

## Appendix B Kinclaven Wood

### Evidence for Bundle Planting

#### Correspondence between arboriculturists in Tree News , 1995, 1996

Ted Green started a run of correspondence about the hitherto un-recognised topic of bundle planting with a letter to the Quarterly Journal of Forestry (Vol 88/3, 1994). He first came across the idea in an article by Richard Potts in Plants Today (Sept/Oct 1989), who described bundle planting in the middle ages in North German wood pastures. The aim of that medieval planting with oak and beech was to create multiple stemmed trees with large crowns to produce quantities of beech mast and acorns for pigs to feed on. Usually bundles were of seven stems planted in a pit at one time. Green's letter then lists six locations in England where he has seen bundle planting, mostly in parks and woodlands within them. His photo of a massive spreading bundle planted beech at Silwood Park in Berkshire is very impressive.

Ted Green writes a similar letter with a list of sites to Tree News (spring/summer 1995) adding 3 new sites in Buckinghamshire, and also with a clearer picture of the Silwood Park bundle planted beech in front of the house. In this letter he makes the point that bundle planted multiple stems are more robust to animal grazing and need less protection. [*nb: The main Tree News letters are attached to this appendix*].

The autumn 1995 Tree News contains 3 scholarly replies to Ted's letter. The first by Oliver Rackham discusses the idea of using genetic features to prove whether a bundle is of one or several separate individuals. Rackham states that he feels the Silwood Beech is a low branching individual rather than a bundle planting. Overall, at that time anyway, Rackham was not convinced by the bundle planting hypothesis.

The second letter was from John White of the FC's Westonbirt Arboretum. He was also intrigued by the Silwood Beech and compared it to a similar copper beech brought down in a gale at Sezincote, Gloucs. He appends an excellent photo of the Sezincote beech cross-cut at its base. Not only is the tree very fluted, for as he says, beech trees often are, but the estate woodsmen found the trunk to be hollow and made up of five stems fused together, and with most of their bark intact. 'Furthermore there was an iron bar stuck up the centre – the ultimate nightmare for chainsaw operators'. For me, the Sezincote Beech photo and description was perfect evidence of the type of picturesque planting described in SNH Review 82 quoted below. If only the estate staff had counted the rings carefully we would know the date of planting the bundle!

Prof Thirgood sent the third reply in autumn 1995 Tree News, talking about the use of several plants often being planted together in the Mediterranean African coast during the 1950s using Eucalyptus. They did not do well due to moisture competition, and he discusses the poorer stem quality which would result when growing timber trees. Thirgood asks whether bundle planting is for aesthetic or utilitarian purposes, and questions whether Green's list of examples could not have come from ancient multi-stemmed stools. Ted Green's response in that journal states that he would like to see bundle planting carried out much more, in the same way as the other main traditional tree practices: coppicing and pollarding. Indeed he makes the point that he sees bundle planted trees as 'working trees' in the same way as coppice stools and pollards.

The spring edition of Tree News in 1996 also had three responses on the subject. The first letter, from Katie Fretwell, Historic Parks and Gardens Surveyor for the NT in Cirencester, is very relevant. She describes a bundle planting trial in 1812 at Gunby Hall, Lincolnshire which though not very successful, highlights the interest at that time of landowners to create extraordinary trees at their mansions. There is a sense of pride verging on rivalry!

The second letter is from myself saying that the descriptions so far were helping explain similar beeches that I had seen in my work as native woodland adviser in Scotland. [*In due course I must document the examples I have in mind, which include Picturesque style planting nearly always of beech, but also one or two natural examples.*]

The third letter to Tree News in spring 1996 from Peter Broadbent describes an example he had seen in France where Atlas cedars had been deliberately fused to form an entire avenue of double stemmed trees. He was able to prove their double planted origin through examining one or two cut stumps, but unfortunately he didn't submit a photo.

*[As an aside, the same issues of Tree News referred to above also contained an article by Clive Hambler and Martin Speight about coppicing and conservation which really put the cat among the pigeons in questioning the whole ethic of coppicing in nature reserves. The resulting letters from Oliver Rackham and also Keith Kirby started a lively and long lasting debate on the issue of semi-natural woodland management. Those were indeed exciting times in the world of woodland conservation and history!]*

#### **Pollard and Veteran Tree Management, Helen Read, Corporation of London, 1991, 1996**

A conference was held at Burnham Beeches in March 1991 on this topic which resulted in the first volume of very helpful articles on veteran tree management. The Ancient Tree Forum was formed following a second event at Epping Forest in 1993 and a second longer volume of the advisory booklet was published in 1996 by the Corporation of London (who own and manage both these forests, and for whom Helen Read is woodland ecologist). This volume had four articles related to bundle planting and beech tree form, with my own article putting forward a sort of classification and descriptions of the wide range of veteran tree types found in Scotland.

A second paper by Bryan Bowes, a botanist at Glasgow University looked in detail at variations in the form of beech trees in Scotland, and examines fluted stems of maiden trees, and also beeches in parks which have been pollarded. In parks trees were often pollarded early in life to create a wide open crown, then left alone for the rest of their lives. That means this type of ornamental parkland pollard were not exactly 'working trees' with the meaning that Ted Green and others ascribe to them, in producing wood products or animal fodder, but trees designed by landscape gardeners for their aesthetic effect. Bowes also describes possible bundle planted beech. The example he shows at Mugdock Park certainly looks like a bundle planted beech, and is very similar to many of those found at Kinclaven Wood. He also describes the structure of the Meikleour beech hedge which is said to date from 1746.

Ted Green's article in PVTM Vol II has more or less the same content as his letters to Tree News, while Chris Damant's descriptive and well illustrated article about possible beech bundle planting in the Chilterns, Bucks, is very interesting. He illustrates at Cadsden Wood what may be a key

identification feature of bundle planted beech, in that the bark on each of the original stems seems to survive even when the clearly separate stems are fused together, as also noticed in the Sezincote beech.

### **Designed Landscapes in Scotland: Notes on their planting and management, 1997**

by Debois Landscape Survey Group, SNH Review no 82, (73pp).

This comprehensive review paper includes a section (3.5.6 on page 36) on 'Multiple Planting' as follows:

“Planting more than one tree in a single planting hole was a practice derived from observations of natural regeneration in unmanaged woodland, and in particular the protection afforded to young trees by a thicket of thorns. This method was recommended by Evelyn in the 17<sup>th</sup> C and by other writers in the 18<sup>th</sup> C. It was also recommended by Sir John Clerk when planting Scots pine woods to ensure the success of at least one plant and was adopted by the Picturesque Movement for the natural effect created by trees planted in this way”.

### **Veteran Trees: A guide to good management, English Nature, 1999**

Helen Read again acted as editor for this new and compendious manual of 176 pages for English Nature. By this time the veteran tree movement was well under way. Page 21 of the manual describes bundle planted trees and the reasons for past planting of them, while the illustration on p22 of the various tree forms of veteran trees has become a classic in its own right.

### **Hafod Estate, Mid Wales, 2003**

Richard Crompton while working on a guidebook 'The Hafod Landscape' (published a year later in 2004 by the Hafod Trust, author Jennifer Macve) wrote to me asking for information about bundle planting of beech. He felt sure that some beech trees in the landscaped parks around Hafod House were planted by bundle planting techniques during the Picturesque landscaping of that estate in the 1790s by Thomas Johnes. Certainly the photo of a large multi-stemmed beech tree on page 15 of that guidebook does indeed look exactly like the examples at Kinclaven Wood, and dating from probably the same period of the late 18<sup>th</sup> C.

### **Comments**

The above references all relate to the period when veteran trees were becoming more widely recognised in the UK and agreed management guidelines were being formulated. The author has not carried out any more recent search for new work on the topic but there may well be new observations recorded in arboricultural journals etc.

The recent book 'The Hidden Life of Trees' by Peter Wohlleben (Collins, 2017) describes how trees cooperate with each other through shared roots, mycorrhizal fungi, and in other ways, and is surely relevant to the strange way in which beech branches fuse and continue to grow.

A wide spread of professions is involved in the topic including botanists, arboriculturists, garden and landscape historians, nature conservationists, planners, and of course foresters (like Wohlleben in Germany) who are interested in all forms of tree and in the way that they grow together.

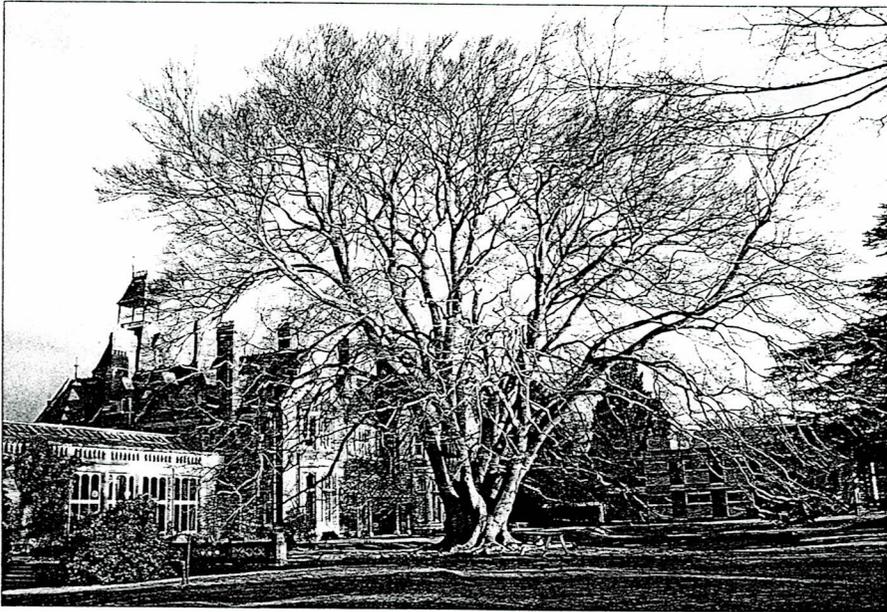
It would help understand the bundle planted and other veteran trees better if more 'forensic dissection' could be carried out on felled or windthrown pollards, coppice stools and bundles, but of course any such work is normally carried out by skilled tree surgeons for safety reasons and can be very expensive. Also there is the general conservation ethic of leaving deadwood untouched for fungi, insects and other wildlife, especially on nature reserves.

Peter Quelch

Revised 2.4.19

## BUNDLE PLANTING

Ted Green



Bundle planted beech at Silwood Park

Ted Green

## ADVANTAGES OF BUNDLE PLANTING

In the last issue of *Tree News* Oliver Rackham yet again extols the incalculable value of ancient trees and points out their rarity in Europe outside Britain. Oliver's efforts as the pioneer spirit in making people aware of the importance and value of ancient trees fortunately has not gone unnoticed, and in recent years has begun to bear fruit. It is, perhaps, in the nick of time that many workers now accept their responsibility to care for ancient trees and accept their place as an important part of our national and natural heritage.

As our interest in ancient trees has gathered pace, the traditional craft of pollarding is again being carried out on young trees, and the conservation of ancient trees is now accepted practice to prevent top-heavy trees collapsing. Pollarding and other traditional crafts such as coppicing and shredding are excellent examples of our ancestors working with trees that gave them a regular and sustainable renewable resource.

These trees could be called "working trees", and another example of traditional working trees was bundle planting – several trees, usually seven in number, planted into one hole.

The craft of bundle planting was first brought to my attention in a very interesting article by Richard Pott on Middle Age wood pasture in Germany (published in *Plants Today*, September/

October 1989), in which he described the planting of trees in bundles to produce multi-stemmed trees with large crowns for mast production in wood pasture. He also pointed out that bundle planting requires far less protection.

In Britain there are some good examples of bundle planting such as:

- Staverton Thicks, Suffolk: a large number of ancient oak pollards appear to have been bundle planted with holly surrounding them. Presumably the holly offered some protection while the oaks were growing and later would have provided winter fodder during lengthy periods of snow and severe frost.
- Toy's Hill, Kent (National Trust): a few bundle plantings of beech, now in woodland.
- Ashridge, Hertfordshire (National Trust): some bundle planting of mixed species – oak, ash, beech – on ancient hedgebanks now in woodland.
- Cadsden Wood, Princes Risborough, Buckinghamshire: some bundle plantings of beech with beech pollards, now in woodland.
- Combe Hill, Buckinghamshire (National Trust): some bundle planted beech.
- Lodge Hill, Buckinghamshire: some bundle planted beech on old hedgebank.
- Silwood Park, Berkshire (Imperial College): one bundle planting of beech and one bundle planting of sweet chestnut in

gardens near main house, so presumably planted as amenity trees.

- Sunninghill Park, Berkshire (Crown Estate): one very large sweet chestnut bundle in parkland.

- Aston Park, Bristol: two bundle plantings of oak with several oak pollards.

The occasional bundle planting could occur from a small mammal cache or larder of uneaten seed, or perhaps good germination after a superabundant seed year. There's also the "rabbit hole job" by an errant forester intent on "losing a few trees"!

Recently I have suggested to organisations involved in planting up semi-arid regions in Africa that bundle planting might provide an alternative method to single planting. The options of far less work in planting, protection and maintenance by watering might prove irresistible to workers.

Bundles would also provide wood just as easily as singles, whilst the large areas of shade created by the large crowns might have a far greater beneficial effect on ground cover than single planting. A large spreading crown can also be achieved by trees grown singly, in parkland for example, but judging by the bundle planted trees at Silwood Park, I think a bundle can produce a larger crown and at a much earlier age than a single tree.

In Britain it is hoped that bundle planting will be renewed on existing sites and

perhaps started on other sites of wood pasture and in parkland where it might have existed in the past. There are obviously many other options for bundle planting, such as on green field sites, permanent set-aside and other sites where protection from animal damage is paramount.

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## BUNDLE PLANTING

Ted Green's "bundle planting" [*Tree News*, spring/summer 1995] – the theory that multi-stemmed trees may result from the fusion of a number of individuals which started close together – is a fascinating idea, but needs verifying. The obvious experiment would take decades to carry out, but there is a way to test whether a tree is one or several genetic individuals.

Most native trees which reproduce by seed, such as beech and oak, are variable, much as people are variable. Individuals have peculiarities of sinuous or angular branching, epicormic twigs, early or late leafing or leaf-fall, amount of red pigment in the young leaves, and so on. If "bundle-planting" and fusion has occurred, it will produce trees in which the multiple stems are individuals, each having different peculiarities from others on the same tree. If the peculiarities are the same throughout one tree but differ on the next tree, then "bundle-planting" is unlikely.

For many years I have looked for genetic peculiarities to determine, for example, whether a big coppice stool is one individual or more than one. It is my strong impression that pollards (including the Staverton oaks, which I know well) are nearly always single individuals, even though the development of buttresses may give the illusion of clusters. (Some pollard willows are of multiple origin, but for a different reason: seedlings germinate in the crown of a pollard, root down through the hollow centre, and then fuse with the original tree.)

Your cover picture – a splendid photograph of a chestnut stool – is a definite example of one tree, not a bundle. The distinctive bark, epicormics and branching habit are exactly repeated in each of the stems. I cannot see anything in Ted Green's photograph of the Silwood Park beech to show that it is a bundle rather than a low-branching individual.

One should not hastily argue from medieval Germany to England: many practices, such as woodland-scale tree-

planting, were widespread in one country but not the other. If people planted trees in close-set groups, this would often result in one plant outstripping and suppressing the others, as tends to happen in gardens today. I am willing to be persuaded that sometimes they would coexist and fuse, but I have seen no clear example of this. A multi-stemmed tree can arise in many other ways, such as coppicing, pollarding, or a cow biting out its top when it was little.

Turning to another item in the last *Tree News*, Ralph Harmer's study of natural colonisation of abandoned land, "Trees for Free", was timely and welcome, but he errs in asserting that "detailed studies of natural colonisation in Britain are rare". On the contrary, ecologists earlier this century were almost obsessed with natural succession. The earliest experiment on the fate of abandoned land was set up in 1882. Many articles in the *Journal of Ecology* in the 1920s and 1930s, and much of Sir Arthur Tansley's great book *The British Islands and their Vegetation*, deal with studies of the natural formation of woodland. My own teacher, A.S. Watt, devoted much of his life to this theme. The history of science is about making new discoveries and also about forgetting old ones.

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Letters should be addressed to *Tree News*, Tree Council, 51 Catherine Place, London SW1E 6DY, and marked "for publication". Please include a daytime and/or evening telephone number. We reserve the right to shorten letters.

## BUNDLE PLANTING

~The Sezincote copper beech

I was interested to read Ted Green's letter, although it was his picture of the Silwood Park beech that set me thinking.

Last year a freak wind brought down a magnificent mature copper beech at Sezincote in Gloucestershire. The trunk seemed normal except for being fluted as beeches often are. When the estate woodmen cut it up they found that it consisted of five stems fused together, but still with most of their bark intact. Furthermore, there was an iron bar stuck up the centre – the ultimate nightmare for chainsaw operators.

My first thought about why this tree should have five stems was that it could have been five scions of copper beech grafted on to a semi-mature green beech stump. Sezincote has several examples of Victorian tree manipulation to produce curiosities. The house is in the Indian style and a young tree on five stems would match exactly some of the splendid ornamental embellishments of the roof.

But now I am not sure. Perhaps this is not a grafted plant at all, but another example of "bundle planting", and for an entirely different reason to those given by Mr Green.

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The Sezincote copper beech – an example of bundle planting?

*John White*

## BUNDLE PLANTING

Jack Thirgood

Bundle planting, as Ted Green terms it, was not uncommon along the Mediterranean African coast back in the 1950s, particularly with eucalypts. Two or three plants in a hole gave an impression of verdant growth, but a false one, because the

apparently more vigorous greening resulted, not from competition, but from the clumping together of individual crowns. Quite apart from the adverse effect on stem form, which would surely also result in this country, this "bundling" was counterproductive because of the increased competition for soil moisture – the critical factor for successful establishment and growth in semi-arid conditions. There certainly was no increase in height or vigour of individual plants within the clump. In fact, individual crowns were reduced.

The same effect would surely occur in this country and raises the question as to whether trees are planted for aesthetic or utilitarian purposes, or both. While bundle planting may result in apparent early greening it is hardly likely to produce trees suitable for timber needs, unless we are content to produce poor quality stems that fail to satisfy European standards.

But is Ted Green satisfied that the veteran park examples he lists in fact result from his bundle planting and not from ancient multi-stemmed stools? And can he explain why it is to be hoped that bundle planting may be renewed or started on other sites?

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Oliver Rackham's letter raises many interesting points that should not be ignored when considering bundle planting. However, he has not addressed the mixed species bundle planting in an ancient boundary bank at Ashridge, Hertfordshire. Also, at several sites bundle plants appear to be associated with nearby pollards.

Pollarding and coppicing are two very different systems of utilising "working trees". Pollards need no protection from animals while coppicing needs constant and permanent protection. I suggest that

it would have therefore been impractical to practise regular coppicing close to or scattered among pollards. However, it is logical to use bundles with pollards. Bundles scattered through areas of pollards would provide a regular mast crop and shade, while pollards cut on a rotation might only produce one mast crop per rotation and offer little shade.

Professor Thirgood points out that the eucalyptus bundles used in the Mediterranean in the 1950s were counter-productive. Naturally, for many reasons, 40 years later I would hope that native species would be used in such bundle planting in Africa to produce seed for animals and perhaps humans, shade, fodder and small diameter wood predominantly for fuel.

He also enquires why I hope that bundle planting should be renewed in Britain. My main reason is to continue an ancient traditional practice similar to pollarding and coppicing. Who knows? One day plantation Sitka spruce at commercial planting densities might be defended as part of our heritage and an example for future generations.

TED GREEN

## BUNDLE DEBATE

To add a garden historian's contribution to the great bundle-planting debate: according to John Pibbs, mixed species bundles are typical of the picturesque park planting of the late eighteenth/early nineteenth centuries. Interest in such planting is demonstrated at Gunby Hall where, in 1812, Peregrine Langton Massingberd recorded that he had planted 60 beech very closely in order to produce, by fusing, "THE BEECH, fully expecting that in 130 years it will be the largest Beech certainly in the County of Lincoln".

He was very proud of his scheme: "What will they say of me, in making trees, of three times the size of the largest growing on the Revesby Estate?" Both copper and fern-leaved cultivars were included, to provide proof of the origins of the resulting tree. But Massingberd's sad postscript of 1825 noted that the trees had "from neglect" failed to unite, and certainly there was no sign of an extra-large beech, or a bundle, on this site when it was surveyed in 1993.

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I am intrigued by the correspondence from Ted Green and others, as the bundle planting idea might explain some ancient beech trees that I've come across in Scotland. Before reading Ted's letters I had been forced to conclude that these huge stems were multistemmed as a result of coppicing, and had partially fused, which is a common enough occurrence in old oak coppice. Alternatively, does the pronounced fluting that is observable in old beech really develop to such an extent that the tree in later life can appear multistemmed?

To remove this uncertainty I suggest that many more examples need to be scrutinised and photographed. DNA testing of the apparently separate stems should be able to prove whether they are of the same genetic individual or not, which should thus prove or disprove the bundle-planting theory. To determine whether genetically identical stems are of coppice origin or arise from very deep fluting would probably need examination of cut stems or stumps. In that respect the Sezincote beech reported by John White seems a very convincing bundle planting, especially as it had an iron bar up the centre which presumably acted as the initial planting stake.

I can report that Dr Bryan Bowes of Glasgow University's department of environmental and evolutionary biology is looking into this very subject in Scotland, and may through careful observation throw some light on the enigma of bundle-planted beech.

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# LETTERS

I have read the recent letters on "bundle planting" in *Tree News*, and they remind me of a visit I made to France a few years ago. I was staying in a hotel in Tours which had been converted from a former chateau. The hotel grounds were surrounded by Atlas cedars at perfectly spaced intervals. I guessed the cedars to be about 100 years old and each one (perhaps 150 in total) had a perfectly normal bole up to a height of three or four metres, but then branched into two main trunks – both looking like trees in their own right.

They seemed so odd that I couldn't resist tramping the boundary looking for clues. Sure enough, I found that a road had been driven through the boundary and, to make the gap wide enough, two of the cedars had been cut down. Their cleanly cut stumps were clearly visible and showed without any doubt that each tree had consisted of two transplants planted side by side.

Just who had planted 150 "pairs" of cedars, and why, I could not ascertain, but they all looked the same age and very healthy.

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## COPPICING AND CONSERVATION

I reply to the article by Clive Hambler and Martin R. Speight in the autumn 1995 *Tree News*. This is, in effect, a plea for letting woodland conservation be dominated by the objective of re-creating wildwood. Human activities, they say, are not an integral part of the making of the historic landscape, but are "the damage our ancestors wrought on our landscape" whose evil effects must somehow be unpicked.

The fact is that in Britain, of all countries, human influence is pervasive and not always negative; it has destroyed species and habitats, but has also created new species and habitats. The cultural landscape, formed by the interaction between mankind and the natural world, is all the landscape that we fully know about. Many aspects of it are of value in their own right as biological habitats, such as meadows, chalkpits and medieval churches. Coppice woods do not claim to be wildwood, and are not just an inferior substitute for it. Biological conservation cannot be isolated from the conservation of artefacts and cultural values.

Trees in this country have a continuous history of some 12,000 years since the end of the last Ice Age. Human activity has

been an obvious major influence for a little over half that period. British wildwood disappeared so long ago that we do not know in detail what it looked like. Even 12,000 years ago, Palaeolithic hunters had already taken their toll of the great Pleistocene beasts, which may explain why the ensuing wildwood was different from that of corresponding periods in earlier interglacials.

Wholly natural wildwood is an elusive concept. In Britain it lasted for a relatively brief period during the Mesolithic. Who knows how it would have changed over the last 6,500 years had it been spared? In North America and Australia human activities have determined whole continents throughout the post-glacial period. By Columbus' time there were not many forests on earth, other than on uninhabited islands, that had never been altered by people's activities. The obsession of some conservationists with untouched wildwood has been steadily undermined by archaeological research.

Wildwood cannot be re-created either by doing nothing or by management. An abandoned coppice wood will not turn into either wildwood as it was in 4500 BC, or the wildwood that might have developed by 2000 AD had it never been encoppiced. For a start, it does not regain lime, once the dominant tree. New woods on former farmland suffer additionally from over-fertility: wildwood was not sodden with phosphate as ex-arable woods are.

Conservationists are not ignorant of the pros and cons of coppicing. Conservation practice takes on new insights such as the vice of tidiness and the virtue of preserving old trees. Coppicing research goes back 70 years and was closely linked to the formation of the county naturalists' trusts in the 1960s. It is now one of the most active fields of ecological science. Many of the findings are summarised in G.P. Buckley's *Ecology and Management of Coppice Woodlands* (Chapman & Hall 1992) – it is a pity that Hambler and Speight did not contribute to this book.

The distinction between historic managed woodland and wildwood is not as absolute as Hambler and Speight make it. Features of historic woods did, unexpectedly, occur in wildwood. The pollen record shows the continuous presence of some non-mobile species of open ground, such as devil's-bit scabious, corresponding to the permanent rides and glades of ancient woodland today. American wildwoods even contain coppice stools: some trees, such as American lime, are self-coppicing. The ability to coppice, which many of the world's trees possess, is an adaptation to some process that happened in wildwood.

The non-shade-bearing part of the woodland flora is a historic, to some degree a prehistoric, feature. There is hard evidence that it is threatened. Early botanical records show that woods lose species with time, but not in the random way that island biogeographers predict. Those that go (from large as well as small woods) are species of rides, glades and

## Hafod Estate, Mid Wales – bundle planted beeches from c1790

*Guide to the Hafod Landscape, published in 2004 by The Hafod Trust, page 15*



Photo: David James

*Golden Spindles (Clavulinopsis fusiformis), a woodland fungus common at Hafod*

prolonged rain cause local flooding and landslips. Its general moistness is, however, a great advantage, when combined with its pollution-free air, in supporting a rich flora, particularly among lower plants. Lichens, mosses, liverworts, and ferns thrive in its patches of old woodland and damp, sheltered combs, and the whole site is particularly rich in fungi, with the unimproved pasture around the mansion site supporting a community of waxcaps of international importance. Certain species of lichen and fungus occur nowhere else in Wales. Among the larger flora of interest, both in their own right and as encouragers of biodiversity, are some fine old parkland and forest trees, including a few surviving from Johnes's time. The largest beech trees are thought to have been planted by Johnes, and include specimens that appear to have been

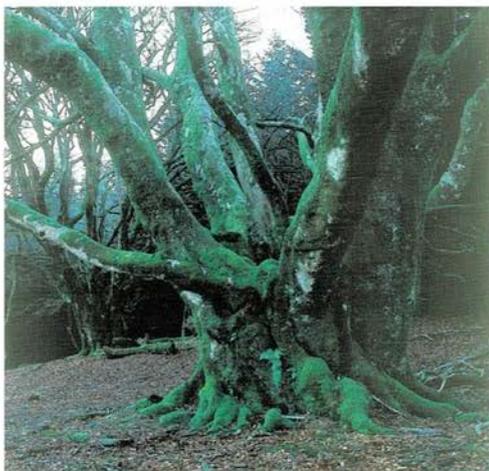


Photo: Christopher Gallagher

*A massive, multi-stemmed beech*

bundle-planted: that is, two, three or more young plants placed in the same planting hole so that they grow together in picturesque forms. Most of the oaks to be found at Hafod are sessile, but a few stands of pedunculate oak have also been identified. There are also some mature small-leaved limes and wild cherries, but sadly no large sweet chestnuts are still standing, though evidence from stumps shows that they were once a feature of the mansion fields and Cae Gwartheg. The Cedar of Lebanon on Middle Hill is known to have been planted by Johnes, but the two Wellingtonias date from the mid-nineteenth century.

More than half of the Hafod estate lies within the Elenydd Site of Special Scientific Interest. This was originally designated primarily as a means of protecting the Red Kite, for which the Hafod hills and valley were a last stronghold when the population was at its most threatened. Today kites are a common sight over a much wider area in mid-Wales and numbers are in the low hundreds, but Hafod remains one of their most favoured breeding areas. Other raptors, including buzzards, goshawks, and sparrowhawks are to be seen, and the numbers and variety of species of smaller birds are increasing as conifer plantations are thinned or removed. A second SSSI – that of the Gro Ystwyth Shingle Heath – falls partly within Hafod; it consists of six scattered pieces of riverside shingle which are unique in their geomorphology and ecology due to their glacial origins and mineral content.

Hafod has its share of invasive species, with *Rhododendron ponticum* being a particularly resilient and widespread weed. While it is futile to attempt to eliminate it entirely, it is hoped that a programme of removal combined with the expansion of grazed areas may bring it under control. Along the river's edge and some of the drives, patches of Japanese knotweed pose a problem and are regularly treated. Self-seeded alien conifers spring up in open spaces after felling of the parent crop. The grey squirrel is the most prevalent animal pest, doing widespread damage to trees, especially vulnerable saplings. That other bane of forests, the deer, is absent apart from very occasional sightings of lone individuals.