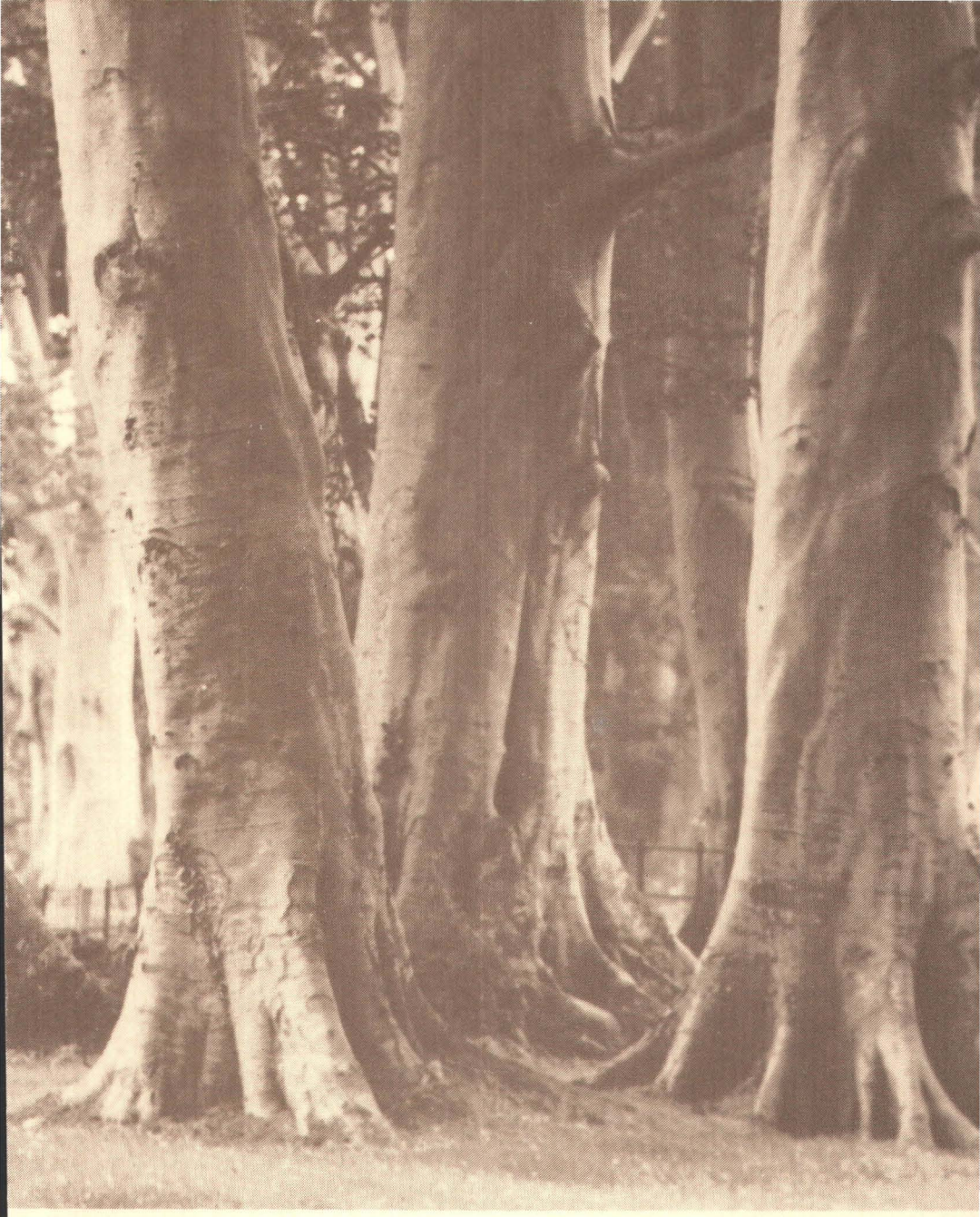
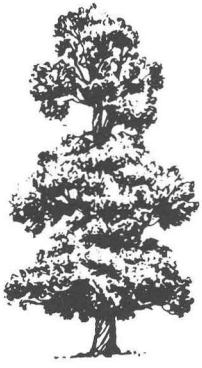


IRISH FORESTRY

JOURNAL OF THE SOCIETY OF IRISH FORESTERS

Volume 43, No. 2, 1986

IRISH FORESTRY



JOURNAL OF THE SOCIETY OF IRISH FORESTERS

Volume 43, No. 2, 1986

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1. Two copies of each paper should be submitted, in typescript, with double spacing and wide margins, correct spelling and punctuations expected.

2. Diagrams and illustrations should be clearly drawn in black ink on good quality paper. Captions should be written on the back of each illustration. Illustrations, wherever possible, should be drawn in an upright position (x axis narrower than y). The approximate position of diagrams and illustrations in the text should be indicated in the margin.

3. Tables should not be incorporated in the body of the text, but should be submitted separately at the end (one table per page). Their approximate position in the text should be indicated in the margin.

4. Nomenclature, symbols and abbreviations should follow convention. The metric system should be used throughout.

5. References should be in the following form:

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6. A short summary of the paper should be included. It should precede the main body of the text.

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Contents

Note: The opinions expressed in the articles are those of the contributors.

Cover: Beech — Powerscourt Estate *(Photo: P. McCusker).*

Printed by the Elo Press Ltd., Dublin 8, Ireland.

EDITORIAL

Timber Farms

When I was a boy an uncle of mine had a car which required a hand start to turn the motor over. Private forestry in Ireland is at the stage of the hand-start engine.

A fine stand of spruce on a high field does not make a farmer. Put a bullock in the same field and the owner can talk of hoose and scarpie in sheep and sit on a high stool with the best of them. The bullock may not give him an income but it gives him a sense of belonging. In any country pub let a man talk earnestly of yield class and forwarders and pine beauty moth — and watch the eyes peer at him from that transition zone that lies just above the rims of pint glasses and below the projecting peaks of cloth caps. When he has quite finished and regained his self-control the conversation rolls itself back up to the real world of mastitis and intervention and precision sowing. Sitting there, hunched up among his own, the thoughts of putting the 'Long Field' down to spruce fades in the man. Trees are not a crop to a farmer. This attitude must change.

Many farmers see themselves as having a right to a traditional way of life on farms that are now clearly uneconomic. That is fine provided the taxpayer is not expected to carry the cost. This country cannot any longer afford parasitic farming. This is not to criticise farmers who find themselves in this predicament. It is simply stating a hard fact.

The EEC is no longer enthusiastic to subsidise production of crops that are already in over-supply. It can only be a matter of time before EEC grants are adjusted to force production of commodities that the Community needs — clearly one of these is timber.

The Minister for Tourism, Fisheries and Forestry, Mr. Liam Kavanagh, T.D., is arranging that farmers in receipt of headage payments in respect of livestock on their holdings will receive their payments if they afforest all or part of their land; headage payments to run for a period of 15 years from first planting. The scheme will be joint funded by the Irish Government and the EEC under Community Regulation 797/85.

With majority voting power shifting towards the towns and cities the political and social arguments for state support of uneconomic wet-land farms must weaken. If logic is to have its day these farms must become the new forests of Ireland.

Under this new reality, if farmers intend to retain their holdings, three factors need to be confronted and resolved.

Agricultural grants and schemes that underpin production of crops now in surplus on lands more suitable to tree production do this nation a disservice. Such grants must be replaced with financial inducements to switch to growing timber crops. If a man wishes to continue to grow cattle where only trees will show a profit — that is his right — but it is not his right to demand of the state to subsidise his folly.

Scale is a reality in the profitability of a forest venture. The odd awkward corner put down to trees might be useful for fence post production as well as providing cover for pheasants and foxes but such cannot be argued as worthwhile examples to farmers to switch to timber as a farm crop. Large tracts of forests, not scattered fields of trees, is what is needed.

There is too a psychological barrier to be overcome. Farmers must clearly see trees as an alternative crop. At the moment most do not. There is work to be done to sell the idea of trees as just another type of farm crop. 'Timber Farmer' and 'Timber Farm' are not such bad titles to call a man and his place of work!

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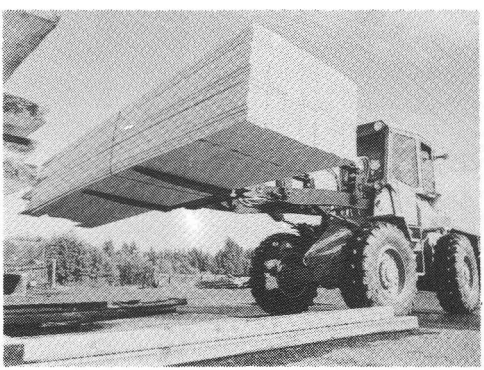

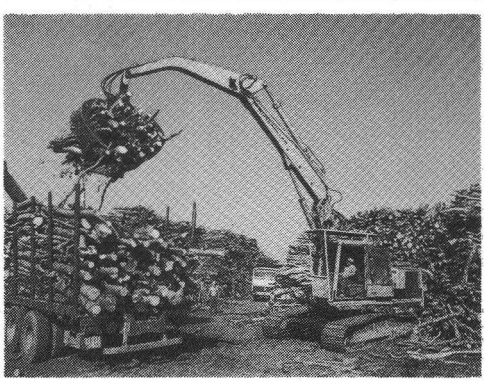

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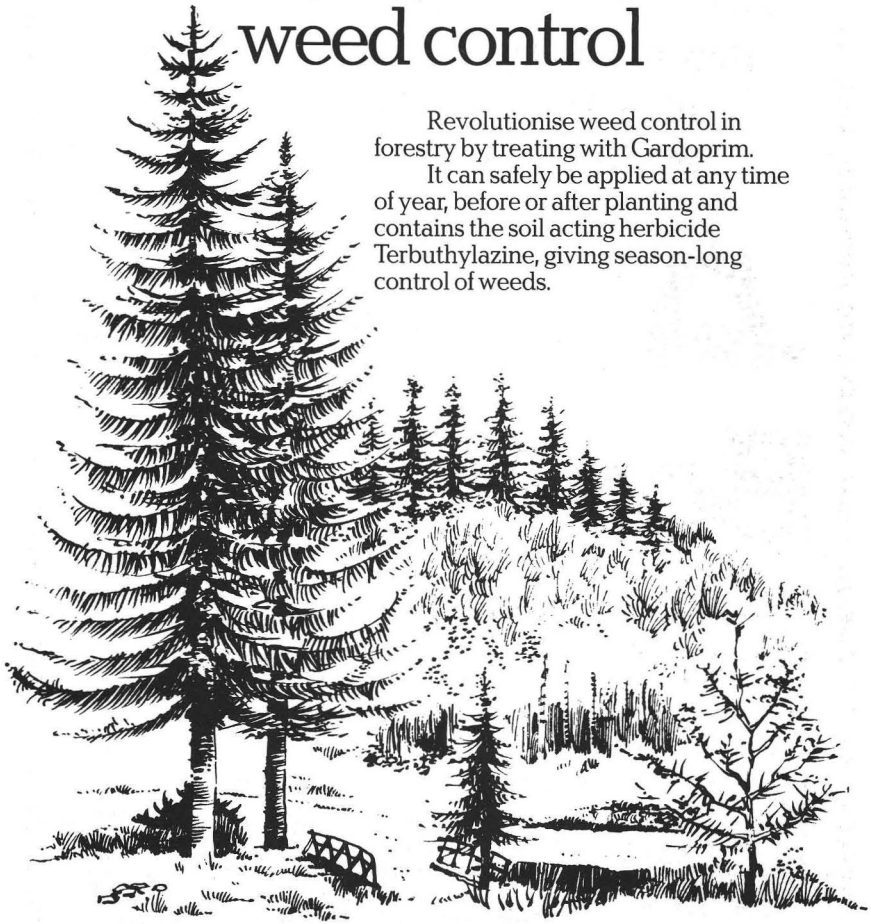

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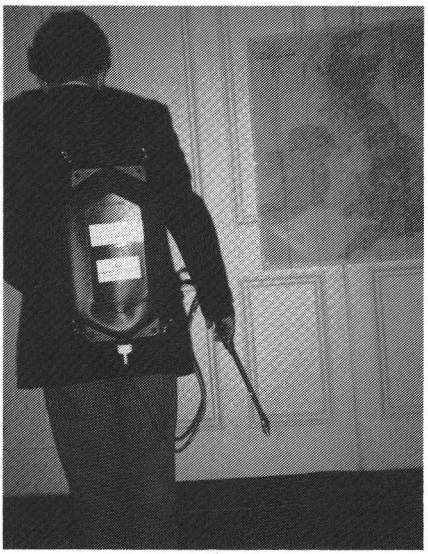

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The Use of Herbicides in Irish State Forests

E. Griffin

Research Branch, Forest and Wildlife Service,
Sidmonton Place, Bray, Co. Wicklow.

ABSTRACT

A brief account is given on the history of the use of herbicides in State forests. The differentiation into contact, translocated and residual herbicides is explained. This is followed by a description of the attributes of the main herbicides and quantities presently being used by the Forest and Wildlife Service and their recommended rates of use. The types of applicators used are also referred to.

INTRODUCTION

Weed control is a fundamental requirement of forest plantation establishment. The control or removal of competing plants is essential to favour the survival, health and growth of young trees. Weeds compete with the crop for light, nutrients and moisture. Later in the crop's life certain weeds, namely rhododendron and laurel, if left uncontrolled, cause problems of accessibility and increase the cost of all silvicultural operations. High costs in establishing plantations cause a severe reduction in overall profitability or net discounted revenue of the crop. Herbicides, when applied correctly, provide cheap and effective control of competing vegetation and thus their increasing popularity both in the public and private forestry sectors.

HISTORICAL

From about the mid 1950s ploughing for cultivation, drainage and weed suppression was common practise. Planting on cultivated bare ribbons encouraged quick establishment of trees. This in turn reduced the need for extensive weed control. Prior to the early 1960s weed control problems were dealt with manually using hooks with some control being carried out mechanically. However, certain vegetation types such as rhododendron (*Rhododendron ponticum* L.) and furze (*Ulex europaeus L.*) were troublesome and expensive to control. Following the introduction of GRAMOXONE (paraquat) a campaign to control furze was undertaken. Subsequently GRAMOXONE was used to control grasses and herbaceous weeds. It was also used to control heather

(*Calluna vulgaris* (L.) Hull) in Sitka spruce crops (*Picea sitchensis* (Bong.) Carr) which had gone into "check" i.e. a state of growth stagnation. GRAMOXONE was tested against rhododendron but because it was a contact herbicide it only defoliated the branches without having any effect on the root system. The big breakthrough for the control of rhododendron did not come until the introduction of 2,4,5-T in 1972. This herbicide gave excellent control of this species and was used extensively for the following nine years. However, it was withdrawn from use by the Forest and Wildlife Service in 1980 because of public unease about its possible side effects. It was superseded by the herbicide ROUNDUP. Other herbi-cides, both liquid and granular were tested during the 1970s, the more successful being 2,4-D for control of heather and ASULOX for the control of bracken (*Pteridium aquilinum* (L.) Kuhn). Granular herbicides did not come into favour for two main reasons: the unavailability of an applicator which would give an even spread of granules and as a result increased mortality of young transplants due to too high doses accumulating around some of the trees.

Types of Herbicides

It is useful at this stage to make some general differentiations between the various herbicides. They can be divided into three main groups:

contact, translocated	applied to foilage
residual	applied to soil

A *contact* herbicide affects or kills only that part of the plant's foilage to which it is directly applied. It does not have any lasting or residual effect in the ground as it is strongly adsorbed onto soil particles. The herbicide will therefore have no effect on deep rooted/rhizomatous plants e.g. GRAMOXONE is such a herbicide.

A *translocated* herbicide is one which when it is absorbed by a plant's foilage is conveyed within the plant to both its shoots and roots. Once part of the plant receives a sufficient dose of herbicide the rest of the plant will succumb. Some of these herbicides can be taken up by plant roots. A number of others, for example ROUNDUP, have no soil activity whatsoever.

A *residual* herbicide is one which when washed into the surface layers of soil is taken up by plant roots and by subsequent germinating weed seeds. Effective for a period of months, the herbicide will kill existing vegetation and keep the area weed free for a period of time, e.g. GARDOPRIM 500FW, ATRAFLOW. These herbicides have low water solubility and also a tendency to adhere to soil particles, which results in very little leaching down through the soil or laterally into watercourses. Where the soil is a peat or has a layer of peat on it, residual herbicides are more strongly adsorbed by the peat and therefore higher dose rates may be needed.

It should be noted that a herbicide may not fall distinctly into one or other of the above groups i.e. the herbicide may have both systemic and residual properties.

The main herbicides presently used by the Forest and Wildlife Service are:

Trade Name	Chemical Name	Vegetation Controlled
ATRAFLOW (50% w/v atrazine)	Atrazine	Soft grasses/rushes annual broadleaved weeds
GARDOPRIM 500FW (50% w/v terbuthlyazine)	Terbuthylazine	Soft grasses/rushes annual broadleaved weeds
ROUNDUP (36% w/v glyphosate)	Glyphosate	Almost all weed species
SILVAPRON D (40% w/v 2,4-D)	2,4-D	Heather
ASULOX (40% w/v asulam)	Asulam	Bracken

Characteristics of Individual Herbicides

ATRAFLOW (Atrazine)

This herbicide gives effective control of grass/rush vegetation for one growing season and sometimes retards the growth of weeds into the second year. The herbicide is mainly residual—it is taken up via the roots but some foliar uptake can occur. Thus the vegetation need not have grown very much at the time of spray application. If rain occurs soon after spraying there should be no loss of herbicide

effectiveness. It can be applied as a pre or post-planting spray to all conifers before bud break — it leads to some scorching of the new foilage after this time and is thus not recommended for spraying during the growing season. Broadleaved tree species can only be treated during dormancy.

GARDOPRIM 500FW (Terbuthylazine)

This herbicide is closely related to ATRAFLOW. Its properties therefore are similar, the main difference being that:

(1) all of the commercially grown conifers species can be over-sprayed at any time of the year i.e. during the dormant and growing seasons. It can thus be over-sprayed on many ATRAFLOW sensitive species.

(2) it is even less water soluble than ATRAFLOW and thus less likely to leach into ground water and/or into streams and rivers.

GARDOPRIM is particularly useful in that a forester with a potential grass or grass/rush problem in his coniferous tree crop, can decide during the growing season whether an application of this herbicide is needed or not.

ROUNDUP (Glyphosate)

This is a translocated herbicide which controls a very broad spectrum of weed species. The herbicide is taken in through the foliage and conveyed around the plant by its vascular system.

Therefore it works best when the vegetation is at its most active growth, before flowering and when the weather is warm and there is adequate soil moisture. If spraying is done during a period of prolonged drought the effectiveness of the herbicide will be significantly reduced. ROUNDUP when applied with water only, needs a rain free period of at least 6 hours and preferably 24 hours to be absorbed fully by the plant. It appears that the use of additional surfactants or additives can enhance the rainfastness and/or efficacy of this herbicide. One of the products showing particular promise is called 'Mixture B'. (Tabbush; Turner; Sale, 1986). ROUNDUP has minimal soil activity.

ROUNDUP is primarily a herbicide for use in preplanting situations. For instance on a reforestation site containing mixed habaceous and woody weed species it should be sprayed in the summer prior to planting. The site will probably be re-invaded with grasses the following spring but that vegetation can be dealt with by other herbicides either pre or post-planting.

As a post-planting treatment in conifers it can be used only when trees are protected from the spray, or in the dormant season between hardening off of the leader growth in autumn and the start

of bud swell the following spring. However, in the latter situation the vegetation may be too dormant to be effectively treated.

ROUNDUP is not metabolised by plant tissue. However, on contact with the soil it is strongly adsorbed to soil particles and therefore is relatively immobile in the soil — thus it cannot be taken up by plant roots. This strong adorption means that runoff into streams is almost negligible. The herbicide is rapidly biodegraded by soils and water micro-organisms into natural products i.e. carbon dioxide, water, nitrogen and phosphorus.

SILVAPRON D(2,4-D)

This herbicide has been used for a number of years to kill heather in checked Sitka spruce plantations. Uptake of 2,4-D by plants occurs through leaves, stems and roots. It is transferred within the plant to regions of growth where it interferes with normal growth processes. Plants metabolise, 2,4-D readily to various degradation products.

In soil, the herbicide generally has a short persistence (one month or less). It tends to be mobile and is primarily degraded by microbial activity. Similarly in streams or rivers it is again degraded by micro-organisms which, along with dilution, is the major means for its loss of activity in aquatic systems.

Research Branch of the Forest and Wildlife Service has been recommending since 1983 that the application of nitrogen at the rate of 434kg urea or 727kg calcium ammonium nitrate per hectare to checked Sitka spruce is a far more cost effective and beneficial method of releasing the spruce than applying 2,4-D (Griffin; Carey; McCarthy, 1984).

It should be remembered that the problem of spruce in 'check' can be caused also by a lack of phosphorus in the soil or the uneven application of phosphate at planting. In such a situation the application of either 2,4-D, or nitrogen, or both, will be of little benefit unless the phosphate is applied beforehand. One can recognise phosphorus deficiency in a plantation by the trees being stunted but with obvious leaders, the needles are short and dull green. The crop will also probably be uneven in height. The problem of phosphorus deficiency can be overcome by applying 350kg of rock phosphate/ha.

ASULOX (Asulam)

This is another translocated herbicide which is absorbed primarily by a plant's foliage although it can have appreciable activity through the soil. It is used to control bracken infested sites. It should, where possible, be applied in the summer prior to

planting because its effects are not apparent until the following spring — after spraying the bracken in July it will die down in its normal fashion in autumn, but in the following spring only 10 per cent of the previous year's number of fronds will emerge. After 4 to 5 years the bracken will have fully re-established itself. However, the trees should be adequately established at that stage. If a tree crop has been planted it can be oversprayed with ASULOX with very slight or negligible damage to the trees; the bracken canopy will usually prevent the herbicide from reaching the underlying crop. However Western hemlock and willows are sensitive to ASULOX and therefore should not be sprayed. The persistence of the herbicide in the soil is short as it is rapidly degraded by micro-organisms. Also it has low water solubility and therefore leaching into streams is not a problem.

Trends in Herbicide Usage

Table 1 below gives the quantities of herbicides used to service the needs of forest management over the past four years.

Table 1: Quantities (in litres) of the main herbicides used by Forest Management during the period 1983-1986.

Herbicide	Year			
	1983	1984	1985	1986
ATRAFLOW	2,553	1,655	8,046	12,670
GARDOPRIM 500FW*	—	—	7,185	20,082
ROUNDUP	5,996	5,145	3,060	7,150
SILVAPRON D	2,223	45	990	2,140
ASULOX	812	1,225	970	1,725

Total cost of all herbicides purchased in 1986 = £297,006.
*Herbicide tested in Research Trials (Forest and Wildlife Service) in 1983 and 1984.
Source: Supplies Section, Forest and Wildlife Service.

While the trends are somewhat erratic, possibly due to herbicides being held over from one year into the next, there has been a very significant increase in the use of residual herbicides i.e. ATRAFLOW and GARDOPRIM 500FW over the past two years; they are particularly suited to forestry because they control the grass or grass/rush type vegetation for the full (growing) season.

ROUNDUP, because of its ability to control such a broad spectrum of weeds, has maintained its high profile among the herbicides and is likely to continue to do so because of the rapidly increasing amount of land for reforestation. While the use of ASULOX is likely to increase somewhat, it will mainly be limited to afforestaion sites; on reforestation sites with bracken in mixture with other weeds ROUNDUP would be required. The use of SILVAPRON D is expected to fall off because it is not as cost effective as applying nitrogen to release checked spruce crops.

Storage

In general it is preferable to use herbicides in the year of purchase. If they have to be held over into the following year they should be stored in a dark frost free shed.

Operator Safety

The operator should wear the following items when handling the concentrate or during spraying of herbicide:

specialised spraying suit
faceshield
mist respirator mask
protective gloves
rubber boots

He should have access to an adequate supply of clean water — so that he can wash his hands before smoking or before having a meal. Water should be available for washing when the spraying is done. Also water is needed to wash off any of the herbicides if they accidentally splash onto the skin or into the eyes of the operator.

Mammalian Toxicity

Atrazine (ATRAFLOW), terbuthylazine (GARDOPRIM 500FW), Glyphosate (ROUNDUP), Asulam (ASULOX), are rated in the lowest mammalian toxicity class while 2,4-D (SILVAPRON D) falls into the second lowest class (Anon 1982). However Silvapron D, at the concentrations encountered in forests, has virtually no effect on most birds, fish, insects and soil organisms (Turner 1977). In practical terms the herbicides used at present are very safe in respect to man and the environment.

Herbicide Applicators

Knapsack sprayer

This has been the traditional applicator used by the Forest and Wildlife Service. High volumes of water are used when applying

Table 2: Recommended Rates of Application of Herbicides

Vegetation Type	Herbicide	Time of Application	Litres/Treated ha. Spot (1.3m diam.)	Band (1.2m width)	Overall
Grass/Rush	ATRAFLOW	Feb. — Prior to bud break	)		
	GARDOPRIM 500FW	February — July	) 5.3	9.6	16
Herbaceous Broad-leaved Weeds	ROUNDUP	June - July Before flowering	—	—	3.0
Bracken	ASULAM	July - August	—	—	7.0 + 3.0 of surfactant oil (no water required)
	ROUNDUP	July - August	—	—	2.0
Heather	SILVAPRON D	July - August	—	—	12.5 (No water required)
Woody Weeds	ROUNDUP	June - August	—	—	4.0
Rhododendron	ROUNDUP	June - August pre-planting. March - April September - November post-planting.	A concentration rather than a rate per ha is recommended i.e. 1 litre of herbicide to 2 litres of water using Micron Herbi/Ulva 8 sprayer. Therefore with a full cover of rhododendron at 1 metre high approximately 10 L of herbicide would be required.		

Notes:

ATRAFLOW & GARDOPRIM 500FW — On a site where there is a heavy mat of dead vegetation or moss, or lop-and-top from previous harvesting, this residual herbicide should be applied using a minimum of 100 litres total mixture (herbicide plus water) per treated hectare. The reason for the increased amount of water is to get the herbicides to their site of action i.e the soil. Where the site does not present the above constraints the herbicide can be applied using the hand-held Micron Herbi/Birky/Knapsack sprayer with a very low volume nozzle, using 1 part herbicide to 2 parts water.

ROUNDUP — Normally applied as an overall spray, with water. When using Micron Ulva 8 usually made up to 10 litres total mixture per hectare, and 40 litres when using the Micron Herbi. For conventional hydraulic sprayers a water volume of between 80-250 l/ha is recommended.

herbicides at 500 litres per hectare (1/ha). Recently, very low volume (VLV) nozzles were introduced which fit standard knapsacks and reduce the total volume output per hectare to 32, 64 and 126 litres for the VLV 50, 100, 200 nozzles respectively. Thus the knapsack is a versatile applicator and can be used for spot, band and overall spraying.

Micron Herbi and Micron Ulva 8

These applicators were first tested by Research Branch of the Forest and Wildlife Service in 1976. Since then, they have become quite popular because of the very low volumes necessary to apply per hectare and also the lightness of the machines. Both have spinning discs which produce a very fine spray — the discs are powered by eight HP2 batteries.

The Herbi is generally used for band spraying of residual herbicides (along tree rows) using total volumes of 20 to 30 litres per hectare. It produces a swath width of 1.2 metres. The applicator is also used for overall spraying at volumes of 40 l/ha.

The Ulva 8 is used for incremental drift spraying of bracken, woody and herbaceous vegetation. Paths are made in the vegetation at right angles to the prevailing wind direction and at between 3 and 5 metres apart. The operator then traverses the paths holding the head of the machine high above the vegetation and uses a light wind to drift the spray back over it. The total volume normally applied is 10 l/ha.

Birky

This recently introduced applicator has characteristics of both the knapsack and the Micron machines. It has a pneumatically driven disc which produces a very fine spray — no batteries are required as the air pump is operated by a hand lever. The tank capacity is 5 litres and it produces a swath width of 1.6 metres.

Spot Gun

This is a modified version of the veterinary drench gun. It applies a precise dose of up to 20 millilitres to each spot to be treated; the tank holds 5 litres. It is particularly suited to applying residual herbicides to the area immediately around planted trees. It can be further modified, using a plastic hollow cone to protect young trees, so as to enable the forester to apply certain non-selective herbicides which could not be otherwise applied during the growing season. The spot gun is very economical with regard to herbicide as it gives out the accurate dosage required per hectare.

Boom Sprayer

Since 1985 the Forest and Wildlife Service has purchased 3 boom sprayer units; two of them are tractor mounted, the other was designed to fit onto the carriage of a Bruunett forwarder. All the units are fitted with Micron 'Micromax' spray heads which allow for effective application of translocated herbicides in small volumes i.e. 40 l/ha. One of the units has been modified to incorporate the conventional hydraulic spraying system which is generally more appropriate when applying residual herbicides. The length of boom is limited to around 9 metres because of the swaying that occurs when machines are traversing ditches, drains, tree stumps, and lop-and-top. The units are of great benefit in treating, both quickly and evenly, large areas of afforestation and reforestation sites, providing the terrain is not too rough. However it is important that the vegetation be at the correct stage of development and that weather conditions are suitable.

CONCLUSIONS

The use of herbicides is likely to increase significantly in the Forest and Wildlife Service over the next decade because of their cost effectiveness. On a typical grass/rush site type applying a residual herbicide by spot treatment costs £46/ha inclusive of labour — with manual control this figure would be between £125 to £190. Manually cleaning a bracken site would cost in the region of £250/ha and this would need to be repeated for a number of years. Controlling bracken chemically would involve one spraying and cost £130. On good fertile sites where woody weeds are a problem the cost of manual cleaning each year can reach over £300 and the operation may need to be repeated for three to five years. Such areas can be treated with herbicide pre-planting for £147 but may need one follow-up treatment with residual herbicide costing £46.

Which system, manual or herbicidal, would you choose?

Mention of product or sprayer by name does not imply endorsement by the Forest and Wildlife Service of any product or sprayer to the exclusion of others which may be suitable.

ACKNOWLEDGEMENT

I wish to acknowledge the work of Mr. J. Brosnan, who was formerly involved in weed control research, and from whose experiments I have drawn some of my conclusions.

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Horse Bunching of Whole Trees from Thinnings on Flat and Sloping Terrain

P. Kofman and H. Phillips

ABSTRACT

Productivity of horse bunching of whole trees from early thinnings was assessed by means of time studies, using a hand-held micro computer. Productivity which varied from 2.8 to 8.8 steres/hour was found to be dependent upon loadsize and terrain conditions (A stere = cubic metre of loose chips). Suggestions are made for improvements.

BACKGROUND

Project Group CPC7 of the International Energy Agency (Felling and bunching of small trees on gentle terrain using small scale equipment) showed interest in the bunching of whole trees from thinnings by horse. As one of the overall objectives of CPC7 was mutual co-operation and exchange of information among its nine member countries, a small study of horse bunching of whole trees was undertaken by representatives of two countries vis P. Kofman (Skovteknisk Institut, Denmark) and H. Phillips (FWS Ireland).

INTRODUCTION

Chipping of whole trees from forest thinnings has become increasingly popular in the heath districts of Denmark. The chips are used for energy purposes eg. heating. Stands are first row thinned to afford access to a tractor-mounted chipper which travels though-out the stand. However in Eastern Jutland, and on some of the islands, as in many parts of Ireland, it is not possible to row thin for various reasons, including windthrow etc. In such areas trees for chipping have first to be concentrated at roadside or strip-road. Skidding by horse is one possible way to achieving this. The method has been studied previously for flat terrain condition (Dekking 1984). This current study embraces both flat and sloping terrain using the same horse and driver.

STAND DESCRIPTION

Two stands of Norway Spruce (Picia abies) in Silkeborg Forest, were chosen for the study (Table 1). One was on flat terrain while the other was on sloping terrain. The trees had been felled by chainsaw and manually bunched in May of the previous year.

Table 1: Stand Data

Stand Number	Silkeborg 84e	Silkeborg 283/284
Tree Species	Norway Spruce	Norway Spruce
Age	25	23
Stems/ha - before thin	6,370	4,400
Stems/ha — after thin	3,300	2,270
DBH(cm) of thinning	4.6	4.7
Height(m) before thin	6.8	10.0
Slop (%)	0	25
	(Silkeborg 84e = Flat Terrain)	

The thinning in stand 84e was heavy and was in contrast with stand 283/284 which received a moderate thinning from below.

In the stand on flat terrain the trees had been manually bunched into piles of between five to eight trees; while on the sloping terrain piles were only three to four trees. In both stands the trees were bunched between the rows (Fig1) in alternate rows. The rows were brashed to allow easy access for the horse.

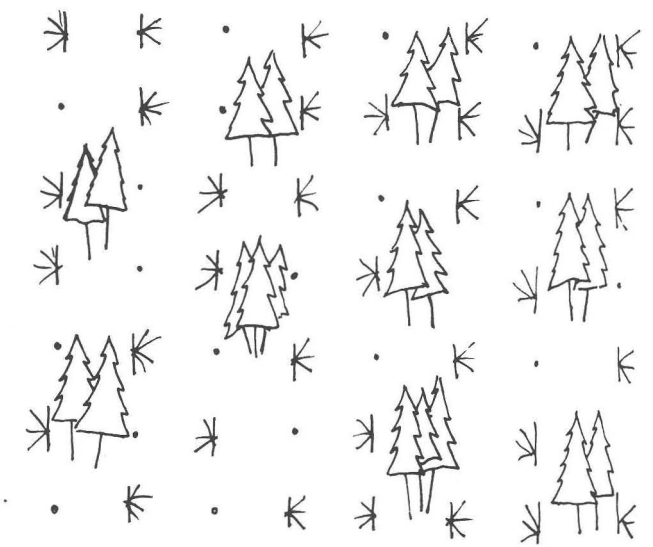


Fig 1. Felling Pattern.

METHOD OF WORKING

The horse was driven into the stand and steered to the bunch/pile to be extracted. The horse was turned, the load chokered using a singly choker chain and the horse then driven to roadside. At roadside the horse and load had to be turned though 90°, positioned and the load unchokered.

During the study attempts were made to attach more than one bunch behind the horse. This failed as it proved impossible to skid one load into another. The bottom load was continually shoved aside due to the light weight of the trees. In some instances the horse driver manually dragged trees from one bunch to another in order to increase his loadsize.

In the stand on sloping terrain some additional manual bunching was done prior to the time study to increase the range of load sizes.

HORSE AND EQUIPMENT

The horse studied was a large draught animal weighing around 900kg. and well experienced in forest work. The harnessing and chokering equipment are show in Fig 2. One point to note is the use of the chest strap, as opposed to the neck collar which is traditional in Ireland.

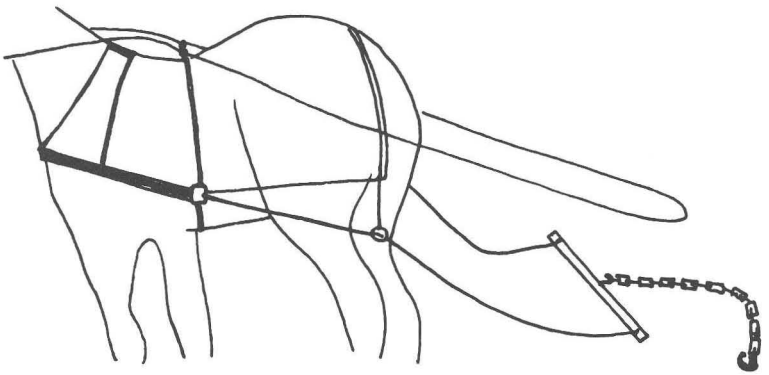


Fig 2. Harness and chokering equipment.

For this type of work, especially on steep and sloping terrain a smaller horse eg. Fjord or Irish Draught would probably have been more suitable and performed better. The loads were never so heavy that the horse had to use great power but it had to carry its own considerable weight uphill all the time. Also the size of the horse proved a disadvantage in manouvering in such close conditions.

Time Study Technique

In the field a small hand-held Husky micro computer was used to record time study observations and ancillary data — loadsize, distance etc. The Husky was pre-programmed using a software package developed by the Skovteknisk Institut. This package consists of a time study module for recording element times and a data collection module. The programme permits the recording of up to ten time elements, data imput and correction, also simple "in the field" data analysis and file handling.

The extraction cycle was broken down into four basic elements:

1. Travel idle
2. Load
3. Travel Loaded
4. Unload.

While these elements proved sufficient for the study in question, it was felt that in future studies, travel idle and travel loaded should be divided to include separate elements for time in the wood and time on the road.

No rating was carried out on the observed times. This absence of rating is standard practice in the Nordic countries (NSR 1978), unlike in Ireland where rating is standard practice.

Two time studies were taken, one on flat terrain and one on steep terrain. This latter study was divided into two parts (Steep 1 and Steep 2). In Steep 1 the presentation of the pile as found on the site was accepted. In Steep 2 some additional manual bunching was done prior to the study to increase the average loadsize and to increase the range of loadsizes to discover what affect loadize had on overall cycle times.

An allowance of 50 per cent was added to the observed times to cover rest and contingencies. Details of the studies are given in Table 2.

Results

For analysis purposes the data relating to distance were adjusted to a base of 20m to enable direct comparison to be made between studies. Simple linear regression revealed a strong correlation

Table 2: Time Study details (allowances included)

Study No.	Stand No.	Terrain	No. Obs.	Trees/ Load	Steres/ Load	*Steres/ Hour	Cycle Time (min.)
1	84e	Flat	40	6.2	0.335	6.04	3.28
2a	283/284	Steep	21	4.0	0.216	3.69	3.46
2b	283/284	Steep	31	6.1	0.329	4.91	3.93

*Note — All distances adjusted to a standard 20m.

between total cycle time and the number of trees per load for both flat and steep terrain (Fig 3). This relationship can be explained by the fact that loading time was strongly related to the number of trees per load ($R^2 = 0.80$). As was expected, unload times were found to be independent of loadsize.

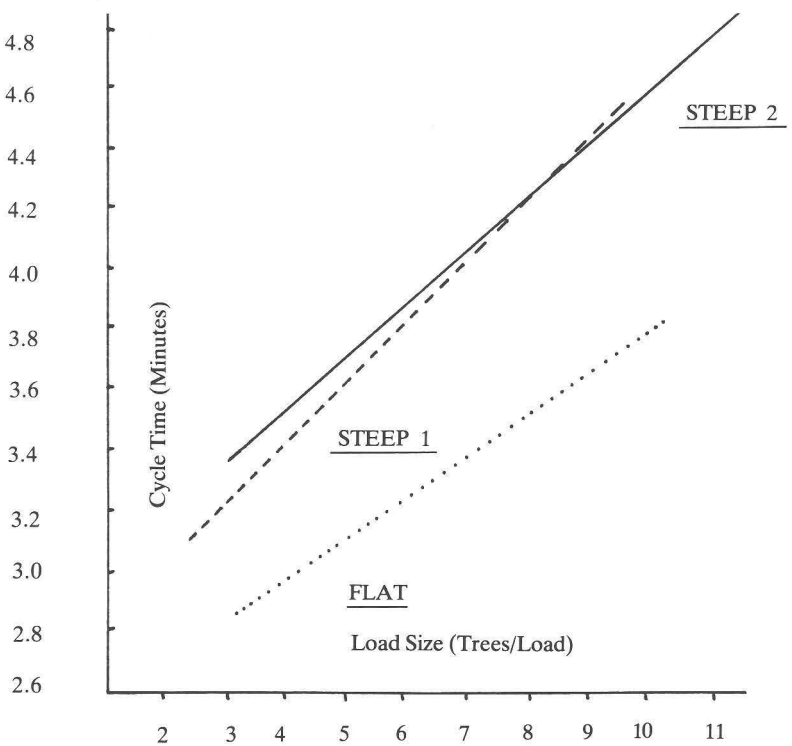


Fig 3. Cycle Time v Loadsize

A significant difference for cycle time versus loadsize was found between the flat and steep terrain (Fig 3). This can be explained by two factors: firstly the increased time level taken to travel unloaded uphill and secondly the additional time taken to choker the loads on the more different steep terrain.

Output in steres was greater for the flat terrain and averaged 6.04 steres/hour. On the steep terrain (all data) output averaged 4.58 steres/hour, a reduction of some 24 per cent. The critical factor apart from ground conditions affecting output is loadsize (Fig 4). The additional manual bunching for the second time study on the steep terrain resulted in an increase in productivity of some 33 per cent. Loadsize reflects the felling and bunching patter undertaken in the stand and is to a large extent controllable at time of felling.

It is interesting to note the range of output on flat terrain compares very favourably with previous studies (Dekking 1984).

Suggestions For Improvement

In general terms improvement can be effected in two ways — by increasing productivity and by reducing costs. In this instance both can be done.

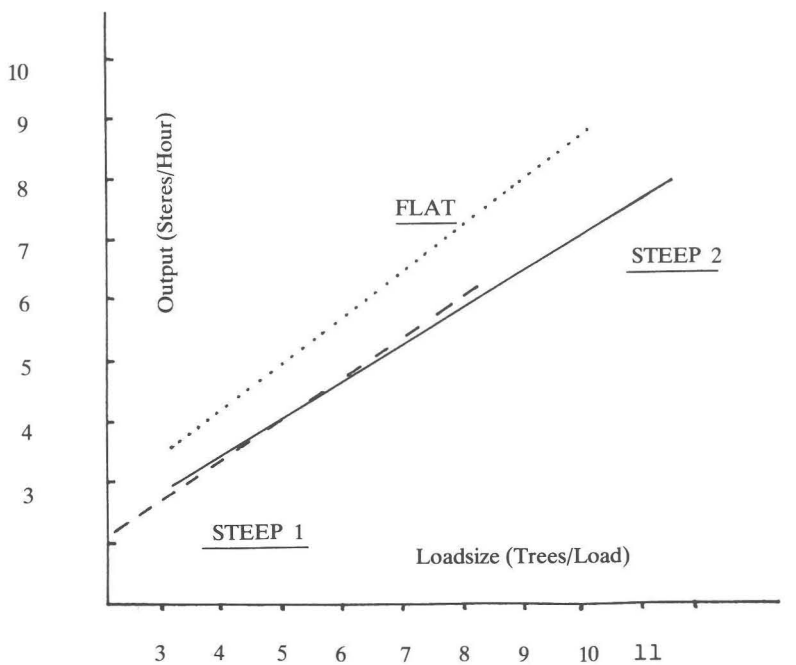


Fig 4. Output as a function of Loadsize

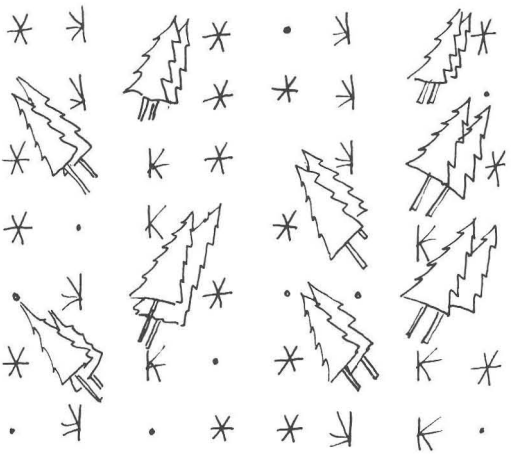
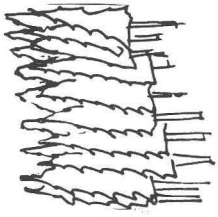


Fig 5. Herringbone Felling Pattern

Present Method



Proposed Method

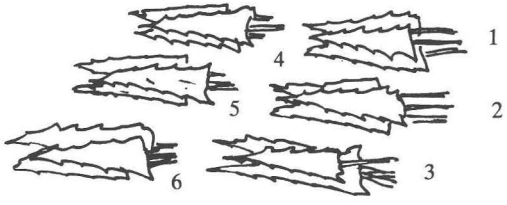


Fig. 6. Unloading at roadside

The productivity of the skidding operation can be increased by increasing the average load size. This in turn can be achieved by changing the felling pattern. At present, every second space between the rows is used for bunching the felled trees and all of the trees along this track have to be brashed. Also as all the bunches lie directly in line it is impossible to load more than one bunch at a time. By adopting a herringbone felling pattern with the butt ends projecting into the rack, loads could be accumulated and loadside increased (Fig 5). This pattern would also permit greater distances between extraction tracks, thus resulting in a 50 per cent decrease in the cost of brashing. Felling costs would change only slightly. Another possible advantage of the herringbone pattern is the likely reduction in damage to the stand.

At roadside a problem arose as regards the area required for unloading (Fig 6). At present with the light loads it was very difficult to place loads alongside one another. With the larger loadsizes for the herringbone pattern which should be compacted during extraction this problem should be over come.

At time of chipping, with the present system of unloading at roadside, the tractor driver is faced with a wall of trees with their butt ends almost in line. If a grapple, full of trees, (they may come from different loads) is pulled towards the chipper many additional trees will follow and end up lying beside the infeed opening leaving a mess which is difficult to clear away. This could be over come if the horse driver could leave the load staggered (Fig 6).

CONCLUSION

Skidding of whole trees from thinnings by horse has potential. Output varied from 2.4 to 8.8 steres per hour and was dependent upon loadsize and ground conditions. Productivity can be increased and costs reduced by adopting a herringbone felling pattern and by changing the pattern of unloading at roadside.

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Private Forestry in the U.K.

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A milestone in British forestry was reached with the planting of the 2 millionth hectare in 1984 (Foot 1985). Of this area, some 56 per cent is in private ownership, with the balance coming under the control of the Forestry Commission.

Area of Productive Forest in Britain as at 31st March, 1985 ('000s Hectares)

	Conifer		Broadleaved		Coppice		Totals		
	PW	FC	PW	FC	PW	FC	PW	FC	ALL
England	196	199	381	41	37	1	614	241	855
Wales	46	128	53	6	2	—	101	134	235
Scotland	358	513	72	4	—	—	430	517	947
Britain	600	840	506	51	39	1	1145	892	2037

PW = Private Woodlands FC = Forestry Commission.
(Forestry Commission 1985)

Currently, some 10 per cent of the U.K. land area is managed as productive forest which, by European standards, is a low figure, but it still demonstrates a major development in afforestation following the destruction of two world wars. The expansion of the forest industry has increased steadily by approximately 20,000 hectares per annum over the last ten years and in a policy statement by the Government in 1980, it was proposed that new planting should continue at broadly the same rate. This programme of expansion has given much confidence to timber growers and users alike.

Over the last ten years some 86 per cent of all new planting has been carried out in Scotland, with the balance being more or less equally divided between England and Wales. The share of new planting between, private and state sectors, has been more or less

equal over this period. However since the early 80s the proportion carried out by private owners has started to rise to somewhere over 75 per cent, as a result of the present Government policy to encourage private forestry investment and the disposal of parts of state enterprise.

As a result of the expansion of the forest estate since 1945, the production of conifer roundwood will double over the next fifteen years, while the levels of hardwood will remain more or less static during the same period.

Annual Wood Production in Britain (Past and Future)
('000 cubic metres o.b.)

	Conifers			Broad-leaved Total	Grand Total	
	PW	FC	Total			
Actual						
1978	760	1950	2710	1400	4110	
1979	880	2060	2940	1400	4340	
1980	890	2410	3300	1300	4600	
1981	730	2530	3260	1300	4560	
1982	860	2690	3550	1000	4550	
1983	940	2770	3710	900	4610	
1984	1110	2760	3870	900	4770	
Forecast (figures from conifer production outlook 1981-2001)						
82-86	1600	2900	4500	900	5400	} Figures are average annual volumes over period.
87-91	2000	3400	5400	900	6300	
92-96	2500	4500	7000	900	7900	
97-2001	3200	5600	8000	900	9700	

(Forestry Commission 1983)

The prospect of increasing wood supplies has resulted in a great deal of interest in industrial development over the last few years as demonstrated by the advent of the new pulpmill at Shotton, the Highland Forest Products development at Inverness, the creation of several new sawmills and the planned expansion programme at Thames Board Mill; Egger at Hexham; Caberboard and Kronospan. In the last few years something in the order of one million cubic metres of new capacity has been created in the pulp and particleboard industries alone. With the current annual import

bill for timber and timber products running at over £4,500 million, these new developments hold out encouraging prospects for the British economy, whilst in turn offering the knowledge of sound market outlets to private forestry investors.

The need for forest expansion can be traced back to the Forestry Policy of 1943, which pointed the way for expansion into the uncultivated land in the hills and uplands. It is estimated that during this period over 900,000 hectares have been planted in the uplands. This work has been carried out by both the Forestry Commission and private forest investors, following the sale of land in a free market. Farmers have often used the proceeds of such sales to re-invest in farm improvements on the the remainder of their holding or, to acquire a more intensively managed farm. (Grundy 1985).

The incentives offered to the private forester have changed and developed over the years. In general they can be summarised under the three main headings: 'grant aid', 'taxation incentives' and 'silvicultural advice backed up by research from the Forestry Commission, acting as the forest authority' (Flintshire Woodlands 1986).

Under the present grant aid arrangements two schemes are offered by the Forestry Commission as follows:

Forestry Grant Scheme

Areas of Wood hectares	Conifers (per hectare) £	Broadleaved (per hectare) £
0.25 to 0.9	630	890
1.0 to 2.9	505	735
3.0 to 9.9	420	630
10.0 and over	240	470

Notes: 1. Level of grant based on area of woodland, not area planted.
2. 80 per cent paid after planting and 20 per cent after five years.
3. For a mixture the rate is calculated pro rata.

(Forestry Commission 1985).

The taxation of woodland income and expenditure is somewhat complex (Forestry Commission 1985). However, in general terms, if the land on which trees are growing is owner occupied or leased for forestry purposes, the trees are treated separately from the

Broadleaved Woodland Grant Scheme

Area of Planting or Nat. Regeneration (hectares)	Planting				Natural Regeneration				
		£				£			
	Yr.	1	5	10 Total	Yr.	1	5	10	Total
0.25 to 0.9		840	180	180 1200		600	360	240	1200
1.0 to 2.9		700	150	150 1000		500	300	200	1000
3.0 to 9.9		560	120	120 800		400	240	160	800
10.0 and over		420	90	90 600		300	180	120	600

Notes: 1. Level of grant based on planting, not woodland area.
2. No conifers permitted in planting.
3. Payment phased over years indicated.

(Forestry Commission (1986))

ownership of the land. The forestry operations, provided they are run on commercial lines, will be assessed under Schedule D, when the occupation will be assessed as if it were a trade.

Well established commercial woodlands are normally assessed under Schedule B, whereby the occupier is taxed annually on one third of the rental value of the land in an unimproved state and no tax is levied on the proceeds of the sale of timber.

Alternatively, the occupier may elect to have forests assessed under Schedule D as if it were trade and this choice is usually made when the occupier sets out to afforest bare land. The tax payable is assessed on any net profits, but of course during the establishment stage of the plantation — over the first 10 to 15 years — net losses will be experienced and in the first few years losses will be substantial. Such losses may be offset against other income and are thus eligible for tax relief at the occupier's marginal rate. It should be noted that upon the change of occupier this has the effect of cancelling the Schedule D election and the woodlands revert to be assessed under Schedule B.

These measures, coupled with other capital taxation rules, have led to a strong and healthy private forest industry.

It would be wrong not to commend the valuable support and advice given by the Forestry Commission to the private sector over many years as the whole industry clearly does recognise the partnership of state and private forestry.

Within the private sector a strong and professional managing and contracting service has developed over the past twenty five years to service the growing market. A number of forestry management companies have become well established, in addition to the numerous private consultants and professional foresters in the employment of individual owners. Furthermore a whole industry, from nurserymen to the tree harvester and investment adviser to woodland insurance agent, has developed in conjunction with the growth of private ownership of woodlands.

The pattern of ownership in private forestry is difficult to analyse but essentially it contains a wide cross-section of interests including traditional estate owners, investment owners (both individual and institutional), farmers, local authorities and conservation bodies, who are without exception currently expanding their holdings at a significant rate.

Considering forestry as a business, the investment owner does enjoy real incentives to invest income that would other-wise be heavily taxed and with the knowledge that historically the value of land has overtaken inflation and timber has kept pace with it, forestry investment is considered by many to have a bright future. The additional attractions to the investor of sporting opportunities, forest recreation, diversification of habitat management and even the simple enjoyment of the countryside have all helped to develop the market.

Over the years there has been no co-ordinated policy for the allocation of rural land and thus, the pattern and rate of afforestation have been determined by supports to forestry and to agriculture in conjunction with constrains imposed by other bodies, usually for nature conservation and landscape reasons. A detailed system of consultation under the control of the Forest Authority has assisted in resolving differences and with few exceptions, this system has been successful. However, the forest industry now faces new socio-economic changes which must be understood and in practice, the industry must be flexible enough to meet the challenges (Countryside Commission 1984).

Perhaps the most significant shift of emphasis in recent years has been the increased interest and involvement of the general public in environmental awareness and recreational usage of the countryside. The industry must ensure it fully reacts to provide benefits in conservation, landscape and amenity areas. This is a major task for all private owners and one which will have certain investment implications; small sacrifices can however go a long way to appeasing these interests.

In addition, there are now suggestions emanating from the EEC debate on agricultural surpluses, that a substantial hectarage in the

U.K. may come out of agriculture and could be used to increase the forest area. Such a development will offer a major challenge to both sectors of the forestry industry. It may also result in further substantial areas of uplands being converted into valuable plantations and amenity areas, whilst providing compensation in terms of employment and financial return to rural communities.

Private forestry in Britain embraces a very wide spectrum of ownership and silvicultural practice and its base is likely to widen considerably. The possibilities of developing farm/forestry woodlands and a greater diversity of integration of rural land uses present new challenges. The timber growers, the investors and the professional foresters are aware of the challenges and the opportunities that lie ahead (Timber Growers 1985). The continued expansion of the forest area coupled with the highest standards of professional practice must undoubtedly ensure a healthy state in which a viable and politically aware industry will emerge for the task of creating further forests and re-establishing those which have already reached maturity.

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Irish Forestry and Overseas Development Aid

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INTRODUCTION

An area of dense forest, greater than the size of the Republic of Ireland is being cleared each year in the tropics. This is equivalent to deforestating the Phoenix Park every 50 minutes (Gorta, 1985a). Tropical deforestation, with the consequential problems of erosion, water-shed mismanagement, loss of potential forest produce (fuelwood, lumber, fodder, food in some cases) and loss of habitat for both flora and fauna "can reasonably be seen as the most important forest question of our time" (Anonymous, 1982b).

Forest organisations and governments are reacting with growing concern and this has been expressed at several recent international meetings. For example, the IX World Forestry Congress, held in Mexico in 1985, was devoted largely to development in the tropics. In view of the magnitude and complexity of this issue, the Food and Agriculture Organisation (FAO) prepared, in 1985, an overall framework to guide future co-operation in tropical forestry. This is called the Tropical Forestry Action Plan (FAO, 1985). The plan has received broad international support: it envisages a doubling of aid to assist tropical forestry over the 5 year period 1986-1990 which, in monetary terms, would amount to US$8 billion or a doubling of present levels of external aid to combat deforestation (WRI, 1985).

There is a general acceptance that tropical countries cannot overcome the problems on their own and solutions will involve the whole international community (Franklin, 1986; Leakey and Last, 1983; Postel, 1984). The Republic of Ireland is a member of that community and any role the country might assume should be co-ordinated with recognised international initiatives. The purpose of this paper is to outline Irish trade links with tropical countries as well as Irish aid contributions from the forestry point-of-view.

IRELAND AND THE TROPICAL HARDWOOD TRADE

The Republic of Ireland imports the equivalent of 120,000m^3 of high quality roundwood lumber from the tropics annually. This material, which is valued at about IR£16 million, comes from

Africa, Latin America and Asia with 61% coming from one single country in West Africa: the Ivory Coast (Gorta, 1985a). The breakdown is shown in Figure 1.

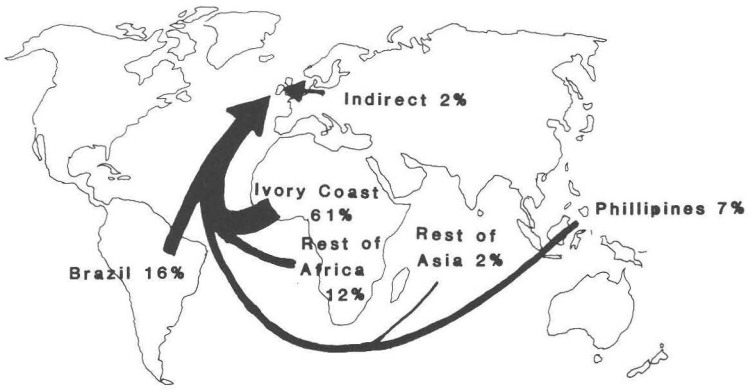

Fig 1. Imports of tropical hardwoods to the Republic of Ireland for the period January 1980 to December 1984 (Central Statistics Office, Dublin.).

The Ivory Coast is losing its tree cover at the rate of over 300,000 ha per year; this is approximately equal to the total area under state forest in Ireland. Over 70% of the area which the Ivory Coast had under trees, at the beginning of the present century, had been cleared by 1980 (Anonymous, 1982a). This clearance has significantly jeopardised the future of forestry in that country and has wasted a considerable potential wealth (Lanly and Clement, 1981). If the present rate continues unabated, the exploitable forest will disappear completely before the year 2000.

The Republic of Ireland is the Ivory Coast's best market for Iroko (Mindell, 1984). Iroko (*Chlorosphora excelsa*) is commonly seen in window and door frames in Ireland and is incorrectly known in popular usage as 'teak'. About 3,000 ha of the Ivory Coast's forests are logged each year to supply the Irish market; this represents 1% of the area deforested in that country. Logging, on its own, does not result in complete deforestation but there is a strong linkage in that the forest is opened to further exploitation. This synopsis demonstrates that Irish trade does not discriminate in favour of regions of the tropics which try to maintain a sustained yield from their natural forest resources.

Timber prices of standing trees in the natural forest are negligible and are based mainly on felling and extraction costs and current demand; they are below replacement cost because no value is apportioned to the length of time it took for nature to produce them, which may be several hundred years (Richardson, 1984). Many countries which use tropical hadrwoods are now examining the policies they should adopt towards importations (Huguet, 1980; Steinlin and Pretzsch, 1984; von Meijenfeldt, 1985). Several solutions have been posed, like a boycott of lumber coming from areas that mine their resources (Editorial (ORYX), 1984). Guppy (1984) advocates the establishment of an OPEC-type cartel of producing countries which would raise timber prices substantially and obtain for the exporter the same external revenue from a smaller area of forest. Decreased availability of quality wood, due to increase in price, would bring forward the day when at least parts of the market would have to find substitutes for tropical timbers.

The International Tropical Timber Organisation has come into existence recently. It is composed of 35 consuming countries and about the same number of producers. The main objective is to provide an effective framework for co-operation and consultation with regard to all relevant aspects of the tropical timber economy (UN, 1984). There is a clear indication that if tropical deforestation continues unabated then sooner or later hardwood supply will dry up and high quality lumber is unlikely to be renewed in the tropics (Sutton, 1981). Mahogany, for example, will probably be commercially extinct by 1990 (Knees and Gardner, 1979).

In the face of almost certain shortages of quality woods, countries like Ireland should consider establishing broadleaf reserves. But what area should be devoted to producing quality timber? If it was decided to supply the equivalent volume of hardwoods, which the country now imports from the tropics, an area of 15,000 ha would be needed if a yield of $8m^3$/ha/year could be sustained. At present 5% of the state's forests are composed of broadleaf species and this amounts to 15,000 ha. This area, however, is not being managed to produce quality wood: about 2,000 ha are currently conserved as nature reserves, whilst the remaining plantations are fragmented into small, hard to manage, parcels. However, these figures do demonstrate that the present area under broadleaves would form the base of an adequate broadleaf reserve in terms of area alone. It might be possible to substitute the scattered plantations with large blocks on good soil and manage them accordingly; this would involve cutting and replanting the small scattered areas with conifers if it was decided not to expand the present area under broadleaves. The reserve would be managed strictly for quality

timber, though it could have some recreational value also. Its value for wildlife conservation would be limited and should not be confused with old woodland nature reserves which should be managed for their conservation interests.

Irish Overseas Aid and Tropical Forestry

Several moves have been initiated during the present decade and these are mentioned briefly below.

In 1983, a committee was established within the Society of Irish Foresters, to explore general aspects relating to Ireland and forestry in the Third World. The first open meeting was held in University College Dublin and this was reported in Irish Forestry (1985 Vol. 42 (1): 53). The concensus of opinion was: "that a new effort be made to encourage greater participation by Irish institutions and Irish foresters in the development of forestry in Third World countries".

On 1 April 1985 Ireland became a member of the International Tropical Timber Organisation.

In October 1985, Gorta's World Food Day Seminar was entitled "The Forest Connection" (Gorta, 1985b); at this meeting the Minister for State for Foreign Affairs, Mr. O'Keeffe, announced new moves to expand Ireland's bilateral aid programme in forestry and these got underway during 1986.

In February 1986 an international conference on forests and trees, known as the SILVA Conference, was held in Paris on the initiative of the President of the French Republic. An Taoiseach, Dr. Garret FitzGerald attended and expressed his intention to examine the possibility of significantly increasing aid going towards problems caused by deforestation; this meeting is reported in Irish Forestry (1986 Vol. 43 (1): 80-81).

In recent years there has been a growing awareness among aid organisations and agencies in Ireland of the importance of forestry in their projects and this has been reflected in support for tree planting activities. I estimate that the total annual funding for forest related projects including multilateral, bilateral and non-governmental contributions is about IR£400,000. This is forecast to rise considerably: one Irish non-governmental organisation, Self Help, hopes to launch an IR£740,000 forest project in Ethiopia in the near future.

Parallel with these developments there has been an increase in forestry graduates going overseas since 1980.

The Irish Forestry Profession and Tropical Forestry

Considering that there is now a commitment by Ireland to aid tropical forestry, an effort should be made to harmonise and

maximise this country's involvement. The forestry profession, in both the private and public sectors, has a central role to play within the overall framework of Ireland's aid programme. To do this, interested institutions could come together within a recognised forum, where an interchange of ideas and experiences could take place. Discussion of this nature should eliminate duplication of activity. Furthermore, Ireland might develop a specialisation in an area in which Irish foresters could play a leading international role. This could be the foundation of a commercial consultancy enterprise. It must be remembered that this country has built up a considerable expertise over the last 80 years in plantation establishment and management and is one of the few countries in the world that has formed nearly its entire resource from an almost non-existant base.

To be more effective, forestry institutions should work with and through other institutions which are involved in overseas development. On the side of the state the main source of expertise is the Forest and Wildlife Service, while the body dealing with trade and the International Tropical Timber Organisation is the Department of Industry and Commerce. It is the brief of Foreign Affairs to orchestrate the state's overall involvement in development matters. On the side of the semi-private or private forestry sector there are the universities, timber growers and industrialists. Another dimension is the group of development agencies like the Agency for Personal Service Overseas (APSO), Gorta, Concern and others who have first hand experience in the tropics. Working through these organisations is not as difficult as this list might imply, because there already exists a certain level of mutual dependancy. In order to be efficient in the international field it is advisable to forge links with major international initiatives, principally the International Tropical Timber Organisation and the Tropical Forestry Action Plan. The latter, which is being co-ordinated through FAO, is a plan rather than a new organisation and aims to make an impact to de-accelerate tropical deforestation. Ireland could contribute to the success of these undertakings and considering its involvement as a tropical importer — has a responsibility to do so.

Note: IR£1=US$1.35.

ACKNOWLEDGEMENTS

I wish to thank Mr. A. O'Connor (Department of Foreign Affairs), Mr. P. O'Donoghue (Department of Agriculture), Mr. R. Smiley (Gorta), Mr. H. Byrne (Concern) and Mr. M. Lambert (Self Help) for assistance in compiling the figures for aid contribution.

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A Financial Appraisal of Sitka Spruce

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ABSTRACT

An economic appraisal of a range of yield classes of Sitka spruce is presented. The effect of different assumptions of timber price, discount rate and grant structure is shown. The quality of Sitka spruce as a structural timber is discussed. It is concluded that the timber from crops now reaching clearfell age is of satisfactory strength.

A comparison is made between the return from forestry and agriculture. Forestry is shown to be more profitable than agriculture on a large proportion of the soils that are marginal for agriculture.

INTRODUCTION

The capability of Irish land to grow trees satisfactorily has been demonstrated in established plantations over a range of different site types. The growth rates are very impressive being 3 to 4 times the European average. The wet mineral soils are particularly productive as shown in the Leitrim Resource Survey (1973-1979) where 70 per cent of the land was described as yield class 24 or greater.

In Ireland the development of forestry depends on the transfer of land from agriculture. The economics of forestry in Ireland are therefore quite different from those nations with a long forestry tradition as bare land afforestation requires significant capital investments and a long delay before any returns are obtained. In the already afforested areas of Europe the cost of reforestation can be funded from the sale of the previous crop.

The economics of forestry can be examined from many different aspects. These include primary production, downstream developments, provision of employment and import substitution amongst others. This paper concentrates on the economics of forestry from the view point of the primary producer.

The objective of this paper is to provide a framework for estimating the expected return from afforestation of different site types. Estimating the returns from an investment that takes about forty years to mature will, inevitably, depend on many assumptions. It is important that these are appropriate to the particular situation before the conclusions apply.

BASIS FOR THE ANALYSIS

The analysis involves the generation of a cash flow of costs and revenue for the complete crop rotation. The revenue is developed

from estimates of timber yield and size classification together with estimates of wood price, while costs are derived from work study estimates. Direct costs only have been included.

Timber yield

Sitka spruce (Picea sitchensis Bong (Carr)) is the species considered. Yield Tables (Hamilton and Christie (1971)) are used to estimate the volume and breakdown by size class of material from each thinning and clearfelling. Implicit in these tables is the assumption that crops are planted at approximately 1.8 metres spacing and that selective thinning to marginal intensity is carried out. These assumptions differ from current practice in that initial spacing is at least 2 x 2 metres and first line thinning is common. It is considered that the deviation from current practice is sufficiently small to justify using the yield tables. Further, the importance of the analysis is to show the relative importance of different factors such as yield class and price.

The area by yield class for Sitka spruce grown in Forest and Wildlife Service plantations is shown in Table 1. This indicates the relative amounts of the different yield classes expected over a great range of marginal to sub-marginal agricultural land.

Table 1: Percentage area of Sitka spruce by yield class on Forest and Wildlife Service land.

Yield Class (m^3 per hectare per annum)	% Area	Yield Class (m^3 per hectare per annum)	% Area
< 12	18.4	18	14.6
12	11.7	20	11.4
14	14.2	22	7.0
16	14.0	24 +	8.7

Timber prices

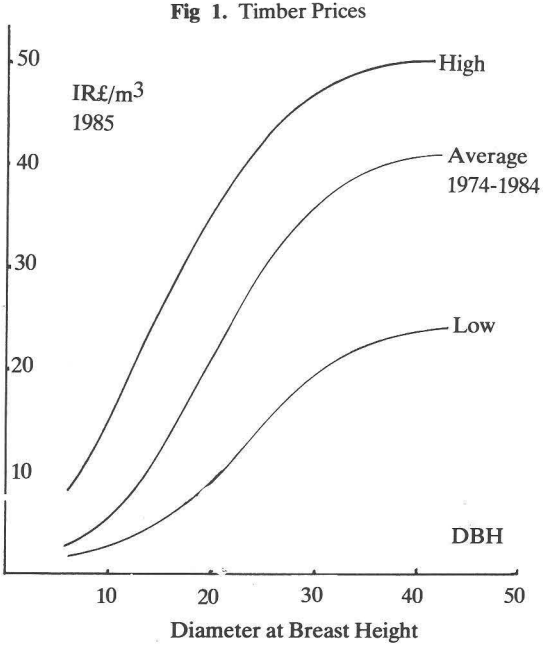
Timber prices, like many raw material prices fluctuate very significantly from year to year. However, an examination of these indicates a relatively stable pattern in the long term. Many forecasts of demand for timber products published in the recent past agree that demand will continue to exceed supply in both Britain, which is our nearest and largest market and in the rest of the European

Economic Community. Further, many of these studies predict that timber prices will at least keep pace with inflation. These analyses include the World Bank (Helterline (1979)), the United States Department of Agriculture (1982), the Economist Intelligence Unit (1981), the Centre for Agriculture Strategy (1980) and the British Forestry Commission (1977).

The assumption can therefore be made that the long term trend of future prices remain the same as in the past. To arrive at the historical level, the prices over a long period are averaged in order to eliminate short term fluctuations. The longer the period the data spans the less likelihood that short term flunctuations will distort the trend.

For the present analysis the average price of all Forest and Wildlife Service (FWS) sales from 1974 to 1984 was calculated. (This was the only period where complete data were available). The consumer price index was used to update the data to 1985 price levels. As timber price is of such importance to the analysis, two alternative prices were used in order to demonstrate the sensitivity of the results to different timber price levels. The highest and lowest prices prevailing between 1974 and 1984 were obtained using the same techniques. The central and the two extreme prices are shown in Figure 1.

Fig 1. Timber Prices



Costs

The relative costs of all operations have been assumed to keep pace with timber prices therefore the effect of inflation can be ignored. Costs of the various forest operations throughout the rotation have been derived from work study estimates in the FWS. These are the costs prevailing in 1985.

The costs are those appropriate for a mineral site type. These costs will vary depending on the circumstances, e.g. need for roading, fencing, etc. However, a central assumption of mean difficulty has been taken (Table 2).

Table 2. Sitka spruce cash flow yield class 20

Year	Operation	Cost (1985 £)	Revenue (1985 £)
0-40	Annual maintenance cost	15	—
0	Establishment	1,218	—
1	Vegetation control	94	—
2	Filling in	11	
17	Road construction	359	
18	Brashing	118	
19	Pruning	268	
19	1st thinning — net return		539
20	Drain and road repair	47	
22	General maintenance	29	
24	Pruning	236	
24	2nd thinning		660
25	Road and drain repair	47	
27	General maintenance	29	
	3rd thinning		992
30	Drain and road repair	47	
32	General maintenance	29	
34	4th thinning		1,513
35	Drain and road repair	47	
40	Clearfelling		12,715

Establishment procedure assumed is as follows

Site ripped.
Fertilising with 250kg unground mineral phosphtate.
Chemical vegation control using tractor mounted sprayer.
Fencing at a density of 70 metres per hectare.

Discounting

As most investors prefer to receive income now rather than later the concept of discounting is used to adjust all costs and revenue taking account of their timing. This reduces the value of all future costs and revenues by the appropriate rate of interest compounded for each year's delay. As cost and revenue are expressed in real terms, the real interest rate (net of inflation) must also be used. The selection of interest rate will however depend on the investor's attitude to delay. An individual with limited resources will be inclined to use higher interest rates, whereas an investor with spare investment capital will tend to use a lower interest rate. The discount rate used by the State in appraisal of forestry is 4 per cent. (the case for forestry (1980, revised 1983)).

Analysis

A sample cash flow for one hectare of yield class 20 Sitka spruce as shown in Table 2 forms the basis for the analyses.

Net discounted revenue (NDR) for a single rotation of Sitka spruce is shown in Table 3. The central timber price assumption has been taken and no allowance made for grants to private growers. The critical effect of yield class is obvious with NDR values at 4 per cent discount rate increasing from –£1,196 for yield class 8 to £3,241 for yield class 24. The price of yield class 24 land is in the region of £1,200 per hectare more than that of yield class 8. There is therefore an increased profit of over £4,000 for an increased investment of £1,200.

The internal rate of return, which is the rate where discounted costs equal discounted revenues, increases from 1 per cent for yield class 8 to 7.5 per cent for yield class 24. This represents a real rate of return over and above inflation of up to 7.5 per cent

Table 3. Returns from a single rotation of Sitka spruce central timber price assumption.

Yield Class (m^3 per hectare per annum)	Discount Rate %					Internal Rate of Return (%)
	2	3	4	5	6	
8	–501	–954	–1196	–1335	–1411	1.2
12	1436	335	–349	–775	–1041	3.5
16	3996	2116	891	91	–443	5.2
20	5413	3249	1781	780	94	6.2
24	7743	5104	3241	1920	979	7.5

Effect of Timber Prices

Predicting timber prices for periods up to 40 years or more is uncertain. The demonstration of how sensitive the results are to different timber prices can help in evaluating the investment. In order to show their effect on the returns the NDR is calculated for the three timber prices, the medium price, which is taken as the most likely to occur, together with two extremes (Table 4).

Table 4. Effect of different timber prices on returns from Sitka Spruce.

Yield Class (m^3 per hectare per annum)	Net discounted revenue assuming 4% discount rate (£ 1985 per hectare)		
	High Timber Price	Medium Price	Low Price
8	–464	–1196	–1656
12	909	–349	–1313
16	2625	891	–550
20	3860	1781	–361
24	5857	3241	386

The effect is seen as significant with the breakeven yield class ranging from approximately 10 to 22 cubic metres per hectare per annum. The two extreme prices are however based on only one year's data, while the medium price is made up from sales over eleven years. The results indicate also the dangers of using a single year's price data as short term fluctuations may lead to distortions in the results.

Several Rotations and Price of Land

The analysis so far has taken account of one rotation only and has not included land price. In Table 5 the returns from an infinite number of rotations are shown, both including and excluding the price of land. The effect of including many rotations is more significant for higher yield classes than it is for lower ones. This results from the shorter rotation length of the higher yield classes. In the case of yield class 24, the NDR at 4 per cent is increased from £3,241 to £4,667 per hectare or 44 per cent.

Land price has been assumed to range from £50 for yield 8 to £1,200 for yield class 24. This is an estimate of the current price for low-lying wet mineral soil (yield class 24) to poor mountain slopes

Table 5: Returns from an infinite number of rotations (Central price assumption).

Net Discounted Revenue 4% Discount Rate (£ 1985 per hectare)

Yield Class	NDR (4%) (Land price excluded)	NDR (4%) Including land price)
8	–1383	–1433
12	–415	–632
16	1084	602
20	2355	1527
24	4667	3422

(yield class 8). There is a significant range in land prices within equally productive forest sites. This will be influenced by location, state of development of the land or other local reasons. This paper only deals with one assumption on land prices.

The increase in profit accruing from higher yield class crops more than compensates for the increased price payable for the better quality land.

Return to Private Investor

The returns to a private forestry investor are increased by availing of grants for afforestation. European Economic Community (EEC) funded grants under the Western Package scheme are available in nine western counties, while FWS grants are available in the rest of the country.

The Western Package grants are cost related representing 80 per cent of the establishment costs payable in two instalments: 75 per cent payable upon completion and 25 per cent four years after planting. FWS grants on the other hand are fixed and payable in three instalments.

Details of grants payable are shown in Table 6. The maximum grant of £800 per hectare is assumed in the case of Western Package areas.

Table 6: Grants available for private afforestation (£ 1985 per hectare)

Western Package Areas		Remainder of Country	
Year 0	600	Year 0	161
4	200	4	62
		8	86

The NDR assuming medium timber prices, infinite number of rotations and taking land prices into consideration is shown in Table 7. The cost of insurance is not included even though this would be a normal cost in private forestry. The effect of the grants on the results is very significant. In the case of the Western Package areas the breakeven yield class is approximately 10 while in the rest of the country, yield classes approximately 14 must be reached before a 4 per cent return on the investment can be achieved.

Table 7: Net return to Private Planters
(average timber prices, land price included, infinite rotations, cost of insurance not included).

Net Discounted Revenue (£ 1985 per hectare)

Yield Class (m^3 per ha. per annum)	Western Package Area	Remainder of Country
8	–612	–1156
12	356	–355
16	1855	879
20	3126	1804
24	5438	3699

WINDTHROW RISK

In some of the more productive wet mineral sites the risk of windthrow may necessitate either changing silvicultural treatment or tolerating wind damage. The silvicultural options include adopting a policy of not thinning and/or reducing rotation length. In Table 8 the effect of profitability of not thinning is indicated. In the

Table 8: Returns from alternative Management options.

Net discounted revenue from not thinning expressed as % of NDR from conventional thinning.

Yield Class (m^3 per ha. per annum	No Thin
24	89
20	90
16	95
12	130

case of the higher yield classes, thinned stands are significantly more profitable than unthinned ones. However as yield classes reduce, the economic benefits of thinning also reduce.

The high wind-risk period is when the crop has obtained vulnerable heights and this can be avoided by prematurely felling the crop. This will lead to reduced profits. The NDR at a range of ages expressed as a percentage of the NDR at the age of maximum mean annual increment is shown in Table 9. These data refer to thinned stands. The general trend is for NDR to increase as rotation is reduced by up to 10 years and then for NDR to reduce rapidly. This is compatible with the fact that the optimum rotation is less than the rotation of maximum volume production. After the optimum is reached however the NDR reduces very rapidly. In the case where no precautionary measures are taken windthrow may result in reduced rotation. Allied to the reduced NDR resulting from this reduced rotation is the possible loss due to damage to the stems by breakage.

Table 9: Returns from reduced rotation.

Net discounted revenue at 4% discount rate expressed as % of NDR at age of maximum mean annual increment (MMAI).

Yield Class	Age of MMAI	MMAI less 5 years	— 10 years	— 15 years
24	100	103	104	98
20	100	103	103	93
16	100	106	108	101

Damage caused by windthrow can in certain circumstances reduce the value of the timber to pulpwood prices e.g. if extensive breakage occurs. This is very site specific and will vary greatly depending on the circumstances. In the drastic situation where pulpwood prices prevail due to stem breakage significant losses may occur.

Wood Quality

The quality of Irish grown Sitka spruce will dictate its utilisation and therefore its price. Quality therefore has an important bearing on profitability. There has been some concern expressed at the

strength bearing capacity of fast-grown Sitka spruce. This results from the emphasis placed by the visual grading rules on ring-width as an indicator of strength. Visual grading, carried out under British standards, indicates that ring width of much of the higher yield class material is too great to be acceptable for structural purposes. This is especially true of wider spaced or very heavily thinned material.

A more recent study has been carried out by the Forest and Wildlife Service and the Institute for Industrial Research and Standards (Fitzsimons, B. F. and Picardo, V. (1986)). Crops now at clearfelling age were sampled by selecting 1,500 planks through the range of yield classes from yield classes 12 to 24 cubic metres per hectare per annum. These planks were graded visually under British rules (BS4978) — British Standards Institution (1973) and mechanically under BS5268 (Curry and Fewell (1981)). The results from the mechanical grading were very satisfactory as shown in Table 10. In the case of visual grading the results were much less satisfactory.

Table 10: Percentage Outturn from Mechanical Stress Grading.

	Percentage by grade		
Yield Class	M 75	M 50	Reject
12	90	4	6
16	95	2	3
20	88	6	6
24	87	6	7
Total	90	5	5

Note: For timber to pass the above strength categories it must attain 75 per cent and 50 per cent respectively of the strength of a 'defined' piece of the same species.

As machine grading is an objective measure of strength it seems that Sitka spruce, grown under the same regime as those crops now reaching clearfelling age, is sufficiently strong for structural load bearing purposes. The initial spacing of these crops was approximately 1.6—1.8 metres and thinning was carried out to marginal or lower intensity.

Returns from agriculture

The returns yielded by agriculture are tabulated in the Farm Management Survey published by the Agricultural Institute

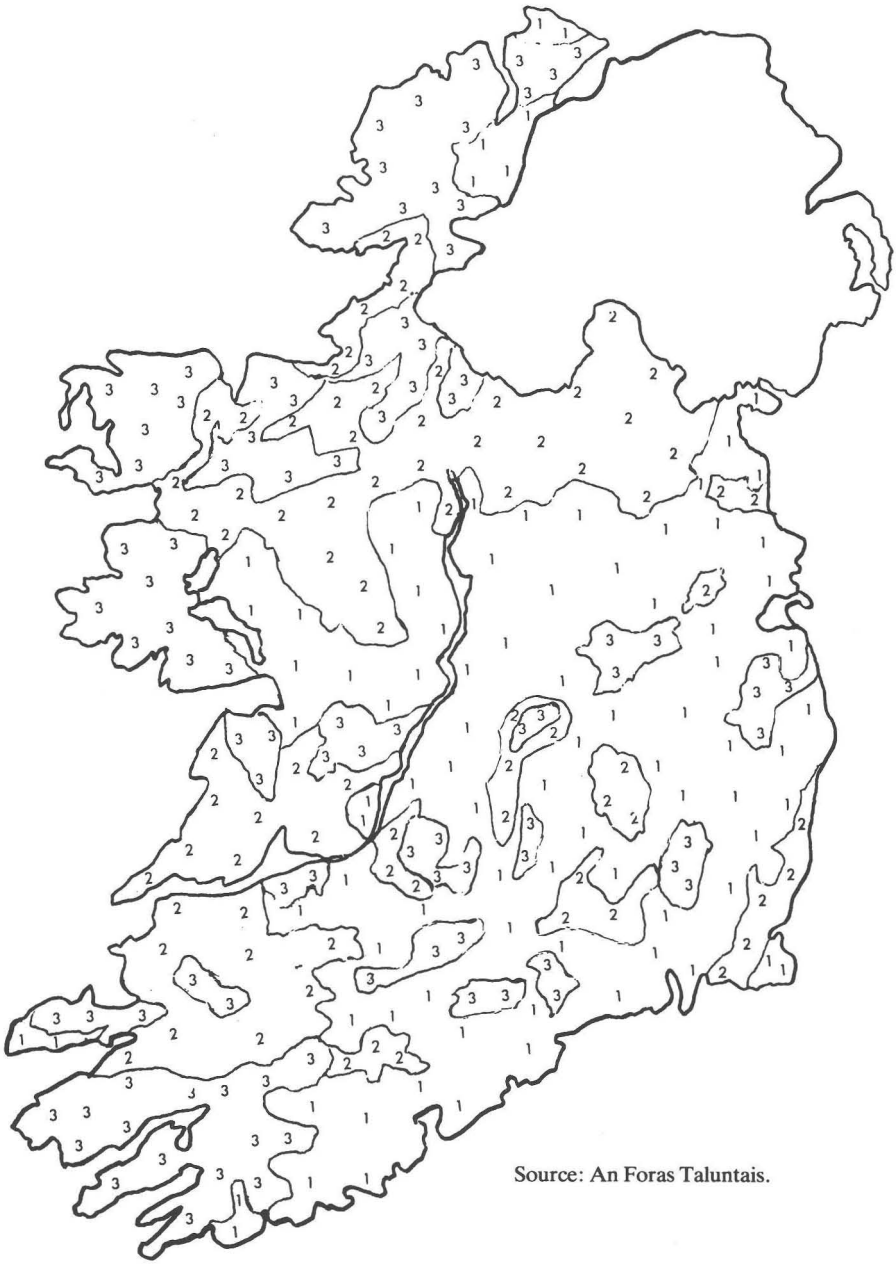


Fig 2. Soil Categories

(Heavey, J. F. et al, 1983). While a direct comparison between different yield classes is difficult, these data can be used to show the relative attractiveness of the different forms of land use. In Table 11 the average management and investment income is shown for soil groups 2 and 3. These soil groups contain the marginal agriculture land that is envisaged as being suitable for forest development. These are classified as limited (soil class 2) and very limited (soil class 3) in their use range for growing agricultural crops. There are very broad classifications ranging over many areas of the country and many soil types. Wet mineral soils are contained in soil 2 while hill land is encompassed in class 3 (Fig 2).

Table 11: Average Management and Investment Income 1983 (£1,985 per hectare)

Soil Class	Management and Investment Income
2	–107
3	–113

Management and investment income is the value of gross output less labour, direct costs and overheads. It is the money available to pay management, land and investment.

The net annual equivalents (forestry) and the management and investment income (agriculture) are directly comparable (Table 11 and 12). The price of land has been excluded in both cases. The returns from agriculture are negative for both soil groups.

Table 12: Net Return to private planter
Average timber price
Land price excluded

Net annual equivalent £1,985 per hectare per year

Yield Class	Western Package Area	Remainder of Country
8	–22	–44
12	22	–5
16	93	54
20	158	105
24	268	198

There is quite a deviation in both agricultural income and returns from forestry on different soil groups. Convery and Dripchak (1983) examined the return from agriculture in greater detail. They showed that the management and investment income from the most profitable 25 per cent of farms in 1981 was £172 per acre higher than from the least profitable 25 per cent. Range was from —£125 per acre to £47 £(1981) . They concluded that "even if farming recovers to the relatively prosperous conditions obtaining in 1979, the lowest 25 per cent will be able to show little or any surplus to reward management and investment income".

It seems reasonable to state that, based on the assumption in this paper, forestry is more profitable than agriculture on a large proportion of the land in soil classes 2 and 3. As these soil classes cover approximately 50 per cent of the land area in the country, available land is not a limiting factor for forestry development.

The actual profitability of forestry may be affected by windblow. This is difficult to assess on a general basis. However, were crops to remain unthinned as a precaution against windthrow the profitability of forestry is still greater than from conventional agriculture in a large proportion of the land in soil categories 2 and 3.

CONCLUSION

The analysis presented indicates that forestry on much of the marginal agricultural land will yield a return of at least 4 per cent on the investment. This applies to soils that can produce yield class 16 cubic metres per hectare per annum or greater. More than 55 per cent of the land owned by the Forest and Wildlife Service falls into this category.

In the case of private investors who can benefit from State and EEC grants the breakeven yield class varies from approximately 12 in the western counties to 14 in the rest of the country.

These conclusions depend on the wood quality of Sitka spruce being of sufficient standard to have a broad utilisation and that all crops are grown to complete rotation. The results of a recent study indicate that the inherent strength of Sitka spruce is quite satisfactory provided that the timber is dried and sawn correctly.

Windthrow can have a significant effect on the profitability of forestry. The adoption of a policy of not thinning can reduce the danger of windblow. This reduces the profit from higher yield crops. In the case of lower yield classes (less than 14), it is more profitable not to thin. The vulnerability to windblow is very site specific and therefore no general recommendation can be given.

ACKNOWLEDGEMENT

I wish to thank Valez Picardo of the Institute for Industrial Research and Standards and Brendan Fitzsimons of the Forest and Wildlife Service for allowing me to use the unpublished data in Table 10.

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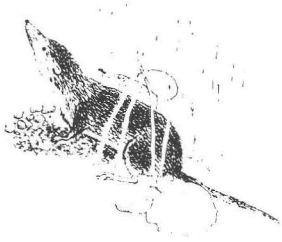
The Other Ingredient



What forester hasn't been stopped in his tracks by the appalling smell of stinkhorn fungi (*Phallus impudicus*)? The common name itself is ancient, going back at least as far as 1724 — "This is known to all our country people by the name of stinkhorn".

Stinkhorns, which are associated with rotting wood, show themselves among the leaf litter as two, commonly three, egg-size growths, which are attached to the substrate by a cord-like strand of mycellium. These 'eggs' are either white or pink; they are edible and are considered an aphrodisiac by some. Indeed the sticky jelly that is responsible for the foetid smell is also edible and quite sweet!

One 'egg' develops more rapidly than the others, the skin splits and the familiar shape of the stinkhorn grows upwards before your eyes. This indeed is hardly an exaggeration. The common stinkhorn can grow a full 15 centimetres in less than two hours. Tropical stinkhorns have been known to grow several centimetres in one minute. It is no surprise then that these fungi were treated with respect and seen as mysterious and magical and many forest folk in the past were filled with fear on coming across these in the half gloom of a deep forest.

The common stinkhorn can reach up to 25 centimetres when fully grown. It then becomes liquified and gives off its familiar overpowering smell that is often mistaken for the smell of putrid meat. This smell, which comes from a dark olive slime, is a powerful attractant to flies. Flies feed on the slime in which the fungal spores are imbedded. Spores stick to the feet and bodies of the flies and by such means are dispersed throughout the forest. Indeed at such times fly droppings can be made up entirely of spores of the stinkhorn. The Dog Stinkhorn (*Mutinus caninus*), a much smaller species, is less common and is not edible.

In an old work on the subject the foetid smell of stinkhorns was described by one scientist as being similar to the smell of wild violets. However, with the passing of time, others came to the opinion that the man in question suffered from a defect of the nose!

Forestry News

RABBIT CONTROL

A curious prescription one hundred years ago to control rabbits from damaging young trees was to smear the tree with the rind of smoked bacon. One application was thought sufficient for the winter. To protect seedbeds it was necessary only to treat the seedlings on the edge of the beds.

IRISH FOREST CHALETS

On June 19th the Minister for Tourism, Fisheries and Forestry, Mr. Liam Kavanagh, T.D., officially opened the first Forest and Wildlife Service chalet complex in Killykeen Forest Park in Co. Cavan. The complex is comprised of 20 timber chalets, a recreation building and a manager's house. Home-grown timber was used exclusively in the construction of the buildings.

The project was financed jointly through a special EEC fund and funding from the Forest and Wildlife Service. The scheme in its inception was seen to be of direct regional benefit in that it would contribute towards the improvement of the tourism infrastructure in the border counties.

Killykeen Forest Park lays claim to having the best coarse fishing in Europe. Because of this it is expected that the chalets will have a high occupancy rate over the greater part of the year.

PINEWOOD NEMATODES

The EEC Standing Committee on Plant Health (Forestry Experts) is seriously concerned about the potential damage that may be caused to European forests by the pinewood nematode — *Bursaphelenchus xylophilus.*

This microscopic eelworm feeds on softwood and can cause rapid wilting and death of *Pinus* species. Some losses have also occured in *Picea* and *Pseudotsuga.* The nematode is a native of North America. It was accidentally introduced into Japan where it is said to have killed more than ten million pines. The nematode is transmitted by insects such as Cerambycid wood-borers. One such beetle can carry as many as 125,000 nematodes.

Recently Finland has placed a permanent embargo on all softwood shipments from North America. This action was prompted by the discovery of nematodes in imported wood chips. There is evidence that the pest can survive on a fungus that is commonly found in wood chips. Such a flexible life style increases the potential for long distance dispersal of the nematode. Experts agree that

kiln drying of wood from infested areas should be considered as a control measure.

Logs and chips imported into Finland from Ireland have also been analysed — but Bursaphelenchus has not been detected.

(D. McAree)

LAWSON CYPRESS IN DANGER?

Native to Oregon and California, where it is a valuable timber tree, *Chamaecyparis lawsoniana* is best known in Ireland as a hedging species. Big commercial markets for this tree lie in Japan where prime old-growth logs can command prices of up to $3,000 per 1,000 board-feet. This market may now, however, have a question mark hanging over its future.

A fatal disease has infected much of the public forests in the USA where this tree naturally occurs. These trees, once they are infected by the root-rot organism, *'Phytophthora lateralis'*, generally die within four years. The spread of the disease has proven difficult to retard. Spores can be carried long distances in water or on soil or forest equipment.

Environmentalists have been requesting the U.S. Forest Service to restrict access and the movement of loggers within certain areas. U.S. Forest Service pathologists argue that the tree, as a species, is not endangered on the grounds that it still exists in areas where infection has been present for a long time.

Whatever the outcome, the problem is of interest to Ireland and to those entrusted with the management of Lawson cypress in this country. We have already recorded a close relative of this fungus within our borders — *Phytophthora cinnamomi* — and Lawsons are highly susceptible and may be killed by this pathogen.

(Dr. M. Keane)

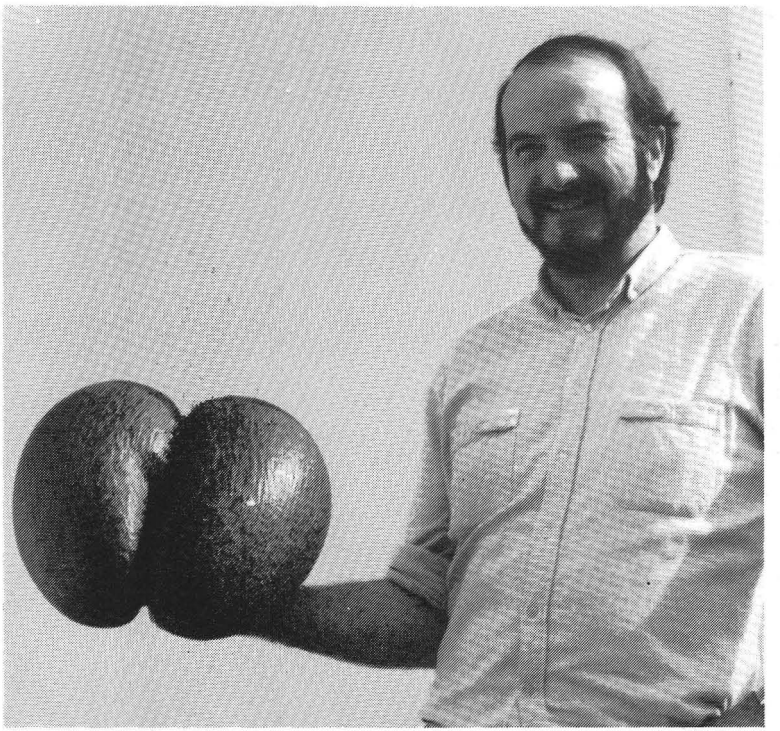
SCHOOL FOREST WEEK

The largest environmental study scheme ever undetaken in Ireland occurred during the week of the 9-13 June when 24,000 primary school children visited state forests. Under the guidance of foresters and wildlife rangers in 20 forest centres these children were given an understanding of many of the wild things, both plant and animal, that live in forests.

The School Forest Week was a joint undertaking between the Department of Education and the Forest and Wildlife Service to mark, in some special way, the EEC "Year of the Youth".

TROUSERS PLEASE, WE'RE IRISH!

In the lobby of the Ernan Park Hotel in Donegal a large nut rests on a wooden cradle in one of the window recesses. The nut is the fruit of the double coco-nut or 'Coco de Mer' (*Lodoicea seychellarum*). This coco-nut grows in the Sechelle Islands and the single-seeded fruits are the largest in the world — weighing up to 18kg each (see photo). The seeds commonly distribute themselves over large distances by floating on the sea, hence the name 'Coco de Mer'. The Seychelle islanders have long been intrigued by the shape of this fruit which they see as being that of a human buttocks!



Fruit of 'Coco de Mer' held by Wildlife Forester Mr. J. Gatins.

HARVESTING OAK BARK

Owing to our moist climate oaks are very much overrun with moss. This must be carefully removed from the bark. Some prefer to scrape the tree before peeling; others again clean the bark at the side of the ranges when the work is extensive, or performed by contract. In either system it is imperative that the moss be cleanly

taken off. Nothing reduces the price like mossy bark. It is very difficult to save bark in the plantation. If at all possible it should be drawn, every day's work as it is barked, to an airy field outside the wood where it will be exposed to sun and wind. When putting it on the stands keep the inside downwards, and on no account lay it up thick. Put it on thin, so that it will get the full benefit of the sun. To retain the proper colour is the sole art of saving bark, and this is best done when saved quickly.

The rick or stack should be convenient to the stand, so that as each portion is saved it can be added to the rick, and the drying stands, thus emptied, refilled. The rick should be six feet wide at the bottom, and nicely battered in on each side to a narrow ridge, taking care to keep the heart well filled to prevent the possibility of water lodging in the bark. This plan of a bark rick does away with the necessity for oilcloth sheets or thatch.

(D. S. Scott, Forester, Ballinacourte, Tipperary — 1879).

VISIT OF SOCIETY OF AMERICAN FORESTERS SEPTEMBER '85

The Society of American Foresters visited Ireland in September 1985 as part of their European tour. The party was comprised of 38 foresters and their wives from states as widely scattered as Alaska, Texas and New York. The Society of Irish Foresters, in conjunction with the Forest and Wildlife Service organised the tour. Our visitors were shown as many aspects of Irish Forestry as could be seen during their seven day stay. Both the President of the Society, Mr. M. O'Brien, and the Convener, Mr. J. O'Driscoll, participated.

Among the areas visited were forests at Glendalough and Avondale and Lord Ardee's estate at Knockrath. The problems of afforestation and species selection on old red sandstone soils were shown at Melleray, Clogheen and Kilworth forests. No tour of Irish forestry would be complete without a visit to forests on blanket bog. Ross and Cloosh proved to be a unique experience for our visitors as many had never seen this site type. At Avondale, Mr. D'Arcy, the then Minister for State of the Department of Fisheries and Forestry, hosted a lunch for our visitors.

(J. O'Driscoll)

MONEY MATTERS!

The following are first year tuition fees of forestry degree course at three universities — 1986-1987 session. Fees in all cases are given in punts.

University of Edinburgh=£595
University College of North Wales=£633
University College Dublin=£1,276

SOCIETY OF INDIAN FORESTERS

Dr. S. N. Rai, the General Secretary of the Society of Indian Foresters, Bangalore, India, has written to the S.I.F. inviting an exchange of views between members of both societies on forests and forestry matters. The Society of Indian Foresters produce a quarterly journal (in English) 'Van Vigyan'. Annual membership is $20. Full address of this society can be had from the editor of S.I.F.

FIFTY YEARS AGO

The re-opening of Avondale Forestry School in January 1936.

Seated: T. McCarthy; H. Kelly; D. Corboy; P. Murphy.
Standing: D. McGlynn (FIC); J. Ruane; Miss Devane (Matron); H. Kearney.

Letters to the Editor

Dear Sir,

I wish to comment on Mr. Fitzsimon's letter in your last issue.

Mr. Fitzsimons is clearly confusing two different but related subjects *viz* biological conservation and landscape conservation. The basic principles of biological conservation are (a) the protection of the genetic resource represented by wild plants and animals and (b) the protection of the ecosystems in which these organisms live. In the context of bogs the objective of biological conservation is to conserve the organisms which can survive in the nutrient poor and harsh conditions and which may be of future value to mankind. Mr. Fitzsimons can hardly argue with that philosophy given that the principal species used in Irish forests have only recently been selected from wild stock. (He should also note that the native stands of Sitka spruce in N. America are not protected and are indeed under threat). By virtue of their development bogs are also of value as a record of past climates and environments and as a baseline against which to measure, for example, air pollution. Like all natural or semi-natural ecosystems they are also of value for education and scientific research, especially for those with a broader vision of life who do not see 'wasteland' wherever only wild plants and animals live.

I am not professionally qualified to discuss landscape conservation but I can appreciate the beauty of the wild, open expanses of bog broken up by lakes and streams against a backdrop of mountains and clouds. So too could Paul Henry as do also the many thousands of tourists who visit the West. Even a former editor of Irish Forestry, N. O Carroll, was clearly appreciative of this landscape when, in 1973, he wondered whether 'we may be in danger of being biased against these areas by a buried folk-memory which associated them with misery and starvation . . .'. He went on to say '. . . we need to be quite clear about what we are doing before we change too many of these areas (i.e. blanket bogs) by the establishment of blocks of forest, any one of which may visually affect many square miles of landscape'. It does not appear to me that foresters are any clearer now as to what they are doing than they were in 1973, for what is patently lacking is a coherent landuse policy which would accommodate all interests.

Finally, Mr. Fitzsimons may be surprised to learn that I am an enthusiastic supporter of afforestation, provided that the plantations are carefully sited where they do not destroy sites of high biological interest and where they are economically justifiable.

Therefore, if I had been asked whether 'in general, conifer plantations improve the landscape' I too would have answered 'Yes', but that of course is a reflection of the sloppy thought processes in compiling the question. Or was it the venue of the poll?

J. R. Cross,
'Carraphouca', Ballycorus Road,
Shankill, Co. Dublin.

Reference: Ir. Forestry *30*, 2, 1973. Have a good hard think about the Western Blanket Bogs.

Dear Sir,

Mr. Fitzsimons seems unaware that wildlife conservation is one of the responsibilities of his Department, which has produced maps showing the location and extent of areas of scientific interest in Ireland, including western blanket bog and some upland areas. These are unique habitats in the European context and we have an international and in some cases a statutory duty to protect them for future generations. There are many studies which show that afforestation reduces the wildlife diversity of upland peat areas.

It obviously comes as a shock to Mr. Fitzsimons to discover that some people view the prospect of miles of Sitka spruce monoculture with the same distaste as he has for open moorland, nevertheless the landscape implications of forest planning and management are extremely important in a country which relies so heavily on tourism revenue.

Afforestation alters the character of a landscape and can have a major visual impact in relation to the position of the plantation, its size, scale, shape, colour and texture, pattern and also access and subsequent management, with regard to topography, vegetation and surrounding views. When these factors are taken into account the overall landscape is enhanced. When they are not, the landscape is despoiled. It is the contrast between open and forested land which is especially important.

I would sincerely commend to all Irish foresters, the very detailed and well argued paper 'Forests in the Landscape' by G. Dunstan, published in the conference proceedings of 'The Future of the Irish Rural Landscape', Department of Geography, Trinity College, Dublin, 1985, which gives guidelines and outlines policies suited to the Irish situation.

Richard Webb,
Newcourt Road, Bray.

Dear Sir,

In response to Brendan Fitzsimons' letter in your last issue I would like to comment, not as a conservationist, since he wisely skirts that arguments against the afforestation of all our blanket bogs, but on the 'aesthetic' ground he chooses.

Firstly the basic facts of life for Irish forestry is that it costs the taxpayer a huge sum every year and will continue to do so for the (politically) foreseeable future. In these circumstances professional foresters would be wise to listen to the opinions of the man and woman who are paying the piper. That the average punter finds monoculture conifer plantations an unpleasant, forbidding environment has been established in numerous objective studies conducted as part of recreational value surveys in the U.K. and elsewhere. Copies of relevant papers are available from my files.

Secondly Brendan's objective analysis of five individuals' opinions contrasts strangely with his own assertion that the dislike of afforestation on blanket peat is a "fashionable" opinion. Fashionable means "prevailing or in use" (Chambers' Dictionary) which implies an objective and wide survey of these opinions.

Thirdly from the use of the words "unappealing", "featureless', "absurd" etc., I wonder if Brendan's opinions are not a bit subjective too? Or is this a grammatical innovation — objective invective?

Pat Warner,
Ballinea, Mullingar.

Note: In the interest of brevity editor retains the right to edit letters.

Book Reviews

COMPUTERS IN FORESTRY
Edited by W. L. Mason and R. Muetzelfeldt. Proceedings of a Conference (on the Application of computers to the Management and Administration of Forests, the Harvesting and Marketing of Timber and to Forestry Research) Heriot-Watt University, Edinburgh, UK 11-14 December 1984. Published for the Institute of Chartered Foresters by Redwood Burn Ltd., Price £15 sterling.

This book consists of some twenty-three papers by computer users and is divided into six general sections covering the following — (1) introduction of computers to a company; (2) computers in forest planning; (3) developments in forest planning; (4) computers in mapping and harvesting; (5) computers in the wood processing industry and lastly (6) developments in Research and Management.

The papers are short, well written and edited with a general audience in mind. The emphasis throughout is what the computer can do to facilitate the user and there is a refreshing absence of detailed jargon. This makes for a very readable and informative book.

Unlike many books on computers, this one starts at the beginning i.e. introducing computers to a company. Good sound and practical advice is given by people who have obviously been through this trauma on more than one occasion. The current users of computers in the various fields of forestry is then covered in the next four sections. Applications in general forest management concentrate on planning both at forest and higher levels. Details of the British Forestry Commission's forest district computer system is outlined, as well as SKOG PLAN — 84 a planning system for forest enterprises from Skogsarbeten, Sweden. The section on computer-aided developments in forest planning concentrates on the design, use and application of databases in forestry. Also in this section are details of the use of computers in stand growth modelling and economic modelling. The latter reflect particularly well the "down to earth" attitude which prevades the majority of the papers e.g. "Economic models do no provide a panacea for all types of decision making but they can often be a useful tool for examining the implications of different decisions prior to a decision being made". Computer applications in mapping and harvesting cover data capture using hand held portable computers in the field, evaluation of various harvesting systems using simulation techniques, topographic modelling and the development of a data base to assist in regional land use planning and forest inventory. The section on computers in the processing industries outlines the use of computers in sawmills to increase volume recovery and to control more efficiently some of the ancillary processes e.g. drying of timber. This section also contains a very interesting paper outlining the use made of the British Telecom "Prestel" information service for marketing of timber and relaying of information on forestry. The final section dealing with future developments of computers in research and Management gives us a glimpse of what is yet to come in the form of "expert systems" and "intelligent knowledge — based systems" or in other words computers that have an in-built intelligence. These computers will, we are told, behave as intelligent assistants, informing, advising and explaining.

Although forestry is by its nature a conservative profession and slow to change, with many foresters viewing computers with a fair degree of scepticism, the fact remains that computers have arrived in forestry. The challenge for forestry is to recognise the benefits and limitations of computers and to use them accordingly. That computers have potential for wide application in forestry, there is no doubt.

This book gives the reader an insight into the practical applications of computers and a glimpse of what is to come.

In summary this book is a very worthwhile read for all engaged in forestry and gives us some hope at least that the future will be made that bit easier through the use of computers.

H. Phillips.

THE STORY OF OUR TREES

H. M. FitzPatrick, on behalf of "Trees for Ireland". Published by David and Ann Luke. 80 pages. Black and white photographs. Soft back. £2.50 including postage.

In a year that saw the advent of School Forest Week, which introduced some 24,000 children between the ages of nine and twelve to an understanding of woodland plants, it is appropriate that this first-rate little book should appear. Suitable for everyone from this age group upwards, it traces the history of our trees from the Ice Age to this century, follows this with the series of excellent drawings of trees by Rosaline Murphy and then describes our forests today.

Starting with the trees that spread here after the disappearance of the ice (should the Black Poplar mentioned, really be Aspen?), the effect that successive generations of man had on the woods is told. The gradual clearance of the forest, which accelerated during the 17th century and the subsequent introduction to estates of foreign European species, are covered. The involvement of the state in afforestation at the beginning of this century and the planting of species from western North America, are described.

The drawings of trees include the twenty-six most common species in Ireland. Besides the outline of each mature tree is a drawing of its leaves, twig, and fruit. The name is given in Irish and English, accompanied by a brief note on the species, and its uses.

The acquisition of land for forests is explained, ranging from old estates to hill farms, with examples being given. Following this are descriptions of some of our better known forests and the principal tree species growing in them. The work of forest nurseries is covered and the life of the tree depicted. Places where trees may be found are included together with the species growing on the various land types mentioned. There is an absorbing chapter on wildlife in the woods. The value of the forest for leisure and education is stressed and there is a brief account of the use of timber. Finally, there are suggestions for projects on trees and arbor days.

This is a well laid-out and very readable book which should be on every school curriculum. It should also be ideal for park shops and similar outlets, both for its price and size. It is light enough to fit the pocket easily and yet substantial enough not be be mislaid. In fact, no family should be without one.

C. P. Kelly.

A MANUAL ON FELLING AND BUNCHING SMALL TREES FROM THINNINGS WITH SMALL SCALE EQUIPMENT ON GENTLE TERRAIN.

Final Report IEA-FE-CPC7 by Pieter D. Kofman, Skovteknisk Institut — The Danish Institute of Forestry Technology — 1985 Amalievej 20, 1875 Kobenhavn V. 116 pages. Price not quoted.

In 1975 twenty one countries signed the Charter of the International Energy Agency (IEA) and in 1978 ten of these signed the Forest Energy Agreement. Representatives from nine of the ten countries participated in a working group on the

felling and bunching of small trees from thinnings with small scale equipment on gentle terrain. These countries were Austria, Belgium, Canada, Denmark, Ireland, New Zealand, Norway, Sweden and the U.S.A.

Ireland's objectives in joining the working group are identified by representative, Henry Phillips, as — (1) creating and maintaining contacts with other organisations and (2) developing expertise and knowledge in the harvesting of thinnings — two objectives which Mr. Phillips says were "met in full'.

This manual is the final report of the working group which calls itself IEA-FE-CPC7. In all some 120 reports form the basis of the work. Together with the experiences of those participating it includes results from countries other than those listed above. Summary reports and evaluations appear in Section 7.

The bulk of the manual — Sections 3, 4 and 6 — is concerned with felling and bunching patterns and descriptions of harvesting operations and methods. There is a very small section (5) on harvested products.

Sections 3 and 4 deal with bunching and felling. There are some forty bunching patterns illustrated on as many pages by schematic drawings many of which have sub patterns. These are useful basic references. Irish readers will need to familiarise themselves with the concept of unbrashed trees being bunched and their perception of a stand unopened for transport will not fit with drawings 3.3.3.5 to 3.3.3.8. The drawing 3.3.5.5 is incorrectly headed in the copy of the manual supplied to this reviewer.

Section 6, consisting of 14 pages, deals extremely briefly with motor-manual and machine felling and with hand, horse, machine and winch bunching of whole trees in selective and combined thinnings. It is presented in a very readable form.

The selection of the harvesting methods which are illustrated in Section 6 is based on an analysis of the literature which forms the basis of the report. For the prospective reader the following is a summary:

Felling:	machine 44%; motor-manual 53%.
Bunching:	hand 23%; horse 12%; machine 22%; winch 28%.
Products:	whole tree (everything except stump) 87%.
Thinning Patterns:	selective 38%; combined 53%.

The productivity figures which appear in Section 6 are entirely limited to the context in which they are presented and for a variety of reasons, they have no application to local situations.

The glossary at the end makes an important contribution towards understanding the terms used. This reviewer enthusiastically welcomes every effort to standardise terms and with this in mind suggests that the glossary is not explicit enough on — road system, skidroad, thinning skidroad and track. Also the words "gentle terrain" which appear in the title could well do with a definition.

This book is a useful primer for students, a good basic reference for people specialising in harvesting and a well worthwhile read for anybody interested in the harvesting of thinnings.

T. Hunt.

Society Activities

DAY MEETING 2nd MAY 1986

This one-day study tour visited Kilmacurra research nursery and Glenealy forest. It was attended by over 70 members. At Kilmacurra the value of the correct choice of seed source, using growth of different provenances of Sitka spruce and lodgepole pine, was shown. Within suitable provenances selection criteria used to select superior individuals, vigour, branch form, health and timber characteristics, were demonstrated. These individuals are then vegetatively reproduced by grafting, the materials and methods being shown to the participants. As they were selected on their phenotype, their true worth is evaluated by progeny tests, methods of doing so were also demonstrated. Rooted cuttings, as an alternative vegetative reproductive technique, was examined and discussed in the propagation houses. The visit concluded with a demonstration of various methods of raising seedlings in containers and the equipment used to plant the so raised seedlings. Leaders were Alistair Pfeifer, Gerry Murphy, Jim O'Dowd and John O'Driscoll.

Jimmy Neilan addressing members at the Day Meeting at Glenealy.

Following lunch at Kilmacurra the study tour particpants departed for Glenealy forest where Jimmy Neilan was leader for the afternoon session. Two main topics were discussed, the first of which was how to manage a native oak woodland. This concentrated on ways and means of improving stem form, seed production and what value such areas would have in years to come. No firm conclusion resulted and the group moved on to view the Eucalyptus plots which were laid down between 1934 and 1937.

Species represented are:

	Top ht. (m)	*Vol/ha (m^3)*
E. viminalis	27	401
E. johnstonii	33	813
E. urnigera	26	408

Their rate of growth was far superior to that of the adjacent Norway spruce.

At the end of a very interesting day the President, Mr. O'Brien, thanked the leaders and those who participated in discussions.

John O'Driscoll.

ANNUAL STUDY TOUR 1986

The 1986 Study Tour was based in Galway and took place from the 27th to the 29th of May.

Day 1: 27th May

The first stop of the tour was at Ross state forest in Connemara where we had travelled from Galway city. The President, Michael O'Brien, welcomed all the participants and introduced the local Forest and Wildlife Service Divisional Inspector, Tom de Gruineil. He bid the party welcome to Galway and introduced the local FWS District staff, Matt Cassidy and Christy Hanly, together with the local foresters, Jim Phelan and Billy Berkery. Mr. Phelan welcomed the Society to Ross and outlined the main features of the forest. It is 2,262 ha in extent with an annual planting programme of 100-150 ha. The main soil type is blanket peat over granite which is planted mainly with Sitka spruce and lodgepole pine. There are also some areas of shallow mineral soil over limestone and these mainly carry crops of Sitka spruce and Scots pine.

The subject for the first stop was the treatment of Sitka spruce on western blanket peat. The particular crop was planted in 1971 following double mouldboard ploughing and received an application of 627 kg/ha of ground mineral phosphate at planting. In 1982 and '83 there was a gradual reduction in growth and this led to a foliar analysis being done in 1984 which revealed that both nitrogen and phosphorus were deficient. Both were applied in August 1985 at 400 kg/ha of urea and 350 kg/ha of ground mineral phosphate. They were spread by helicopter at a cost of £165/ha. The crop is expected to grow at Yield Class 18 but there is a possibility that further applications of nitrogen will be needed. The question of thinning the crop arose and local staff were of the opinion that the crop would be thinned using a tracked forwarder. With rain falling thanks were paid to the local staff and the party made its way on through Ross and into Cloosh Valley state forest.

Here we were met by Martin Coady and Kevin Blehein. Cloosh Valley is one of the largest state forests and was among the first to be established on blanket peat. Planting began in 1952 and has resulted in a forest of just over 5,000 ha. Lodgepole pine is the dominant species occupying over 70% of the area. The forest is in one block and elevation varies from 30 to 150 ha. Blanket peat is the predominant soil type with frequent rock outcrops. The management of lodgepole pine was the theme of the first stop. The crop in question was planted in 1976 and because of basal sweep and high roading costs respacing was done on a small area in 1984. Half of the existing crop was removed with the emphasis on retaining the better stems. Half of the remaining stems were then pruned to 2m. The total cost of the operation was £110/ha. It is expected that pruning to 5m will be carried out on selected stems after a further five years. The point was raised about the danger to the health of the remaining crop caused by respacing where the stems removed in the operation are left on the ground. No diseases or pests have been found but it was pointed out that there had been an outbreak of pine beauty moth in respaced lodgepole pine at

Lough Ennel forest. Another point raised was, should the crop not be grown for pulp without any respacing. The consensus was that at current pulp prices the crop would not pay for itself.

Continuing the theme of crop structure and timber quality the next stop was at a lodgepole pine spacing trial where the hosts were from the Research Branch of the FWS represented by Brendan Fitzsimons, Frank Collins and Padraig O'Halloran. The experiment was planted in 1964 and has five treatments ranging from 1.2 to 3.6m^2 spacings. The main conclusions are:

1. Mean and dominant height are reduced at the widest spacing by 12-15%.
2. Basal area and volume production are reduced by wider spacing but current basal area increments are similar for all treatments.
3. Branch diameters increase at wider spacings but branch number per whorl is not affected.
4. The degree of basal sweep is greater at the wide spacing but the number of stems affected by sweep is independent of spacing.

The crop is growing at Yield Class 16, although about 80% of stems have some degree of lean. Brendan Fitzsimons referred to preliminary results from a conversion study he is doing on lodgepole pine and the results are reasonably encouraging. Some other contributors were sceptical of the future of crops of lodgepole pine with pronounced sweep and a suggestion was that these crops should be clearfelled for pulp and the area replanted to Sitka spruce. After paying thanks to the Research staff it was time to adjourn for lunch down the forest road where strong tea was kindly provided.

Suitably fortified we travelled to the first stop of the afternoon which was a demonstration of site preparation machinery where Christy Hanly was the leader. Double mouldboard and tunnel ploughs were on view, together with a Fiat crawler tractor. The advantages of tunnel ploughing over conventional methods were mentioned as an unbroken forest floor, ease of harvesting and improved rooting. A large part of the 1984 planting programme had been tunnel ploughed. A demonstration of tunnel ploughing was laid on where we saw peat being extruded by the plough in a long continuous ribbon. There was a brief discussion of methods of draining after tunnel ploughing and as rain was again falling it was time to return to the bus and bid farewell to Cloosh Valley forest and its staff.

The bus travelled on through Cloosh where now there is a large forest estate on what thirty years ago some would have regarded as useless bogland. The final stop of the day was down the country road at Formoyle where Greenbelt Ltd. have planted over 240 ha of blanket peat. Tunnel ploughing was the main method of ground preparation used and all of the plantable area received a broadcast application of 350 kg/ha of rock phosphate. A 3:1 mixture of Sitka spruce to Skeena River lodgepole pine is the species selection. The projected Yield Class of the spruce is 18 and further fertiliser inputs may be necessary to attain the projected yield. Tim O'Brien explained that his company's policy in acquiring land was to have a mixture of blanket peat and other soil types. He envisaged that blanket peat would comprise 10-15% of his land portfolio. He was confident of achieving his projected yields. The company had just completed an 800 ha planting programme and planned to continue at this level. At present about 2000 ha is being planted annually under the Western Package Grant Scheme and this should be at least maintained if not increased for the remainder of grant period to 1991. The question of fires in a plantation such as Formoyle arose but it was pointed out that fire insurance is readily available.

After much vigorous discussion it was time for the President and discussion leader for the day, Michael O'Brien, to wind up proceedings by thanking Tim O'Brien and Greenbelt for our visit to their site. The bus took the coast road back to Galway where we enjoyed scenic views of Galway Bay and beyond to the distant hills of the Burren.

Eugene Hendrick.

Day 2: 28th May

The first stop of the day was at Derryvokeel in Castledaly state forest on the northern slopes of the Slieve Aughty range. Most of the forest lies between 90 and 360 m elevation on soil types ranging from peaty gleys to blanket peat over 6 m deep. The first planting started in 1956 and the annual planting programme is about 100 ha.

Eugene Hendrick, leader for the morning, introduced the local FWS District staff, John Desmond and Frank Murphy and the Castledaly foresters, Martín Ó Neachtáin and Gerry Farragher. John Desmond led us through the first stop which was a crop of Sitka spruce planted in 1966 at a stocking of 3,100 stems per ha. Thinning was carried out in 1984 and this removed 35% of the stems by taking out every fifth line and every fifth tree in the remaining lines. Extraction was by Mini-Bruunett, parallel to the lines. Thinning and extraction across the lines would probably be more stable, but where contractors are involved it is much easier and less troublesome to let them work on the lines. The problem of stability on peaty gleys was discussed and it was felt that mole draining or ripping at establishment followed by early thinning would be the solution to windthrow on these sites. A system of wind risk assessment would be very beneficial. Should these sites be thinned at all? Wide initial spacing followed by pruning and no thinning is another option. It was emphasised by a number of participants that it most important to start thinning early, even when the crop was only 8 m high. It was also felt that foresters were neglecting their aim of producing prime sawlog timber by adopting a thinning system that predisposes the crop to windthrow.

The second stop of the morning was at Boleyneendorrish where Liam O'Flanagan gave a presentation on mixtures of Sitka spruce and lodgepole pine. Much of the area in the property was planted to mixtures during the 1960s, Lulu Island being the main provenance used. There are some smaller areas of mixtures containing north coastal and interior provenances. There is increasing interest in the use of lodgepole pine as a nurse for Sitka spruce on blanket peat where it can remove the necessity for continual nitrogen fertilisation. This has been a problem in the past where south coastal lodgepole pine was used in mixture. This tends to outgrow and suppress the spruce. The ratio of spruce to pine depends on the site ranging from 3 spruce to 1 pine on good sites to 1:1 on poorer areas. Lulu Island appears the most suitable provenance. Pruning would be needed for the spruce because of the increased spacing. This topic generated much discussion, especially on the mixing intensity of pine and spruce and pine provenance selection for mixtures. The morning session was concluded with thanks being paid to all those who contributed and it was time to make for Coole Park and lunch.

At Coole we were met by Jim Farrelly and Joe Lillis who had kindly provided lunch facilities. After a pleasant lunch and repose in the sun we journeyed through the Park and into the estate garden. The estate itself dates back to 1768 when it was bought by Robert Gregory and remained in the ownership of that family until 1928 when it was sold to the state. The owner at that time was Lady Augusta Gregory, the dramatist and folklorist who was co-founder with W. B. Yeats and Edward Martyn of the Abbey Theatre. Development of Coole Park as an amenity area began in 1972. A nature trail was laid out, part of which we used during our visit. This took us through the pleasure garden, the focal point of which is the famous 'autograph tree', a great copper beech some 150 years old. Lady Gregory invited her literary guests to carve their initials on it and amongst these were those of George Bernard Shaw, Sean O'Casey and many other well known authors and poets. Of particular interest in the garden is a Catalpa which was brought from Ceylon by Sir William Gregory.

After this very interesting excursion the next stop was a stand of ash where Brendan Fitzsimons of Research Branch, FWS, gave a short talk on the production of ash for hurleys. Ideal sites for ash are free draining deep soils. Here ash can attain the three most important features necessary for a good hurley butt, fast growth,

straight stem and good buttressing. The main advantage of ash timber is its ability to absorb shock and hence its use for hurleys and tool handles. Best hurleys are got from stems less than 30 years old with a d.b.h. of 25-28 cm with 6 to 7 rings per inch and knot-free. Spacing should be 3 x 3 m. Protection is needed from hares and an application of 800 kg/ha of 10:10:20 compound fertiliser is beneficial on most sites. The stems must be kept clean to 1.5 m. On suitable sites the profit from an ash crop for hurley production can exceed that from Sitka spruce.

We proceeded from the ash wood to the old orchard which is now a deer enclosure. Here Tim O'Connell, the local Wildlife Management Officer, was our leader. Deer numbers are on the increase, mainly because of increased ground cover resulting from afforestation. Fallow deer are the most numerous, numbering approximately 10,000. All of the Forest and Wildlife Service properties in the Slieve Aughtys have fallow deer at some time during the year. Native red deer are concentrated in Killarney and elsewhere they have hybridised with Sika deer, our third species. Before the Wildlife Act deer were treated as vermin and were unpopular with forest managers because of damage to plantations. At that time they were considered of little economic value. In recent years, however, deer have attained a new status and deer farming has become popular. Venison is sold mainly for export to the Continent. Considerable revenue is generated for the FWS from game lettings. Mrs. E. Collen of the Irish Deer Society mentioned the aims of the Society as backing up the Wildlife Act and conservation of deer. She emphasised that culling must be properly done, taking out the females during the period from November to February.

We returned to the buses and travelled to the last stop of the day where George Hipwell, our leader for the afternoon, introduced Jim Ryan of Conservation Section, FWS. He stated that the aim of the Section was to identify and protect areas of scientific interest. They have an important role to play in the Western Package Scheme in seeing that no money is spent damaging any important wildlife habitat. The Coole-Garryland Nature Reserve comprising 368 ha was established in 1976 to ensure the conservation of the woodland and turlough ecosystems. It contains a variety of habitats, including high forest on pockets of deep soil, dwarf woodland on limestone pavement, bare pavement, a turlough complex in the hollows and Coole lake. The woodland is dominated by native species, mainly oak and ash, with some introduced species. There are a lot of native woody plants including yew, spindle tree, whitebeam, wych elm, guelder rose and purging blackthorn. Some of these, such as the yew-wood on limestone pavements are prime examples of what the region was like thousands of years ago. Turloughs are areas where water level fluctuates widely and are unique to this country. Garryland turlough is unique in having a margin of oak and ash. Coole lake is part of the turlough system and the level fluctuates widely depending on rainfall. This visit ended a very enjoyable day and after paying the customary thanks we set off in the warm evening sun along the eastern edge of the Burren through Kinvara and back to Galway.

Richard Jack

Day 3: 29th May

Leaving the hotel we headed north to the Tuam plant of the Irish Sugar Company to see the new containerised seedling unit. The leader for the day, John Fennessy, introduced Brian Hussey of Woodland Investments which is one of the main partners in the venture. After welcoming the party to Tuam he outlined the main features of containerised seedling production. The facility at Tuam uses the Hiko system developed by Hilleshög of Sweden who are also involved in the venture. At this stage Cyril Colleran manager of the unit was introduced and he led us into the building where container filling and seed sowing are done.

Sitka spruce is the main species grown. Seed quality and weight determine germination success and heavier seed germinate quicker and produce better plants. Seed is purchased from the Forest and Wildlife Service and graded at Hilleshög in Sweden. After grading and cleaning the seed is prechilled for 9 days which increases germination from 21% (for unchilled seed) to 92%. Seeds are then sown into container sets on top of a peat/perlite compost. Fertiliser is not added at this stage as it reduces germination. The composition and compactness of the compost also affect germination success. Two seeds are sown into each tray to ensure that over 95% of the containersets are full. After seeding 2 mls of Higerm are applied to cover the seed and improve germination. Following these operations the containers are moved to an extremely large (300 m long) controlled environment polythene house where heat, light, CO_2 levels, moisture and nutrient levels are continuously monitored and controlled. Maintaining waterbalance is of vital importance and this is done by choosing a compost that gives up its water easily and matching the liquid feed concentration with the amount of water that is applied. The frequency of watering is determined by a sun integrater which measures sunlight intensity and adjusts the amount of water applied accordingly. Before the seedlings are hardened off outside the containersets are thinned to remove doubles from individuals cavities. This takes a team of 20 people about 10 days. The capacity of the house is 1,000,000 seedlings and four sowings are done each year. Damping-off is prevented by spraying with Captan. The seedlings are moved outside 8-10 weeks after seeding. A daily check is kept on the plants and they are watered when necessary with a dilute nutrient solution. Frost is not a major problem. Sitka spruce is frost hardy at 28-30% dry matter and the plants have survived –9°C frosts. Cold east winds are a problem.

Handling, transport and planting of the seedlings was dealt with by Dermot Houlihan of Woodland Investments. The containersets in the greenhouse are placed on specially built metal pallets. These can then be removed to the outside area by a machine with a special lifting arm. These pallets are then used to transport the plants to the planting site. At this stage the seedlings are one year old and are about 25 cm tall. A demonstration of planting using the containersets was given. Each container set fits into a hip bracket and a special planting tool is used which removes a plug to the exact dimension of the seedling. The seedling is removed from the container set and planted and firmed. Planting costs about £50 per 1000 seedlings. The whole operation was carried out quickly and efficiently. A discussion began on the merits of the system with some doubts being expressed about the survival rate of such seedlings planted on exposed sites. Dermot Houlihan assured us that the survival rate of seedlings planted early in the year at a particular site compared very favourably with transplants. After further discussion it was time to leave this very interesting development. John Fennessy paid thanks to the various participants for a comprehensive tour of the plant.

Our next destination was Cong Forest where we were met by Peadar Campbell and Barry Lamb. Peadar Campbell gave us a brief history of the forest. It once formed part of the Guinness Estate and was acquired in 1939. The first planting took place in 1940 and the forest is now 1,174 ha in size. Soils are generally shallow over limestone crag. The main species are Sitka and Norway spruce with some Scots pine and Japanese larch. The present standing volume is about 40,000 m^3. A lot of the thinning is dome by direct harvesting, about 2,200 m^3 in 1985.

The biannual driven woodcock shoots held in late January and early December are particularly well known. In closing his speech Mr. Campbell wished everyone a happy visit to Cong.

At this stage the party divided into two groups to take turns for a visit to Inchagoill island on Lough Corrib. In sunny weather the first group boarded the small boat owned and operated by Mr. John Lustin. The journey to the island takes about

35 minutes and is extremely pleasant with magnificent views of the surrounding countryside. On arrival we were met by Pat Quigley and Joe Noone of Oughterard Forest. The island is 42 ha in area and is the largest in Lough Corrib. Almost the whole of the island is wooded and it is owned by the state. There is a well sheltered small bay with a good pier on the north eastern side of the island where fairly large boats can dock with safety.

Mr. Quigley led the way from the pier where we had had a pleasant lunch on a walk around the perimeter of the island. The island had a monastic settlement and several remains of this can still be seen. At Teampall-na-Naomh there is a beautiful Romanesque doorway which was reassembled in the 19th century by Sir Benjamin Lee Guinness. In the western corner of the wall there is a remarkable piece of carving of a Greek or Byzantine cross of a type seen on very many ancient Irish tombstones. St. Patrick's church is nearby which is reputed to have been founded by the national saint. Outside the church there is a stone slab cut in the form of a rudimentary cross said to be the most ancient of its kind in Ireland. The island itself was inhabited until 1930.

After the historical tour it was back to forestry and the management of crops of fast growing Sitka and Norway spruce on the island. The crop in question was Sitka and had been respaced in 1981 and was excellent with very good form. After a short discussion it was time for the first party to leave the island. We were met by the second group who had in the meantime a guided tour of the gardens surrounding Ashford Castle. At around 5.15 the day had come to an end and we bid a reluctant farewell to Cong. We headed back to Galway and to the annual dinner where a splendid time was had by all.

Lousie O'Reilly

Participants

Denis Beirne, P. J. Bruton, Bernard Burke, Sean Campbell, Matt Cassidy, Sean Clancy, Tony Clarke, Eamon Cunningham, Lyal Collen, Euphemia Collen, Maureen Cosgrave, Myles Cosgrave, Jim Crowley, B. G. Dean, Michael Davoren, John Desmond, Joe Doyle, Frank Drea, John Duane, Padraig Egan, John Fennessy, P. J. Fitzpatrick, Lily Furlong, Joe Fahy, Jim Fallon, Gerry Faragher, Ted Farrell, Donal Fitzpatrick, Jim Flaherty, Tony Gallinagh, Frank Gibbons, Pat Giblin, Tom Gruinell, Christy Hanley, John Haughey, Pat Helbert, Tim Hynes, Eugene Hendrick, George Hipwell, Dermot Houlihan, Richard Jack, John Kelly, Eamon **Larkin, Michael Lillis, P. J. Lyons, Philip MacDonnell, Tony Mannion, Jim** McHugh, Marie McNamara, Michael McNamara, Sean McNamara, Frank Murphy, J. W. Murren, P. J. Murray, Alan Navratil, Tom Noonan, Michael O'Brien, Tim O'Brien, Jim O'Dowd, Martín Ó Neachtáin, Pat O'Kelly, Brendan O'Neill, Tim O'Regan, Louise O'Reilly, Martin Ruane, Frank Rush, Richard Schaible, Fred Topping, Ari van der Wel, Dan Walsh, Michael Ward.

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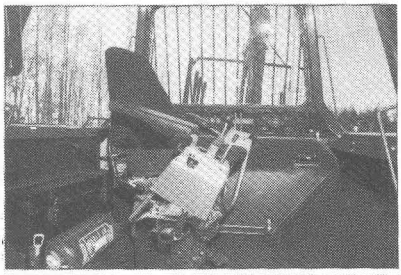

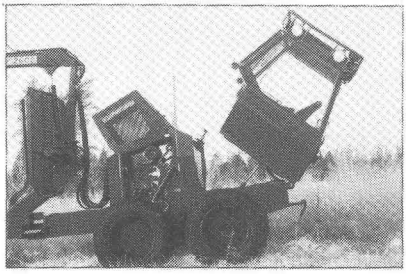

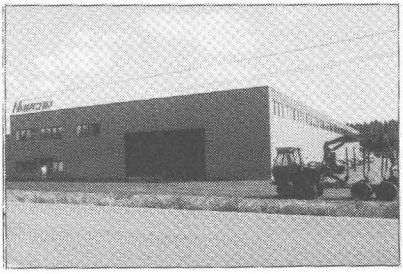

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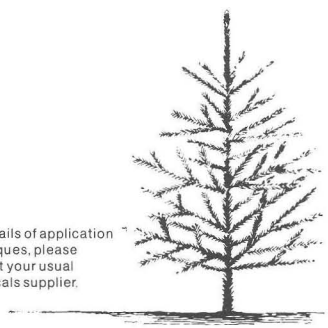

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IRISH FORESTRY

JOURNAL OF THE SOCIETY OF IRISH FORESTERS

Volume 43, No. 2, 1986

Published twice yearly. Price £6.

In this issue:

ISSN 0021 - 1192