.3.3 Storm damage

Storm-damaged woodlands can contain large amounts of dead wood. In the short term this provides potentially good conditions for saproxylic species but over-zealous tidying up can result in a significant loss of dead wood habitat. A code for dealing with such woodland is given in English Nature (1994). After a storm event in a woodland, follow the guidance in section 5.4 together with the following additional points:

- Living but broken trees should be kept if possible. If necessary (ie in public areas) reduce any hazard without felling the tree completely. Try to retain a mixture of age groups.
- Trees where the crown has been blown off but the bole remains should be left if possible. Some species may regenerate and continue to live; others may not but will provide a valuable dead wood habitat while they decay. Reduce any potential hazards if necessary.
- Broken branches and stumps should be left and not sawn flush.
- Fallen mature timber should be left **in situ** as far as possible. Especially, try to retain pieces that are badly damaged or show signs of decay. If some has to be removed to a different position use the same criteria as in 5.4. Reduce pieces in size as little as possible and keep the branches as intact as possible.
- Leave some fallen trees with upturned root plates; these are beneficial for insects such as solitary bees and wasps.
- Do not leave the wood for some years and then come in to clear and destroy it; many organisms will be destroyed with it.
- Do not remove, treat or burn stumps.
- Leave the wood to regenerate naturally if possible. If planting is necessary then use a species composition appropriate to the area.
- Leave some of the open spaces/glades created by the storm.
- Attempting to stand up wind-thrown veteran trees is usually unlikely to succeed, though reducing the 'sail area' helps increase the chance of survival. Some species may continue growing horizontally, and some may naturally layer, in which case they should continue to be looked after as other veterans.

5.4 Management of dead wood

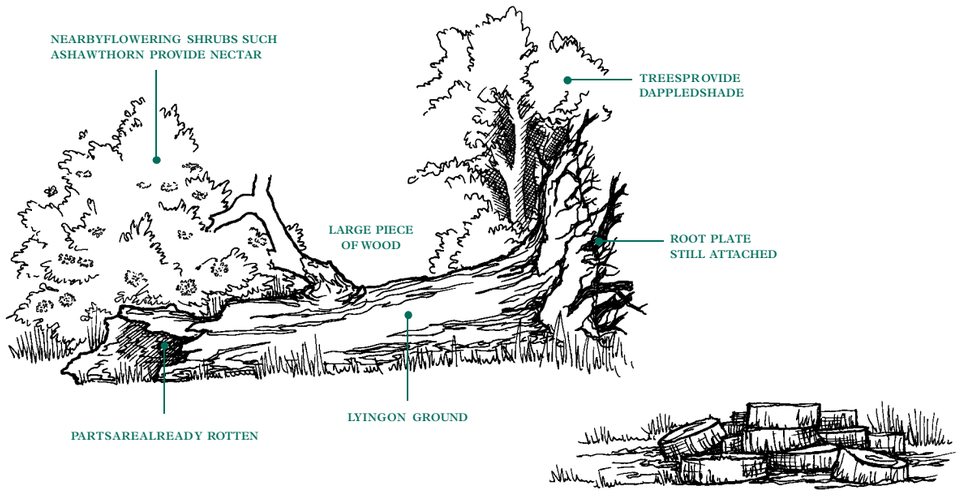
The management of dead wood is an important aspect of the management of ancient trees. While the survival of the trees themselves is not usually affected by what happens to their branches when on the ground, many of the organisms associated with veteran trees can be found in fallen dead wood. If all fallen branches and slightly decayed trees are removed from a woodland, it may be impoverished by the loss of more than 20% of its species. All types of dead wood are valuable but some are more so than others, with each type (depending on its species, state of decay, size, etc) supporting its own assemblage of invertebrates. The decay rates of logs on the ground are very variable depending on the species and situation but as an example large oak logs in the USA are predicted to take over 170 years to disappear.

The conservation value of dead wood has received much greater attention in recent years but there is still plenty of room for improvement in terms of our management of it. The following principles of managing dead wood can be applied to almost any site, particularly woodlands. They are especially important on sites with large numbers of old trees and/or large numbers of saproxylic species.

5.4.1 Dead wood on the ground (Figure 27)

- **Size and shape.** Size matters and the bigger the better! The more the internal temperature and humidity of the dead wood is buffered from drying out and very high temperatures the greater the number of organisms it will support. The smaller the piece of timber the higher the surface area to volume ratio is, which causes greater temperature fluctuation and desiccation. Large diameter branches and tree trunks should be cut up as little as possible, preferably not at all - they should certainly not be cut into rings as these dry out quickly and in public areas are subject to disturbance. A range of 'natural' sizes is useful. They also look more natural if they have broken rather than having sawn ends.

Figure 27. *Diagram of an 'ideal'piece of dead wood.*



- **Position. Ideally it should be left where it falls. If this is not possible, the ideal place to move it to is somewhere with dappled shade but:**
  - Some organisms prefer wood in open conditions, eg jewel beetles, solitary bees and wasps re-using beetle holes and dead wood lichens.
  - Dead wood fallen into water should be left if possible. A different range of organisms live in it.
  - Dead wood in a range of different conditions is ideal.

Shade can also be encouraged, eg brambles/bracken can be left when they grow up. Freshly fallen dead wood is best in more open conditions and more decayed wood is better in shade. If felling a tree with the intention of leaving it as dead wood it can be felled into an open situation if it is likely to be shaded in the future by regeneration.

If it is possible to leave dead wood on only part of the site, choose that part with the highest potential value for saproxylic species (ie with dead wood of good quality and quantity and with good nectar sources).

- **When moving wood:**
  - Move as short a distance as possible.
  - Keep wood as intact as possible.
  - Move as soon after cutting/falling as possible.
  - Move into partial shade/sun.
  - Leave on the ground, not on top of other wood.
  - Move near nectar sources (beneficial for many dead wood insects).
  - Move adjacent to dead wood in a more advanced state of decay (to provide continuity of habitat).

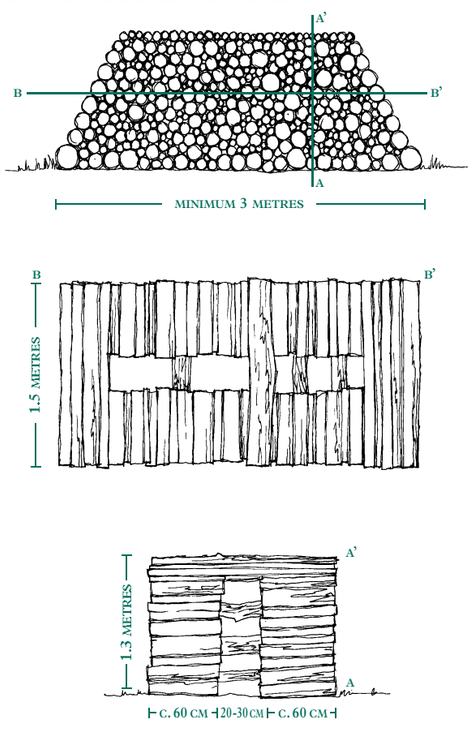
- **Species of tree.** The wood from native species of tree especially those naturally occurring on the site is best. Introduced species can be valuable (eg sweet chestnut rots in a similar way to oak). Longer lived tree species tend to support a wider range of invertebrates. Broadleaves are more valuable than conifers except in Scotland (and perhaps a few other areas such as the Breckland).

- **Wood with deca y.** Dead wood showing any sign of decay should always be left. It is more valuable for wood to decay from the inside out than from the outside in - decay derived from internal heartrot is likely to be far more valuable than that initiated from the bark or from the cut ends of sawn timber (Figure 28).

Figure 28. *See colour plate page 88.*

- **Burning** is a major source of damage to dead wood. Bonfires to burn brash (small branches cut from trees), or timber, kill living organisms, damage the soil structure and can physically damage living trees if they are lit too close. However, some organisms live in burnt wood. If a bonfire has been lit, do not start the next one with the charred wood of the previous one.

Figure 29. *The design of a 'Waterhouse'log pile.*



- **Remo val of wood.** Do not remove dead wood as firewood. If you have to remove it do not leave it on site to mature first. Make sure that any felled/cut is removed before the end of April or left permanently. If it has to be left and stored on site cover it with a polythene sheet. This speeds up the seasoning process and prevents invertebrates from laying eggs in it.

- **Habitat piles .** Tying small diameter twigs into tight bundles that retain moisture better can increase the value of them. They may then attract some specialised species.

  Loose 'habitat piles' may be of value for vertebrates and a different range of invertebrates. Habitat piles made from larger diameter logs are better but the logs are always more valuable if on the ground (ie not on top of other logs). Piles of smaller logs are usually more valuable if lashed together or made into a 'Waterhouse'log pile (see Figure 29).

- **Root plates and stumps .** Leave the root plates of fallen trees as they fell unless they constitute a safety hazard. They can be good for nesting bees, wasps and birds and the holes left in the ground provide valuable damp patches/pools.

  Leave tree stumps in the ground. Consider cutting high stumps if this does not interfere with other management techniques.

- **Brash on grazed sites .** The retention of brash on heavily grazed sites can have a useful function in protecting tree regeneration. Stock can be prevented from getting caught in the dead branches by arranging them in such a way as to block access.

5.4.2 Standing and canopy dead wood.

Dead wood in the canopy of trees is different from that lying on the ground. Together with standing dead trees it forms an extremely valuable habitat (Figure 13). A variety of saproxylic species need timber to be still standing, either to maintain the moisture regime or aspect or because the 'search images' of the prospecting colonisers are geared only to habitats on standing trees. Broadleaved trees when they have died standing lose their twigs first, then small branches and bark. They tend to lose larger branches from the top downwards. As they offer little wind resistance they often remain standing for a long time and may take decades to decay. They do need periodic checking for stability. If necessary remove the branches and leave the trunk standing (creating a 'monolith'). Fallen trees can also be fixed in a vertical position, by strapping to living trees, to perpetuate this habitat type. Small dead elms should also be retained if possible.

Creating standing dead wood by ring barking live trees

Ring barking is the removal of the bark and cambial layers all the way round a tree. This prevents the distribution of water and the products of photosynthesis and, over a period of time,kills the tree. It can happen accidentally, for example by grazing animals or grey squirrels, or intentionally. Ring barking can help create standing dead trees but they often decay from the outside, which is not quite as valuable as a natural decay column in the middle of a tree.

When considering ring barking a tree, make sure that it is not in a position where it will constitute a hazard in future years. The ring of bark removed needs to be both wide and deep to be effective.

5.4.3 Dead wood in living trees

The dead wood that is found in living trees is especially valuable for saproxylic organisms. The following guidelines should be followed in order to maximise the quantities of this rare habitat.

- **Leave decayed wood inside hollow trees; be careful when carrying out remedial work.**
- **Leave dead limbs on trees.**
- **Be careful not to cut into cavities or damage them in any way.**
- **Leave dead bark.**
- **Keep commercially poor trees (they are usually the best for dead wood species).**
- **Try to retain trees that are due to be felled because they contain defects (they usually have interesting features), or at least retain the wood.**
- **Ensure that there is a continuous supply of dead wood on the site. Use short lived or fast growing species such as horse chestnut or birch to close up the generation gap if necessary and/or consider inducing rot in some trees.**
- **If branch removal is necessary, cut back only the weaker ends of the branches or cut part way through and knock them off to leave a natural shattered branch stub.**

5.4.4 The quantity of dead wood

It is difficult to put a figure on the amount of dead wood required for saproxylic species. Broadly speaking the more the better and, ideally, all should be left. It has been estimated that one hectare of undisturbed woodland produces six tonnes of dead wood annually, equivalent to half the annual leaf fall, and that in the wildwood three to eight trees per hundred were standing dead. A suggested aim is for over 40 m^3 of dead wood over 5 cm diameter per hectare and more than 50 standing dead trees, some over 40 cm in diameter. This is considered a good site by Kirby *et al.* (1998). **Quality is better than quantity** and the aim should be for a good representation of all successive stages in decay on the site.

There are various methods of estimating the amount of dead wood, both standing and fallen. That most widely used is outlined in Kirby *et al.* (1998) and given in Appendix 5. A simpler method is being developed by the Woodland Trust.

5.5 Summary of how to manage surrounding land for veteran trees

The key to managing the land around veteran trees is to remember that anything that is carried out to the land will also affect the trees. Aim for as little disturbance and input of substances as possible, especially close to the trees themselves. Extensive grazing is compatible with veteran tree management but intensive grazing and cultivation are not. Try to avoid any sudden changes of regime especially where these greatly alter light levels or affect the root systems. Wherever possible reduce chemicals or additives used on the land or livestock. Finally, avoid physical damage to the tree (especially the roots) either intentional or accidental.

Further reading: Alexander, Green & Key (1996), English Nature (1994), Ferris-Kaan *et al.* (1993), Fry & Lonsdale (1991), Fuller (1995), Green (1996c, 1997), Harding *et al*. (1988), Hodge & Peterken (1998), Key & Ball (1993), Kirby (1992), MacMillan (1988), Peterken (1996), Speight (1989), Spencer & Feest (1994), Watkins (1990),Winter (1993).