Broadleaves — Have They a Future?

# IRISH FORESTRY

JOURNAL OF THE SOCIETY OF IRISH FORESTERS

Vol. 44, No. 2, 1987

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The following notes are designed to aid the speedy processing of scientific contributions to the journal.

1. Two copies of each paper should be submitted, in typescript, with double spacing and wide margins, correct spelling and punctuations expected.
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4. Nomenclature, symbols and abbreviations should follow convention. The metric system should be used throughout.
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*Note:* The opinions expressed in the articles are those of the contributors.

*Cover:* Spessart Forest, Germany. Sessile oak 50 yr. old.
Y.C. 7 mixed with beech as protecting understory.

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*EDITORIAL*

# Bring Back the Hunch Men!

Oak is grown in West Germany on a rotation of 240 years. That is an exercise in faith. That confidence, that faith, is refreshing.

No one can predict the demand or price of anything 240 years from now. Economists who lash about, attempting exercises in extrapolation over long time distances delude themselves. Worse, they try to make a science out of fortune-telling. They produce no more than a shimmer and present it as 'the best there is' — not understanding that even 'the best there is', is also worthless. We simply do not have at our disposal the means to predict the price of anything 200 years hence.

What other industry must wait that length of time before decisions bear fruit? The production of modern aircraft from the time of inception to the issuing of passenger tickets now occurs in the space of 25 years: reason enough there to attempt to predict price and demand. Twenty five years — yes! Two hundred and forty years — surely not!

Decisions to establish long rotation broadleaved forests must be done as an act of faith. End-price cannot be part of the debate. At best we can only go with the idea that there will always be a quality price for quality broadleaved timber. Even that could be wrong: we have no control on the fickleness of fashion. Other than 'gut reaction' we have little to guide us. That too is a problem. It is now no longer fashionable to back 'a hunch'. It's not scientific. Indeed the 'hunch men' are suspect. Don't give me intuition — give me reports — is the motto of modern management. But perhaps, given the scale of uncertainty that clogs up the question of long rotation crops, playing a hunch may be the best card we have.

If we are then to devise a strategy for broadleaved forests we should channel forestry skill — into finding the best silviculture — finding the most suitable soils — finding the best choice of species — and into deciding the correct size and the correct location of broadleaved forests needed to sustain a future broadleaved industry — and let us forget the senseless arguments on possible prices for a cubic metre of oak two centuries from now.

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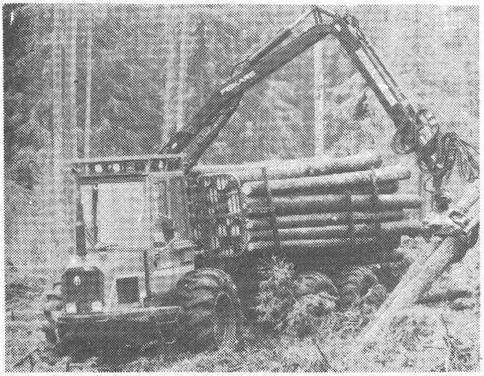

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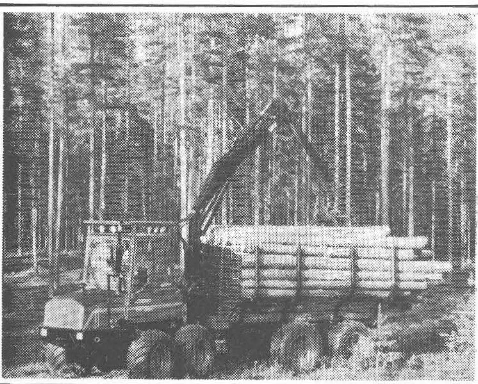

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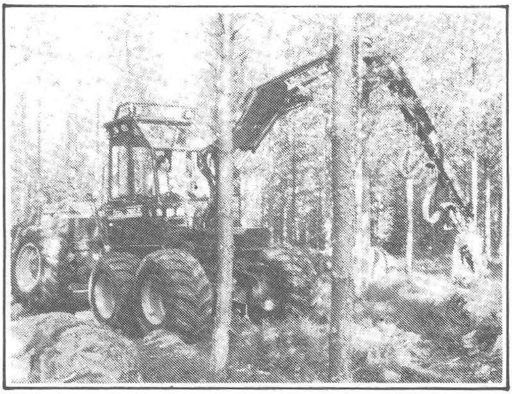

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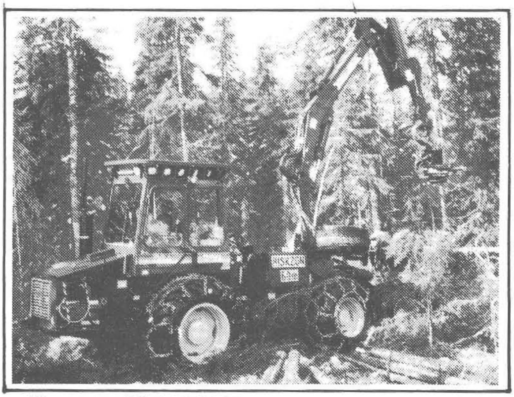

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# Special Issue

## Broadleaves — have they a future in Irish forestry?

The six papers appearing in this issue of the Journal are all based on the papers read at the Society's symposium which was held at University College Dublin in April 1987.

# Status and Value of Native Broadleaved Woodland

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## INTRODUCTION

The title of this symposium "Broadleaves — have they a future in Ireland" prompts questions as to their past and present status. Travelling around Ireland the impression gained is of a country well stocked with broadleaved trees and woodland, but this is a false impression obtained from the dense network of hedges combined with small patches of young woodland and scrub on pockets of poor soil or steep slopes. With less than 6% of Ireland under woodland it is the least wooded part of Europe (excluding Iceland), and the area of broadleaved woodland is only 1% of the land area. In order to understand the reasons for this, and to understand the significance of our broadleaved woodlands, it is necessary to examine briefly how the present situation evolved.

### *The Rise and Fall of Ireland's Woodlands*

The post-glacial development of our forests to their maximum extent c 5000 BC, when they covered almost the entire island, and their subsequent decline as a result of the combination of climatic change and human activity is well documented (e.g. Watts 1986). Man first began to have a major impact on the forests in neolithic times c 3500 BC, and Edwards (1986) suggests that the relatively tree-less nature of the landscape dates back to the Bronze Age. Certainly by the Middle Ages very little of the original forest remained. McCracken (1971) estimated that there were only one million hectares of woodland in 1600 AD, but Rackham (1960) concluded from the Civil Survey of 1654-56 that only 170,000 ha remained, and that by the 1830s there was only a tenth of that area. This very low figure is supported by evidence from entomological research which shows that there is a marked absence of insects associated with ancient woodland (M. Speight. pers. comm). Plantations in the 18th and 19th century saw a temporary reversal

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in the downward trend but today only 84,000 ha of native broadleaved woodlands remain (Purcell 1979, Clinch. pers. comm.) of which perhaps less than 20,000 ha (0.2% of the land area) represents ancient woodland.

Thus in the 5,500 years since the beginning of the Neolithic period the original forest cover has declined from nearly 100% cover to only 0.2% of the land area, and with this demise have gone the traditions and woodmanship associated with them, a factor which is important to an understanding of present-day attitudes to woodlands and trees.

## The Present Day Resource

Our present-day broadleaved woodlands may be grouped into three categories:

1. Remnants of the wildwood (Peterken 1981) largely confined to the poorest sites, greatly modified, abandoned sylviculturally 100-180 years ago, and with trees of mostly fire-wood quality.
2. Plantations, most of which are 150-200 years old, (but with some younger stands) on better sites, with some good quality timber but much of it over-mature. Exotic species, such as beech, are common and the native species may be of foreign provenance.
3. Secondary woodland on abandoned farmland, usually scrub-like with the better quality timber often selectively removed.

Few woodlands exceed 100 ha in extent and many are only a fraction of this size. Most are damaged to various degrees by overgrazing, the spread of introduced species such as *Rhododendron ponticum,* and the selective removal of good quality trees. The generally poor conditions of the trees and woodlands, due to a combination of the often poor site type and sylvicultural neglect, has given rise to the widely held view that good quality hardwood timber cannot be grown in Ireland.

What did the wildwood look like to the first Neolithic people? The popular concept of forests dominated by oak is certainly incorrect for this is largely a product of 18th and 19th century management. Oak (probably mostly *Quercus robur*) would have been present mixed with elm, ash and hazel on the more fertile soils. On sandy soils and acidic sites there would have been a mixture of pine, birch and *Q. petraea,* while soils with impeded drainage would have carried alder, ash, sally and probably *Q. robur*. Structurally these woodland types were probably very varied with gaps caused by windthrow or death and many of the trees would have been much larger than any we can find today (Mitchell 1976).

The present-day distribution of woodland types according to soil type broadly reflects that described above and, except for the loss of Scots Pine, the species composition is the same although the relative proportions have changed, largely as a result of human activity. Ash, for example, has largely replaced elm as the principal tree of more fertile soils, while the selection of oak (mostly *Q. petraea*) for the charcoal and tannery industries has resulted in a virtual monoculture of this species to the detriment of others.

The four principal types of present-day native woodland are summarised in Table 1. Within these woods are found most of our 25 native tree species, including hazel and yew (Table 2), and a few introduced species of some importance, e.g. beech and sycamore. Certain species such as ash, elm and hawthorn are often abundant in hedgegrows.

## Value and Uses of Broadleaved Trees

With the very small area of broadleaved woodland left in the country, and the present overwhelming importance of plastics, metals and concrete, it is very easy to forget how important timber was in the everyday life of our ancestors, even up to the present century. This is something of a paradox given the degree of destruction of our woodlands. Timber was used for almost every aspect of daily life, e.g. housing, furniture, domestic utensils, vessels, agricultural implements, fencing, and in more recent times for industrial purposes such as charcoal production, and of course for firewood. Each timber type has specific as well as general uses, (Jones 1986), for example — oak was the principal timber for construction, elm for carts, ash for tool handles and yew and fruit tree timber was highly prized for vessels (Table 2).

Many of these uses have fallen out of fashion as timber has been replaced by other materials, but oak, ash and beech are still in demand, especially for furniture. Some other species have potential value for general and specialised purposes, e.g. cherry (Pryor 1985) and yew for veneer and turnery (Table 2). Several species are of value for non-timber uses. Holly for example is important for decorative purposes at Christmas and commands high prices. Wild apple and cherry represents an important genetic reservoir for improving cultivated varieties for both fruit production and horticultural purposes. The FAO, for example, is compiling a list of stands of *Prunus* spp. in Europe as a source of genetic material. Strawberry tree, rowan and whitebeam are of horticultural significance. All species have a value for amenity and landscape purposes and most are important for firewood, which at present is the principal use of this resource. Last, but by no means least, all

**Table 1:** Principal Native Woodland Types in Ireland

| **Dominant Tree Species** | **Shrub Layer** | **Other Flora** | **Soil** | **Tree Characteristics** |
|---|---|---|---|---|
| 1. *Quercus petraea*<br>E.g. Wicklow Woods | Holly<br>Occasionally hazel | Herb layer poor<br>Bryophytes & lichen flora rich especially in west | Acidic, usually poor sandy soils but occasionally on deeper loams | Mostly coppice 120-180 years old. Height 14m occasionally 25m, DBH 0.6m |
| 2. (a) *Q. robur*/ash<br>E.g. Charleville Estate, Co. Offaly | Hazel | Tree and herb flora species — rich. Bryophyte & lichen flora well developed in the west but less so in drier sites | Deep calcareous clays | Standards, sometimes with coppice. Trees up to 200 yrs old, some over 400 years. Height 25m DBH up to 1.5m |
| 2. (b) Ash/Hazel<br>E.g. Burren scrub | Hazel<br>blackthorn | As for 2a | Shallow soils over limestone | Scrub or low woodland. Rarely greater than 10m. Usually secondary woodland. |
| | This is a variant of the *Q. robur*/ash woods, largely confined to shallow soils. | | | |
| 3. Alder/willow/ash<br>E.g. Fiddown Marsh, Co. Kilkenny | Willow | Sedges and moisture-loving species | Alluvium, clays & fen peats subject to waterlogging | Scrub or low woodland. Rarely greater than 10m. |
| 4. Birch<br>E.g. Widespread<br>Raised bog type — All Saint's Bog, Co. Offaly. | Various depending on soil | | Various, but usually acidic. Occasionally raised bog peat. | Usually secondary woodland except on raised bogs. Up to 12m in height |

**Table 2:** Native Irish Trees and their principal uses past and present.

| | | |
|---|---|---|
| Alnus glutinosa | Alder | Charcoal, turnery, clogs |
| Arbutus unedo | Strawberry tree | Carving, cabinet making |
| Betula pendula | | |
| B. pubescens | Birch | Turnery |
| Corylus avellana | Hazel | Pea sticks, wattle |
| Crataegus monogyna | Whitethorn | Hedges, horticulture |
| Euonymus europaeus | Spindle | Furniture |
| Fraxinus excelsior | Ash | Hurleys, turnery, furniture, veneer |
| Ilex aquifolium | Holly | Turnery, decorative purposes |
| Malus sylvestris | Crab apple | Turnery, vessels, carving, horticulture |
| Populus tremula | Aspen | |
| Prunus avium | Gean, wild cherry } | Turnery, vessels, cabinet |
| P. padus | bird cherry } | making, horticulture |
| Quercus petraea | Oak | Construction, furniture, |
| Q. robur | | joinery, veneer, charcoal |
| Rhamnus catharticus | Purging buckthorn | |
| Salix alba* | White willow | Basket work |
| S. atroçinerea | Sally | |
| S. caprea | | |
| S. pentandran | Bay-leaved willow | |
| Sambucus nigra | Elder | |
| Sorbus aucuparia | Rowan | |
| S. hibernica | Whitebeam | Horticulture |
| Taxus baccata | Yew | Veneer, turnery, vessels |
| Ulmus glabra | Elm | Furniture, turnery, piles for under-water uses, coffins |

(*Possibly introduced)

our native species are important for conservation purposes as many species of flora and fauna are directly or indirectly dependent on them for their survival. Approximately 20% of our plant life (excluding algae), 28% of breeding birds and 50% of our invertebrates (i.e. about 6,000 species) are woodland species in the broadest sense. Further loss of our remaining woodland fragments would almost certainly lead to the extinction of some of these species.

## CONSERVATION OF OUR NATIVE RESOURCE

The principal attempts to conserve our native broadleaved woodlands so far have been taken in the context of establishing nature reserves under the 1976 Wildlife Act. The Office of Public Works is also conserving broadleaved woodlands in the National Parks, including the extensive Killarney Woods. The underlying philosophy is to conserve the woodland ecosystem, rather than the trees per se, in order to maintain the genetic resource as represented by the flora and fauna, for future use by man (Neff 1974).

At present 24 woodland nature reserves totalling c 1700 ha have been established under the Wildlife Act and approximately 100 ha are protected in National Parks. Another 20 sites are scheduled as reserves and our aim is to conserve at least 60 sites covering 5000 ha (Neff 1984). Legally, these reserves must be managed to maintain their scientific interest. The principal management objectives have been discussed by Neff (1974) and may be summarised as follows:

1. To maintain the woodland ecosystem.
2. To maintain, and where necessary, increase the diversity of native species and habitats. This will require unconventional sylvicultural treatment such as creating a range of age classes, allowing trees to become overmature and leaving dead and rotting timber.
3. To remove, or contain, harmful influences such as overgrazing, invasive exotic species and inter-planted conifers.

It is important here to note the distinction between nature reserves and broadleaved plantations. In the former, timber production, while not being totally excluded, will play very much a secondary role to the conservation of the totality of organisms, while the latter should be managed primarily for timber production and any conservation and wildlife value will be a happy corollary.

So what role then have woodland nature reserves in the context of a future for broadleaved trees in Ireland? Nature reserves are not wastelands but a valuable resource. They are, among other things, the cheapest and easiest means of conserving genetic material which can continue to evolve subject to the physical and biological pressures of the environment. This repository can be tapped for human use as required, without destroying the resource. It includes not only the trees, which may be used to improve timber quality, but all other organisms such as lichens, which may be of value for monitoring air pollution, or predatory insects which may be used for pest control. It is encouraging therefore to see the first steps being taken to tap this resource with the establishment of trials to test the susceptibility of Irish provenances of oak to oak wilt disease (*Ceratocystis fagacearum* (Bretz) Hunt.) and the establishment of provenance trials of oak and ash. Results from these trials will be of value in assessing the potential of native material for use in plantations.

## CONCLUSION

Have broadleaved trees a future in Ireland? In as far as there are now c 2700 ha. of broadleaves protected in nature reserves or National Parks our native broadleaved trees are assured of a place in the future, albeit a very small place. Given the likely decline of agriculture on marginal land it is almost certain that scrub and eventually broadleaved woodland will re-establish to some extent (grants for planting conifers notwithstanding) just as it has in the past.

The crux of the matter however depends on whether it is considered economically worthwhile to grow broadleaves as a substitute for conifers on some of the better soils. At present the price of hardwood timber is kept artificially low by the supply of cheap imports from N. America and the tropics. However the supply of this timber is likely to decline in the foreseeable future as the forested areas are reduced and as the environmental consequences of clearfelling tropical forests become more apparent (Keogh 1986). There is therefore a strong argument in favour of planting at least a proportion of our land with broadleaved trees.

Broadleaved trees have received a bad press in Ireland, largely because of the poor quality of the old stands, but given the right conditions I believe they have potential to produce good quality timber. It is therefore encouraging to see the reawakening of interest in their cultivation (Fitzsimons & Luddy 1986). In the final analyses however it is up to the foresters of the country to decide whether there is a commercial future for broadleaves in Ireland, and whether the resource that is being conserved in nature reserves and National Parks can be utilised more fully for future generations.

## REFERENCES

EDWARDS, K. J. (1985). The anthropogenic factor in vegetational history. In: The Quaternary history of Ireland Ed. K. J. Edwards and W. P. Warren, pp. 187-220 Academic Press.

FITZSIMONS, B. & LUDDY, W. B. (1986). Growing ash for hurleys. Irish Forestry *43:* 32-55.

JONES, M. (1986). Coppice wood management in the eighteenth century: an example from County Wicklow. Irish Forestry *43:* 15-31.

KEOGH, R. (1986). Irish Forestry and Overseas Development Aid. Irish Forestry *43:* 122-127.

McCRACKEN, E. (1971). The Irish woods since Tudor times. David & Charles, Newton Abbott.

MITCHELL, G. F. (1976). The Irish Landscape. Collins, London.

NEFF, M. J. (1974). Woodland conservation in the Republic of Ireland. In: Colloques phytosociologiques, III. Les forêts acidiphiles. Ed. J. M. Gehu, pp. 273-285. J. Cramer, Vaduz.

NEFF, M. J. (1984). The future of nature reserves in the Republic of Ireland. In: Nature conservation in Ireland: Progress and problems. Ed. D. J. Jeffrey, R.I.A. Dublin, pp. 151-160.

PETERKEN, G. F. (1981). Woodland Conservation and Management. Chapman and Hall, London.

PRYOR, S. N. (1985). The sylviculture of wild cherry or gean (*Prunus avium L.*). Quarterly Journal of Forestry *79:* 95-109.

PURCELL, T. J. (1979). Inventory of Private Woodlands — 1973. Forest and Wildlife Service.

RACKHAM, O. (1986). The history of the countryside. Dent & Sons Ltd., London.

WATTS, W. A. (1985). Quaternary Vegetation cycles. In: The Quaternary history of Ireland. Ed. K. J. Edwards and W. P. Warren, pp. 155-186. Academic Press.

# Silviculture of Broadleaved Species in Western Germany

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## 1. *Natural Area of Oak and Beech*

About two thousand years ago, beech (Fagus silvatica) and oak forests (Quercus petraea and Quercus robur) formed the greater part of all forested land in Middle Europe, which was about 95% of the total land area.

Tacitus has told us that the Roman legions had to traverse large and broadleaved wildernesses with nearly no understory. This must have been the typical old beech stands which would tolerate no undergrowth under their shadowy canopy.

Indeed, the natural area of both European and sessile oak and of beech, covers all of central Europe.

The oak species can be found — in the northern Harz Mountains up to an elevation of about 500 to 600m. In Switzerland sometimes it reaches over 1000m and in the Caucasus and Pyrenees Mountains to 1500m. Typical sessile oak regions are considered to be located between sea level and 400 to 600m, going higher when there is a variation of local climates towards warmer and drier conditions. European oak will not go as high. Sessile oak will not follow European oak into the inner continent, where winters are long and hard. Its natural border to the east can be established as an average January temperature of –5° Celsius.

In climatical adaptation, beech seems to be very similar to sessile oak, but it does not extend its area west of Scotland and is lacking in Ireland. In its northern area it is present at sea level. In the Alps and the Carpathians an altitudinal border begins to form, which goes higher when advancing southwards. On the southern slope of the Alps this border is at about 950m, on Corsica 800m, in the Appennino Mountains at 1200m. This shows that a moderately humid, cool and not too dry and hot climate suits beech.

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The natural phytosocial associations of the broadleaved species show a vast variety of combinations. In central Europe we distinguish in a larger scale.

— limestone beech forests, associated with maple (*Acer pseudoplantanus*), ash (*Fraxinus excelsior*), limetree (*Tilia cordata* and *T. platyphyllos*), elm (*Ulmus glabra* and *U. laevis*), wild service tree (*Sorbus torminalis*) and European cherry (Prunus avium).
— brown forest soil beech forests, associated with maple, oak, spruce and a more grassy soil vegetation.
— European oak — hornbeam forests of low elevation sites on strong loams and clays, associated with limetree, maple and ash.
— Acid-brown to podsolic forest soils of sessile and European oak forests; on wetter sites dominance of European oak, on drier and warmer sites dominance of sessile oak, both associated with birch and aspen and on warmer sites with beech and hornbeam.

The classical altitudinal forest vegetation in northern Germany is (example of the Harz Mountains).

— a Querco — Carpinetum to an elevation of 300m;
— a Dentario — Fagetum on rich sites (*Dentario bulbifera*) between 300 and 600/800m elevation.
— a Luzulo — Fagetum on poorer sites (*Luzula albida*) between 300 and 600/800m elevation;
— a Fago — Picetum between 500 to 700/900m elevation, alternating with a Picea — Fagetum;
— a pure Picetum — hercynicum higher than 800/900m elevation.

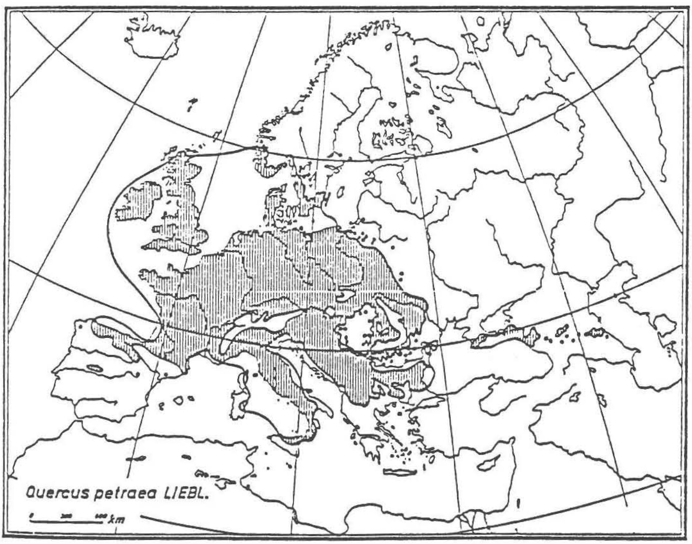



**Fig. 1:** Natural Area of Sessile Oak (MEUSEL 1965).

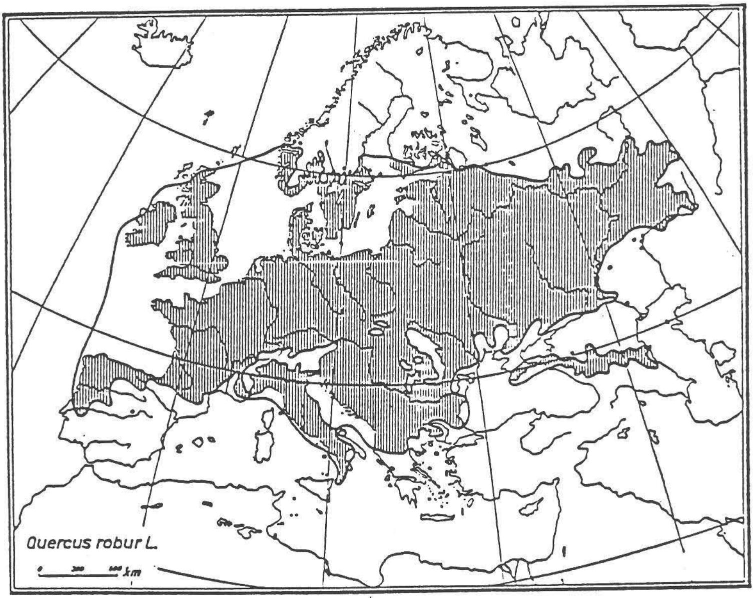



**Fig. 2:** Natural Area of European Oak (MEUSEL 1965).

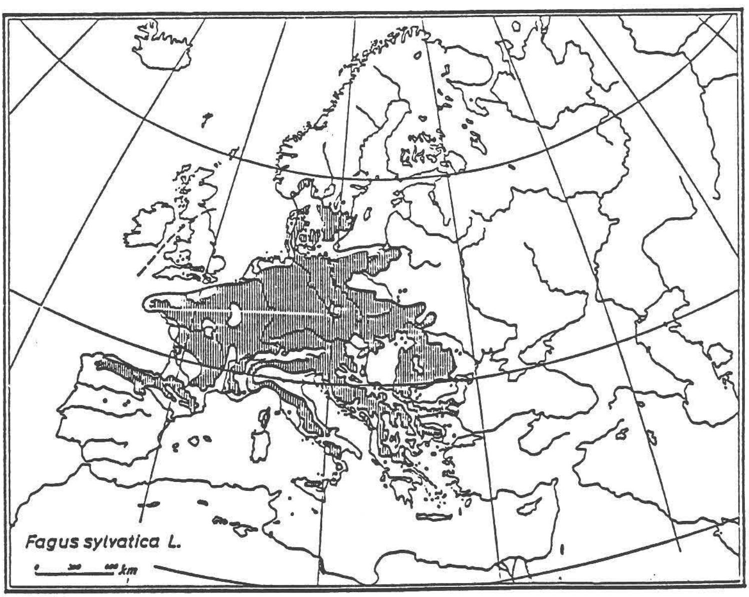



**Fig. 3:** Natural Area of Beech (MEUSEL 1965).

## 2. *Silvicultural and Economic Interest of German Forestry in Broadleaved Species*

To obtain an impression of the silvicultural and forest economic trends in West Germany an example from Lower Saxony will be considered (Fig 4).

— The vertical line shows the area of clearcut between 1975 and 1995, separating the main economic forest species; the horizontal line indicates the species used in reforestation.
— It can be seen that 1400 ha of oak is to be clearcut between 1975 and 1995. However, over the same time period it is planned to replace other species at clearfelling with oak, to reach a total of 10,450 ha of oak. Beech will be replaced by oak on 300 ha, but the total area of beech will remain about the same, being preferred to spruce and pine where appropriate.
— The area under spruce and pine will be decreased substantially. Douglas fir is the only coniferous species which will have its area increased, rising from 850 ha to 8.900 ha.

Why are we doing this? The reasons for doing so are as follows:

(1) The distribution of spruce and pine are the result of three historical conditions.

— Scots pine (P. sylvestris) was used 150 years ago as a pioneer species on devastated heathland in northern Germany. These soils were strongly acid. It was hoped that such planting would result in site improvement through the hundred year accumulation of humus. This would allow a wider selection of more valuable and productive species to be planted on these improved soils.
— The existing vast area of Norway spruce is the result of this species economic association with mining industries in the Harz Mountains.
— Theoretical forest net interest calculations based on the expectation of an optimal soil rent and normal forest age class distribution led to a consequent expansion of fast growing coniferous species.

However, over 200 years of experience in middle European forestry shows that this expectation has proved to be fundamentally wrong.

From this long experience it is now clear that the abiotic risks of stormthrow, snowbreak, wildlife, and the biotic risks of beetles and other insect or fungal attacks must be seriously considered, along with mistakes in forest management and incorrect choice of species.

**Figure 4:** Clearcut and reforestation in ha between 1975 and 1995 — Lower Saxonian State Forests.

| cut \ replanted | | oak | beech | other hardwoods | softwoods | spruce | Douglas fir | pine | larch |
|---|---|---|---|---|---|---|---|---|---|
| oak | 1400 | 1400 | — | — | — | — | — | — | — |
| beech | 1300 | 300 | 800 | — | — | 100 | 100 | — | — |
| other hardwoods | 50 | — | — | 50 | — | — | — | — | — |
| softwoods | 1100 | 300 | — | 100 | 300 | — | — | 400 | — |
| spruce | 6500 | 2600 | 200 | — | — | 1700 | 1000 | 1000 | — |
| Douglas fir | 850 | 150 | — | — | — | 100 | 600 | — | — |
| pine | 29500 | 5600 | 400 | — | 200 | 1200 | 7100 | 14500 | 500 |
| larch | 300 | 100 | — | — | — | — | 100 | — | 100 |
| | 41000 | 10450 | 1400 | 150 | 500 | 3100 | 8900 | 15900 | 600 |

**Table 1:** *Species area changes in Lower Saxonian state forests from 1960 to 1986.*

| | |
|---|---|
| Oak | from 27,000 ha (1960) to 32,000 ha (1986) |
| Beech | from 72,000 ha (1960) to 65,000 ha (1986) |
| Other Hardwoods | from 4,000 ha (1960) to 7,000 ha (1986) |
| Softwoods | from 8,000 ha (1960) to 11,000 ha (1986) |
| All broadleaved | from 111,000 ha (1960) to 115,000 ha (1986) |
| Spruce+Douglas fir | from 107,000 ha (1969) to 111,000 ha (1986) (86:9000 ha Douglas fir) |
| Pine and larch | from 87,000 ha (1960) to 90,000 ha (1986) (86:15000 ha larch |
| All coniferous | from 194,000 ha (1986) to 201,000 ha (1986) |

**Table 2:** *The standing volume in 1986 in these forests in* /m3

| | Oak | Beech | Other Hard | Soft-Wood | Broad-Leaf/ All | Spruce/ Douglas Fir | Pine/ Larch | Conif./ | All Species |
|---|---|---|---|---|---|---|---|---|---|
| MI0 $m^3$ | 6.3 | 17.1 | 0.9 | 1.0 | 23.9 | 23.9 | 12.0 | 35.9 | 61.2 |
| $M^3$ha | 197 | 263 | 129 | 91 | 220 | 215 | 133 | 179 | 194 |

Permanent periodical losses of valuable timber may be accentuated by these risks and when species are planted on wrong sites or when thinnings are not executed at the right period or when too dense monocultures are maintained over a too long period. These dangers, even under the best forest management, still remain a non-calculable possibility.

The dramatically different natural evolution of broadleaved species and coniferous species is seen in Figure 5. As a matter of fact throughout Germany, logging of valuable coniferous species, accumulated over only a 100-150 year rotation period, will not be able to pay the necessary investment in new plantations and expensive thinnings. Therefore, we have to conclude that avoiding risks is the soul of silviculture and of forest economics.

This therefore, leads us to consider the broadleaf option. As oak and beech constitute the main species in natural forests in Central Europe they are well adapted to these site conditions. The correct choice of site is the first thing that is required to avoid risk. Good site mapping will show the possibilities of all the different species choices. In other words the right tree for the right soil. This makes sense ecologically and economically.

In a worldwide market competition we are convinced that no pulpwood, and comparable quick growing product, will be able to successfully compete with the production of such material from other regions where the growth conditions — climate — are much more favourable.

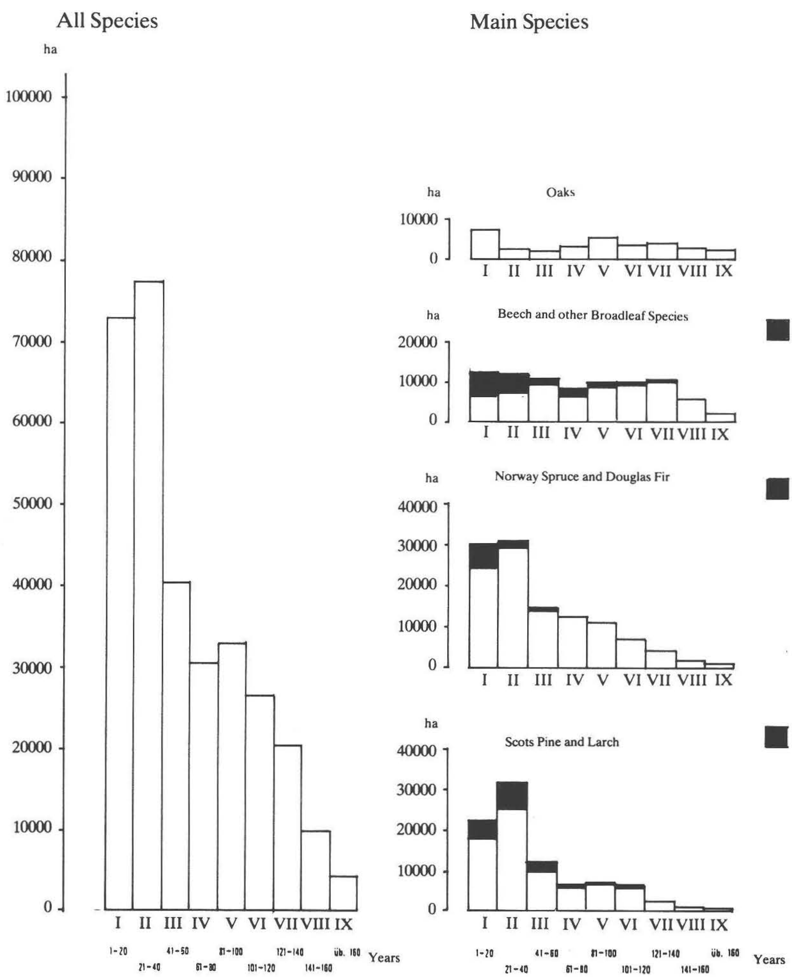
Our best sliced veneer oak, produced on a rotation of about 240 years will cost 10,000-15,000 DM/$m^3$. Such timber, which is not thrown too early by periodic storms, does exist in our forests; it is not simply a paper calculation. Beech timber, although not as valuable, is also present in old stands.

The consequences of these facts and the results of site mapping is that, using the same example of Lower Saxony, the following modification can be outlined (Table 1) while the standing volume in 1986 in these forests is shown in Table 2.

In the Federal Republic of Germany, species distribution on a total forest area of 7,400,000 ha (corresponding to 29.7% of the national territory) is as follows:

| | | |
|---|---|---|
| Oak | 592,000 ha. | = 8% of the forest area |
| Beech and other broadleaf | 1,7000,000 ha. | = 23% of the forest area |
| Norway spruce and other | 3,108,000 ha. | = 42% of the forest area |
| Scotch pine and larch | 2,000,000 ha. | = 27% of the forest area |

**Figure 5:** *Age Classes in Lower Saxonian State Forests 1984.*



The most valuable sessile oak forests are to be found in the centre of the Republic in the Spessart Mountains in a rather warm mountain climate influenced by the warm air of the Rhine valley, and in the Pfälzerwald in southwestern Germany. Good oak forests of both species can also be seen in the Steigerwald in Bavaria and in Lower Saxony.

The best beech stands are located in the Lower Saxonian Mountains and the Hesse Mountains in an atlantic climatic pattern.

3. *Silvicultural Properties of Oaks and Beech*

Sessile oak, and European oak, are light-demanding species with a moderate tendency of sessile oak to tolerate some more shade in its early youth. The consequence of this is low competition tolerance in the successional pattern. The canopy of both oaks can easily be influenced by side competition of other crowns, and a too dense canopy will cause a formation of water-sprouts on the stems of cramped crowns, which devalues timber quality for veneer.

Both oaks are easily drawn up in the nursery phase with few problems. Both species have a high survival rate when planted out because even young plants tolerate a lot of drought. There are only a few risks in plantations: moderate insect and fungus diseases, and perhaps bud damage by hares and roedeer, so that plantations need to be fenced. The most irritating damage is caused by late frosts which can heavily attack young plantations up to ten years of age. But these late frost injuries never kill a young oak, because a general property of all oaks are the sleeping buds and regular prolepsis sprouting. So black frozen leaves will be immediately replaced by the sprouting of sleeping buds during the same vegetation period.

Both oaks are characterised by a long life duration. Thick timber can be harvested at an age of 160 to 180 years, but over 300 years the wood will get no rot and can go on growing in dimension and to a total height of some 35m in the Spessart, and about 30m in northern Germany. This long life duration means a high flexibility in rotation times and a timber harvest corresponding to the best market conditions.

In contrast, beech is one of the most shade-tolerant and superstrong species in competition. It is a latecomer in the successional pattern, and a climax species which will win every competition with other species. Only its vitality will diminish under cooler high mountain conditions, where it can be suppressed by Norway spruce.

The greatest risks to young beech are late frosts, mice, hare and roedeer attacks. Young seedlings can tolerate a long shadow condition. The sprouting may be moderate in an early age. Best growth will begin at an age of only 60 years and continue until an age of about 150 years. The crowns of beech can respond readily to any opening; so dense stands can grow again in diameter even after very late thinnings.

The rotation time cannot be modified in the same way as described with oaks, because the natural life duration of beech is restricted to about 200 years. Beyond 160 years white rot quickly devalues the timber, so that a rotation time betime 140 and 160 years seems to be the best.

Beech is a good mixture species. It is a stabilising factor in spruce and pine stands and is necessary in oak stands to avoid sprouting from sleeping buds. With beech stands can be mixed ash, maple, silver fir, spruce, Douglas fir, European and Japanese larch and many others, but all mixtures need help by thinnings against the competitive strength of beech. The total height of beech stands may reach 40m.

## 4. *Silvicultural Techniques*

### 4.1. *Sessile and European Oak*

4.1.1. *Site Choice:* A good sessile oak site is a sandy loam with a regular moderate water supply, but with no stagnant water. Nutrition can be at a low level, soil reaction between pH 3.5 and 5.0 (KC1 analysis). European oak tolerates heavier loams and clays and is a species of groundwater soils of the vast river plains, but also tolerates a low nutrition and pH grades.

4.1.2. *Regeneration:* Because of low temperatures natural regeneration of oaks is an exception in Germany — in contrast to French conditions. To obtain a natural regeneration it is necessary to clearcut the old stand the same winter because the seedlings need full light and warmth in the following spring.

The normal procedure is as follows: Clearcut. Take off all brush. Plough the soil totally in the whole area, or in plots or in furrow planting strips. Use plant material of 2/0, 1/2 or 2/1. Planting rate should be at 7,000 to 10,000 plants per hectare with an additional 2,000 plants per hectare of beech, hornbeam or limetree in mixture.

In southern Germany, with richer seed crops, sowing methods are more usual, sometimes a soil preparation has to be executed, but not always. Most frequently, strips are opened at a spacement of 1.2 to 1.5m with 15 to 20 acorns sown per metre run. The acorn must fall into the mineral soil. In plantation work the same spacing is adopted to facilitate cleaning later.

4.1.3. *Cleaning Operations in Young Stands:* Bad stem form as well as competition from birch, pine and softwood vegetation have to be controlled. Sometimes the grassy ground vegetation must be controlled.

4.1.4. *First Thinnings:* The first thinnings begin at an age of about 25 to 40 years with dominant heights of about 8m. These first thinnings must be very moderate, because the natural differentiation still has to express itself. In a negative selection bad stem forms are eliminated. The mixture is held at an understory position.

4.1.5. *Following Thinnings:* The young stand thinnings end at an age of 50 years. Until now, a well thinned stand has to be equalised to a good spacement of future trees.

4.1.6. *Main Thinnings:* They begin at an age of about 50 years (dominant height 14 to 18m) with moderate but repeated interventions during

50 and 80 years, two times per ten years;
80 and 100 years, one time per ten years;
100 and 150 years, one to 0 times per ten years.

In the first operation, 140 to 300 future trees will be selected at a spacement of 9 to 6m in the dominant canopy. The thinning method has to be principally a thinning from above to guarantee a good permanent development of the crowns. With the same operation, the beech or hornbeam or limetree understory usually develops, but should not be allowed to compete with the crown of the future trees.

In Bavaria (Spessart) no future trees are selected, but an individual estimation of the best trees takes place at every thinning.

4.1.7. *Old Stand Thinnings:* In old stands the crowns of the future trees can no longer be influenced by thinnings. So the thinnings are confined to the elimination of ill trees, competing understory beech and some good oak stems as an early harvest.

4.2. *Beech*

4.2.1. *Site Choice:* A good beech site is on limestone with the exception of too-dry rendzina — soils, good mild loams with a pH over 4.0; and near the German coast, also loamy sands. Beech roots will not tolerate bad aeration and stagnant or ground water.

4.2.2. *Regeneration:* Beech is the classical species of natural regeneration in Germany. Occurrence of good seed crops is every

**Figure 6:** *Net Profit Calculation for Sessile and European Oak* (Lower Saxonian State Forest, RIPKEN 1987).

| | | Sessile Oak | | | European Oak | | |
|---|---|---|---|---|---|---|---|
| Rotation Time/Years | | | 200 | | | 180 | |
| Yield/3 per Hectare and Year | | 4 | 5 | 6 | 4 | 5 | 6 |
| A. **Financial Returns (without harvesting costs)** | | | | | | | |
| 1. Value at 200/180 years | **DM/ha** | **82.360** | **97.550** | **111.380** | **51.400** | **64.900** | **76.650** |
| | DM/year/ha | 412 | 488 | 557 | 286 | 361 | 426 |
| 2. Returns of Thinnings | **% of 1** | **40** | **50** | **60** | **30** | **40** | **50** |
| | DM/year/ha | 165 | 244 | 334 | 86 | 144 | 213 |
| Total of Financial Returns in DM per Hectare and Year | | 577 | 732 | 891 | 372 | 505 | 639 |
| B. **Financial Expenses** | | | | | | | |
| 1. Regeneration | **DM/ha** | **17.000** | **17.000** | **17.000** | **17.000** | **17.000** | **17.000** |
| | DM/year/ha | 85 | 85 | 85 | 94 | 94 | 94 |
| 2. Cleanings (2 x rotat. time) | **DM/ha** | **1.400** | **1.400** | **1.400** | **1.500** | **1.500** | **1.500** |
| | DM/year/ha | 7 | 7 | 7 | 8 | 8 | 8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3. Fertilising | **DM/ha** | **400** | **400** | **400** | **400** | **400** | **400** |
| (1 x rotat. time) | DM/year/ha | 2 | 2 | 2 | 2 | 2 | 2 |
| 4. Insect Control | **DM/ha** | — | — | — | — | — | — |
| | DM/year/ha | 5 | 5 | 5 | 5 | 5 | 5 |
| 5. Protection against Game Species | **DM/ha** | — | — | — | — | — | — |
| (without fences) | DM/year/ha | 8 | 8 | 8 | 8 | 8 | 8 |
| 6. Other Control Measures | **DM/ha** | — | — | — | — | — | — |
| | DM/year/ha | 1 | 1 | 1 | 1 | 1 | 1 |
| 7. Road Construction | **DM/ha** | — | — | — | — | — | — |
| | DM/year/ha | 30 | 30 | 30 | 30 | 30 | 30 |
| 8. Other Expenses | **DM/ha** | — | — | — | — | — | — |
| | DM/year/ha | 22 | 22 | 22 | 22 | 22 | 22 |
| 9. Administrative Expenses | DM/year/ha | 265 | 265 | 265 | 265 | 265 | 265 |
| Total of Financial Expenses in DM per Hectare and Year | | 425 | 425 | 425 | 435 | 435 | 435 |
| Net Profit in DM per Hectare and Year | | 152 | 307 | 466 | –63 | 70 | 204 |

7 to 15 years. At an age of 120/130 years a seed harvesting cut is executed when a good crop appears. Normally the soil will be moderately cultivated to ensure adequate covering of seed. After germination and first development of the young seedlings, so-called lighting-cuts will follow every 3 to 7 years to open the old stands. This is very necessary because old crowns of beech quickly close again after thinnings. Twenty to twenty five years after the sowing-cut a final-cut will end the operation. This method — a very traditional one — has a major disadvantage. It gives no chance for the development of mixture species (mainly ash and maple), which nevertheless are very welcome, because they can increase considerably the economic value of the stands.

So modern tendencies are to lengthen the regeneration period over 40 years to open the canopies in an irregular manner with a group selection to remove bad stem forms. In the openings, so created, the fast but light-demanding mixture species can develop with an advance of 10 to 20 years before the beech regeneration will come. The management for valuable mixture trees is then much easier.

4.2.3. *Cleaning Operations in Young Stands:* Young beech may be heavily attacked by mice and game species. So grass control, even by herbicides, is necessary. Softwoods have to be taken out, a fence built and trespassing roedeer shot.

4.2.4. *First Thinnings:* In beech stands, strong competition has to work a long time. For up to 40 years (dominant height of about 15m) thinnings will hardly take place in order to favour the best stems and natural pruning. Only very bad stem forms are removed.

4.2.5. *Main Thinnings:* From 15 to 20m in height (corresponding to 40 to 60/70 years) the dense closure of the stand is abandoned. 200 to 400 future trees will be selected with at least 5m of branch-free height. Two times per ten years, up to an age of 120 years, thinnings will be carried out to help the main crowns of the best formed stems. From 120 to 150 years these thinnings pass to regeneration cuts as described. The most important difference in old beech thinnings compared with oak thinnings is the possibility of increasing diameter development even at an old age of beech. In every thinning, consideration to assist mixture species is absolutely necessary in old stands.

**Figure 7:** *Net Profit Calculation for Beech* (Lower Saxonian State Forest, RIPKEN 1984).

| | Beech | | |
|---|---|---|---|
| Rotation Time/Years | 120 | 135 | 150 |
| Yield/m$^3$ per Hectare and Year | 8 | 8 | 8 |
| A. **Financial Returns (without harvesting costs)**<br>1. Timber Price/m$^3$ at Rotat. Time/DM | 250 | 274 | 345 |
| 2. Average Price of Thinning Material/m$^3$/DM | 145 | 184 | 163 |
| Total of Financial Returns in DM per Hectare and Year | 395 | 458 | 508 |
| B. **Financial Expenses**<br>1. Regeneration DM/year/ha | 42 | 37 | 33 |
| 2. Cleanings DM/year/ha | 20 | 18 | 16 |
| 3. Disease Control DM/year/ha | 13 | 13 | 13 |
| 4. Road Construction DM/year/ha | 40 | 40 | 40 |
| 5. Other Expenses DM/year/ha | 24 | 24 | 24 |
| 6. Administrative Expenses DM/year/ha | 200 | 200 | 200 |
| Total of Financial Expenses in DM per Hectare and Year | 339 | 332 | 326 |
| Net Profit in DM per Hectare and Year | 56 | 126 | 182 |

5. *Financial Returns*

The financial returns of oaks and beeches are shown in Figs 6 and 7. They are based on a net profit calculation, which can be explained as follows:

— For sessile oak have been calculated different models for a production of 4.5, and $6m^3$ of wood per hectare per year and expecting a rotation time of 200 years;
— For European oak the same conditions have been conceived, but a shorter rotation time adopted;
— For sessile oak a percentage of 10% of very valuable timber (veneer and others) has been estimated, 5% for European oak;
— For beech three current rotation times with a high yield class ($8m^3$ per year per hectare) have been calculated, but based on prices and costs of 1984.

The results can be commented upon as follows:
— The longer the rotation time the better will be the net profit. This is the result of thicker timber with lower harvesting costs and the distribution of all investment costs over a longer period.
— The lower the yield class, the less one can expect a reasonable return on oak production.
— As a matter of fact, the returns are influenced largely by the fluctuations of market prices, and the increase of costs — mainly the administrative expenses — which can hardly be influenced.

*Final Remarks*

The outlined silvicultural techniques can only give a raw impression of the many varieties practiced with broadleaved species in Western Germany. Many silvicultural techniques have been considered for a long time in the different German regions. This overview can only give the main and principal rules, more or less in use everywhere.

# Management of Broadleaved Woodland in Britain

Julian Evans B.Sc., Ph.D. F.I.C.For.*

## INTRODUCTION

On my last visit to Dublin in October 1985 I was privileged to listen to the internationally esteemed statesman, Mr. Sean MacBride, urging that Ireland should "increase substantially the plantation targets for afforestation". He lamented the fact that "we have never fulfilled the plantation target of 10,000 ha per year" (MacBride, 1985). It is encouraging to hear that now not only is there a groundswell of opinion to see more trees planted but that the case for broadleaves is being seriously argued. Britain has gone through a similar reappraisal and today in the mid-1980s the interests and policies in the limelight are very different from those of a decade ago.

This paper covers five points which reflect current trends in broadleaved management. Much of what is covered will be found in detail in Evans (1984) — Sulivculture of Broadleaved Woodland, Forestry Commission Bulletin No. 62.

## BROADLEAVED WOODLAND IN BRITAIN

Broadleaved trees and woodland are a dominant feature of much of Britain's landscape. In the past they were the principal source of building material, fencing, and fuel and today continue to supply half the country's consumption of hardwood. Their value for amenity, sporting, and conservation is inestimable. These many roles bring to broadleaved woodland both interest and complexity in management.

### *The broadleaved resource*

In 1980 broadleaved woodland of all types accounted for 37.5 per cent of all forest in Britain. Of the total growing stock of timber broadleaves account for a larger proportion of the total volume (51.5 per cent) because the average age of broadleaved woodlands

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is greater than coniferous forest and because most isolated trees and small clumps outside the forest areas are broadleaved. The analysis of the broadleaved resource by countries and woodland types are given in Table 1.

**Table 1:** Broadleaved resources in Britain

| Woodland areas (000 ha) | England | Wales | Scotland | Great Britain |
|---|---|---|---|---|
| Broadleaved high forest | 429 | 59 | 76 | 564 |
| Coppice with standards | 11 | | | 12 |
| Coppice | 26 | 2 | | 28 |
| Scrub | 80 | 8 | 61 | 148 |
| Volume of growing stock (million m$^3$) | | | | |
| Woodland | 68 | 10 | 13 | 91 |
| Non-woodland trees | 19 | 3 | 3 | 25 |

Source: Forestry Commission Census of Woodlands and Trees, 1979-82.

In addition to the areas shown in Table 1 there are some 202,000 ha of clumps and lines of broadleaved trees not formerly classified as woodland.

*Age-class and species in broadleaved woodland*

Figures 1 and 2 show age classes and species present in high forest.

**Fig. 1:** Age-class distribution of broadleaved high forest.

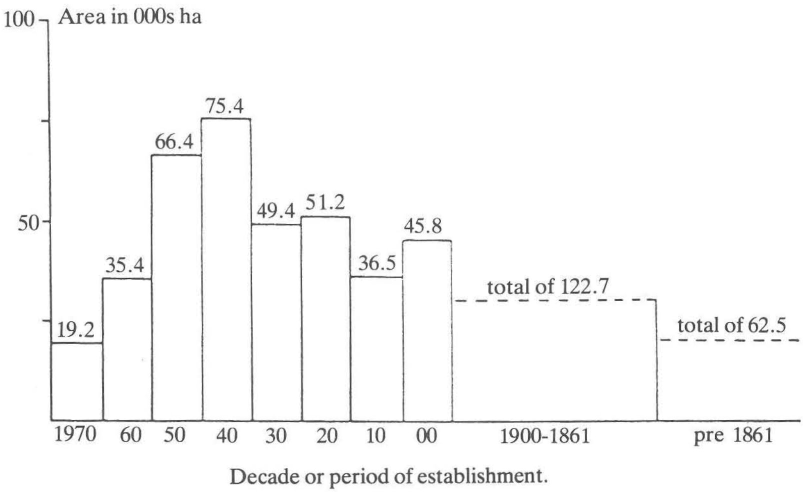


**Fig. 2:** Analysis of broadleaved high forest by principal species.

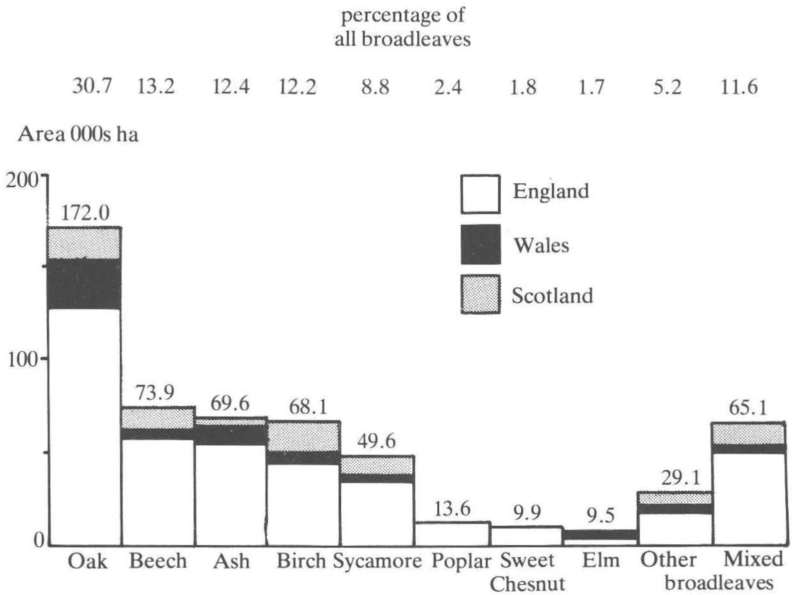



Table 2 shows the ownership pattern of high forest and the predominance of the private sector controlling some 90 per cent of the broadleaved estate.

**Table 2:** Distribution and Ownership of Broadleaved High Forest.

| 000 ha | Forestry Commission | Private Woodland Dedicated and Approved | Private Woodland Other* | Total |
|---|---|---|---|---|
| England | 44.0 | 86.5 | 298.8 | 429.3 |
| Wales | 6.1 | 3.9 | 49.3 | 59.3 |
| Scotland | 4.0 | 10.9 | 60.8 | 75.7 |
| Great Britain | 54.1 | 101.3 | 408.9 | 564.3 |

*Includes some stands of coppice origin amounting to 61,000 ha of Great Britain in total.

*Production of wood*

At current levels of consumption half of Britain's demand for hardwood is satisfied by home-grown production as shown in Table 3.

**Table 3:** Hardwood Supply and Demand in Britain.

| | 000 $m^3$(r) | | | |
|---|---|---|---|---|
| | 1955 | 1960 | 1970 | 1980 |
| Home grown production | 1455 | 1580 | 1326 | 1210 |
| Import of logs | 556 | 587 | 279 | 114 |
| Import of sawnwood and veneers(1) | 1407 | 1517 | 1337 | 1057 |
| Total supply | 3418 | 3684 | 2942 | 2381 |
| Domestic consumption of identifiable hardwood | ca (3400) | (3660) | 2918 | 2332 |
| Exports | — | — | 24 | 49 |

Note: (1) converted from $m^3$(sawnwood) by dividing by 0.6.
(r) roundwood volume equivalent.

*Other important features*

Woodland size

Thirty-nine per cent (295,000 ha) of all broadleaved woodland consists of small, predominantly farm woods of less than 10 ha. Small size tends to magnify costs and depress returns in growing timber but, if anything, enhance environmental importance as a landscape feature.

Farm woods and hedgerow trees

According to the Peart report (MAFF 1985) about one farm in five has woodlands. The total area amounts to 276,000 ha of which 216,000 ha are in England and Wales. For farms with woodland the average area is about 6 ha/farm but not often all in one block.

Hedgerow trees are an important non-woodland source of hardwood timber which, along with small woods less than 2 ha, contribute about 20 per cent of the total output in Britain. The total resource of non-woodland trees, clumps $<$ 0.25 ha and hedgerow trees amounts to 25 million $m^3$ (Table 1).

Relative neglect

A substantial proportion of broadleaved woodlands as well as the area of scrub (Table 1) are a neglected asset. This is particularly true of many farm woodlands. Neglect arises more from not knowing how to manage and not knowing the potential value of woodland rather than inherently poor quality; indeed very few areas looking like woodland have no utilisable value.

Environmental importance

Britain's broadleaved woodlands are an immensely important environmental asset as a landscape feature, for amenity, in wildlife conservation and in providing cover for country sports notably hunting and shooting. These factors, though often curtailing the maximising of economic timber production potential are features which must be accepted but which, with care, can be turned to advantage of both the woodland owner and the public.

Two important texts dealing with conservation and traditional woodland management in Britain of great relevance to broadleaves are Rackham (1980) and Peterken (1981).

## Use of Exotic Species

Coniferous afforestation in the last 70 years has been dominated by use of exotic species — spruces, pines and larches — but in broadleaved forestry introduced species have found limited usefulness, as Figure 2 illustrated, apart from the long naturalised sycamore and sweet chestnut. Red oak (*Quercus rubra*) and Norway maple (*Acer platanoides*) have been planted intermittently but never to the extent found elsewhere in NW Europe. Exotic alders (grey, Italian and red) all have a minor place on industrial wastes, calcareous soils and in upland forestry respectively. Use of poplars and willows is restricted to certain clones for disease control reasons.

Southern beeches (*Nothofagus*)

This genus has been evaluated extensively in the last ten years because of the potential of *N. procera* and *N. obliqua* for very fast growth, up to Yield Class 20, attractive appearance and value for wildlife — more insect species have been found associated with these species, despite their recent introduction (early 1900s), than most native broadleaves except the oaks.

The main obstacle to more extensive use of southern beech is proneness to winter cold damage when temperatures fall below –15°C for long periods. There is evidence of some variation in hardiness and vigour among provenances (Potter 1987): Cautin and southern Malleco for *N. procera* and *Llanquihue* for *N. obliqua* appear the best Chilean sources but for both species collections from stands just inside Argentina are also promising. Home collected seed from earlier introductions generally performs well.

Eucalypts

This very large genus has also recently been evaluated systematically (Evans, 1986) and, apart from the favoured western seaboard only two species' groups are hardy enough to survive British winters — *E. gunnii* ssp *gunnii* from central Tasmania and *E. pauciflora* ssp niphophila and ssp *debeuzvillei* from above about 1400m altitude in SE Australia. The 'gunnii' group exhibit fast growth and tolerance of a wide range of sites and may have some biomass or pulpwood potential in the long term.

## ESTABLISHMENT

Natural regeneration

Most broadleaved stands are regenerated by planting but opportunity is taken to use natural regeneration when present — most notably sycamore, ash and birch. Oak and beech will regenerate naturally but the infrequency of good mast years has deterred widespread use of this system. The new broadleaves policy and the opportunities afforded by tree shelters should lead to greater use of natural regeneration.

Coppice

Coppice was once an almost dominant regeneration system but its practice is now largely confined to sweet chestnut. About 19,000 hectares are commercially cultivated in SE England, and some small areas of mixed coppices, hazel and hornbeam. The practice is seeing something of a revival for wildlife conservation, resurrection of traditional management and for firewood production.

Treeshelters

Without doubt an important recent advance in broadleaved silviculture is the development of treeshelters (Tuley, 1985). From an experiment with just 40 in 1979 many millions are now used every year to aid establishment.

The treeshelter, a transparent or translucent plastic tube generally 1.2m tall, fully protects the newly planted tree (or naturally regenerated seedling) from small mammals, livestock and deer. Taller treeshelters are needed for protection against fallow and red deer, and especially strong ones in fields with cattle. The tree's planting position is clearly identified for easy inspection and weeding. Weeding can be with herbicide without risk of harm to broadleaves because the tree is fully enclosed.

Improved initial growth, especially in height, is frequently observed typically a doubling in the first two or three years. It is not uncommon for oak to produce annual increments of 40-60cm while in a treeshelter.

Some problems have developed as treeshelter designs have evolved but most now are overcome and the current recommendation is that they are suitable for establishment of all species and should be left around the tree until they disintegrate naturally (Evans and Shanks, 1986). The cost of the treeshelter technique, about £1 in total for treeshelter, stake and plant, limit their use in conventional forestry to establishment of areas less than about two hectares. For larger areas at spacings of 3m or less, it will generally be cheaper per hectare to protect by fencing.

### Good weed control

The other significant advance in establishment is the recognition, especially for broadleaves, that good weed control means killing competing weeds not just preventing them overtopping the young trees. Competition for moisture and nutrients, especially by grasses in early summer, can severely restrict growth. Rigorous weed control by mulch or herbicide, to a distance of at least 60cm around newly established trees, repays handsomely in improved survival and growth — the mown lawn environment appears to be one of the most stressful for young trees!

## Emphasis on Quality

Unlike coniferous forestry maximising volume production is less important than growing highest possible quality of crop; so many features of broadleaves can downgrade quality — stem form, branchiness, timber defects, pests and diseases. Ensuring top quality has many aspects and only brief comment can be made of the main ones.

### Site selection

Sheltered sites, of moderate fertility to encourage good stem form, are ideal for most broadleaves but it is now clear that many wood defects, shake in oak and possibly discolouration in ash and beech and mineral streak in wild cherry are at least partially site related. One current recommendation is to avoid planting oak for timber production on light, freely-draining soils where risk of shake is now known to be high.

### Seed sources

In addition to what was mentioned under exotics, it should be noted that seed for oak and beech to be grown for timber production should, under EEC regulations, come from registered stands of pure species and good form. Unfortunately there has been little progeny testing of such stands or, indeed, evaluation of different provenances of these species. What has been done suggests that for oak a good local seed source is likely to be amongst the best that can be used and that for beech many continental origins are better than local stands with Forêt de Soigne, Belgium being markedly superior.

Adequate stocking

The new broadleaves policy insists that to attract full grant support broadleaves are not planted at spacings greater than 3m apart when establishing a timber crop. This blanket requirement has two silvicultural reasons. First, most broadleaved stands show notorious variation in stem form with only a few trees being straight and light-branched: initial stockings in excess of 1,000 per hectare provide some degree of choice and selection to achieve a reasonably good final crop though this number is far below the many thousands per hectare from which our best crops have traditionally been grown. Secondly, some species, but most notably oak, benefit from side shelter to help upward growth and suppress heavy branch development. Very wide spacing leads to open, rounded crowns and generally a less well developed central axis.

This 3m rule is essential in establishing bare ground but on former woodland sites other regrowth, from coppice, or in-growth of willows, birches, elder etc., can provide the necessary side shelter though obviously it will not substitute for adequate numbers for three crop selection unless desirable species such as sycamore or perhaps lime come up in the regrowth.

Cleaning and protection

The forester's job is to intervene in the life of his crop to ensure that the best trees are favoured and not harmed. Cleaning woody regrowth and climbers remains essential on some sites, especially former woodland and on calcareous soils and heavy clays.

Protection of broadleaved woodlands after establishment concentrates on preventing damage from squirrels and rabbits and from damage by farm livestock. Squirrels are especially damaging to thin-barked species such as beech, sycamore and oak; control is quite practicable by a number of means but does require concerted effort in a locality by all woodland owners.

Early final crop selection

Thinning is a powerful tool to manipulate stand composition. In broadleaved silviculture it should always be directed to favouring the best formed stems of desirable species. An aid to this is to mark such stems in advance, perhaps choosing 300-400 per hectare just prior to first or second thinning, and then favouring these in a selective, partial crown thinning. Thinning intensity has been the subject of much research, in particular the use of free growth where a few well-formed trees are given complete crown freedom to accelerate diameter increment. Such thinning achieves this benefit at the expense of some lost volume per hectare but the silviculture is not yet widely advocated for oak, the main species under investigation, owing to continuing problems over controlling epicormic branches. Regular selection thinning is the key to developing a fine broadleaved stand.

### Pruning

Singling of stems in the immediate post-establishment phase, and pruning of side branches up to about 5m is still fairly widely practised on private estates. Both operations encourage good stem form. Control of epicormics on oak is under active research (Evans, 1987) but so far no readily applied control method is available though there is a suggestion that season of thinning does influence epicormic emergence (Wignall *et al.*, 1987). The conventional silviculture of very long rotations, light, infrequent thinning and encouragement of an understorey will, of course, limit the problem.

### Felling

Having taken pains to grow a fine stand it unfortunately remains much easier to inflict severe damage to broadleaves by bad felling practices than to conifers with their much tighter crowns. Care is needed to avoid felling in a way which stresses the stem causing it to crack as it hits the ground: typical faults are for the trunk to fall across an already felled log, a rock or stream/gully or for one of the tree's large limbs to hit the ground first.

## Policies and Grants

In October 1985, in recognition of the many values of broadleaved woodland and the need to encourage further planting and better management of woodland, the British government announced a new Broadleaved Woodland Grant Scheme. The scheme, with attractive rates of grant support for both planting and natural regeneration, is only for establishing pure broadleaved crops and conduct of operations in accordance with Management Guidelines for Broadleaved Woods. These guidelines and the scheme were the result of five years of increasingly greater political interest in broadleaves — House of Lords Select Committee report (1980) Broadleaves in Britain symposium (1982) Broadleaves in

Britain discussion paper (1984) — and were finally hammered out between the timber industry, the Forestry Commission, professional foresters, and countryside and conservation interests to achieve compromises and balance between the sometimes competing objectives, and the attendant silviculture, of production, conservation and amenity. The guidelines and operation of the grant scheme are currently under review but in their first two years have been successful in encouraging more planting of broadleaves.

Grant support for broadleaved establishment varies according to size of area, as with other forestry support grants, but currently ranges from £600 to £1,200 per hectare paid in instalments over the first 10 years.

## Concluding Remarks

This paper has skated over a large subject, has tended to concentrate on silviculture, and necessarily omitted many topics such as selection and improvement of broadleaves, the possible benefits of nitrogen fertilising of ash or of phosphate on sweet chestnut coppice; silvicultural systems to encourage natural regeneration and whole subjects such as ancient woodlands, landscape conservation, and farm woodlands and agroforestry. Nevertheless, it is hoped that the above will indicate not only what British foresters believe important in good management of broadleaves but that once again, after neglect during the upland afforestation era, broadleaved forestry is itself important.

## REFERENCES

EVANS, J. 1984. *Silviculture of Broadleaved Woodland.* Forestry Commission Bulletin No. 62. HMSO.

EVANS, J. and SHANKS, C. W. 1986. Tree shelters. *Research Information Note* 86 SILS Forestry Commission.

EVANS, J. 1986. Reassessment of cold-hardy eucalypts in Britain. *Forestry 59* (2), 223-241.

EVANS, J. 1987. Epicormics and their control. In: *"Advances in Practical Arboriculture".* Forestry Commission Bulletin No. 65. HMSO.

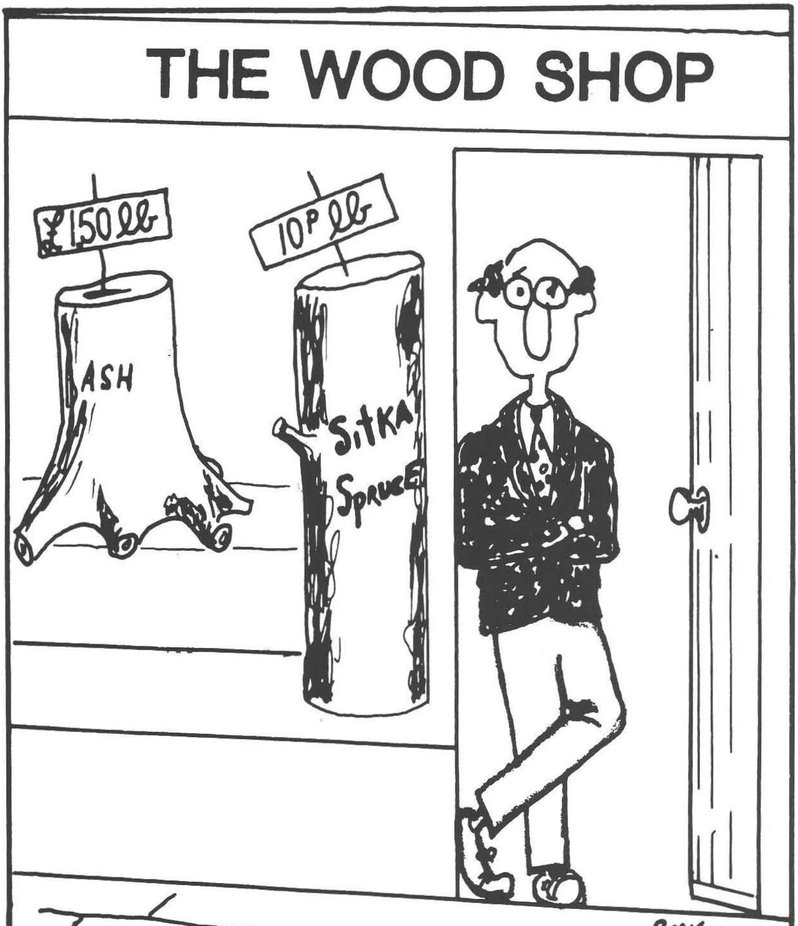
MAFF, 1985. Woodland as a farm crop. Working Group of MAFF, DAF Scotland. Welsh Office. Forestry Commission. Aug. 1985.

MacBRIDE, S. 1985. A world afforestation policy. In: *"The Forest Connection".* Proc. World Food Day Symposium, GORTA 26-28.

PETERKEN, G. 1981. *Woodland conservation and management.* Chapman and Hall.

POTTER, M. J. 1987. Provenance selection in *Nothofagus procera* and *N. obliqua. Research Information Note* 114/87 SILS Forestry Commission.

RECKHAM, O. 1980. *Ancient Woodland*. Edward Arnold.
TULEY, G. 1985. The growth of young oak in shelters. *Forestry*, *58* (2), 181-195.
WIGNALL, T., BROWNING, G. and MacKENZIE, K. A. D. 1987. The physiology of epicormic bud emergence in Pedunculate oak (*Quercus robur* L.). Response to partial notch girdling in thinned and unthinned stands. *Forestry*, *60* (1) 45-56.



# The French Approach to Broadleaved Silviculture

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## ABSTRACT

French forest land covers one quarter of the country (14 million hectares). Broadleaves represent two-thirds of this area, with oaks (34% of the total area) and beech (15%) as major species. When possible, oak silviculture aims at producing high quality wood which is obtained through a long (more than 200 years) and patient management. Such management incorporates within it the most recent understanding from science and the requirements of modern economic needs.

Beech is considered a good afforestation and reforestation species in many areas including alkaline soil. No more than 100 to 120 years should be needed to produce trees with an improved wood quality as compared with present and rather conservative management techniques.

For both these species, planting may have to replace natural regeneration. A strategy for future afforestation with broadleaves is discussed. It involves short and long lived species, industry wood and timber production, and use of a series of common or high wood quality species.

## INTRODUCTION

Forest land covers a quarter of France (14 million hectares). Broadleaved forests represent two-thirds of this area. They are mainly composed of oak (34% of total forest land) and beech (15%) (Direction des Forets, 1967). Most aspects of the present management of broadleaved stands have been defined more than a century ago, thanks to the "méthode française" which was built up together with our German neighbours (Parde, 1986). Since that period it has been adapted to modern economic trends.

Therefore even-aged stands tend to be favoured against more versatile but certainly more labour consuming types of stand managment, like coppice and coppice with standards.

Management methods aim at producing a high quality wood which is the only product that will withstand all economic changes and all "hiccups" of history.

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In this paper information will be given on:

— silviculture of high yield class oak in Central France

— modern trends in beech silviculture.

In the conclusion, a strategy for the future is proposed for broadleaved production.

## A Case Study — High Forest Oakstand Management

### (1) With natural regeneration

Several oak species grow naturally in France (Becker *et al,* 1982):

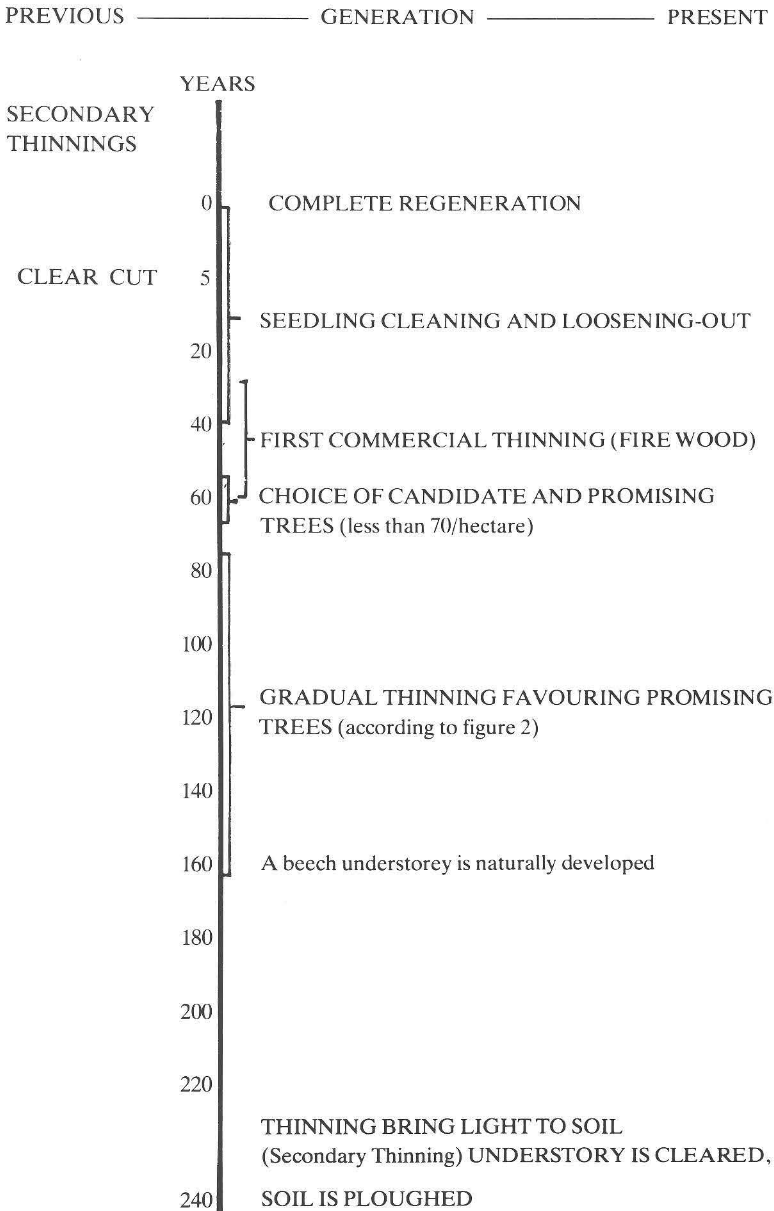
*Quercus cerris* L.
*Quercus coccifera L.* = Kermes oak
*Quercus suber L.* = Cork oak
*Quercus robur L.* = *Q. pedunculata* Ehrn. = pedunculate oak
*Quercus pubescens* Willd=durmast oak
*Quercus rubra L.* = *Q. borealis* Michx = American red oak
*Quercus petraea* (Mattuschka) Liebl = *Q. sessiliflora* Salisb. = sessile oak
*Quercus pyrenaica Willd.* = *Q. toza* Bast.
*Quercus ilex L.*
*Quercus virgiliana* (Ten.) in eastern Corsica.

The major species are pedunculate and sessile oak which the modern oak stand management generally refer to. The introduction of the American red oak and its present extension in reforestation should also be mentioned.

An example of French oak management will be given. It refers to methods currently applied in Central France which is the primary region for the production of oak veneer. The State Forest of Blois stands on a fertile soil with a mild climate and an evenly distributed rainfall. This distribution, leading to a deficit during summer, has a major consequence on wood quality. Growth rings are mostly composed of spring-wood which shows the best veneer quality of homogeneity, tenderness, low density, low shrinkage and with growth rings of 1-1.5mm (Lanier, 1986).

The main stages of oak stand management of Blois State forest are summarised in Figure 1. The natural regeneration is usually easy to obtain with an average good oak-mast every fourth year with lighter ones intervening. Therefore the period between seeding, thinning and clearfelling of the mature stand is generally rather short (5 years), whereas in other regions it is longer but should never exceed 10 to 15 years (Lanier, 1986), to bring full light to the

**Fig. 1:** A 240 year rotation in an oak stand.




Goal: 70-80 trees/hectare with dbh = 80cm.

seedlings. Thinning of seedling thickets may have to be rather severe and should be in favour of straight thin-branched trees. First commercial thinning for firewood or fence-poles may occur as early as 30 to 50 years after regeneration. Around year 60 promising trees are located and identified. If possible they should be evenly spaced (12 x 12 to 13 x 13m). During all subsequent thinnings most of the forester's attention will be paid to these trees while at the same time keeping in mind that their choice may have to be changed if any unexpected event should occur: disease, wind-damage, forking, etc.

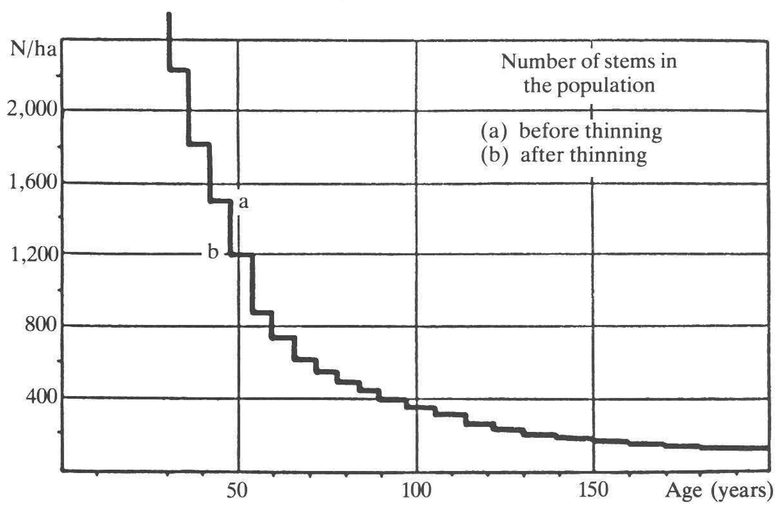
Experience has shown that absolutely pure stands do not look as healthy, and never re-generate as readily, as mixed stands. Therefore, high yield class oak stands should accept a certain percentage of a beech (or hornbeam in other regions) understorey.

At the end of the rotation, obtained after gradual thinnings (Figure 2), the stand contains 70 to 80 trees per hectare, including beech, with a 80cm dbh.

Modern silvicultural techniques show that a rapid regeneration can be obtained through understorey clearing and soil ploughing immediately after the seeding thinning. This will help bring acorns in close contact with soil and so will ensure a high germination.

A careful use of selective herbicides may be necessary where brambles or certain grasses tend to compete with seedlings for light.

**Fig. 2:** Gradual reduction of oak stand density with age. From Lanier (1986). N/ha = number of trees per hectare.



WITH PLANTATION

The high sale price of quality oak wood (more than 6,000 French Francs per standing cubic metre of prime log) and its price stability through all economic changes would suggest that foresters develop more oak stands when possible. Planting is therefore needed.

Most authors recommend planting 4,000 to 5,000 seedlings per hectare but many foresters recommend planting at even higher density. Different solutions are proposed:

*Management and harvest paths.* Frequent access to all parts of stands, especially when mechanisation is considered, will result in seedling damage and soil compaction unless such movement is limited. Therefore management and harvest paths are opened every 30 to 50 metres and kept in good maintenance until the next regeneration. Such paths do not have to be planted.

*Patch Planting.* In this method all trees of each patch, except one, will be thinned out. Therefore the number of patches should be roughly the same as the number of trees remaining at the end of the rotation. If each patch consists of 50 seedlings planted at a distance of 1 x 1 metre, 100 such patches will need roughly 5,000 trees per hectare. But there are several disadvantages in this method.

— high maintenance cost of unplanted area.
— strong competition by existing vegetation around patches if not controlled.
— low choice of selection in each patch: one tree in every 25 if outer rows are not considered.
— not adapted to slopes.

*Strip planting.* This involves 3 to 4 row strips of trees planted 1 x 1 metre spacing, with 9 metre unplanted strips. This leads to a distance of strip axis of 13 metres. The local density within strips remains at 10,000 per hectare whereas the general density is as low as 3,000 per hectare. This method has advantages and disadvantages:

— reduction of planting cost.
— greater choice within strips than with patches,
but
— enormous border effects.
— high maintenance cost of unplanted strips.

*Mixed planting.* The ideal solution would be to interplant strips (or patches) with trees or let the local tree and shrub vegetation develop and cover unplanted area. The difficulty is to find species which will not overgrow oak trees.

CONCLUSION

Any oak reforestation scheme should first consider species and provenance according to site and climate. Pedunculate oak is considered more flexible than sessile oak for climate but more demanding for soil. The former prefers fertile and moist soil with clay and sand, it withstands alkaline soils but should be replaced by the latter when soil becomes acid, dry or poor. (Becker *et al,* 1982). Good and updated information on silviculture may be found in a recent publication by Louis Lanier, Professor of Silviculture in Ecole Nationale du Génie Rural des Forêts, in Nancy (Lanier, 1986).

SILVICULTURE OF BEECH (*Fagus sylvatica L.*)

Beech is the second most important and most common broadleaved species in France. Its ability to accommodate many types of climate and soil, including alkaline soils, makes it a suitable species in reforestation and afforestation. Unfortunately its wood never reaches as high a sale price as oak.

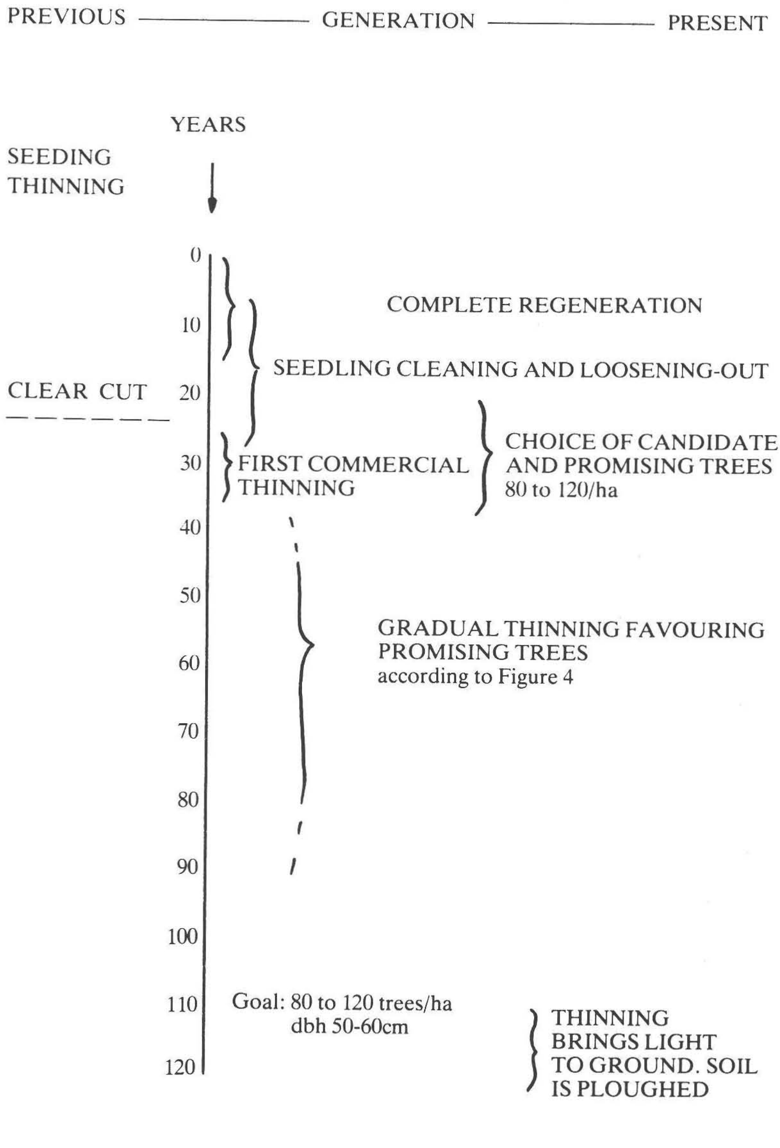
Different books have been devoted to this very important European hardwood: "Fagul" in Romania, "die Rotbuche" in Germany and, more recently "Le Hêtre" in France (Milescu *et al,* 1967; Schober, 1972; Teissier du Cros *et al,* 1981).

Many factors tend to prove that beech silviculture should be vigorous and stands should be submitted to shorter rotations than the current French average, which is generally 140 to 150 years. Authors suggest that rotations should not exceed 100 to 120 years through earlier and more vigorous thinning, leading to wider crowns, wider growth rings, lower wood density, and less internal wood constraints.

The main stages of beech stand management are summarised in Figure 3. A complete natural regeneration is seldom obtained unless one waits for 10 to 20 years, except in medium to high elevation areas and on slopes. Since beech does not suffer when covered by the canopy of the previous generation it is possible to keep it sheltered against excess of light and frost damage. This characteristic is probably the only important difference between oak and beech stand management. Therefore, no details will be given on this management which is considered classical in many Central and West European countries.

Beech may also be planted. In France planting is done to fill in incomplete natural regeneration. Planting is also done in reforestation programmes (1,000 to 1,500 ha a year). In this process, provenance choice is very important. Provenances with specific soil adaptation (Teissier du Cros and Lepoutre, 1984), late

**Fig. 3:** A 120 year rotation in a beech stand
(from Teissier du Cros *et al.*, 1981)



flushing and high vigour (Teissier du Cros and Thiebaut, 1986) are required. To avoid genetic pollution and degeneration, provenance transfer should be limited to areas far from natural beech stands, which is very rare in this country. Therefore local provenances will be preferred until provenance tests produce valuable results.

Planted beech trees, especially those planted at wide spacing and in fertile soils, tend to be forked (Dupre *et al*, 1986). This habit is probably partly related to polycyclism (Lammas-shoot) (Dupre *et al*, 1985). Therefore it is suggested to plant beech trees at a local density of at least 10,000 per hectare. As for oak, different planting schemes have been studied. But beech has the advantage of withstanding competition for light (which will improve its form). So, when possible, it is suggested to plant beech in strips with oak or with faster growing light demanding species such as wild cherry, ash, maple and others.

Naturally, regenerated or planted beech stands are thinned according to different schemes. However, French habits, which are certainly very conservative, have to be changed and should take into account the very valuable information available from northern European experience with beech siluvculture, showing that shorter boles and wider crowns may be obtained with earlier thinning and shorter rotations (Figure 4).

## Strategy of the Future

Large scale planting of long rotation species are certainly not advisable if intermediate incomes are needed.

Figure 5 shows a very simplified afforestation scheme which can be proposed to any management unit of at least 20 to 50 hectares. It involves a large number of species and should be adaptable to a broad range of site conditions.

*Short rotation intensive forestry* is studied in many West European countries including Ireland. It has the advantage of being easily introduced on abandoned farmland and it should bring early incomes. Species involved are mainly willows and poplars. But the production is only oriented towards industry and should therefore be concentrated within a short distance of area of utilisations.

*Timber producing poplar*. Poplar cultivation is a tradition in most parts of temperate Europe. It is usually a very intensive system. It includes wide spacing, soil maintenance, fertilisation and pruning. Several outstanding clones have been released by research institutes in the Netherlands, West Germany, Belgium and Italy. Many of those are well adapted, disease resistant and vigorous. Rotations are variable being 12 to 15 years in Southern France, up

**Fig. 4:** Gradual reduction of beech stand density with age (Lanier 1986).

- - - - - 1=traditional in Normandy

— - — 2=according to Schober, class 1, yield tables

—— - 3="Danish" silviculture

▬▬ 4=possible silviculture in France with choice of candidate and promising trees

↓ =clearcut

APS =promising trees

APS+P =candidate trees chosen at age 50

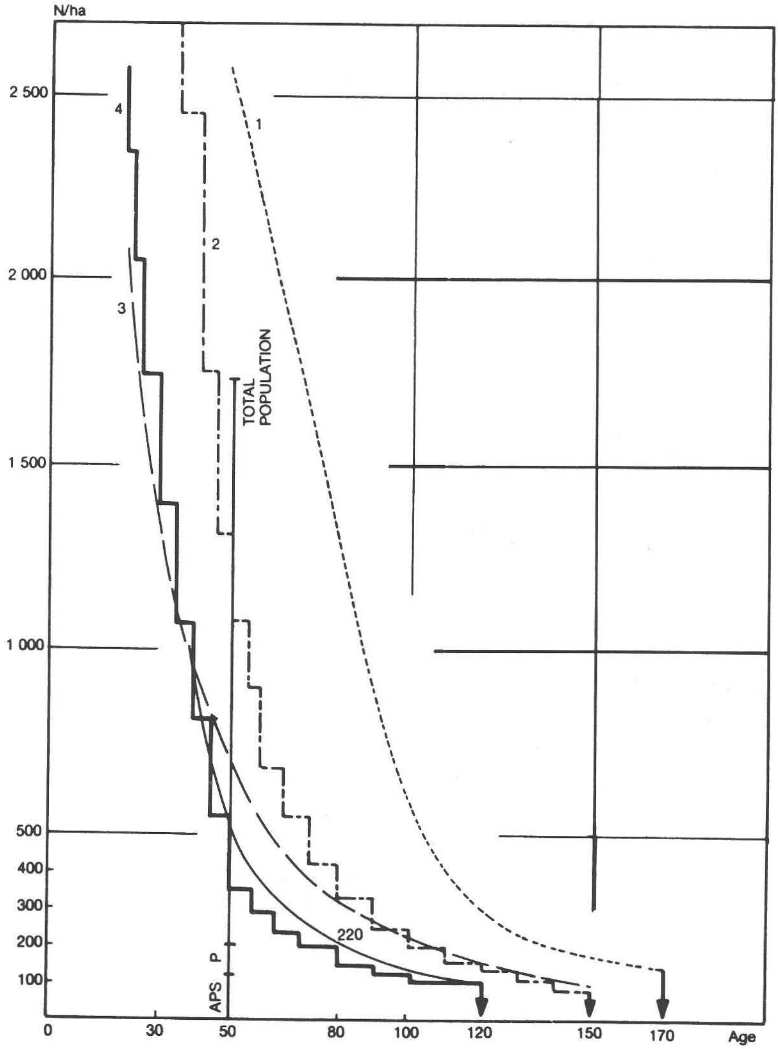


**Fig. 5:** A strategy for the future (SRIC = Short rotation intensive culture)

| Industry wood → | | | | |
|---|---|---|---|---|
| | ← Timber → | | | |
| Willow | Poplar | Mazzard | Beech | Oak |
| | | Maple | American red oak | |
| (SRIC) | | Ash | | |
| | | Yellow poplar | | |
| 5-10 years | 20-30 years (70 in GFR) | 50-80 years | 120 years | 200 years |

to 25 years further north, but also up to 70 years with black cottonwood in Germany in beech stands partly damaged by tornadoes.

*High wood quality* may be produced with certain broadleaves in 50 to 80 years. French improvement and culture studies concern wild cherry (*Prunus avium*), yellow poplar (*Liriodendron tulipifera*), waved grained maple (*Acer pseudoplatanus*) and hybrid walnut (*Juglans nigra x regia*).

*Medium to long rotations* are needed for the production of beech, American red oak, pedunculate oak and sessile oak. Improvement studies of beech and American red oak were initiated in France over 10 years ago. First results are now becoming available. But little is known of the variability of Pedunculate and Sessile oak. Different studies including isozyme variability and provenance studies have recently been initiated.

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## REFERENCES

BECKER, M., PICARD, J. F. and TIMBAL, J. (1982). Larousse des arbres, des arbustes et des arbrisseaux de l'Europe occidentale. Librairie Larousse. Paris. 331p.

DIRECTION DES FORETS (1967). Les Français et leur forêt. Paris. 127p.

DUPRÉ, S., THIEBAUT, B. and TEISSIER du CROS, E. (1985). Polycyclisme, vigueur et forme chez de jeunes hêtres plantés (*Fagus silvatica* L.). Revue Forestière Francaise Française 37 (6) 456-464.

DUPRÉ, S., THIEBAUT, B. and TEISSIER du CROS, E. (1986). Morphologie et architecture des jeunes hêtres (*Fagus silvatica* L.). Influence du milieu, variabilité génétique. Ann. Sci.For. 43 (1) 85-102.

LANIER, L. (1986). Précis de sylviculture. E.N.G.R.E.F. Nancy. 468p.

MILESCU, I., ALEXE, A., NICOVESCU, H. and SUCIU, P. (1967). Fagul. Ed. Agros-Silvica. Bucarest. 581p.

PARDE, J. (1986). Naissance et dévelopement d'une sylviculture européenne commune. Annales de Gembloux. 92. 87-110.

SCHOBER, R. (1972). Die Rotbuche. Saüerländers. Frankfurt. 333p.

TEISSIER du CROS, E. and LEPOUTRE, B. (1984). Soil provenance interaction in Beech (*Fagus silvatica* L.) Forest Science 39 (2) 179-185.

TEISSIER du CROSS, E., LE TACON, F., NEPVEU, G., PARDE, J., PERRIN, R. and TIMBAL, J. (1981). Le Hêtre. Institut National de la Recherche Agronomique. Paris. 613p.

TEISSIER du CROS, E. and THIEBAUT, B. (1986). Beech variability studies in France. Further results. IUFRO Project Group. Beech improvement and silviculture. Ljubljana. Yugoslavia. 7p.

# Broadleaves in Ireland

## Can Broadleaves give adequate financial returns?

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### INTRODUCTION

The following paper describes briefly the existing stock of broadleaf forest in the Republic of Ireland, with particular emphasis on the area owned by the state, for which detailed information exists. It is shown that the nature of the broadleaf estate indicates that financial considerations were not paramount in the decision to plant broadleaves. The question of whether or not broadleaves can be grown at a profit is examined.

### THE GENERAL PICTURE

Broadleaves are not a major element in Irish forestry. Though they are common in hedgerows, which gives many parts of the country the appearance of being reasonably well wooded, stands of broadleaves represent only about 0.5% of the land area. There are two main sources of information on broadleaf woodlands in the Republic of Ireland: the 1973 Inventory of Private Woodlands and the 1978 Forest Service Inventory. Together these give a comprehensive picture of the situation up to around 1970, as outlined in Table 1.

**Table 1:** Broadleaf High Forest (ha)

| Private | State | Total |
|---|---|---|
| 33,000 | 11,000 | 44,000 |

The figure for Private Forests represents 62% of the total area under high forest on private land, whereas the area of state forestry under broadleaves is 3% of the estate. The total area of broadleaf high forest is 9% of the forested area in the country.

Table 2 gives the details by age class of both state and private broadleaf woodland.

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**Table 2:** Areas in Thousands of Hectares

| | Age Class | Private | State | Total |
|---|---|---|---|---|
| pre | 1900 | 19.9 | 3.9 | 23.8 |
| | 1909 | 1.7 | 0.1 | 1.8 |
| | 1919 | 1.2 | 0.1 | 1.3 |
| | 1929 | 2.0 | 0.1 | 2.1 |
| | 1939 | 3.4 | 1.1 | 3.5 |
| | 1949 | 3.2 | 1.4 | 4.6 |
| | 1959 | 1.2 | 1.7 | 2.9 |
| | 1969 | 0.2 | 1.4 | 1.6 |
| post | 1970 | 0.2 | 2.2 | 2.4 |

Much of this area is overmature; two-thirds of the private and one-third of the state woodlands were planted before the turn of the century. As state plantation started after that time much of the existing state broadleaf woodland has been acquired rather than planted. The slight increase in state planting of broadleaves since 1920 only mirrors the general increase in afforestation, though very recently the amount of broadleaves planted has risen to 5% of total, from about 3% in 1970.

Table 3 gives the breakdown, by species, of the broadleaf high forest in 1970, both state and private.

**Table 3:** Broadleaf High Forest (ha) (by dominant species).

| | | | |
|---|---|---|---|
| Oak | 10,600 | Sycamore | 3,400 |
| Beech | 10,600 | Elm | 1,700 |
| Ash | 6,500 | Alder | 1,500 |
| Birch | 5,200 | Other | 1,700 |

Virtually every commercial species that will grow in Ireland has been planted somewhere at some time, but a small number dominate.

*The Forest Service Broadleaf Woodlands*

The Inventory of private woodlands involved an element of sampling; more comprehensive statistics are available for the Forest Service estate. Table 4 gives a breakdown of four of the major species.

**Table 4:** Broadleaves in state woodlands.

| Status | No. of Stands | Area (ha) | Average Stand size |
|---|---|---|---|
| OAK | | | |
| High Forest | 1175 | 2460 | 2.1 |
| (Pure | 554 | 1120 | 2.1) |
| (Dominant | 621 | 1340 | 2.2) |
| Second Species | 1166 | 2654 | 2.3 |
| TOTAL | 2341 | 5114 | 2.2 |
| BEECH | | | |
| High Forest | 1582 | 2760 | 1.7 |
| (Pure | 422 | 770 | 1.8) |
| (Dominant | 1160 | 1990 | 1.7) |
| Second Species | 1599 | 2968 | 1.9 |
| TOTAL | 3181 | 5728 | 1.8 |
| ASH | | | |
| High Forest | 630 | 1027 | 1.6 |
| (Pure | 177 | 234 | 1.3) |
| (Dominant | 453 | 793 | 1.8) |
| Second Species | 806 | 1567 | 1.9 |
| TOTAL | 1436 | 2594 | 1.8 |
| SYCAMORE | | | |
| High Forest | 196 | 259 | 1.3 |
| (Pure | 55 | 79 | 1.2) |
| (Dominant | 141 | 180 | 1.3) |
| Second Species | 214 | 355 | 1.7 |
| TOTAL | 410 | 614 | 1.5 |

As is clear from the figures, more broadleaves appear in mixtures than in pure stands. The statistics for the other broadleaf species present a similar picture. Thus the major part of the broadleaf estate is in mixtures.

For example, in the case of Sycamore it is pure on only 69 ha and it is dominant in mixtures with 16 other species. There are also 214 stands where sycamore is the second species in mixture with 18 different dominants. That gives a total of 35 mixture types in just 400 stands. In regard to other species certain mixtures of the major species are more common than others, such as oak/ash, oak/beech and ash/Norway Spruce, but the overall picture is one of great diversity.

The management approach to broadleaf silviculture is localised and variable. There is no reliable information available on the yield of these broadleaf plantations and the quality of the stands is frequently poor. In all, management of broadleaves has been poor and unclear in direction.

*Financial Considerations*

Can broadleaf species be grown to give a financial return?

To calculate this, various assumptions have to be made regarding the elements of economic analysis. They are

1. What interest rate is to be used, if any.
2. Yield: in terms of volume, quality and timing.
3. Establishment costs.
4. Other costs throughout the rotation.
5. Timber price.

In relation to interest, a range of rates can be tested: yields can be estimated using yield tables and establishment costs depend on techniques used. Timber price, however, can only be guessed. For this reason, the procedure followed in the present analysis is to make assumptions regarding the first four items above and then show what price per cubic metre would be required at clearfelling to break even financially.

(i) INTEREST RATE

Given that the question of the correct interest rate to use for relatively short rotation coniferous forestry has never been satisfactorily resolved, it is difficult to know what interest rate should be applied to rotations in excess of 100 years. At present 4% is generally deemed an acceptable return on forestry investment in Ireland, and is the interest rate most commonly used to compare silvicultural alternatives. This is much lower than the interest rates on recent borrowings, but it is justified on the basis of an examination of the historical return on investment in the economy over a period of decades. Perhaps such an argument could be extended to cover much longer periods and that an even lower rate be justified. Many advocates of planting broadleaves argue that no interest rate at all should be applied — and a system similar to the German should be used: that is, if income from the forest as a unit exceeds expenditure each year the forest is considered profitable. There are two difficulties with this approach.

(i) In Ireland, as we have seen, there is very little existing woodland, and new state planting is currently funded on money borrowed at high interest rates. This is true even if the money is nominally raised from sales of timber or other assets, because funds realised from such sales could be used to reduce the state borrowing requirement rather than be reinvested in forestry.

(ii) Without the use of any interest rate the comparison of different silvicultural practices is difficult. For example, an investment of £1,000 to give a return of £1,100 in 100 years time could be considered more profitable than an alternative silvicultural practice which would yield £1,099 in two years, assuming the second investment cannot be repeated within the 100 years. This analogy is not as far-fetched as it might at first seem. If it is decided to spend money treating a 150 year old oak stand to produce high quality veneer at age 250 rather than felling its already valuable trees, this is the sort of comparison that is being made.

The use of zero interest rate is justifiable only where there is no choice, as in cases where the money from a standing crop must be reinvested in planting of a certain species, in a fixed way, to produce a specified product.

As this is not the case in Ireland, a range of interest rates are used in the analysis.

(ii) YIELDS

The British Forestry Commission yield tables are used. Two clearfelling times are considered. They are age of maximum mean annual increment (MMAI) and normal felling age. The figures used for the four species to be examined in this analysis are:

| Species | Yield Class | MMAI (years) | Normal Felling Age |
|---|---|---|---|
| Oak | 4 | 90 | 160 |
| Oak | 6 | 80 | 140 |
| Oak | 8 | 70 | 120 |
| Beech | 4 | 105 | 130 |
| Beech | 6 | 95 | 120 |
| Beech | 8 | 80 | 110 |
| Sycamore/Ash | 8 | 45 | 70 |
| Sycamore/Ash | 10 | 40 | 65 |
| Sycamore/Ash | 12 | 40 | 60 |

(iii) COSTS

The establishment costs to be used in an analysis such as this can vary greatly. Factors which influence the results are:

— whether or not to include the price of land
— planting grants
— whether the planting is afforestation or reafforestation

— site difficulty
— need for protection (tree guards?)
— whether or not overheads are included

Many of these factors will vary with species. To simplify the analysis a range of establishment costs are taken, from £2,000/ha to £5,000/ha. It is assumed as a rule of thumb that the establishment costs represent 75% of total discounted costs. Thus an establishment cost of £3,000 gives a total discounted cost of £4,000/ha. Higher establishment costs are likely to represent a bigger proportion of total discounted costs.

(iv) PRICE

The present analysis seeks to determine the prices required at clearfelling to give an internal rate of return equal to the specified interest rate.

For thinnings a price/size curve has been assumed. It is the same price/size curve calculated from all state sales of conifers over the period 1974-1986, for trees with a mean diameter of 30cms or less at breast height. Thereafter a premium of £10/m$^3$ is added to the broadleaves. This is to allow for the relative increase in hardwood value at larger dimensions.

*Results*

Of the four species examined, oak, ash, beech and sycamore, tables 5 and 6 below present the best results of the crops examined (Sycamore YC 12) and the poorest (Beech YC 4), assuming clearfelling at age of maximum mean annual increment.

**Table 5:** Sycamore Yield Class 12.

Amount required (IR£/m$^3$) at clearfelling to repay investment at a range of interest rates.

| Assumed Establishment Costs (IR£/ha) | Interest Rate 2% | 4% | 6% |
|---|---|---|---|
| 2000 | — | 30 | 102 |
| 3000 | 16 | 66 | 178 |
| 4000 | 32 | 101 | 254 |
| 5000 | 48 | 137 | 330 |

**Table 6:** Beech Yield Class 4.

| Establishment Costs | 2% | 4% | 6% |
|---|---|---|---|
| 2000 | 150 | 1190 | 9100 |
| 3000 | 230 | 1840 | 13580 |
| 4000 | 310 | 2450 | 18070 |
| 5000 | 390 | 3060 | 22550 |

The very significant impact of both establishment costs and interest rates are evident.

Tables 7 summarises the results for the four species, taking an assumed establishment cost of £4,000/ha.

**Table 7:** Price required (£/m³) at 2% and 4% by species and Yield Class. Clearfelling at age of Maximum Mean Annual Increment and normal clearfelling.

| | Price required (£/m³) at 2% MMAI. | | | | |
|---|---|---|---|---|---|
| **YC** | **4** | **6** | **8** | **10** | **12** |
| Oak | 300 | 150 | 90 | | |
| Beech | 310 | 155 | 95 | 60 | |
| Ash | | 350 | 95 | 60 | |
| Sycamore | | 350 | 95 | 60 | 30 |

| | Price required (£/m³) at 4% MMAI. | | | | |
|---|---|---|---|---|---|
| **YC** | **4** | **6** | **8** | **10** | **12** |
| Oak | 1,800 | 770 | 410 | | |
| Beech | 2,450 | 1,170 | 580 | 370 | |
| Ash | | 870 | 250 | 160 | |
| Sycamore | | 870 | 250 | 160 | 100 |

| | Price required (£/m³) at 2%. Normal Clearfelling Age | | | | |
|---|---|---|---|---|---|
| **YC** | **4** | **6** | **8** | **10** | **12** |
| Oak | 720 | 340 | 182 | | |
| Beech | 370 | 186 | 112 | 68 | |
| Sycamore | | 350 | 95 | 60 | 30 |

| | Price required (£/m³) at 4%. Normal Clearfelling Age | | | | |
|---|---|---|---|---|---|
| **YC** | **4** | **6** | **8** | **10** | **12** |
| Oak | 17,000 | 5,700 | 2,200 | | |
| Beech | 4,900 | 2,160 | 1,156 | 730 | |
| Sycamore | | | 385 | 245 | 150 |

## DISCUSSION

As has been shown the existing stock of broadleaves is scattered, mixed and not suitable for extensive management prescriptions due to its diversity. The quality of much of it is poor. Many of the stands are not intensively managed. However, it is well to remember that from an amenity point of view such diversity can be attractive. If, on the other hand, broadleaves are to be planted with the objective of producing quality hardwood the considerable cost involved should not be overlooked.

Of the species examined here, the higher yield classes of ash and sycamore may have a reasonable prospect of giving a return at 2%. The position of oak and beech is questionable in this regard — as it is not known whether these species will produce timber of sufficient quality to fetch high prices given the short rotations and low costs assumed in this analysis.

As the figures above have been calculated using both the estimated age of maximum mean annual increment and what is considered normal felling age, the dimensions at clearfelling are not large, compared to longer rotations. It is questionable whether this relatively small dimension hardwood would fetch prices anything like those required at the 2% interest rate.

To produce larger logs and better quality timber requires increased rotations and hence greater prices. To achieve the sort of quality timber which allows the best veneer oak in Germany to make over £10,000/$m^3$ requires expensive establishment, very high initial stocking and very long rotations.

To put those high prices in context, a stand of YC 6 Oak grown to 250 years of age and established at a cost of £5,000/ha would need to fetch £5,000/$m^3$ using a 2% rate of interest for every cubic metre, on all trees not just select trees only. At 4% the average price would have to be over £600,000/$m^3$! Even the best specimen trees appear unlikely ever to be worth that — yet that is the *average* price per $m^3$ which would be required at clearfelling.

Ultimately we must conclude that the decision whether or not to plant oak and beech cannot be taken on the basis of financial considerations where the rotation lengths are very long. It cannot be dogmatically stated that in the year 2250 the best quality veneer oaks will not be selling for these enormous prices, but it appears unlikely.

## REFERENCES

HAMILTON, G. J. and CHRISTIE, J. M. "Forest Management Tables (metric)" HMSO 1971, London.
Inventory of State Woodlands, 1978. Forest & Wildlife Service, Dublin.
PURCELL, T. J.
Forest & Wildlife Service, Dublin, 1979. Inventory of Private Woodlands, 1973.

# The Market for Irish Hardwood Timbers

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SUMMARY

An outline is given of the development of Irish hardwood forests and trade. The current situation concerning imports, exports, production and consumption is presented showing the impact of a low-level resource on the development of an indigenous hardwood industry. Details of British hardwood prices are given for comparison. The prospects of developing an Irish hardwood resource is considered.

## INTRODUCTION

Historical developments have materially influenced Ireland's role as a hardwood producing country. Even though hardwoods, especially oak, are the natural climax species, we have virtually no managed hardwood forests. From a hardwood forest cover of some 30% in the 15th century, agricultural expansion, land policy and social unrest as well as some industrial development succeeded in reducing this to 1.0% by the end of the 19th century.

In the reforestation programme, initiated at the turn of the century, all the emphasis was laid on the planting of softwoods so that no resurgence of hardwood forestry occurred. Although, at present, some 6% of the land is afforested, only 18% of that is under hardwoods. This amounts to about 50,000 ha (or less than 1% of the country) of hardwood forest. Even at a yield class of 4, the expected cut should be in the order of 220,000m$^3$ — however no more than about one-tenth of that volume reaches Irish sawmills annually.

## THE HARDWOOD TRADE

There has been a growing hardwood trade in Ireland over the past 400 years, initially in the utilisation and export of oak products, for building, cooperage, joinery and furniture and for the provision of bark for tanning and charcoal for smelting. With the opening up of foreign trade a steady growth in the import of hardwoods and hardwood products, has occurred, particularly those of tropical origin.

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By the early 18th century the greater part of the Irish woods had been cut and exports rapidly dwindled, to be replaced by imports, which in 1735 amounted to some £24,180, most of it softwood but including walnut and some tropical timbers (McCracken 1964). The trend of dependence on imports with a modium of exports persists to this day, in the hardwood industry.

Table 1: Value of import and export trade in hardwoods and hardwood manufacturers, 1983 and 1985.

| Category | Imports, £000 | | Exports, £000 | |
|---|---|---|---|---|
| | 1983 | 1985 | 1983 | 1985 |
| rough and sawn timber | 17936 | 20556 | 3181 | 4588 |
| veneers and plywood | 11339 | 9316 | 569 | 719 |
| manufactured goods, (excluding furniture) | 9816 | 10656 | 4123 | 3821 |
| hardwood furniture | 16479 | 22921 | 13997 | 15942 |
| Totals | 55570 | 63449 | 21870 | 25070 |

(CSO 1984 and 1986)

*Import/Export*

Table 1 summarises recent trade figures for import and export of hardwood timber and manufactures (CSO 1986). Imports exceeded exports due to a low level of home production of timber and at least 20% of the £20 million import of raw material could be supplied from Irish timber, were it available. The position of the furniture trade is interesting. It shows an export figure almost three-quarters of the import value. Considering that most of this is based on imported hardwoods, there could be a substantial improvement of balance of payments if we were in a position to provide our own raw material. It may not be easy to redress the disparity between import and export values of veneers and playwood so readily, because of the high cost of establishing such industries here.

An interesting comparison can be made between like timbers. Table 2 shows the import/export quantities and values of unprocessed tropical and temperate hardwoods for 1986 (CSO 1987). The bulk of imports were tropical hardwoods, which generally were cheaper than the temperate hardwood equivalents.

Table 2: Import/export of unfinished hardwood timber, 1986.

| Category | Imports | | | Exports | | |
|---|---|---|---|---|---|---|
| | MT | £000 | £/MT | MT | £000 | £/MT |
| round or roughly squared | | | | | | |
| tropical | 113 | 36 | 319 | 0 | 0 | 0 |
| temperature | 703 | 145 | 206 | 3763 | 447 | 119 |
| sawn but not planed | | | | | | |
| tropical | 48017 | 15184 | 316 | 3974 | 1882 | 474 |
| temperature | 8575 | 3593 | 419 | 10030 | 1646 | 164 |
| Totals tropical | 48130 | 15220 | | 3974 | 1882 | |
| temperature | 9278 | 3738 | | 13793 | 2093 | |
| Grand Total | 57408 | 18958 | | 17767 | 3975 | |

(CSO 1987)

Tropical hardwoods to the value of £1.882 million, were re-exported, apparently at a handsome margin when the price per $m^3$ is compared with that of imports. The exported temperate hardwoods valued at £2.093 million, was largely oak, almost £0.5 million being in the round for veneering abroad. The value per $m^3$ of the various categories is worth noting. The lower price per $m^3$ for exported temperate hardwoods compared to their imported counterparts reflects a lower quality timber and the poorly developed market in homegrown hardwoods.

## HARDWOOD INDUSTRIES

The production of raw material in Ireland depends on harvesting a sparse population of hardwood trees of mixed quality which, because of their small numbers and the low volume available in any one area, can only be planked in small sawmills before being processed further. The search for hardwood trees of quality can be extensive and therefore costly, which reflects, in turn, on the price offered for the timber. There are at least 22 sawmills converting hardwoods. Five are concerned solely (or mainly) with hardwoods, but their consumption of sawlog is about 15,000$m^3$, or over two-thirds of the estimated consumption. Because of the fragmented nature of the hardwood sawmilling industry, firm statistics are

Table 3: Structure of Irish hardwood sawmilling industry.

| Mill Size | No. | Hardwood log volume ($m^3$/p.m. | Headrig type: Vertical bandmill | Horizontal bandmill | Band rack | Circular rack |
|---|---|---|---|---|---|---|
| 1000-5000$m^3$* | 9 | 17500 | 2 | 2 | 5 | 0 |
| <1000$m^3$* | 13 | 4500 | 3 | 3 | 4 | 5 |

(FWS, 1986 and McCabe 1987).

*Note: Mill size refers to total production of sawn timber (assuming 50% conversation) whether hardwood, and softwood combined. There are no mills with a production capacity exceeding 5000$m^3$ p.a. which are involved with hardwood production.

difficult to obtain. Table 3 gives an indication of the structure of this sector of sawmilling. Seen in the context of an industry 157 mills strong, consuming a total of 762,000$m^3$ of timber (hardwood and softwood) per annum, the relatively small scale of native hardwood conversion can be appreciated. Hardwoods generally require larger headrigs than do softwoods for their conversion, an expense hard to justify in present circumstances.

A quick appraisal of the type of headrig employed also indicates that fewer than half of them have equipment suitable for the conversion of hardwoods. No more than two of the mills are known to have kiln drying facilities. Current prices for hardwood timber on the Irish market are summarised in Table 4 (O'Brien 1987). Due to the small scale of the industry, difficulty of procuring timber of quality and lack of assured supply, the basic log price is low.

Table 4: Some hardwood prices in Ireland.

| | Item | £/$m^3$ |
|---|---|---|
| Roundwood | fuelwood | 10 |
| | sawlog | 27-50 |
| | oak veneer | 270 |
| Sawnwood | quality beech | 420 |
| | American white oak | 700+ |

(O'Brien 1987).

Even the value of the sawn product is low compared to some other imported temperate hardwood timbers. From these figures, the value of sawlogs purchased by Irish sawmills would amount to about £850,000 while the value of sawn produce should be in the order of £3 million to £3.5 million. It is interesting to note that over half of Irish sawn hardwoods appear to be exported, the remainder finding its way into the home industries.

*Downstream industries*

There was a time when Irish hardwoods were the backbone of the furniture industry, but not any more. Reference to Table 1 shows that there is a reasonable trade in furniture, but the greater proportion of it is manufactured from imported hardwoods, frequently of tropical origin. At present very little Irish timber is used in furniture. The bulk of prospective furniture material is exported — either as veneer log or sawn. Craft and sport industries are also high in added value; ash for hurleys is the timber most in demand in this sector. The craft requirements however, are small and varied. The next group of industries is lower in added value and consists of joinery, coffins, turnery and tool handles, and boat building. Of these, coffins and boat building probably absorb most of the Irish hardwoods. The tool handle, turnery and joinery industries use little Irish timber, mainly because of lack of supply. There are occasional upsurges of such products as brush backs and shoe heels made from Irish timber, but probably most finds its way into pallets and boxes, and of course, fuelwood — the latter not infrequently consumes quite superior trees which, but for lack of an organised market, would be sold more advantageously as furniture stock.

## Future Prospects

From the above, it is evident that the native hardwood trade is not strong. The situation must deteriorate further unless action is taken, because without a strong base there will be no investment in hardwood production, and the existing reserves will be depleted, as is only too evident in the current exploitation of some of the last remaining oak woods. The prime question is can we afford to invest in hardwood production, will there be a return on any investment made? Without positive assurances that it is worth growing hardwoods there can be no will to do so, and the native hardwood trade will decline further. An examination of prospects both abroad and at home should help put this problem in perspective.

*World Hardwood Trade*

It is predicted from several sources that there will be a continuing growth in world demand for timber. An increase in hardwood log demand is foreseen whereby an extra 100 million $m^3$ of hardwood logs, and an extra 182 million $m^3$ of hardwood pulpwood will be required, worldwide, by the year 2000. This analysis concludes that a yearly overall growth in industrial wood consumption of 1.8% can be expected over the next 13 years at least (FAO 1983). This pattern applies to European hardwood consumption at virtually the same level (*vide* Table 5) and a continuing importation of hardwoods into Europe is envisaged.

Table 5: Future World timber demand.

| Item | Millions $m^3$ | | Yearly Growth |
|---|---|---|---|
| | 1980 | 2000 | % |
| Total | 1233 | 1818 | 1.8 |
| Hardwood sawnwood | 200 | 291 | 1.7 |
| Hardwood in W. Europe | 74.5 | 101 | 1.7 |
| Hardwood sawlog imports (Europe) | 3.8 | 5.2 | 1.7 |

(FAO 1982).

Even in the current recession, there is an increased demand for timber, sawn hardwood imports having increased from 33,263 metric tonnes (MT) in 1975 to 48,965 MT in 1980 and to 56,628 MT in 1985, an increase of 70% in 10 years. Admittedly, signs of a downturn were evident in 1982 and '83, but in the succeeding two years there was notable recovery. Thus, even in the home market, there is evidence of strength of demand for solid hardwood timbers (CSO 1974-'86).

An important aspect of future development is an expected hardening of prices. The net effect of the anticipated increase in consumption will be to put considerable strain on existing forests to meet the demand. Already 11 million hectares of forested land are being denuded annually in the tropics, mainly due to population pressures, but also due to exploitation. Replanting throughout the tropics just exceeds 700,000 ha (Wardle 1982). Valuable timber species are becoming scarce due to lack of management of forest resources and Sutton (1981) predicts that the exploitation of quality hardwood trees in such that "except in fast growing, intensively managed forests these quality trees are essentially a non-renewable resource".

Costs in future will undoubtedly increase because supply will be drawn from more remote locations, different, and more difficult species to process will be harvested and marketed. Replacement costs will increase as efforts are made to redress the imbalance (assuming that it will be redressed!) A further impact on import costs is the tendency among exporting tropical countries to limit or prohibit the exportation of unprocessed timber, thereby generating their own added value industries and increasing their revenue.

*Development of an Irish resource*

The foregoing indicates that there are compelling reasons to examine the feasibility of producing our own hardwood timbers. A scenario of production and consumption is presented in Table 6

Table 6: Actual and projected hardwood sawlog production and consumption in Ireland.

| Item | Base Period (1979-83) | 1990 | 2000 | 2010 |
|---|---|---|---|---|
| *Production* | | | | |
| Growing stock (millions $m^3$ over bark | 7 | 8.5 | 9.2 | 9.8 |
| Net annual increment ('000$m^3$ over bark) | 80 | 100 | 200 | 200 |
| $m^3$ over bark/ha | 1.1 | 1.3 | 2.4 | 2.2 |
| Removals ('000$m^3$ over bark) | 50 | 60 | 70 | 80 |
| Consumption Sawn Hardwood ('000$m^3$) | | | | Av. annual change 1980-2000 |
| low forecast | 80 | 90 | 120 | +2.0% |
| high forecast | | 100 | 180 | +4.1% |

(FAO 1936).

(FAO 1986). From this it is obvious that, from a small base there can be little improvement in the rate of felling in the near future and the annual increased productivity of roundwood is rated at 1.6%, whereas sawn hardwood consumption increase is rated at between 2 and 4.1%, depending on economic growth forecasts. Assuming 50% conversion, no more than 35,000m$^3$ of sawn hardwood will be produced in 2000, leaving a shortfall of requirement between 85,000 and 145,000m$^3$, equivalent to 51,000 to 87,000 MT (approx.).

Both here and in Britain there is a growing concern that hardwood production is being neglected. Financial models have been constructed and, based on the traditional net discounted revenue (NDR) approach, these are frequently discouraging. However, there are two proposals which sound promising: that is the production of hurley ash in Ireland (Fitzsimons & Luddy 1986) and furniture-grade sycamore in Britain (Stern 1982).

At log prices of £90 to £350, depending on quality and end-use, returns in excess of 4% per annum are possible. Other hardwoods

Table 7: 1987 prices for timber in Britain.

| Species | £ Stg./m$^3$ | | |
|---|---|---|---|
| | Roundwood | Saw & dried | |
| | butt logs | 25mm stock | 75mm stock |
| *British grown* | | | |
| sycamore | 69-96 | 232 | - |
| ash | 83- 96 | 334 | 551 |
| oak | 110-138 | 559 | 830 |
| rippled sycamore | 138-413 | 409 | - |
| select oak | - | 754 | - |
| *Imported* | | | |
| prime joinery beech | - | 348 | 431 |
| sycamore | - | 362 | 541 |
| N. American ash | - | 488 | 712 |
| American cherry | - | 548 | 756 |
| prime European oak | - | 698 | 1038 |
| rippled sycamore | - | 913 | 958 |
| European walnut | - | 1377 | 2317 |

(Boddy 1987 and Gormley 1987).

which may yield viable financial returns are cherry, oak and walnut; the latter two because of the particularly attractive prices they command. The approach to hardwood plantations is very different to that of softwoods, and seems to lend itself to development by dedicated private tree farmers who seek an investment for their family's future. In that situation, the returns on a hardwood plantation at maturity would be substantial, assuming much of the establishment and maintenance costs could be written off in such a family venture. Various developments from improved tree selection, vegetative propagation, the use of tree shelters and "free growth" forestry, all point the way to increasing the growth

Table 8: Values of different grades of British home grown hardwoods.

| Item | Relative value | % Total volume | % Total value | 1st Quality butts £Stg/m$^3$ |
|---|---|---|---|---|
| **Oak** | | | | |
| Veneer butts | 10 | | | |
| | | 20 | 53 | |
| 1st quality butts | 6 | | | |
| beam quality | 2.5 | 30 | 20 | |
| fencing | 2 | 35 | 23 | 138 |
| pallet | 1 | 15 | 4 | |
| **Ash** | | | | |
| veneer butts | 5.3 | 5 | 10 | |
| 1st quality white | 4 | | | |
| | | 55 | 74 | 96 |
| 1st quality coloured | 3.3 | | | |
| 2nd quality | 1.3 | 15 | 7 | |
| pallet | 1 | 25 | 9 | |
| **Beech** | | | | |
| 1st quality white | 2.5 | | | |
| | | 50 | 66 | 85* |
| 1st quality coloured | 2 | | | |
| 2nd quality | 1.3 | 30 | 23 | |
| pallet | 1 | 20 | 11 | |

*estimate (Venables 1985)

potential of hardwood thus shortening the rotation and bringing hardwood forestry into the realm of profitability, at least at low rates of interest.

*The British market*

Having noted the reasons for lower prices in Ireland, a brief review of British price structures shows that, with a more organised market, better prices are obtainable. Table 7 lists some current prices for through-and-through sawn timbers. All these timbers are capable of being grown in Ireland. Typical roundwood prices for first quality butts of British grown timbers are included (Bobby 1987, Gormley 1987). Comparative values of different grades of timber as shown in Table 8 give a clear indication of the importance of establishing and maintaining a good crop of the highest quality (Venables 1985). These data are included to illustrate that, with a developed market, firmer and more structured prices for hardwood timbers should be available in Ireland.

## CONCLUSIONS

The current structure of hardwood forestry and downstream industry in Ireland is weak and, if left to its own devices, cannot survive. Even in Britain self-sufficiency is expected to decline from a level of 50% in 1970 to 21% by 2000 (FAO 1982). As noted, Europe will continue in deficit and tropical countries will not be able to meet the demand. Therefore, even though prices have been stable since the early 80s, notable increases must be expected as increasing demand is met by reduced and more costly supply.

There is growing evidence that hardwood forestry can be economically viable. With more productive land becoming available due to curtailment of agricultural production, there is now greater potential for the establishment of viable hardwood forests. The development of such forests is desirable for other reasons — improved environment and diversified forestry being two important considerations, both of which help to ensure more willing acceptance of forestry as a land use. The creation of hardwood forests would not only protect the residual hardwood industries, but allow for the development of new ones which would further reduce our dependence on hardwood imports. In the national sense over emphasis on the NDR criterion would be detrimental to the development of a hardwood industry. Faced with outside developments and the less quantifiable benefits of diversified forestry I am not at all sure that the NDR criterion will truly reflect the real value of developing an indigenous hardwood resource. What is certain is that there is a growing opinion that hardwood forestry is a worthwhile venture — and we should approach it positively.

## REFERENCES

BODDY, JOHN, TIMBER LTD. 1987. Timber Catalogue with prices 1987. John Boddy Timber Ltd., Boroughbridge. 24pp.

CENTRAL STATISTICS OFFICE, 1974 to 1986. Trade Statistics of Ireland, December 1973 to December 1985 inclusive. Dublin, The Stationery Office.

CENTRAL STATISTICS OFFICE, 1984 and 1986. Trade Statistics of Ireland, December 1983 and December 1985 inclusive. Dublin, The Stationery Office.

CENTRAL STATISTICS OFFICE, 1987. Trade Statistics under tarriff headings 44.03 to 44.05 for 1986; unpublished. CSO Dublin.

FAO 1982. World Forest Products; demand and supply 1990 and 2000. FAO Forestry Paper 29. Food and Agriculture Organisation of the United Nations, Rome. 346pp.

FAO 1986. European timber trends and prospects to the year 2000 and beyond, Vol. II. Food and Agriculture Organisation of the United Nations, New York. 253pp.

FITZSIMONS, B. and LUDDY, W. B. 1986. Growing ash for hurleys. Irish Forestry, *43*(1): 32-51.

FOREST & WILDLIFE SERVICE (1985) and McCABE, J. (1987). Unpublished information.

GORMLEY, J. 1987. Personal communication.

McCRACKEN, E. 1964. The Irish timber trade in the seventeenth century. Irish Forestry *21*(1): 7-20.

STERN, R. C. 1982. The use of sycamore in British forestry in: Broadleaves in Britain. The Institute of Chartered Foresters, Edinburgh. pp 83-87.

SUTTON, W. R. J. 1981. The world's forests: an inexhaustible wood supply? Proc. Seventh Asian Plywood Mfrs. Conference, Sydney, Oct. 1981: 59-63.

VENABLES, R. G. 1985. The broadleaved markets in: Growing timber for the market. The Institute of Chartered Foresters, Edinburgh. pp 22-29.

WARDLE, P. A. 1982. World outlook for hardwoods in: Broadleaves in Britain. The Institute of Chartered Foresters, Edinburgh. pp 3-11.

Due to the lack of space in this issue
'The Other Ingredient' has been omitted.

# Letter to the Editor

To clarify the position of the present state of broadleaved forests in Ireland the editor invited Mr. R. M. Keogh, Crop Structure and Wood Technology Section, Forest Service, to submit statistics on broadleaved forest cover. Mr. Keogh has kindly done so as a letter which follows:

Dear Editor,

Considering your request to me for an over-view on broadleaf statistics, the following data may be of interest to readers. They present, for 1985, all figures for broadleaf woody vegetation in the Republic of Ireland in context of the forest as a whole. Burren-type scrub and preserved areas are included; this information is not normally given in countrywide breakdown of forest area.

All figures in hectares.

Total Area of Republic: 7,028,000
Land Area of Republic: 6,889,000
Total Forest Area: 432,068

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| Ownership | Conifer | Broadleaf | | | | | Total (2+7) |
| | | High Forest | | Scrub | | Total Broad-leaf | |
| | | Non Protected | Protected* | Non Burren Type | Burren Type** | | |
| State | 309,839 | 12,509 | 2,700 | 1,213 | 250 | 16,672 | 326,511 |
| Private | 17,610 | 32,347 | — | 33,102 | 22,498 | 87,947 | 10,557 |
| Total | 327,499 | 44,856 | 2,700 | 34,315 | 22,748 | 104,619 | 432,068 |

*Includes 1,700 ha of woodland in statutory nature reserves and about 1,000 ha of forest in national parks.

**Burren (Co. Clare): a region of 45,000 ha of carboniferous rock outcrop.

| Broadleaf High Forest | | | | |
|---|---|---|---|---|
| Dominant Species | Private | State | | Total |
| | | Non Protected | Protected | |
| Oak | 7,660 | 2,084 | 1,635 | 11,379 |
| Beech | 7,858 | 4,247 | | 12,105 |
| Ash | 5,430 | 614 | 990 | 7,034 |
| Sycamore | 3,080 | 367 | | 3,447 |
| Elm | 1,664 | 124 | | 1,788 |
| Birch | 4,452 | 683 | | 5,135 |
| Alder | 1,138 | 161 | 75 | 1,374 |
| Other Broadleaf | 1,065 | 4,229 | | 5,294 |
| | 32,347 | 12,509 | 2,700 | 47,556 |

The total broadleaf figure of 104,619 ha sets an absolute limit on the amount of woodland still in existence which may be derived from the 'original' natural forests. When an allowance is made for early plantation work on estates and reversion of farm land to scrub, it is likely that the actual figure for ancient woodland would be considerably less — perhaps as low as 20,000 ha.

Figures for elm are undoubtedly overestimated as this species has suffered attacks from Dutch elm disease since the inventories were undertaken.

There is a small area of Burren-type scrub (about 50 ha) in protected statutory natural reserves but this area has not been extracted from the high forest category to avoid complications in presentation of the data.

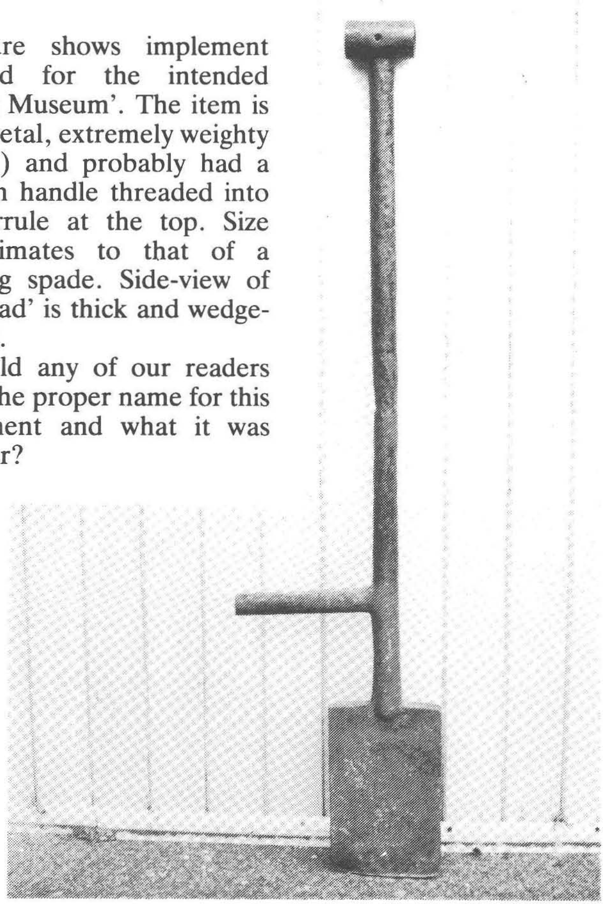
The information is based on (1) The Forest and Wildlife Service, 1978 Inventory of state forests; (2) Purcell, T. J. 1979 — The inventory of private woodlands, 1973 — Forest and Wildlife Service; (3) Ministers' reports of the Forest and Wildlife Service (1981-84); (4) Neff, M. J. 1974. Woodlands in the Republic of Ireland. Colloques phytosociologiques III. Les forêts acidiphiles: 273-285; (5) Kirby, E. N. 1981. An ecological and phytosociological study of *Corylus avellana* L. in the Burren, Western Ireland. Ph.D. thesis, National University of Ireland; (6) Cross J. (personal communication).

R. M. Keogh.

# Can You Help Please ?

Picture shows implement received for the intended 'Forest Museum'. The item is solid metal, extremely weighty (6.7kg.) and probably had a wooden handle threaded into the ferrule at the top. Size approximates to that of a planting spade. Side-view of the 'head' is thick and wedge-shaped.

Would any of our readers know the proper name for this implement and what it was used for?



(Photo: M. Keane)

# Forestry News

## AN IRISH MARKET?

George Roche runs a shellfish and smoked fish factory in Dunmore East.

Oak sawdust is the only sawdust Mr. Roche will use to smoke fish. Oak gives the desired taste to the meat and will not put a colour on the fish. No other broadleaved species will give the taste that oak can achieve. Conifer sawdust is not suitable for smoking fish — it turns the meat a reddish hue and gives it a sharp taste.

Not only salmon but also mackerel, cod, haddock and herring are smoked at this factory. It takes eight hours to smoke a salmon properly and about half that time to smoke the other species. The factory smokes about 2000 lbs. of fish at a time. To generate smoke, sawdust is fed by an automatic feeder onto a metal plate — 3-4 dessert spoons of sawdust at a time. The smoke produced is led through a series of chimneys into the smoking chamber where the fish are laid out on racks.

All of this brings us back to supply of sawdust. Until recently the factory has been getting its sawdust from a sawmill in Carlow. This sawmill is now experiencing a shortage of suitable oak for its mill. The consequence of this is that Mr. Roche's fish processing has of late to import dried sawdust in 45 kilo bags from Germany!

(Information kindly supplied by George Roche, Dunmore East Ltd.).

## LIFTING AND PLANTING:

(Extract from 'Safe Dates for Handling and Planting Sitka spruce and Douglas fir by P. M. Tabbush).

Planting dates should be chosen to ensure that roots will grow rapidly after planting and before the buds burst in spring. This ensures that the new roots make good contact with soil and are able to supply the needs of the developing shoots.

Douglas fir in particular benefits from warm soils, and cultivation will generally improve its establishment.

For Sitka spruce during 1985/86 at the Northern Research Station Nursery, root growth potential (RGP) for direct lifted plants was high between December and April, but then declined rapidly almost to zero by Mid-May. (RGP is the availability of a plant to make new root growth under nearly ideal conditions). Douglas fir RGP is often lower than that of SS and this may go some way to explain the sensitivity of DF to poor plant handling practices.

*Autumn Planting:*

Provided shoots have become lignified (hardened) plants may be lifted for autumn planting from early October until the end of November. From then on cold soils will limit establishment success. Sitka spruce is generally less suitable for autumn planting than DF because it tends to be planted on colder sites. The aim is to plant when RGP and soil temperatures are both high. Plants destined for autumn planting should be identified by early August so that nurserymen can condition them to prevent soft extension growth in late season.

(Information kindly supplied by Forestry Commission, Forest Research Station, Alice Holt Lodge, Surrey. Research Information Note — safe dates for handling and planting Sitka spruce and Douglas fir — P. M. Tabbush).

## WORLD'S OLDEST WOODEN TEMPLE:

Japan's Horyuji Temple was built in the Seventh Century. It was made of Hinoki Cypress *(Chamaecyparis obtusa)* that was 1,000 years old at time of felling. Carpenters of the Asura era (593-710 AD) skilfully joined beams manufactured from right-twisting trees with those from left-twisting trees to prevent warping.

## THE COMING OF TREES:

During the recent construction of a section of the gas pipeline at Newlands Cross, near Dublin, a discovery was made of a number of buried soil horizons. Richard Preece, of Cambridge University, Peter Coxon, of Trinity College, Dublin, and Eric Robinson, of University College, London, analysed pollen grains and animal remains from the exposed layers.

It was established that the Newlands Cross soil was laid down over the span of time between 10,000 and 7,000 years ago. During this 3,000 years the countryside changed from one of open grassland of arctic alpine plants to herbaceous vegetation which in turn gave way to the development of woodland of hazel and elm and oak. It is thought that this reflects the spread of plant species across the Irish sea as the climate improved.

From the same horizons it was established that approximately 7,600 years ago patches of forest were cleared, very likely by burning. The researchers suggest that evidence for this is two-fold — an increase in carbon particles and a temporary decline in the numbers of land snail, Discus rotundatus, a species sensitive to forest clearance.

A discovery of a flint flake at a lower level indicates that people were already in Ireland at that time.
(Extracted with kind permission from — New Scientist April 1987)

TWO VIEWS:

Following poem, from 'Kilcooley: Land and People in Tipperary', by W. Neely, was received from Owen Mooney.

Kilcooley, once the Kilcooley Demesne, owned by the Ponsonbys, is now part of Urlingford Forest. Tom B. Ponsonby (T.B.P.), was the author of the poem and was a keen farmer and forester: he was appointed to the British Forestry Commission after the 1914-18 war. A.C.F as mentioned in the poem was A. C. Forbes, the first director of Forestry in Ireland.

## A FORESTRY PROBLEM

Says T.B.P to A.C.F.—

*"To natures teaching you are deaf.*
*You wish to make the forest pines stand stiff in military lines*
*and even trees that love to be in each other's company*
*you segregate in horrid masses, pretending they are different classes,*
*whose dignity would be impaired if they a common table shared.*
*This snobbish outlook should not be imposed upon the noble tree".*

Says C.C.F. to T.B.P.—

*"I do not like modernity which even dares to criticise*
*that which the Germans authorise.*
*I claim that nature's simple methods should most certainly*
*be bettered.*
*What is the use of telling me that nature understands the tree.*
*This theory long ago was shook By Herr Forestmeisters weighty book".*
*"From leading shoot to forest floor the woodland must obey the law*
*Let us preserve in sylvan glade the social order man has made.*
*The youngest in the nursery must certainly secluded be.*

*Those older must not be allowed their elder brethern to crowd,*
*for they, in quiet dignity, like gentlemen in clubs should be.*
*Yea further, if I had the art, the sexes would be kept apart.*
*What forester who thinks aright can possibly enjoy the sight*
*of full grown trees allowed to breed and scatter round them fertile seed*
*that might produce a little tree of quite incestuous pedigree.*
*No, spare our British forestry from utter immorality".*

*From such attack, from one so high, poor T.B.P. can but reply.*
*He thinks the noble forest trees should be like other families.*
*Let Pa and Ma together stand with little trees at either hand*
*the older ones protect the young from winter blast and summer sun,*
*and those whose type are what we need should certainly be left to breed.*
*Despite what German teachers say, his preference is for nature's way.*
*Sadly he yields to doctrine brief, that Reason must not shake Belief.*
*No voice can charm the adder deaf, nor T.B.P. charm A.C.F.*

B and B!

It is the nature of forestry that those that work in the profession must, from time to time, take overnight accommodation away from home. On occasion such accommodation can prove less than standards expected. The following extract from Arthur Young's Tour of Ireland, 1775-1779, falls somewhat short of a wholehearted endorsement of one such shelter.

"Slept at Ballyroan, (Queen's County) at an inn kept by three animals, who call themselves women; met with more impertinence than at any other in Ireland. It is an execrable hole".

# Book Review

GROWING TIMBER FOR THE MARKET
Proceedings of a discussion meeting organised by the Institute of Chartered Foresters. Heriot-Watt University, Edinburgh. 29-31 March 1985. Edinburgh Institute of Chartered Foresters 1985. pp118. Index, Contributers, Participants. ISBN 0 907284 06 X.

The plantations established in Britain since the mid-1950s are now becoming productive and the volume of softwood on the market will increase very rapidly up to and beyond the end of the century. There is also a renewed interest in the broadleaved species of lowland forests. Since supply to the bottom end of the softwood market is now nearing saturation there is an urgent need to plan for greater penetration of the construction market and therefore, home produced softwoods will be in greater competition with imported material. To be competitive, attention will need to be given to the characteristics, quality and presentation of the home product.

The discussion meeting reviewed the technical and economic factors affecting Britain's ability to produce timber for the home market. Thirteen papers read at the meeting were divided into four sessions. The first session on markets deals with the coniferous and broadleaved markets, the coniferous fibre markets and mobilising the timber resource. Session two entitled "Timber" discussed the characteristics of coniferous wood, the features essential to good quality broadleaved timber and how it may be produced, the contribution of the geneticist and the influence of thinning and spacing on the marketing of timber. The third session deals with the economics of producing timber for the market. The final session examines reports from discussion groups on "The Influence of Juvenile Wood Characteristics on the Value of the Log,"New Silvicultural Horizons for Broadleaved Forestry" and "Log Classification and its Influence on the Paying Capacity of the Resource".

The proceedings are then summarised in the final chapter.

Available from: Institute of Chartered Foresters, 22 Walker Street, Edinburgh. EH3 7HR.

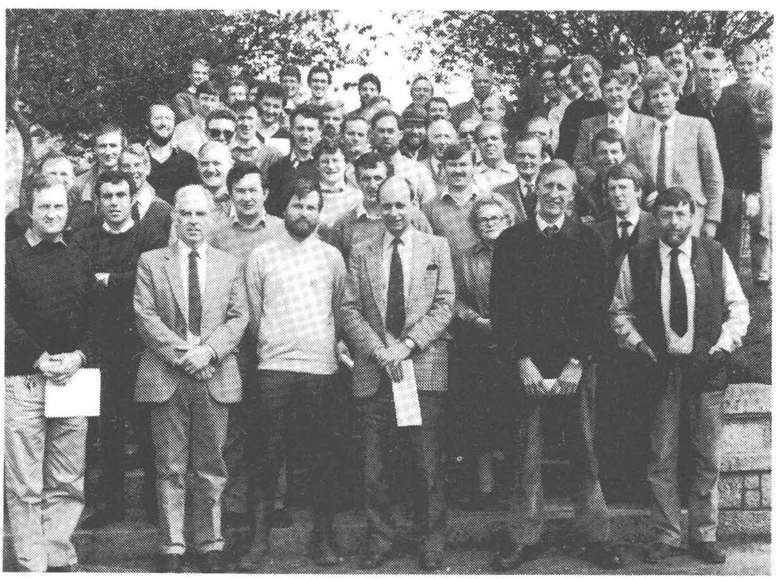
Pat Crowe.

# Society Activities

DAY STUDY TOUR : 23rd APRIL 1987

This one-day meeting took place at Tollymore Forest, Co. Down. Fifty five members attended and were welcomed by Mr. Forbes, Chief Forest Officer, Northern Ireland Forest Service. Leader for the day was Mr. W. J. Wright, Forest Management Officer. Local hosts were: M. H. Beatty, District Forest Office, Down/Armagh; A. J. Clark, Senior Head Forester, Harvesting; D. Fitzpatrick, Head Forester, Tollymore; J. Mooney, Forester, Tollymore; K. Elliss, Forest Engineer H.Q.; J. McQuillan, Work Study Officer H.Q.; R. Boyd, Research Head Forester H.Q.; J. McCurdy, Conservation and Wildlife Head Forester.

The forest is located on the eastern foothills of the Mourne Mountains within a recently designated area of outstanding natural beauty. It comprises four management units. Planting began in the mid-twenties and at present the felling of mature stands is taking place. Because of the high aesthetic value of the forest and surrounding area a landscape plan has been prepared. Felling and replanting must conform to this plan. The use of broadleaves is an important element of the plan.



Harvesting techniques were demonstrated at first thinning and clearfell sites. A Norcar forwarder was used in the thinning situation and a Gremo forwarder in the clearfell area where it performed well on a fairly steep gradient. The Forest Park, with its old estate features and national beauty, keep it to the forefront in forest recreation. Visitor usage of the park was described in detail. At present, 200,000 visitors use the facilities each year including a large number of students on educational visits. Problems associated with rank growth of rhododendron and laurel at the later thinning, clearfell and replanting stages were highlighted and methods to overcome them were discussed. The current practice is to cut growth back using brushcutters and treat the regrowth with herbicides. Staff are paid on a payment-by-results system which was described in detail. A selection of tree shelters on display in a felled area created considerable interest. A discussion about fallow deer management — the park has about fifty — emphasised the variety of topics encountered on this one-day visit. The President, Mr. Prior, thanked the leaders and the members who participated in the tour.

D. Fitzpatrick.

## ANNUAL STUDY TOUR 1987 — SOUTHERN ENGLAND

### Day 1 — The Forest of Dean

On our first day we journeyed to the Forest of Dean where we spent most of the time among its fine broadleaved woodlands.

Mr. John Everard, the Deputy Surveyor, welcomed us to the forest and introduced his colleagues, Mr. David Craze, Mr. Ted Jury, and Mr. John Anderson. In 1971 a Ministerial Directive was issued stating that the proportion of the woodlands under broadleaves (then at 42%) should not be reduced. The primary aim of management in the Forest of Dean is the production of wood for industry. Recreation, conservation and forest management are, however, intimately integrated throughout the forest. The main soil types are acid brown earths and coniferous heavy textured soils. There are also small areas of thin limestone derived soils and gleys. The forest is at an elevation of between 100 and 300 metres. A number of small open cast coal mines occur within the forest.

Mr. Anderson, the forester in charge of recreation, then brought us to the viewpoint overlooking the Severn River and the Cotswolds. The forest attracts one million visitors annually, most of whom are day visitors, and has a quarter of a million camper nights per year. There are five nature trails in the forest. A sculpture trail has recently been opened and has proved to be very popular.

We then proceeded to walk through part of the forest. We were shown a stand of southern beech — a mixture of *Nothofagus procera* and *N. obliqua.* It is felt that these species have no great future in Britain because of their susceptibility to frost; three years ago trees of up to 50cm dbh were killed by winter frosts. We saw stands of beech in varying stages of maturity. Prices for beech (at roadside) were as follows:

| | |
|---|---|
| Thinnings | up to £40/m$^3$ |
| Good quality sawlog | up to £56/m$^3$ |
| Veneer quality | up to £300/m$^3$ |

Ash fetched £80/m$^3$ for trees of 30cm DBH. Firewood was selling at £10/m$^3$.

We then saw a stand of Douglas fir Yield Class 24 which had been planted in 1912 — the mean volume per tree was three cubic metres. This stand will be felled soon as trees over 80cm dbh present difficulties for sawing.

The final stop before lunch was a stand of 80 year old naturally regenerated oak which had been underplanted with beech. It covers an area of 160 ha and is the largest block of its type in Britain. Mr. Everard felt it should be retained for its uniqueness and also for training foresters in the silviculture of oak; he hoped eventually that it will produce veneer oak.

After lunch we visited an area where oak is being naturally regenerated using the Uniform System. Because of conservation restraints only two thirds of the area under oak can be regenerated — the other third must be retained in perpetuity. On the lighter soils they have found ring shake to be a severe problem, up to 50 of stems can be affected. The shake is not a problem where oak is grown on deep heavy textured soil.

We were then introduced to Mr. David Langford, the forester responsible for conservation. There are 300 ha of woodland set aside as a bird breeding reserve. He consults regularly with the Royal Society for the Protection of Birds as to the management of these woodlands. A number of years ago nesting boxes were put up on trees which attracted pied fly-catchers back into the area. The bird life in the reserve is abundant judging by the variety and amount of bird singing to be heard. There are many species of raptors present also. Grey squirrels in the reserve are controlled annually using warfarin-treated wheat.

On our final stop we visited a Norway spruce stand Yield Class 16 which is currently being felled. It was sold at auction for £50/m$^3$.

standing. The average tree size was 1.1m$^3$ with 90% being sawlog standard. Norway spruce will not be replanted here because of the danger of attack by the great spruce bark beetle. Hybrid larch will be planted instead. After thanking our hosts for such an interesting and stimulating tour of the Forest of Dean, we returned to Hereford.

Eugene Griffin.

Day 2 — Ebworth Woods, Sheepscombe.

After leaving Hereford we made our way by Gloucester into the Cotswold Hills and on to Sheepscombe. Here we were met by our host for the day Mr. John Workman, whose family has owned and managed Ebworth Woods for over a century.

The estate comprises 300 ha of woodland, mostly beech, and is a National Nature Reserve. It is interesting that an area that has been managed for the production of commercial timber for so long should be rated so highly for its conservation and aesthetic interest. The Nature Conservancy Council regard the areas as one of the few Grade 1 Beechwood sites in Britain. The area is also a Site of Special Scientific Interest (S.S.S.I.). Three men do all felling, extraction and local deliveries of timber.

Accompanying the party on our visit were David Russell, forestry adviser to the National Trust and Laurie Clark, Woodland Warden from the Nature Conservancy Council.

All soils are derived from Jurassic limestone and are generally thin and free draining. Some heavy textured soils derived from Lias clays occur. Rainfall is 90cm (36") per year. In some periods severe droughts can occur. During the summer of 1976, in particular, more than half the trees died in a 200 year old beech stand. Ash was even more severely affected during this period.

Following an introduction we walked through the woodland. Very little planting takes place now and natural regeneration is relied upon to provide sufficient stocking of the preferred species, beech. Sycamore competition is a problem as is *Clematis* (old man's beard). Successful regeneration to produce commercial quality beech would not be possible without control of grey squirrel. Warfarin is used in late spring before the damage period in mid summer.

In the past beech was planted in 3 row: 3 row mixtures with larch. A row of larch adjacent to the beech is removed after 20 years and the remaining rows in subsequent thinnings. Although the mixture is difficult to manage it provides frost protection to the beech.

Ash occurs sporadically but is not thrifty on these soils except in the valley bottoms. Where it does grow well it makes very good prices, in the region of £100 per cubic metre, sold felled. Beech makes about £600 per cubic metre, also sold felled. The morning walk ended at Mr. Workman's home were beverages were kindly provided to accompany lunch.

In pleasant weather we made our way through the gardens and on into the woods again. At one of the small areas of oak there was a vigorous discussion on the merits of introducing oak plants to aid regeneration in an area where the prime consideration is conservation of a genetic resource. Our final stop of the day was at a magnificent 200 year old beech stand over 36m tall.

After a rewarding day it was time to leave Sheepscombe and John Prior paid thanks to John Workman for his hospitality.

Eugene Hendrick.

Day 3 — Forestry Commission, Forest Research Station, Alice Holt

Co-ordination of our visit to Alice Holt wa in the hands of Mr. Brian Hibberd who met us on our arrival. We were introduced to the work of the Research and Development Division of the Commission by its Director, Dr. Arnold Grayson. The Division is organised as 16 branches located at two Research Stations, the Director's office and main Research Station at Alice Holt Lodge and the Northern Research Station at the Bush Estate, south of Edinburgh. Three hundred and fifty scientists and professional foresters are based at the two research stations. The total national budget for forestry research is £10-£11 million p.a., of which 60% comes from Forestry Commission funds.

The object of Research Division is:
(1) To improve the quantity and quality of wood production;
(2) To improve the environmental impact of forestry and;
(3) To reduce operation costs.

Research priorities are of four types:
(1) Problems that emerge in the course of management;
(2) Problems that researchers recognise;
(3) Problems which the Commission is specifically asked to deal with and;
(4) Problems described by Dr. Grayson as being of a "political" nature.

Air pollution was seen as an example of the political category which is revealing of the Commission's attitude to this problem. A great deal of money is being spent on the topic by the Commission. The attention given to the topic may be evidenced by the fact that

Air Pollution Studies formed our subject for the remainder of the morning for which we were in the hands of Project Leader, Dr. Andy Wilson. He gave us a talk which included background information on forest decline in Germany and the United States. Apparently no symptoms of damage have been detected in the UK. He described for us the Commission's research effort which is directed at studying the effects of air pollution on plants. This is not a particularly new line of investigation. It was pursued quite vigorously in many parts of the northern hemisphere long before the emergence of the present forest decline problems. The Commission uses open top chambers for its research. These provide a partially controlled environment and allow plants to grow in atmosphere with ambient levels of pollutant gases, with filtered air (the filters are about 90% efficient) or with partially or differentially filled air. Although it was not mentioned, it would appear from examination of the installation which was visited at Headly, near Alice Holt, that gas concentrations can also be enhanced. The chambers are situated at three locations in the UK. The Headly site consists of 16 chambers and elaborate monitoring and gas analytical facilities. The cost of installation is £100,000 per site and the total budget over seven years is £1.25m. Given the equipment and work required, these costs are not excessive. What is disturbing is that this money comes from Research Division's grant in aid and consequently their effort in other areas is diminished.

Air pollution studies would seem to be largely a public relations, 'political' exercise. The chambers while impressive cannot control climate. It has been established that sensitivity to air pollution varies with many factors which include species, the physiological state of the foliage, nutritional stress, moisture stress and climate. The experimental design is flawed by the lack of complete climatic control limiting the information which can be gained from the project. As is so often the case in research, results are relatively easy to obtain. The difficulty lies in designing the experiment so as to ask the right questions.

After lunch in the Alice Holt canteen (a memorable culinary experience), Mr. Donald Thompson, Wood Utilisation Officer, spoke to us about his work. His comments on the problems of marketing UK softwood in the future had a familiar ring. Home production is forming an increasing proportion of the softwood sawlog market. It now represents 16% to 18% of the market. In 10 years, it is estimated, the figure will be 23%, forcing it out of the soft end of the market into more competitive, more demanding and of course more lucrative areas. The emphasis now has to be on raising standards of quality and presentation.

With Sitka spruce, the emphasis is on strength properties because Sitka is not a joinery timber. Spacing and thinning influence strength properties. In Mr. Thompson's opinion, spacing greater than 2m results in serious reductions in strength as measured by stress grading. He suggested that where windthrow hazard dictated a no-thin regime, crops will never, because of truncated rotation, reach structural size, a contention disputed by many. At present there is over-capacity in British mills in the small roundwood and larger size categories. Less than 10% of British timber is kiln dried — an obviously unsatisfactory situation. It has been shown that timber performs better in stress grading if it has been dried. While he gave relatively little attention to hardwoods, Mr. Thompson did express concern about the price differential between top grade and all other material. The area of broadleaves planted is increasing. Will there be markets for this material, particularly material of intermediate quality? Markets must be found for this material. Poplar has possibilities as a structural timber. It is similar to Sitka spruce in strength and preservation properties. Preservation itself is causing difficulties now because of the toxic nature of wood preservatives.

Mr. Tim Rollinson and Ms. Janet Gaye spoke about the work of the Mensuration Branch. Their activities cover yield studies (yield tables, growth modelling, thinning and respacing studies and yield class investigations) and measurement studies (measurement methods, special projects and general advice). Yield Tables are designed to provide models of stand growth and yield which can be used for planning decisions, in particular to compare results of alternative treatments and to forecast timber production. They were never intended for use in individual stands. Because of the way in which they were compiled standard errors could not be measured, but for an individual stand, final crop volume may differ from the tables by as much as 30% to 40%. Allied to this is the problem of Yield Class estimation in young stands. Mr. Rollinson recommends that the minimum age for top height measurement for Yield Class estimation is 15 years. Top heights of younger crops are subject to excessive bias due to growth in a single season. Productivity estimates of young crops could be in error by as much as four yield classes.

Yield tables make no allowance for loss in production due to roads, rides, 'normal' understocking, etc. While there is some disagreement as to what the 15% deduction for losses should represent, Mr. Rollinson believes that a 15% reduction over-estimates losses due to the factors listed above. However, recent field checks suggest that the volume of timber greater than 7cm diameter remaining in the wood after clearfelling may well be in the range 10% to 15%. This is, for the most part, non-utilisable material. The significance of this source of error depends upon the purpose of the production forecast and the measurement of volume upon which sale price will ultimately be based.

Calculation of Production Class reduces the margin of error attached to yield table volumes. Production Class can be estimated for a forest or for a region. Measurements required are not particularly onerous, but unfortunately can only be successfully made in unthinned stands.

The main limitation of yield tables as they presently exist can be listed as follows:

1. They are inflexible, available only as paper copy, which cannot easily be read or utilised by computer.
2. Despite the large number of models, not all treatments are covered.
3. They are based on historical data.
4. They are constructed at stand level and are unreliable for estimating individual tree volume.
5. They can only be used for pure crops. The suggested assumptions to be used with mixtures are known to be invalid.
6. They assume full stocking whereas in fact, this is rarely the case.

Future developments in yield tables will seek to:

1. Improve flexibility.
2. Give more detail.
3. Improve accuracy, and;
4. Cover more treatments.

Mensuration Branch has for long been concerned with errors associated with the measurement, collection and transfer of data collected from sample plots. Ms. Janet Gaye has examined methods of data capture in order to maximise accuracy, speed of collection and checking and consistency of measurement. She detailed the many sources of error involved in paper based procedures and explained how these could be minimised by suitable data logging services. The Epson HX20 microcomputer, cost £490, meets the Commission's requirements for an improved data capture system. The Epson has a 32K memory, a microcasette drive and is fully programmable in Basic. With the Epson, checks against previous data and detection of operator errors are done in the field and can be corrected immediately. When the forester is happy with the data the tape is sent into headquarters where it is read into the mainframe computer.

Ted Farrell.

Day 4 — The New Forest

Following an overnight stay at Hindhead, which is one hour's journey from London, bright sunshine and clear skies greeted us on our journey South West to the New Forest. The New Forest lies in a broad, shallow basin — the Hampshire Basin — surrounded by the low chalk downlands of Cranborne Chase, the Wiltshire and Hampshire Downs, Ballard Down and the spine of the Isle of Wight, close to the English Channel. We were greeted on our arrival by Mr. Roger Newland and Mr. Jeff Green, who acted as our hosts for the day.

Group photo at New Forest.

The New Forest was started in 1079 A.D. by William the Conqueror. The land consisted of relatively infertile woodland and furzy waste, sparsely scattered with farms and homesteads. The act of afforestation transformed a whole neighbourhood into a royal hunting preverve. Grazing of domestic animals on the King's land was however permitted and thus were established the rights of pasture still practised by the Commoners of the New Forest. It has been said that the Commoners' ponies and cattle are the architects of the Forest. As the peasants who lived in the Forest were forbidden to fence in their animals lest any fence would interfere with the free run of the deer, their animals as well as the deer severely diminished the ability of the woodlands to perpetuate themselves. The dearth of new trees became a serious problem during the middle ages, which saw an enormous increase in the consumption of wood. Enactments were made to enable large areas in the New Forest to be enclosed for the purpose of establishing woodlands, later to be thrown open when the trees had outgrown the danger by cattle. This process became known as the 'rolling power of enclosure'. The first tree act was passed in 1483 and others followed.

The Forestry Commission took over the management of the Forest in 1924. The total area of the New Forest today is 37,544 ha of which 27,022 ha are managed by the Forestry Commission. The remainder is privately owned in villages and homesteads.

The area is divided into two categories:

Enclosed land: Total area 8,646 ha; included in this category are Crown Freeholds, old hunting lodges, farms and enclosures for growing timber.

Unenclosed forest: Total area 18,376 ha. The open forest embraces heathlands, grass, lawns, rivers and unenclosed woodlands named Ancient and Ornamental in Queen Victoria's reign. It is over the entire unenclosed area of the Forest that Common Rights are practised such as grazing, turbary, etc.

*Forest Management:* As can be imagined there is a conflict between commercial forestry and conservationists. This means that the management forester has to have all his proposals vetted by a Consultative Panel for clearance a year before proposed work takes place. Sixty two percent of forest is coniferous and the remainder broadleaved. This ratio has to be maintained. Conifers are thinned on a five year cycle, broadleaves on a ten year cycle. Even though the highest elevation is 180m and rainfall is a low 71cm (28") per annum, windthrow is a problem. As a result crops are now being thinned earlier. Pulpwood makes £17.70 per ton on roadside and £5 to £8 per ton standing.

Natural regeneration of Douglas fir is now being widely practised as grazing by stock is less of a problem with naturally regenerated plants than nursery stock. Because of conservation constraints crops cannot be fully clearfelled on maturity. Fifty stems per ha are retained. Natural regeneration of Douglas fir is very profuse. When the crop reaches about "nose" height it is thinned out with a hand-held brush cutter to a spacing of 2 x 2m. When the natural regeneration reaches a height of 4.5m then the remaining trees are clearfelled.

In the afternoon Mr. Paul Borwick, Head Forester Management, introduced the group to the problems encountered in reafforestation sites. The site we visited had been clearfelled of Corsican pine and replanted with the same species. The reafforestation consisted of Japanese paper pot plants, soil scarification and spot treatment with chemical. There is a drift away from bare rooted plants to the pots because of the low rainfall which causes severe drying out after planting, resulting in heavy losses even though the potted plants are 20% more expensive.

Tree shelters are now widely used in the planting of broadleaves. Tubex white coloured shelters are favoured.

Our next stop was at a harvesting site where Douglas fir was being clearfelled. Mr. Dick Maylough and Mr. Kenny Stewart were the Harvesting Foresters on the site. Thirty five thousand cubic metres are harvested annually. The timber is sold by tender to the merchant. This crop of Douglas fir made £46.20 per $m^3$ at roadside (overbark).

Our final stop was at a campsite where the Recreation Forester, Mr. Martin Fletcher, outlined the recreational uses of the New Forest. Two categories of people visit the forest; day visitors and campers. There are twelve campsites and 143 car parks in the forest. Camping has grown from 90,000 camper nights in 1956 to 800,000 camper nights in 1983. Present peak capacity is 5,000 pitches per day.

Michael Davoren.

## Day 5 — Tilhill Nursery and Westonbirt Arboretum

Day five of the tour started off with a visit to Tilhill Nursery in Surrey, about half way between Hindhead and Farnham. On arriving at the nursery, Mr. John Fennessy introduced us to the Director of Tilhill, Mr. John White. We were also introduced to the Operations Manager, Mr. Robin Simmes. Mr. White gave a brief introduction to the running of the nursery.

The nursery has an area of about 100 hectares. It is generally flat and is about 60 metres above sea level. The soil is derived from the sand of the Folkstone beds. It is easily worked and is relatively free draining. The pH varies from 4.6 to 6. In certain areas of the nursery lime is added to make the soil less acid. The nursery is generally low in potassium and get 20 tons of spent hops per acre every year as organic matter. The total nursery stock is 58,000,000 trees, comprising of 20,000,000 conifer transplants, 30,000,000 conifer seedlings, 6,000,000 conifer standover stocks, 1,500,000 hardwood seedlings and 500,000 transplants and under-cut stock.

Our first step was to look at the conifer seedbed area. This ground was sterilised in late summer prior to sowing. On the lighter soils the ground is covered with polythene for 6 weeks, to aid the sterilisation process. Sowing then begins in March, depending on the weather conditions. In all about 20 acres of ground is covered in seedbeds. The beds are protected from birds by netting and from frost by a sprinkler system. On cold nights when the temperature drops below a certain point an alarm sounds and the sprinkler system is activated. The nursery has a storage capacity of 10,000,000 gallons of water but, as 10 consecutive nights of frost would utilise 84,000,000 gallons of water, Tilhill are hoping to increase their water reserves.

Our second stop was to look at lining-out. This is done by using a lining-out board onto which the plants are clipped. The board is then placed in the trench and the roots are covered. The operation is then repeated along the bed. The operation costs £3 per 1,000 with each man doing up to 20,000 plants a day. When the lining-out runs late into the season, the plants are held in cold-storage to delay growth. Each bed contains 6 to 8 lines of plants in order to make maximum use of the limited sprinkling area. Weeds are controlled by using 'Simazine' and 'Kerb'.

The third stop was at a demonstration of precision sowing. This operation is carried out using a vacuum precision drill. Prior to sowing, the seeds are soaked in water for 24 hours. They are then left hanging in a bag in a cold room so that the excess water is allowed to drain from them.

This system of establishing trees occupies 2 to 2½ times the area of ground compared with conventional seedbeds and gives a germina-tion rate of 70%. The beds are box pruned and undercut to a depth of 3 to 4 inches half way through the growing season. This system of growing trees seems to be showing great results with regard to root and foliage development and would appear to be a more economi-cal way of producing good quality transplants.

The fourth stop was a visit to the cold stores. There were three cold stores in all, two small jacket type stores and a more modern 'Humi' cold store costing about £200,000. They are used for the storage of both seeds and plants. Trees are stored during the dormant season before growth is initiated. Use of the cold stores facilitates the extension of the planting and lining-out seasons.

The next stop was at the machinery shed. The machines used were:

1. Vacuum precision drill.
2. Grass sowing machine, for sowing seedbeds.
3. Transplanter for the larger hardwoods.
4. Lateral pruner.
5. Reciprocating undercutter.
6. Lifting machine.

The cost of the above machines is approximately £26,000 in total.

The last stop was at the polyhouses. These are polythene tunnels in which Sitka spruce is grown from a limited supply of genetically superior seed material. The aim is to produce a tree with 10% to 15% greater volume of timber. About 2,500 seeds costing £200 were planted into small pots and allowed to germinate. After germination they were planted into bigger pots and allowed to develop well, so that at the end of the second year in the polyhouses they are big enough to take 100 cuttings from each tree. The cuttings are planted and allowed to root, after which they are taken from the polyhouses and lined-out outside at twice the normal spacing. At the end of the growing season, five cuttings are taken from each tree and planted in the polyhouses to repeat the operation. The cost of these transplants would be two to three times the normal cost.

After that very interesting tour it was time to leave Tilhill. The President, Mr. John Prior, extended our thanks to Mr. White and Mr. Simmes.

Our next destination was to the Westonbirt Arboretum in Gloustershire. The curator Mr. John White welcomed the Society and took us on a tour of the Arboretum. The Arboretum was established in 1829 when Robert Holford started planting his first trees in a fertile field.

These trees were mainly oaks, pines and yews. Towards the end of the century his son George extended the planting into the old woodland nearby and started planting 'Silkwood' which today is maintained as a scientific collection. Sir George's nephew took it over in 1926 and continued to collect and add more trees. Then in 1956 the Forestry Commission acquired the property and built a visitors centre in 1978 which includes a shop, cafe and other amenities.

The area of the Arboretum is 600 acres and contains 16,000 listed specimens. About 700 new species and about 500 packing up species are planted each year. About 190,000 visitors visit the Arboretum each year and the bulk of these arrive in the autumn to see the beautiful colours of the trees and shrubs such as the Japanese Maple, Acer Glade and the hickory.

The Arboretum is maintained by a workforce of 25 with the help of sit-on mowers, hydraulic lifts, etc. On our walk around we saw some very interesting specimens such as Rhododendrons, Great White Cherry of Japan, Japanese Maple, Lawson Cypress, *Sequoiadendron giganteum,* Wellingtonia, Dove tree, and many many more too numerous to mention.

After the walk we adjourned to the visitors' centre where we had the opportunity to have a cup of coffee and invest in some literature from the shop. After our brief stay in the visitors centre we headed for our hotel in Carmarthen where we had dinner and a very enjoyable evening.

Padraig Egan.

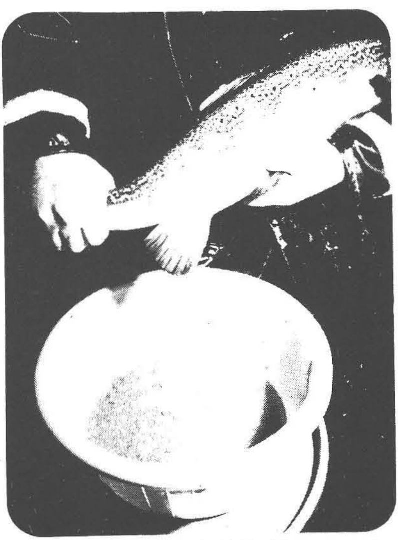
*Attendance*

Convenor: John Fennessy.

John Brady, Euphemia Collen, Lyal Collen, John Connelly, Maureen Cosgrave, Myles Cosgrave, Tony Crehan, Jim Cronin, Jim Crowley, Michael Davoren, Pat Doolan, Jim Dooley, Joe Doyle, Padraig Egan, Ted Farrell, John Fennessy, Gerry Fleming, Mathias Fogarty, Lily Furlong, Frank Gibbons, Eugene Griffin, Eugene Hendrick, George Hipwell, Tim Hynes, Richard Jack, Pat Kelly, Brendan Lacey, Eamonn Larkin, Eddie Lynagh, Pat MacAuliffe, Philip MacDonnell, Jimmy Mackin, Tony Mannion, Gerard Mawn, K. McDonald, P. J. McElroy, Michael O'Brien, L. P. O'Flanagan, Pat O'Kelly, Martain O Neachtain, Brendan O'Neill, Tim O'Regan, Denis O'Sullivan, John Prior, Gerard Riordan, Martin Ruane, Domnick Ryan, Mossie Ryan, Robert Tottenham, Joe Treacy, Ari van der Wel.

# The Ones that Get Away...

Salmon angling at Castleconnell, Co. Limerick.



Salmon 'stripping' at the E.S.B. Hatchery and rearing station, Parteen.

About 700 hen salmon get away every year - away from the ESB's Hatcheries at Parteen and Carrigadrohid - but they leave their eggs behind and from these the ESB fishery experts rear up to 5 million fish every year, salmon which are then planted out in Ireland's rivers to improve fish stocks and to provide better sport for Irish and visiting anglers.

They're not narrow-minded at Parteen; they rear trout as well and these too, go to swell the population in Irish lakes and rivers.

It's all part of the ESB's ongoing programme to ensure that the rivers and lakes which it uses to produce electricity will also yield another harvest - and good sport as well.

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