JOURNAL OF THE FORESTRY COMMISSION

No. 34 : 1965

PRINTED FOR DEPARTMENTAL USE

FORESTRY COMMISSION PUBLICATIONS ISSUED BETWEEN 1st APRIL, 1965 AND 1st APRIL, 1966

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JOURNAL OF THE FORESTRY COMMISSION

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PRINTED FOR
DEPARTMENTAL CIRCULATION
WITHIN THE FORESTRY COMMISSION
25 SAVILE ROW
LONDON, W.1

EDITING COMMITTEE

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ACKNOWLEDGMENTS

Articles

We should like to thank the Ministry of Agriculture, Northern Ireland, for allowing us to reproduce J. R. McNeill's article, "International Labour Office Course at Arnhem, Holland"; the Iowa State University Press for excerpts from J. P. Anderson's *Flora of Alaska*, contributed by R. Lines as "Conifers in Alaska"; the Division of Fire Control, U.S. Forest Service for D. M. Fuquay and R. G. Baughman's article, "Can Glass and Metal Containers Start Forest Fires?"; the editor of *The Forester* for W. H. B. Forbes' article, "Northern Ireland Forest Fire Statistics for Forest Years 1962 to 1965" and E. Estyn Evans' article, "Bog Butter: Another Explanation"; the editor of *The Shooting Times and Country Magazine* and Ian King for the article "A Big Stag from Thetford"; the Japanese Department of Forestry for the article, "Protection Forest for Fishery in Japan"; the Nature Conservancy's Unit of Grouse and Moorland Ecology for G. W. Johnstone, Adam Watson and Harold Cummings' article, "Wild Life Studies"; the Forest Products Research Laboratory for the articles, "Plywood Fibreboard and Wood Chipboard" and "The Preservation of Western Red Cedar Shingles"; the editor of *American Forest Products Journal* for G. W. Blomgren, Jnr.'s Article, "The Psychological Image of Wood"; the British Association for the Advancement of Science for L. C. Troup's article, "Work Study in Forestry" which was prepared for its annual meeting in September 1965; the editor of *Nederlands Bosbouw Tijdschrift* for E. H. P. Juta's article, "Accidents in Forestry Work in the Netherlands"; the editor of *Indian Forester* for E. Mammen, M. S. Tomar and N. Parameswaran's article, "A Salute to Dr. William Schlich, Tropical Forestry Pioneer"; and the Ministry of Agriculture, Northern Ireland and C. S. Kilpatrick for the article, "Public Response to Forest Recreation in Northern Ireland".

We are also grateful to the editors of the *Timber Grower* and the *Dean Forest Mercury* for articles by our staff that previously appeared in these publications.

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Drawings

A. W. Coram drew the sketches on the title page and on pages vi and vii. The drawings on pages 179 and 180 were adapted from illustrations in *Wealden Iron* by Ernest Straker. The sketch on page 100 is by Rex Evans and appears by courtesy of *Shooting Times and Country Magazine*. Other drawings are by the authors of the articles with which they appear.

EDITORIAL

The Forestry Ministers

There was a change in the Ministerial direction of the Forestry Commission during the year. Three Ministers now share responsibility for forest policy, namely:

The Minister of Land and Natural Resources
The Secretary of State for Scotland
The Secretary of State for Wales.

Our New Chairman

Mr. Leslie A. W. Jenkins, the new Chairman of the Forestry Commission, assumed office on 1st July, 1965. His appointment had been announced by the Minister of Land and Natural Resources in the House of Commons on Monday, 14th June, and followed the Government statement that the composition of the Commission would be changed in view of its new role as a timber seller, and in accordance with present-day practice for bodies with executive functions.

Mr. Jenkins has been associated with the timber trade for many years. On leaving school he joined John Wright (Veneers) Ltd. and was Chairman of that Company from 1956 to 1959. He subsequently became in turn Managing Director of I. and R. Morley and of the Rank Organisation.

Mr. Jenkins is President of the National Association of British Manufacturers. He is also Vice-President of the new Confederation of British Industry, Director of the National Industrial Fuel Efficiency Service, Director of Restall, Brown and Clenell Ltd., and a member of the Institute of Fuel and of the Industrial Coal Consumers' Council. He also serves on the British National Export Council and the Commonwealth Export Council.

Early in the war Mr. Jenkins organised the whole of the Canadian supply of birch logs required for the Mosquito aircraft programme.

Commenting on his new appointment, Mr. Jenkins said: "Forestry is a vital industry from many points of view. The Forestry Commission is at an important state of development, when we are increasingly reaping the fruits of investment and labour over the past years. We must make the most of this indigenous raw material, especially in our current balance of payments circumstances. But forestry is also of the highest social importance, and has to be run with full regard to its value, alongside agriculture, in the economic life and the amenities of the countryside.

With all these aspects, I regard my task as deeply interesting and highly challenging."

The Commissioners

The Forestry Commission itself was reconstituted during the year. The new Chairman, Mr. Leslie A. W. Jenkins, is assisted by four full-time Commissioners, namely:

Sir Henry Beresford-Peirse, Bt., C.B., F.R.S.E., *Deputy Chairman and Director General*
Mr. M. Compton, *Commissioner for Administration and Finance*
Mr. J. Dickson, *Commissioner for Harvesting and Marketing*
Mr. A. Watt, C.B.E., *Commissioner for Forest and Estate Management*

The remaining five members of the Commission, who serve in a part-time capacity, are:

The Earl of Carlisle
Alderman E. Gwynfryn Davies
Mr. F. Sellers
Major Sir William Strang-Steel
Mr. Tom Taylor.

The Commissioners who retired during the year were the Earl Waldegrave, who was our Chairman from 1963 to 1965, Major D. C. Bowser, Capt. J. Maxwell Macdonald, Mr. G. E. H. Palmer, and Colonel J. F. Williams-Wynne.

We record with regret the death, on 5th September, 1965, of the Rt. Hon. Thomas Johnston, P.C., C.H., at the age of 83. Tom Johnston, who was best known as a Socialist leader, was the war-time Secretary of State for Scotland, from 1941 to 1945, and Chairman of the North of Scotland Hydro-Electric Board from 1946 to 1958. From 1945 to 1948 he served as a Forestry Commissioner, and also as Chairman of the National Forestry Committee for Scotland, and played a leading part in getting our great post-war expansion under way.

Re-organisation

Major changes were made, during 1965, in the organisational structure of the Commission. In place of the three territorial Directorates, for England, Scotland, and Wales, we now have a strengthened Headquarters, to which the territorial Conservators and Deputy Surveyors report direct. A feature of the new organisation is that several sections of Headquarters are outstationed from London, at Basingstoke, Alice Holt, Edinburgh, and Cardiff.

The principal posts in the new Headquarters organisation include the Director of Research, Mr. J. R. Thom; the Senior Officer for Scotland, Mr. G. Forrest; and the Senior Officer for Wales, Mr. J. Q. Williamson.

The staff of Mr. M. Compton, Commissioner for Administration and Finance, includes Mr. J. J. V. Summers as the head of the Secretariat, Mr. W. M. Cormack in control of Finance, Mr. T. H. McGeorge in charge of Establishments, and Dr. F. C. Hummel responsible for Management Services.

Mr. A. Watt, Commissioner for Forest and Estate Management, is assisted by three Conservators, namely Mr. P. F. Garthwaite dealing with Forest Management. Mr. J. H. Booth concerned with Estate Management, and Mr. L. H. Williams in charge of Acquisitions and Disposals of Land.

The Commissioner for Harvesting and Marketing, Mr. J. A. Dickson, has on his staff Mr. G. D. Rouse as Conservator for Harvesting, Mr. E. G. Richards as Conservator for Marketing, and Mr. E. H. Macmillen as Chief Engineer.

Changes in the Conservancies

Owing to the many moves due to general re-organisation, we can only include here the more senior members of the staff.

Mr. J. E. James has moved to South Scotland (from South Wales) as Conservator and his new Administration and Finance Officer is Mr. A. A. Cowan.

Mr. G. E. Godwin is now Conservator of Forests for North-east England, while Mr. C. A. Barrington has taken charge of the South-east England Conservancy.

Mr. J. Q. Williamson is now Conservator of Forests for South Wales, as well as holding the more senior post of Senior Officer for Wales as a whole.

Mr. J. H. James has become Conservator for the North Conservancy, with his office at Aberystwyth. This has involved a major transfer of staff from Shrewsbury, where the Commission had had a regional office ever since 1922.

Within each Conservancy, the new pattern of control reflects that found in the structure of the Commission's Headquarters. Each Conservator is assisted by an Administration and Finance Officer, an Assistant Conservator for Forest Management and an Assistant Conservator for Harvesting and Marketing, together with appropriate estate and engineering staff.

The Basingstoke Outstation

In June 1966, several sections of the London Headquarters organisation moved to a fine new block of offices at Priestley Road, in the "new town" of Basingstoke, Hampshire. The sections concerned include:

Establishments
Salaries
Audit
Purchasing
Education and Training
Engineering
Silviculture
Estate Management
Acquisitions and
Drawing Office,

together with the usual supporting services.

The Alice Holt Outstation

Two other Headquarters sections are now outstationed along with Research at Alice Holt Lodge, near Farnham, Surrey. These are:

Planning and Economics and
Work Study.

Remaining in London

Besides the Commissioners and their senior staff, the following sections remain in London, at 25 Savile Row, W.1:

Secretariat
Harvesting and Marketing
Information
Publications
Organisation and Methods and
Accounts and Costings.

Honours

Two of our Head Foresters were named in the 1965 Birthday Honours List. They were Mr. L. G. F. Cross of Bramshill Forest, South-east England Conservancy, and Mr. D. M. Watt of Monaughty Forest, East Scotland. Both received the M.B.E.

Mr. Cross helped to organise the 1964 Forestry Exhibition at Blackbushe in Surrey. Mr. Watt, an outstanding silviculturist, has had charge of Monaughty Forest in Morayshire for thirty years.

In the 1966 New Year Honours List, Major D. C. Bowser, O.B.E., J.P., one of our Commissioners who retired during the year, received the C.B.E. Major Bowser was until recently Chairman of the Scottish National Committee and has done a great deal to strengthen co-operation between the Commission and outside bodies.

Mr. R. H. Smith, who retired during the year from his post as Conservator, South-east England, has been decorated with the O.B.E. Mr. Smith was noted for the good relations he built up between private woodland owners and the Commission in his conservancy.

Miss J. Geekie, Senior Executive Officer in the Edinburgh office, has become an M.B.E. During the war Miss Geekie served in the Timber Production Department and for the past twenty years has held several key executive posts in the Commission.

Forester E. J. D. Wilkinson, based at Alice Holt Research Station, has received the B.E.M. Mr. Wilkinson has for years been in charge of the Commission's travelling show unit which attends the chief agriculture shows in Britain to provide publicity for the Commission's work, and also valuable technical information for all engaged in forestry practice.

We send our congratulations to all those who have been so honoured during the past year.

Obituaries

We regret to announce the death in July, 1965, of Mr. T. S. Pryce, District Officer in East England. Mr. Pryce, a keen ornithologist and interested in many different sports, had been in the Commission's service for thirteen years.

Appointments

Dr. F. C. Hummel, who left the former Mensuration Section of the Research Branch in 1961, on an approved assignment to F.A.O. in Mexico, returned in June 1966 to the Commission. He is now Controller of Management Services at Headquarters.

Mr. A. J. Cole has joined us from the Ministry of Defence as Assistant Chief Engineer, on the mechanical side.

Promotions

We are pleased to report that many of our staff have been promoted, since our last issue, to more senior posts.

Mr. J. Summers has been promoted from Principal to Assistant Secretary at Headquarters.

Mr. T. Farmer, former Chief Clerk for South Scotland, is now Principal at Headquarters.

Mr. J. Lenman, former Chief Executive Officer, is now Deputy Controller of Finance.

Mr. R. Coote, formerly Chief Clerk in South-west England, has been made a Chief Executive Officer at H.Q. Mr. C. Nicolson, formerly Chief Clerk, North Scotland, has become a Chief Executive Officer in Edinburgh. Mr. E. Tinson has been promoted from Senior Executive Officer to Chief Executive Officer at H.Q.

Mr. P. F. Garthwaite, former Divisional Officer, has been made a Conservator at H.Q. (Basingstoke). Mr. J. H. James, formerly our Chief Education and Training Officer has been made Conservator for North Wales. Mr. G. D. Rouse, a former Divisional Officer in South-west England, has been made a Conservator in charge of Harvesting at H.Q. (London).

Mr. C. D. Begley, District Officer in South-east England, has been raised to the rank of Assistant Conservator and is now stationed at Basingstoke in charge of Education and Training. Mr. D. Graham-Campbell, former District Officer in South Scotland, and Mr. J. B. Kennedy, former District Officer in East England, are now Assistant Conservators in the Silviculture section of Headquarters, both being stationed at Basingstoke. Mr. D. A. Mithen, former District Officer in the New Forest, is now Assistant Conservator in East England. Mr. R. M. G. Semple, our Silviculturist (South) has been promoted to Assistant Conservator in Research Division.

Mr. J. M. Gwynn, North-east England Conservancy, has been promoted to Assistant Chief Land Agent at H.Q. (Basingstoke).

Departures

Mr. H. A. Turner, who had been Secretary of the Commission since 1950, left us in July 1965 for the recently formed Ministry of Lands and Natural Resources.

Retirements

Our Deputy Director General, Mr. G. B. Ryle, C.B.E. retired in October, 1965 after 41 years' service with the Commission. Mr. Ryle spent most of his early Commission days in Wales and organised a programme of land acquisitions during the time of the 1936 depression. During the war he was put in charge of the Timber Production Department in South Wales. He went to North Germany after the war to help reconstruct the timber trade. Back in England he was promoted to Conservator for South Wales and later to Director for Wales, and at this time helped to start our major scheme of afforestation in the remote Upper Towy valley. He went on to become Director of Forestry for England and, finally, Deputy Director General.

During the year four of our Conservators retired.

Mr. G. J. L. Batters, O.B.E., retired from the post of Conservator, North-east England in September, 1965. Mr. Batters has always been associated with the Border country and helped to establish the great Kielder Forest. He has always shown a great consideration for private woodland owners and an interest in the well-being of all Commission tenants.

Mr. Frank Best, hitherto our Conservator for North Wales, retired in January 1966. A man deeply interested in all aspects of country life, Mr. Best is considered to be the greatest authority on silviculture in North Wales.

Mr. J. A. B. Macdonald, Conservator for South Scotland, retired in October after almost 44 years with the Commission. Mr. Macdonald spent 26 years in the Research Branch and developed a keen interest in the afforestation of the northern moorlands, During his 14-year period as Conservator he was responsible for the successful planting-up of many such areas that had hitherto been considered unplantable. Mr. Macdonald was awarded the O.B.E. in 1963.

Mr. R. H. Smith, Conservator for South-east England for 17 years, retired in December. The private woodlands side of his conservancy is considered to be one of the most exacting to manage, for many owners are business men with only a recently acquired interest in forestry; but Mr. Smith always maintained good and sympathetic relations with private owners, and this area is now outstanding for the quality and quantity of its estate woods.

Mr. R. R. Donald, Assistant Conservator for South Scotland, retired in October, 1965. Mr Donald entered the Beaufort Forest School in 1921 and served in many grades and districts throughout Scotland. His biggest achievement was the launching of the great Galloway afforestation schemes, in the Glen Trool Forest Park. Mr. Donald was made an M.B.E. in 1961.

Mr. A. D. Palmer, Chief Clerk for Director, England, retired in April. Mr. Palmer began his forestry career in 1916 as a Boy Clerk in the old Office of Woods, before the establishment of the Forestry Commisssion in 1919. Noted for his resolute determination, Mr. Palmer was always scrupulously fair in dealing with staff matters and offered encouragement to many young officers starting their careers with the Commission.

Mr. W. V. Jackson, for many years a District Officer Grade I in the North-west England Conservancy, retired in November. Mr. Jackson is well-known for his service at Sherwood Forest where he dealt successfully with the problems of industrial pollution and high fire risk, in a densely-populated coal-mining region.

Mr. Jack Maund, District Officer Grade I in North-east England Conservancy, retired in January, 1966. Mr. Maund has always been associated with utilisation and the promoting of good relations with the timber trade.

Our best wishes for a long and happy retirement go out to all staff who have retired this year.

Forestry and the Countryside

Speaking at the "Countryside in 1970 Conference" on 12th November, 1965, Mr. Leslie Jenkins, Chairman of the Forestry Commission, said:

"It is probably true to say that the National Parks Commission, the Nature Conservancy and the Forestry Commission are the three public bodies within the Government family which are most closely concerned with the countryside and its use.

Certainly these three bodies together can and do exercise an abiding influence on the scenery, welfare and amenities of rural Britain.

We share a great responsibility. I say share, for from top level down to the field the two Commissions and the Nature Conservancy do try to work together to reconcile their direct functions in the common interest, and to a great degree succeed.

In the Forestry Commission we have a special problem. We cannot forget that primarily our job is to produce timber to meet the increasing demands of industry; and to produce it efficiently, and as economically as we can, in the interests of the taxpayer. This does not mean that we have no soul, or do not feel ourselves to be part of the countryside. After all our roots are in the countryside—most of our staff work and live in it.

Since I became Chairman of the Forestry Commission a few months ago I have been deeply impressed by the concern for the landscape and the public enjoyment of it which genuinely inspires the whole organisation. Of course we cannot always please everyone. However, the fact that we have enlisted the

invaluable advice of Miss Sylvia Crowe on our side surely speaks for itself. This is not just a gesture. We mean to combine business with scenic beauty, and business with the pleasure of a public that is seeking it more and more in and around our forests.

I have read the reviews of the various Groups' findings with the greatest interest. And yet I must confess I am a little disappointed for there are some signs of an unawareness that so much that is advocated is in fact being done already by the Forestry Commission on their land. It may not be generally known, for example, that we are pioneers in one aspect of amenity. Thirty years ago we created our first Forest Park—in Argyll—and since then we have opened six others.

In these Parks we provide for hill climbing, sailing, shooting, pony trekking and nature study. Moreover, the Forest Parks and other areas under our control give splendid opportunities for adventure training for the youth of the country, while the "nature trails", which we have laid out, provide exercise and education for the less adventurous.

The Minister of Land and Natural Resources, Mr. Willey, has referred to the need for camping and caravan sites. Our own statistics amply confirm the demand for them. During last season, which was by no means a good one, nearly six hundred thousand people stayed overnight at our major camping and caravan sites alone.

We are also operating picnic sites throughout the country which have been enormously popular—we estimate in fact that about four million people have picnicked on our land this year.

One of our major problems is the provision of car parks which are big enough to cope with the demand and at the same time do not spoil the amenities of our forests. We think that we have a good idea in what we call the "natural forest car parks" which we are introducing on the basis that camouflage can have its uses in peace as well as war.

In all, with our Forest Parks, our camping and caravan parks, our picnic sites, our arboreta and our other facilities, we estimate that we probably provided recreation for nearly five million people last season.

But we are not complacent. There is still a great deal for us to do—and to learn—and there are stimulating possibilities.

We have got to be even more imaginative in providing for the enjoyment of the huge tracts of magnificent scenery and the great variety of wild-life of which we are custodians.

As the largest land managers in the country we have all the more responsibility to lead—and much more to give, and I hope perhaps the more to gain from sound advice.

Here I would like to say how much we in the Forestry Commission welcome the constructive views of the voluntary bodies on our work. They can be, and are, such a great help to us and we hope we may count on their full liaison and co-operation with us on many of the matters mentioned in the various study groups associated with the Conference.

The countryside must be alive and dynamic, a great force in the economic life of the nation as well as a joy to all who desire the peace and opportunities for relaxation it can offer.

I am delighted to see that one of the six principles adopted by this Conference is that "The prosperity of Agriculture and Forestry are of primary importance in the management and care of the countryside and in the creation of good landscape".

We in the Forestry Commission will do all we can to assist in attaining this end."

Here and There in the Woods

A Royal Visit

On 1st May, 1965, Her Royal Highness Princess Margaret, accompanied by the Earl of Snowdon, visited Inchnacardoch Forest in Inverness-shire. They also went round the new pulp and paper mill, owned by Scottish Pulp Ltd., which was being constructed at Fort William.

The Kielder Forest Museum

Walkers visiting Kielder Forest in Northumberland can now look with a more knowledgeable eye on the natural life around them. A small museum opened in May, 1965 at Lewisburn—where there is a camping and caravan site in the heart of the forest—gives the visitor some insight into the plants and living creatures which he may hope to see as he walks through the forest; and also some idea of the risks which he brings with him if he is careless or inconsiderate. The Lewisburn museum has grown from exhibits which forestry workers have been arranging for some years. Now, with expert help from Newcastle University and a grant from the Carnegie Trust, it starts a fuller and more permanent life in a converted cottage.

Two-tone Horns and Flashing Lamps

Under new Road Vehicles Regulations (S.I. 870 and 871, 1965) which came into force in June, 1965, the Forestry Commission is one of the few public bodies authorised to use two-tone warning horns and flashing blue lamps on its road vehicles. The reason for this is our need to reach forest fires without delay.

Other bodies who enjoy this privilege are the fire brigades, police, ambulance, salvage corps, blood transfusion units, bomb disposal squads, coastguards, and National Coal Board vehicles used for pit rescue work. A distinguished company of men in a hurry!

Beyond Comment

The big man leaned on his axe. "A good woodman," he said, "is strong in the back and thick in the head." A huge grin split his brown face. Behind him an army of pine trees marched to the horizon, dense and regular as a scrubbing brush.—*From a press report of a forest visit.*

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TOURS ABROAD

A TOUR OF FINNISH FORESTS

by L. C. Troup

Assistant Conservator, Work Study, Research

In late June and early July, 1965, I accompanied the Director General, Sir Henry Beresford-Peirse, on a tour arranged by the State Board of Forestry for Finland. The tour fell into two distinct parts. The first week was spent in southern Finland and included visits to both State and private forests, research areas, nurseries, seed orchards, factories and a forest school. The second week was spent in Lapland where the greatest State forests are to be found and here logging, draining, ploughing and screefing equipment were demonstrated and a further factory and forest school visited.

We are very grateful to the Director General of the Finnish Forest Service, Dr. Antero Piha, and to his staff for arranging the comprehensive itinerary which covered most aspects of the forest industry. The tour was conducted with the greatest efficiency and everywhere we were met with friendliness and notable hospitality.

The notes which follow are not in any sense a diary of events but rather a record of what seem to be the salient points under various subject heads. Appendix A gives the itinerary and Appendix B lists the names and appointments of those who met us.

Land Utilisation, Growth, Volumes Removed and Ownership Tables

(1) Land and Water

	Square miles
Land area	117,730
Water	12,270
Total area of country	130,100

(2) Land Use

	Million acres	*Percentage*
Forest land	53	71
Waste land	11	14
Agricultural land	7	10
Building sites, roads, etc.	4	5
Total land area	75	100
Total of which swamps	24	32

(3) Forest Growing Stock

	Million hoppus feet over bark	*Percentage*
Scots pine		43
Norway spruce		38
Birch		17
Aspen, Alder, etc.		2
Total growing stock	39,077	100

Growing stock per acre of forest land 730 hoppus feet over bark.

(4) Annual Forest Growth

	Million hoppus feet under bark	*Percentage*
Scots pine		37
Norway spruce		39
Birch		22
Aspen, Alder, etc.		2
Total annual growth	1,193	100

Growth per acre of forest land per annum 22·5

(5) Total Wood Removal in 1964 (preliminary estimate)

	Million hoppus feet under bark	*Percentage*
Saw timber	427	30·7
Cordwood	528	37·8
Fuelwood	313	22·4
Waste wood	105	7·5
Natural losses	22	1·6
Total	1,395	100

(6) Forest Ownership by Percentages

	Area	*Growing stock*	*Growth*
Private	62·7	65·8	73·0
State	28·0	22·9	15·3
Companies	7·1	8·9	8·9
Parishes, etc.	2·2	2·4	2·8
	100	100	100

Discussion

(a) Perhaps the most significant fact which emerges from the tables is that Finland is overcutting to the extent of some 200 million hoppus feet under bark per annum (see tables 4 and 5). This represents about 17 per cent over and above the annual increment but, if conifers alone are considered, the overcutting may exceed 20 per cent. This serious state of affairs is well recognised by the authorities and positive steps are being taken to improve

the situation by implementing the so-called MERA Programme for swamp reclamation, planting and fertilising (see below). It will be seen from table 2 that 32 per cent of the land area is swamp and this represents some 24 million acres of which half are considered to be drainable.

(*b*) Table 6 indicates that State forests are situated on the poorest land! 28 per cent by area but having only 22·9 per cent of the growing stock and a mere 15·3 per cent of the annual growth. In fact the main State holdings are in northern and eastern Finland where the soils are poorer and the climate harsher. Both the growth per arce of forest land 22·5 hoppus feet under bark and the stocking per arce 730 hoppus feet over bark are average figures whose higher ranges are represented by private woodlands and lower ranges by State forests. By U.K. standards these figures are, of course, extremely low and are indicative not merely of very difficult cultural conditions but also progressively harmful overcutting coupled with inadequate regeneration and improvement works in the past. To this can be added the pressure of increasing world demand which, in turn, has led to the establishment of an industrial capacity that exceeds the increment of the forests. At present, two further pulpwood mills are being established: these the Forest Service view with bleak resignation mingled with the hope which MERA appears to offer.

The State Forest Service

The Service, which was founded in 1859, now controls some 28 per cent of the productive forest area of Finland. Total holdings of land are about 21 million acres mainly situated in northern and eastern Finland, and tending to lie in regions of harsher climate and poorer soil. The forest area designated as "Commercial" is constituted as follows in thousands of acres:—

Forest Land

Productive	*Of Low Production*	*Total*	*Roads, Storage Areas, etc.*	*Wasteland*	*Total*
8,490	1,882	10,372	32	3,950	14,354
59%	13%	72%	—	28%	100%

The State Service holds a further 6,600,000 acres and these include the protection forests of Lapland, areas reserved for resettlement schemes, national parks, nature reserves and some 1,240,000 acres of lakes and waterways.

The Service is a profit-making undertaking and in the period 1960–64 a surplus amounting on the average to about £4 million was paid annually into government funds. About 90 per cent of the income was from sales of timber. As might be expected, by far the greatest expenditure is for logging and delivery and about 70–75 per cent of the budget has been absorbed in this way. Annual salaries and wages are over £6 million, the staff being about 250 graduates, 350 forest technicians and 8,000 workers. The great majority of workers are farmers who must supplement their income by working in State forests and the aim is to make them as nearly full time Forest Service men as possible: 200 days' work per year was mentioned as the sort of figure which would be regarded as reasonable. It remains to add that most of the farmers are woodland owners and may derive a major part of their "farm" income from harvesting trees.

The organisation of the Service is shown in Appendix A. It will be noted that the headquarters, known as the State Board of Forestry, directs a regional administration consisting of four regions. However, it is shortly intended to

amalgamate the east and west regions and to re-organise the headquarters on strikingly similar lines to those recently adopted by the Forestry Commission.

Regions roughly correspond to massive conservancies and their headquarters include various specialists such as a Silvicultural inspector, management plan officer, transport officer and swamp drainage expert.

Districts vary in size from about 25,000 acres to 250,000 acres with an average of about 50,000 acres. They are controlled by a District Officer aided, in most cases, by an assistant District Officer. The largest districts are those which include protection forests where little or no cutting is done because of the very low stocking and the scarcity of seed years: successful seed years have occurred every 15 years on the average during this century; they were every 30 years in the nineteenth.

The district is the basic unit for all purposes. Thus management plans are made for whole districts and the foresters (forest technicians) work to the District Officer whose main tasks are the supervision of marking, planning logging areas, and organising the work of extraction as a whole including transport, storage and delivery of timber. Timber is mainly delivered to the buyer and this may require arrangements to be made for floating, intermediate transport and, sometimes, long distance transport. Whenever possible contractors are used for the extraction and transportation phases in order to avoid heavy capital investment in machinery. Districts are also responsible for carrying out the increasing amounts of planting, sowing, fertilising and drainage.

In three of the regions (North, Ostrobothnia and East) there are machinery depots which co-ordinate the demands for heavy, centrally held machines and arrange for their maintenance, either by mobile mechanics or, in the case of major repairs or overhaul, by drawing the machine back to the depot.

Vigorous attempts are being made to raise production. The following figures indicate the progress.

	Reforestation (acres)	*Ditches (miles)*	*Area Drained (acres)*
1960	47,000	2,580	43,700
1961	60,300	2,860	49,100
1962	77,900	3,830	67,900
1963	84,000	3,510	63,800
1964	101,300	5,100	87,200

Swamp drainage is normally undertaken by the *Lokomo* plough. This is preceded by logging such trees or stands as may exist (the term "swamp" is used to cover all gradations from poor woodland standing on impeded soil to out-and-out muskeg). For economical use the *Lokomo* requires large areas and long runs, and back-acting bucket excavators are still used for small areas and for the construction of lateral drains where these are required. Two *Lokomos* and one *Vaggeryd* excavator were seen in action. Costs quoted were as follows:—

Lokomo in Saarijarvi Forest District	11s. 1d. per chain
Excavator in Saarijarvi Forest District	22s. ,, ,,
Lokomo in Savukoski Forest District (Lapland)	3s. 8d. ,, ,,

(Costs are for machine, including delivery, labour and planning).

Within the last two years some 9,000–10,000 acres have been fertilised and much larger programmes are planned for the future. A *Metska Viska* blower-type distributor was demonstrated at one forest and costs were said to be about £5 per acre all-in for the distribution of 240 Kgs/ac. of phosphatic fertiliser.

Five major nurseries provide most of the plants needed for the Service. They total some 220 acres and are supplemented by 30 small nurseries based

upon districts. Plans have been made for the extension of the central nurseries in order to provide the increasing numbers of trees which will be needed (See below).

Discussion

(a) Table 6 shows that the State is a relatively junior partner in the forest industry although it is, of course, by far the greatest single owner. Private woodlands are of decisive importance and the various private woodland organisations have considerable influence; this is considered in the next section of the report.

(b) The organisation of the Service is of particular interest. The "Board" as such consists of the Director General, Deputy Director General, Chief Inspector of Silviculture and the various Section Chiefs. The Chief Inspector of Silviculture has an out-stationed specialist in each region and both he and the local experts advise the regional chiefs and the district officers.

The structure is three-tiered and differs from our own mainly in the size of the regions. These may be regarded either as very large conservancies or as directorates. Certainly had we in our re-organisation abolished conservancies and retained and reconstituted directorates our organisation would have been very similar indeed. However, comparisons should not be chased too far. Districts, although much larger than ours, have no private woodland responsibilities; are (despite MERA) still essentially concerned with logging rather than establishment; and are, on the whole, uniform topographically, geologically and climatically.

From a Headquarters viewpoint there is some advantage in dealing with four (soon to be three) regions, but the regions themselves have to direct 20 or so districts and seem to be less favourably placed than our Conservancies in this respect. Nevertheless, the work of regions is intensive rather than extensive in scope and many conservators in this country might feel it a fair exchange to double the State Forest Work and pass private woodlands over to a separate body; however, again it is necessary to be cautious: private woodlands predominate in Finland and a separate organisation to deal with them was an understandable, historical development which has not lost its relevance; in our case we are becoming, in some regions, the major holders of productive forests and a separate private woodland organisation has less relevance to our circumstances.

(c) The resettlement policy of the Finnish Government involves the loss of 250,000–370,000 acres of State Forest land annually. This is not popular with the Service since the most productive land is selected for these schemes. Although most of the so-called "farms" remain substantially as woodland there is some clearance for agriculture and the forest units so created are said to be too small for really efficient management and certainly too small for the employment of expensive machinery. The resettlement policy has led to a gradual reduction in the annual timber deliveries from State Forests, as indicated by figures for the following three-year periods:—

1956–58	155,300,000 hoppus feet per year
1959–61	144,200,000 hoppus feet per year
1962–64	124,800,000 hoppus feet per year

Recreational and scientific responsibilities are taken seriously. There are seven national parks and ten nature reserves totalling about 312,000 acres. Additionally there are 255 protected, so-called "primeval forests" totalling about 50,000 acres. State forests used for the same purpose as

national parks number 177 with a total area of roughly 168,000 acres. With the exception of nature reserves all these areas are used for recreational purposes. Furthermore, a hill area in Lapland, covering about 240,000 acres (Saariselka-Raututunturi) has been set apart as a wilderness area. There are also 250,000 acres of waterways where fishing is allowed.

Private Woodlands

Table 6 shows the proportion of forests owned privately whilst Appendix B illustrates the organisation which has been evolved.

The State Board of Forestry has the task of controlling and improving private forestry under the stipulations of the Private Forestry Act. The field organisation provided for in this enactment consists of Forestry Boards (19) working on an autonomous basis. The practical works of improvement is supervised by the Central Forestry Associations (2). Grants for improvement work are sometimes available on application to the State Board: they are not given automatically but depend upon an examination of income and expenditure.

The task of the Central Forestry Boards include liaison with the State Board of Forestry but they also have direct access to the Minister of Agriculture. Their duties include the implementation of the Forest Improvement Law which deals with drainage, the improvement of unproductive forests and the construction of motor roads; this part of the work is carried out by 16 Districts for Forest Improvement and these are regarded as very important in the MERA Programme.

The duties of the 19 District Forestry Boards are:—

(*a*) to enforce the Law Concerning Private Forests and other legislation.

(b) to attend to the general promotional work for private forestry. This is done by providing owners with professional advice, instruction and services and by drawing up management plans and by supervising the work of the Forest Management Associations.

The Boards are autonomous and each may make its own regulations within the compass of directives given by the State Board of Forestry. Each Board consists of six members elected by Forest Management Associations in the area of each specific Board. The general manager of each Board is the chief forester on the permanent staff.

The Forest Management Associations are forest owner organisations and their functions are established by the Act on Forestry Associations. Their function is the promotion of knowledge and skill in their areas, which normally cover a rural commune. They provide foresters to help owners with their marking, marketing and silvicultural work and their administration is completely in the hands of the forest owners.

The activities of the Central Forestry Associations and the District Forestry Boards are financed by annual State subsidies which cover about one half of their expenditure; the other half has to be acquired as income. The Forest Management Associations work completely on a self-financing basis, each forest owner whose forest annually produces not less than 20 cubic metres of timber having to pay to his Association 2–6 per cent of the net yield assessed for communal taxation. Associations also charge for their professional help.

There are eleven schools for forest owners; silviculture, technology and logging methods are taught. In 1963 there were 49 courses of less than 14 days' duration and 23 which exceeded two weeks (5-month courses are quite normal). In addition, courses are held in temporary accommodation such as agricultural colleges and elementary schools. Forest excursions are also arranged.

Educational activities are mainly controlled by the District Forestry Boards.

Discussion

(a) This massive and far from simple organisation—which varies from fully official members in the higher echelons to semi-official in the lower—was said to work very well and to give forest owners a feeling of being able to direct their own destinies. The function of the State Board of Forestry is clearly to determine general policy in consultations with the Minister of Agriculture and the Central Forestry Associations. Apart from the specific function of approving grants, the Board then leaves the administration of private woodlands entirely to the Central Associations and their dependent bodies.

(b) The task of welding 28,000 separate forest owners into a cohesive body is considerable but it is clear that the private woodlands organisation has achieved much. Its educational activities are particularly notable.

The MERA Programme

As explained earlier in the report overcutting and increasing demands for wood products has caused much anxiety. In Spring 1964, the Forestry Financing Committee (MERA Committee) met to consider the steps which should be taken. The Committee consists of representatives of the State Board of Forestry, Bank of Finland, Central Forest Association Tapio, Central Association of Finnish Woodworking Industries and Forestry Commission of the Central Association of Agricultural Producers. As a result the MERA Programme was produced.

Targets are as follows:—

Type of Work	*Present Level*	*Target* 1970
Seeding and planting 1,000 acres	310	740
Forest drainage 1,000 acres	380	618
Fertilisation of forest land 1,000 acres	17	74
Forest road construction miles	870	1,090

Plans were laid to provide for the necessary increase in planting stock by the expansion of nurseries and the establishment of seed orchards.

The plan will need nearly three times the money being invested today as indicated by the following table:—

		Financed by the			
Time	*Forest Owners' own Financing*	*Grants in Aid*	*Loans*	*State Total*	*Grand Total*
1	2	3	4	5 (=3+4)	6 (=2+5)
Present level	12·5	9·2	9·0	18·2	30·7
%	41	30	29	(59)	100
1970	43·8	20·1	24·7	44·8	88·6
%	49	23	28	(51)	100

(millions of marks £=about 9 Finnish marks)

Discussion

(a) The MERA Programme will not begin to make much impact until about 1980 when the results of fertilising and drainage are expected to emerge. From 1980 onwards it is expected that an annual cut of 1,387–1,525 million hoppus feet will be possible. This is much the same as the present removal but will not then result in overcutting.

(b) The longer term objective is to double the MERA Programme so as to make available extra raw material towards the end of the century and after.

(c) This is a far-sighted programme but one that would have been better introduced ten or fifteen years ago. However Finland has had appalling post-war difficulties such as the payment of war debts (resulting in over-cutting) and the resettlement of the Karelian refugees. All in all MERA is a splendid effort which seems almost certain to succeed in its objectives.

Research, Work Study and "Planning and Economics"

Research is carried out by the following organisations:—
The Forest Research Institute
The University of Helsinki
The State Institute for Technology
The Pulp and Paper Research Institute
The Central Association of Finnish Woodworking Industries (*Metsateho*)
The Work Efficiency Association (*Työtehoseura*)
The Office of Logging Techniques.

The Forest Research Institute

This was established in 1917. It has eight departments, is based on Helsinki, and is quite separate from the State Forest Service.

Soil Science Department studies the physical and chemical properties of the soil, soil development and fertilisers.

Peatland Department deals with the silvicultural utilisation of swamp, their ecology, hydrology, drainage and cultivation. There are numerous permanent, swamp sample plots.

Silvicultural Department studies regeneration, thinning methods, forest tree breeding (see later for notes on the Tree Breeding Association) and its genetic bases, and forest protection. Tree improvement studies have consisted of various clone tests, hybridisation work and extensive field experiments. Pest and weed control have also figured prominently in recent work.

Forest Biology Department studies the morphology, physiology and ecology of forest trees and includes mycology and microbiology in its work.

Mensuration and Survey Department studies the methods of forest mensuration; the structure, growth, yield and development of tree stands; the principles of forest management; carries out national inventories and assists the Forest Economics Department in enquiries. This department is now engaged in the fifth national inventory of Finland's forests. Previous inventories have been periodic but the present venture is to be continuous, beginning in southern Finland and gradually covering the whole country. The department also maintains an extensive series of permanent sample plots.

Forest Technology Department deals with forest work and tools, the measuring of timber and the properties of wood. It has recently settled many questions concerning small sized wood (size limits have been reduced because of the shortage of material). A great number of measurement studies have also been conducted.

Forest Economics Department studies business and marketing questions in forestry and forest industries, conducts surveys into the utilisation of the yield and, together with the Mensuration and Survey Department undertakes "forest balance" studies. It is also responsible for continuous wood utilisation statistics, and stumpage statistics on which forest taxation is based annually.

Forest Statistics Office gives a general service to the other departments and, later, forest statistics for the whole country will be centralised in this office.

In addition to the Research Departments there is an Experimental Forest Department, Nature Conservation Office (soon likely to become separated from the Institute) and a Secretarial-Financial Office. The experimental areas, comprising forests in different parts of the country, total some 170,000 acres. They are not solely used for research but are also economic forests.

At present the Institute has two outstations: one in Lapland dealing with swamp studies and another in southern Finland dealing with genetical questions —particularly those concerned with suitable strains of Scots pine for Lapland.

University of Helsinki

The Faculty of Agriculture and Forestry includes nine forestry departments all conducting research and experiments to a greater or lesser degree. Our main contacts so far have been with Professor K. Putkisto of the Forest Technology Department. His work has been in the fields of mechanisation and work study.

The State Institute for Technology

This is based on Helsinki and deals with wood science, including structural, physical and chemical studies, wood preservation and problems linked with pulp and paper production.

The Pulp and Paper Research Institute

Also in Helsinki, this institute was established and is maintained by industrialists. It studies industrial processes connected with pulp and paper factories and evolves improved processes. Additionally all major factories have their own research departments whose findings are *not* made public!

The Central Association of Finnish Woodworking Industries (*Metsateho*)

Metsateho is a private association which carries out large scale investigations into forest working techniques including machinery and also into the various manufacturing processes connected with wood-using industries. Their findings are generally applicable to large concerns as opposed to *Tyotehoseura* (see below).

The Work Efficiency Association (*Tyotehoseura*)

A private but State-subsidised organisation which is charged with studies to help the small farmer/forester. Additionally it studies building techniques and house equipment problems. Most of the *Tyotehoseura* forest studies are designed to help the owner who has little equipment other than an agricultural tractor and relatively unsophisticated extraction and processing techniques.

The Office of Logging Techniques

This is one of the sub-sections in the State Board of Forestry and is comparable with the Work Study Section in the Forestry Commission but confines its activities to studies of logging and the evolution of improved methods. The work is mainly centred on Hirvas in Lapland, the Chief Inspector being an out-stationed Headquarters officer. Some of the recent studies conducted by this Office are reported further on.

Discussion

(a) Many different organisations are concerned with research and development and there is some overlapping of functions. The Director General of the Finnish Forest Service thought that co-ordination of effort could and should be improved, and said that thought was being given to the improved effectiveness of the Co-ordinating Council charged with this task.

(b) The Forest Research Institute is more or less comparable with our own Research Branch but is quite independent; and we gathered that there is no interchange of officers between the "field" and the Institute. This policy of life specialisation differs sharply from our own. This is not the place for a discussion of the pros and cons. but it should be recorded that one or two officers thought it would be wasteful to allow specialists to go to line management. Research, then, is clearly a career with its own structure and its own grading and promotion procedures.

(c) Work studies and rationalisation are dealt with by five bodies and though there is overlapping, the emphases tend to be different. The Forest Technology Department of the Forest Research Institute concerns itself with intensive studies of particular individual problems such as piled measure but does not study whole sequences of operations. Nor does it do work evaluations (work measurement). The Forest Technology Department of the University of Helsinki conducts its own enquiries but these are reported to be rather limited in scope. *Metsateho* has large resources at its disposal and most of their recent work has been the evaluation of new machines and new logging techniques. *Tyotehoseura* concentrates on the problem of the farmer/forester. The Office of Logging Techniques carries out large scale studies into the mechanisation of logging and these are sufficiently replicated to give very reliable results including standard data.

Education

Forestry graduates are trained at the University of Helsinki. Courses for private woodland owners have already been mentioned. The State Board of Forestry controls 7 schools for the training of forest technicians (see Appendix C), 1 woodworking school and 4 forest workers' schools. A forest machinery school and a forest foreman school are soon to be founded.

During the tour, schools at Evo and Hirvas (*Rovaniemi*) were visited. These are modern schools and have spacious classsrooms and living quarters. Evo was founded in 1862 as a forest graduate school but from 1879 forest technicians also received training; from 1908 onwards graduate training transferred to the University of Helsinki and Evo became a training centre solely for technicians. In 1964 10-month courses for forest workers were also begun.

Courses for technicians last for two years and there is keen competition for places. Up to 450 applicants may seek to enter each school but there are only 40–45 places at each. A condition of entry in addition to appropriate educational standards is that students should have at least one year's practical experience. Lectures are given from 1st September to the end of April and practical work takes up most of the rest of the year. There are four weeks holiday. (A school curriculum has been obtained, partly translated and sent to the Chief Education Officer.)

All forest schools have a large forest area attached to them. Thus Evo has about 20,000 acres and this is substantially worked by the students. A full range of work is available and increasing attention is being paid to establish works. Evo has a small Scots pine seed orchard surrounded by an elk-proof fence; this was being partly used for the production of grafting material and coning was rather poor.

Discussion

(a) The courses for forest technicians are similar to those at our own forester training schools but are conducted in what are, perhaps, rather more opulent surroundings. Forest workers courses are of interest and one wonders if we could not, with advantage, arrange for short residential courses for selected young forest workers; this would supplement our present Forester Training Schools and Newton Rigg courses, and, whilst 10-month courses would probably be impracticable, 3 months might be feasible.

(b) What we should certainly emulate in the future is a forest machine school. This could be done on a useful but unambitious scale, in about two years time, using the work study experimental team and the gear which it seems likely to accumulate, as the core. Courses for both supervisors and operators could probably be arranged.

The Tree Breeding Foundation and Nursery Practice

The Tree Breeding Foundation established in 1947, is an independent, State-subsidised organisation whose task is the practical application of tree breeding techniques including the collection and sowing of seed from plus stands, the collection and preparation of grafts and the establishment of seed orchards. Details provided by the Director of the Haapastensyrja forest tree breeding station, in southern Finland, are:—

Numbers of registered plus trees	4,170
Numbers of registered plus stands	3,600 hectares
Area of seed orchards	300 hectares
Area of seed orchards by 1970	2,500 hectares

Haapastensyrja station:—

Established 1960; area 200 hectares	
Tree breeding collection of grafts	10,000
Annual production of grafts	200,000
Plastic greenhouses	4·5 hectares
Plastic greenhouses by 1967	10 hectares

The work of the foundation has been given impetus by the MERA Programme and tree breeding nurseries have expanded on an impressive scale. Of particular interest were the "plastic greenhouses" used for raising seedlings. These were seen both at Haapastensyrja and also at a State Forest central nursery at Saarijarvi and seem likely completely to replace conventional seed beds which, like ours, are in the open. The greenhouses consist of simple, laminated arches placed 2 metres apart and bolted together by over-lapping tie-beams; heavy duty polythene is used as the cover and provision is made for the automatic drawing back of certain polythene sections in order to give ventilation when required; overhead, pipe irrigation is also provided. The laminated arches are available in various sizes. Those seen were twelve metres broad and either three or four metres high. Any number may be joined together, the largest greenhouse seen being eighty metres.

In this system the seed beds are made of sphagnum peat and are two metres broad and fifteen centimetres in height. Fertilisers are applied to the top layer and the seed sown, usually in May; either one or two nitrogenous top dressings are given during the growing season and the greenhouses are removed in the autumn. The seedlings then stand-over for the winter and are lined-out in the following spring. Surprisingly enough no frost damage has followed the removal of the greenhouses.

Enhanced yield and growth have been obtained by this method. Figures quoted are:—

Scots pine seed sown conventionally:	yield 40,000 per Kilogram
Scots pine seed sown in greenhouses:	yield 100,000 per Kilogram

Furthermore usable 1+0 seedlings are now obtained whilst 2+0 were quite usual in the old method.

At the Saarijarvi forest nursery an excellent refrigeration plant has been installed. This is mainly used for seedlings which are lifted in the spring to release space for further sowings; the seedlings are carefully graded and stored until lined-out locally or exported for lining-out elsewhere. The sorters are provided with well-designed tables which have oval slots to help counting and bundling.

Lining-out is done in conventional fashion using a metal lining-out board which has no advantages over our own larger models. Soil preparation includes the spreading of peat over the characteristically sterile, sandy soils and the application of a balanced fertiliser (usually a national "Y" fertiliser). 1+1 transplants are usually obtained.

At the tree breeding centre which we visited twenty-four persons were employed when grafting. Stocks are usually about two feet in height and are normally three years old (the Director said that he would prefer younger stock and preferred the stocks to be derived from elite trees). In grafting, wax is not used for Scots pine and Norway spruce, the junction being secured by rubber bands approximately nine inches long by five sixteenths-broad. Wax is still used for hardwood grafting. After about two seasons the grafts go out to the seed orchards now being vigorously established in southern and central Finland.

Special attention is being paid to clones which are likely to succeed in Lapland where growing conditions are severe and seed years very scarce. 2,500 hectares of seed orchards are planned of which 2,400 will be Scots pine and 100 Norway spruce. About 400 grafts are planted per hectare and annual fertilisation is the rule. The average size of each orchard will be about 20 hectares but these will often be grouped within the same general area, to give improved concentration.

A recently established seed orchard at Jamsa was visited. Coning was beginning in a small scale but the retarding effects of *Melampsora pinitorqua* were evident. The alternate host of this fungus, aspen, is so widespread in Finland that *Melampsora* is expected: its effects disappear after a few years.

Discussion

Plastic greenhouses have reduced the costs and raised the yields of seedlings. The system is not unlike that of Duneman which was examined but not adopted by the Commission. However, the Finnish system should be examined by one of our experts to see if we could gain by introducing something similar into this country.

Floating of Timber

Although timber floating has no relevance to our conditions it is of interest and Appendix C contains a short account prepared by the State Forest Service. It will be seen that 60 per cent of Finland's timber is still floated and this proportion is unlikely to reduce materially in the near future. The work of floating is conducted by floating associations: these are independent, non-profit-making companies of which there are over twenty. Charges are apportioned at the end of each floating season in accordance with total costs and the amounts despatched by each individual owner.

Industrial Notes

Forest Industry in 1964

	Number of plants	*Production in* 1964	*Exports in* 1964
Export sawmills—approx.	600	1,225,000 standards	1,000,000 standards
Prefab house factories—approx.	20	?	33,000 sq. metres
Plywood mills	27	512,000 cubic metres	440,000 cubic metres
Portable board mills	6	142,000 cubic metres	40,000 cubic metres
Fibre board mills	8	239,000 tons	165,000 tons
Mechanical pulp mills	23	1,350,000 tons	175,000 tons
Semi-chemical pulp mills	4	190,000 tons	—
Chemical pulp mills:—			
Sulphite	19	1,469,000 tons	971,000 tons
Sulphate	14	2,076,000 tons	979,000 tons
Paper mills	25	2,053,000 tons	1,725,000 tons
Board mills	16	926,000 tons	784,000 tons

Utilisation of Roundwood in 1964

	Million solid cubic metres (under bark)
Sawmill industry	11·6
Plywood industry	1·4
Particle board industry	0·2
Fibre board industry	0·3
Mechanical pulp industry	3·1
Semi-chemical pulp industry	0·5
Sulphite pulp industry	6·4
Sulphate pulp	7·0
Other industries	0·4
	30·8*
Export of roundwood	1·4
Industrial fuelwood	0·9
Wood used by rural and urban communities	11·1
Other items	1·6
	45·7*
Import of roundwood	1·7

* Owing to rounding off, the sum is not the same as that obtained by adding up the individual items.

Distribution of Exports in 1964

Continents	*Mechanical Wood Industry per cent*	*Chemical Wood Industry per cent*
Europe	93·3	79·5
E.E.C. (European Economic Community)	30·9	36·1
E.F.T.A. (European Free Trade Association)	57·1	24·8
East Bloc	1·1	15·0
Rest of Europe	4·2	3·6
North America	3·7	7·0
U.S.A.	3·6	6·9
Latin America	0·0	4·5
Africa	0·6	2·6
Asia	1·9	3·8
Oceania	0·5	2·6

Factories

Six factories were visited and descriptive literature is available for each. Brief notes follow.

Metsaliiton Selluloosa Oy, Aanekoski

An integrated mill which together with other factories is controlled by a co-operative association of private forest owners. 70 per cent of the raw material is floated to the factory, the balance coming by road (from a 30-mile radius) and by rail. The factory owns some 70,000 acres of forest but the main supplies come from the 10,000 (approx.) private owners. Depending upon the season between 1,000 and 2,000 workers are employed in the forests and they are supervised by 60–70 foremen. The factory itself employs 1,000 men and 200 women and works on a four-shift basis. Products are sulphate and sulphite pulp, paper, groundwood pulp and sawtimber; there is also a chemical recovery plant. 1,300,000 cubic metres are used annually as follows: Scots pine 500,000; Norway spruce 300,000; Birch 500,000.

Kaukopaa Mills of Enso-Gutzeit Oy

Enso-Gutzeit is a State-owned company and the Kaukopaa mills, one of their holdings, is the largest in Europe and is responsible for some 10 per cent of Finnish paper and pulp exports. The products are Kraft boards and bleached, unbleached and semi-bleached pulp. Tall oil and turpentine are also recovered. The annual input to the mill is about 4,000,000 cubic metres (111 million hoppus feet) of which 17 per cent comes from the company's own 800,000 acres of forest. Only pine and birch are used, 75 per cent of the former and 25 per cent of the latter, and barking is done entirely by pocket barkers. Scales of pulp which were 35 per cent ten years ago have dropped to 7 per cent, the balance being processed into Kraft boards.

Metsa-Saimaa Mill, Lappeenranta

This is a factory producing saw timber, blockboard and laminated board. The input is 1,500,000 cubic metres of birch and Scots pine, the former being used for the veneer facings and the Scots pine for saw timber and the cores of blockboard and laminated board. Of particular interest was the barking process. Birch is preheated in a log pond and passes through a VK26 barker together with the smaller conifers; the larger conifers pass through a Cambio which has

been found unsatisfactory for the birch. Despite this, the VK is regarded as a rather troublesome machine for continuous use being of a lower specification than the Cambio and vibrating excessively. This factory, which belongs to the same co-operative association as the Aanekoski mill, receives 85 per cent of its supplies by the huge Saimaa waterway.

Tampella Oy Fluting Board Mill, Heinola

An integrated pulp mill using birch only. Barking is done by pocket barkers as a first step and this is followed by drum barking. The process is semi-chemical and there is almost complete recovery of the cooking chemicals. The board is not fluted at Heinola but exported elsewhere for conversion to corrugated medium.

Askon Tehtaat Oy Furniture Factory, Lahti Faneri Oy Plywood Mill, Lahti

These factories are associated, Faneri Oy providing material for Tehtaat Oy. The plywood is made in similar fashion to that at Metsa-Saimaa but the birch is not barked: the rotary plywood cutters do this, those parts having bark being rejected. The furniture factory makes a wide range of equipment from house and office furniture to kitchen fittings.

Oulu Oy, Oulu

This plant is mainly a producer of pulp for export and uses 90 per cent Scots pine and 10 per cent birch. It is a sulphate process producing unbleached, semi-bleached and fully bleached pulp; no further processing is done in the factory.

Tall oil and turpentine are by-products. This mill differs from the others in taking 30 per cent of its supplies from State forests; this is explained by its situation in the northern part of Finland where State forests begin to assume dominance.

Discussion

A representative cross-section of Finnish forest industries was inspected and left an impression of great efficiency. All concerns pursue research actively and are, of course, deeply concerned to ensure continuity of supplies. It is interesting to note that 1·7 million cubic metres of roundwood were imported into Finland in 1964.

Equipment Notes

In Lapland an interesting demonstration of extraction equipment was arranged by the Chief Inspector of Logging Techniques. The work demonstrated was the extraction of 3-metre pulpwood lengths from a thinned area. Racks were about 30 metres apart and the costs per piled cubic metre quoted are for loading, extraction of about 1·5 kilometre and unloading.

(a) Nuffied tractor coupleld to trailer with loading done by a boom crane. Piles are winched along the ground and loaded by the crane. A two-man crew is necessary and the performance is 5–6 piled cubic metres per hour. All-in cost is 16 marks/hour, i.e. about 3 marks per piled cubic metre. Total cost of equipment—20,000 marks.

(b) Hiab 173 with grab mounted on a County tractor with power-driven trailer.
A two-man crew was used since the short reach of the Hiab made a good deal of restacking necessary. The performance was 9 piled cubic metres per hour and the all-in cost 20 marks/hour, i.e. about 2·2 marks per piled cubic metre.
Total cost of equipment—35,000 marks.

(c) Hiab 173 mounted on MF65 half-track with trailer.
Operated by one man, the towing arm of the trailer was telescopic so enabling the rear bay to be loaded easily. Performance and cost were the same as for (b) above.
Total cost of equipment—45,000 marks.

(d) Hiab 177 mounted on a Timberjack with trailer.
Operated by one man. Performance 10 piled cubic metres per hour and all-in cost 23 marks/hour. Cost is therefore very much the same as (b) and (c).
Total cost of equipment—65,000 marks.

(e) Volvo H10/LM218 tractor with front mounted hydraulic grab and bogie trailer.
Operated by one man, this equipment entered the forest, lifted a load of pulpwood and transported it to a waiting trailer on the rack. Performance was 9 piled cubic metres per hour and all-in cost 21 marks/hour. Cost is therefore comparable with (b) to (d).
Total cost of equipment—40,000 marks.

Two pieces of cultivation equipment were demonstrated:—a front-mounted screefer which removed continuous patches of turf about one foot wide at six foot centres and which at the same time cleared scrub by means of a toothed raker set about 2 feet from the ground and forming a part of the screefing unit. It did its job fairly well but has little relevance to our conditions. The Finns are also dissatisfied and are turning more and more to ploughing. The second device demonstrated was a newly-evolved, double throw plough, direct mounted and using a vertical hydraulic cylinder, pulleys and cable to raise and lower the plough. The plough itself is a scaled-down *Lokomo* minus wheels and weighing one ton. (Further details are being sent from Finland.)

Valmet Terrain Tractor

Two machines were demonstrated descending steep, rocky ground and traversing a soft area at the foot of the slope. One of the machines travelled light whilst the other skidded 2½–3 tons of tree lengths. Performance was impressive but would have been aided on the soft ground by chains and by better operator performance. This machine which develops 46 horse power and is powered by a *Valmet* 310D engine may be compared to a fully developed version of our own County Timber Tractor—now in prototype only. In Finland, the *Valmet* has done good service but is generally regarded as under-powered for winter conditions. Accordingly the manufacturers are shortly to produce machines of double the horse power: these will then be closely comparable with the Timberjack, Garratt Tree Farmer and similar skidders.

Discussion

(a) It is interesting to note that the more sophisticated equipment detailed in (b) to (e) has produced costs which are more or less equivalent—higher performances being counter-balanced by higher capital costs. Nevertheless the studies, which are going ahead actively, should reveal (a) the best equipment for different stand conditions and terrain types (b) the effects upon the logging operation: thus system (e) reduces the piling element and should result in slightly lower logging costs.

(b) We do not seem to have much to learn from Finnish cultivation techniques. Their development work on ploughs has been partly based upon British patterns.

(c) The *Valmet* Terrain Tractor is an excellent machine. We should consider purchasing if our current trials with the County Timber Tractor confirm that such machines may have a place in U.K. forestry.

Wage Negotiations

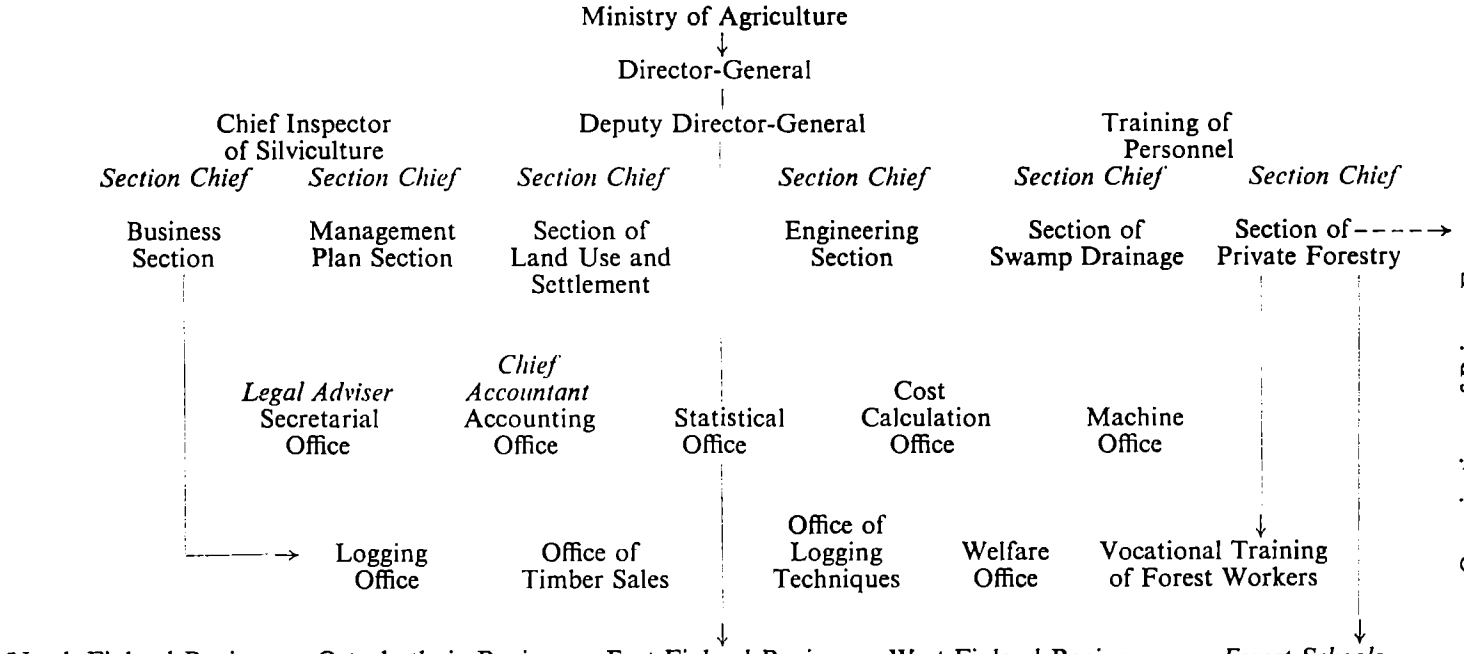
These appear to be conducted in a similar fashion to those in Sweden. There are annual meetings attended by representatives of the State Forest Service, employers and unions. Incentive schemes are largely based upon work study data but negotiations take account of earnings during the period under review and compare these with changes in cost of living indices. The main negotiations are said to be conducted in the context of one of two main operations and the findings derived from a study of these operations are applied to all operations. Thus, a five per cent increase in pay having been shown reasonable for the operation studied (say pulpwood preparation) would be applied to all operations. However, there are regional variations and, during the meetings, the opportunity is taken to correct out-of-date tables.

Discussion

A wage negotiation booklet has been obtained and is being translated. This could be of interest and importance to us for there seems little doubt that wage negotiations will increasingly need the attention of Conservancies (a reasonable sub-unit for this purpose) under the overall direction of Headquarters. This likely increase in negotiation will be in proportion to the evolution and adoption of work study standard time tables which require to be put into cash terms which will not be altered solely because basic wages rise or hours of work fall. It follows that management must keep careful records of earnings of the main tasks. The procedures outlined in Work Study Paper No. 23—*A Scheme for Labour Control*—are suitable for this purpose.

ORGANISATION CHART OF THE FINNISH FOREST SERVICE

APPENDIX A



APPENDIX B

ORGANISATION OF PRIVATE FORESTRY

Ministry of Agriculture

State Board of Forestry

2 Central Forestry Associations

				Numbers of Officials	
				Graduates	*Foresters*
	Tapio (Finnish speaking)	Skogskultur (Swedish speaking)		31	4
14	Districts for Forest Improvement		2	48	119
17	District Forestry Boards		2	146	279
Representatives to Central Union of Forest Producers	346	Forest Management Associations	40	2	659
				227	1,061

Representing 28,000
separate forest owners

APPENDIX C

THE FLOATING OF TIMBER

The fact that Finland has vast water systems and that these can be used for floating has meant that the Finnish wood-working industry is mainly to be found on their banks. Earlier, raw timber was transported to the mills almost entirely by floating and even now floating is of central significance in long-distance transportation. There are about 40,000 kilometres of floating channels in Finland and probably about half of these are used. Timber is floated loose or in bundles. The proportion of the latter type of floating is growing every year. Floating is handled by the floating associations and wood is also floated privately.

According to statistics collected by the Central Federation of Finnish Wood-Working, floating made up 60 per cent of the wood-working industry's total transportation of raw timber in solid cubic metres per kilometre, whereas road and rail transportation each answered for about 20 per cent. Of the timber arriving at mills, 50 per cent was floated, 43 per cent carried by road and 12 per cent by rail. Floating, like rail transportation, is a typical way of transporting timber on long journeys. For both forms of transportation, the average distance covered is over 200 kilometres, whereas it is 50 kilometres by road. The various forms of transportation have cost an average of

10·5 pence by road per solid cubic metre per kilometre
2·7 pence by rail „ „ „ „ „ „
2·2 pence floating „ „ „ „ „ „

At the moment, the most important work ahead in the development of floating is the construction of bundle-floating channels. By dredging out shallow places, and building canals and bundle transfer mechanisms, they are aiming to make uninterrupted bundle-floating channels from the upper courses of the water-systems right through to the river estuary and the coast. At the moment, there are already 30 bundle transfer machines in Finland. The largest construction work of this kind was finished two years ago in the River Oulu system, where bundle transfer mechanisms were built at twelve power-station dams and some 400 kilometres of bundle-floating channels produced.

There will be many advantages from the change-over to bundle-floating, including the following:—

—transportation costs will drop
—sinking loss will be eliminated
—the floating channel capacity will grow and the reliability of floating increase
—the transfer to the mill of certain working stages involved in timber supply, which so far have taken place in the forest, will reduce costs and simplify the labour force question
—it will be possible to float birch and small wood
—it will be possible to float fresh unbarked timber.

At Pyhakoski on the Mantyharju route in the River Kymi system—one major mechanism, with two other bundle transfer mechanisms, makes it possible to float bundles intact from eastern Finland right into the industrial area of Kymenlaakso in southern Finland. These rapids fall about two metres and this is just about the maximum using a bundle flume. Whereas the transfer speed in normal transfer mechanisms is about 30–40 bundles an hour, this system gives considerably better results. The disadvantage is the heavier water consumption.

NOTES ON THE SIXTH F.A.O. STUDY TOUR
RUMANIA — 6th - 17th JUNE, 1965

by
R. Faulkner
District Officer, Genetics, Research

Theme: Regeneration as a Means of Increasing Productivity

Participants

Austria	Dr. E. Neuberger; Ing. F. Swartz
Belgium	Dr. R. Goosens; Ing. P. Roisin
Fed. Rep. of Germany	Mr. W. Ernst; Dr. E. F. Brunig; Dr. P. Burschel
France	Mr. P. Cochet
Italy	Dr. M. Cappelli
Netherlands	Is. H. H. G. Overbeek; Mr. F. A. Haffmans
Spain	Dr. R. de Rada
U.K.	Mr. R. Faulkner
F.A.O.	Mr. M. Anderson
Rumania	Ing. H. Novescu (Technical Director); Ing. I. Milescu (Section Head—Administrator); Prof. Dr. I. Popescu-Zeletin (Bucharest Inst. of Biology); Ing. C. Avram (Chief Section of Technical Services); Dr. Ing. T. Balanica (Head of Documentations Section); Ing. S. Purcelean—Laboratory Chief—(Ecology & Site Types) For. Res. Inst. Bucharest.

Note:—*A copy of the full Tour Notes supplied by the Rumanian Forest Service is held in Silv. (N)'s Library.*

Sunday, 6th June

(An extra day spent at Snagov Forest Garden and Tree Breeding centre)

Head of Dept. Ing. V. Benea (office at Cornetu); Dr. V. Enescu (Selection & Seed Orchard); Dr. Tomescu (Flowering & Fruiting Biology; Phenology; Periodicity); Dr. Beldia (Ecology of *Pinus* spp., *Larix* spp., *Tilia* spp., *Quercus* spp. and studies of Douglas fir and *Robinia*) Ing. D. Tataranu (Provenance). Total staff 30.

Other substations at Sator, Simeria, Sinaia (Carpathian), and Moldova (E. Rumania) also 5 centres to be developed for seed orchards.

Snagov arboretum and forest garden was founded in 1933 originally as a species trial area and aclimatization centre for trees to be planted in the 'Field Zone'.

Provenance

Studies began on *Pinus nigra* 4 years ago. Seed stands have been surveyed and systems of methodology investigated. In future the recommendations of the Stockholm Congress (1963) will be followed together with the I.U.F.R.O. suggestions of Viscot. Laboratory and field research for identification is followed up by field tests. Paper chromatography is being used to detect variations (based on 10 tree samples) along with statistical analysis of cone, seed, needle, bark etc. characters—based on a Polish method.

A new sub-species (variety, hybrid?) has been found between *P. nigra* var. *palasiana* and *P. nigra* from Jugoslavia. A calcifuge type has also been found on the Danube near the Jugoslavian border.

New work is to begin on *Larix decidua.*

Seed Orchards & Stand Selection

The Rumanians have a great deal of information on periodicity and seed production. This has enabled them to balance the area of seed stands against seed requirements. Selection principles are similar to those used by the F.C. The country has been divided into zones for practical purposes and seed is only taken from *Q.C.* I & II stands. Some stands which can be felled when the cone crop is ripe and in a good seed year, are specially earmarked for this purpose.

Seed stand management, including the use of fertilizers, is to be practised in the future.

This year investigations into flower induction are to be started on Larch, Pine and Douglas fir.

Grafting methods seen were a little dated; mostly bottom worked rootstocks using a side veneer with raffia bindings. Rootstocks side pruned to leave the single leader on larch.

Half-sib progeny tests were based on line sown seed in beds. Successful progenies lined out at 15 cm x 20 cms. in 2 line (i.e. 20 plant) plots. Standard of work was not high. Under test were 5 families of 3 provenances of Scots Pine. Other tests were based on selections of seeds selected for seed colour!

A one-year-old Scots pine orchard was also seen; spacing 5 m. x 5 m. with the ground under bare fallow. Fertilizers are to be given in the 2nd year.

Phenology

Phenological studies have been carried out at Snagov for 20 years. There are 10 research centres in Rumania where flowering biology and fruiting records have been kept for 10 years on a wide range of tree species.

Nursery Investigations

These are also carried out at Snagov. Current work is mainly concerned with the residual effects and levels of application of Atrazine. Standard of experimentation seems to be good.

Forest Garden

An interesting collection of mainly hardwood species and species hybrids in the genera *Quercus, Fraxinus, Tilia* and *Ulmus;* with a fair collection of conifers. An excellent natural stand of *Alnus glutinosa* was a delight to see on account of the excellent stem quality.

Miscellaneous

(1) *Radioactive Isotopes.* Investigations are to be started on the possibilities of using radioactive isotopes for stimulating seed germination.

(2) *Exotics.* To date 110 introductions from 70 countries have been made.

(3) *Seed.* 30,000 Kgms. of seed are used annually (no data in species).

(4) *Forest Type Maps.* The whole country has been type mapped on a scale of 1:2,000.

(5) *International Liaison.* 2 years ago 20 stands of Norway spruce were selected as seed supply areas for the 4-man Scandinavian team (organised by Max Hagman of Finland)

(6) *Publications.* On tree breeding work was not prolific. A summary of work from 1949–56 is given in "Selectia si Ameliorarea Speculor Forestiere din R.P.R. Realizari din 1949–56" by V. Benea. Ser. IIa *Manuale-Referate-Comumunicari* No. 10. Inst. Cerct. Silv. Bucharest 1957. 73 pp.

Monday, 7th June

Morning

Introductory speech by the Minister of Forests at the Ministeruel Economies Forestiere, Bulevardul Republicü 16-18, Piata Universitatü, Bucharest.

Afternoon

1. *Cornetu Forest Expt. stn. for Willow and Poplar*

20 km. S.W. of Bucharest. Established 1960. No tour of laboratories. Work concerned with species and clone selection; mass production methods of rooted cuttings, training of field staff in techniques of raising cuttings.
Staff:—6 graduate research officers; 1 horticulturist; 1 biologist; 7 technicians.
Area:—150 acres of cleared forest plus a reserve of 600 acres of forest for future development, trials, etc.

The most productive clones used in Rumania are Robusta R16; "Celei"; I 214 and "Thevestina" R103—5 million rooted cuttings (total) produced annually.

Salix alba selections used for planting in the Danube riparian lands.

Experiments.

Only 1-year-old and not therefore demonstrating very much. The use of more up-to-date experimental designs would, I think, have saved much effort and ground and give more informative results.

2. *'Stefanesti' Forest Expt. Stn—Seed Lab. & Nursery*

15 Km. NW of Bucharest in the Silvo-Steppe Region. Established 1948.
Total Area:—1,218 acres; Nursery 160 acres. Staff: 6 graduates; 9 technicians; 8 Laboratory workers; 12 regular field workers and 60 seasonal workers. 80 per cent of the work is mechanised. Irrigation is essential because of seasonal droughts.

Seed Laboratory

Co-ordinates the work of 5 similar laboratories in other parts of the country and is affiliated to the International Seed Testing Association. The room used for this work is small (16′ × 16′ approx.) and fitted with 1 Copenhagen tank and 2 incubators. Most of the equipment appeared fairly old.

Current investigations are on the effects of microelements on the stimulation of germination and the use of morphological, germination and seedling tests for provenance determinations. This work had just begun and was not clearly explained.

Weed Control Expts.

Begun in autumn 1964 to compare the effects of Alipur (a carbomide derived from urea) and Atrazine, in powder and granular form, on a variety of hardwoods. Results are not yet available. Trizodon and Izotriozodon (chemicals manufactured in Rumania) are also under test.

Finnish Type Polythene Shelters and Duneman Beds

Under test as methods of intensive culture. The use of the former seemed to be rather pointless under central European conditions and ventilation problems to keep down the heat had arisen. The experimental techniques and designs were far from satisfactory. Really a glorified 'Look-See' Trial.

Radioactive Isotopes

Nutrition of clone R.16 with nitrogen and phosphorus using radioactive isotopes. Again new work and no conclusions. Earlier work in 1963 had shown differences in uptake of nutrients between different clones. There were also seasonal effects.

Irrigation

Large-scale irrigation experiments were under observation using rotary sprinklers. The sampling points for water fall seemed totally inadequate for reliable measurement (*vide* G. D. Holmes' work in England several years ago)—Only 4 rainfall gauges were seen per 300 ft. (or thereabouts) diameter circle of watering.

General

The nursery is mainly used for the mass production of ornamental trees, shrubs and poplars. Production of forest planting stock is relatively small. Standards of maintenance and growth (judged by F.C. standards) was very good.

Tuesday, 8th June

1. *Radesti Forest—Group Regeneration of Oak*

Composition of Forest

Beech 42% (for veneer: rotation 140 yrs.); Sessile oak 20% (heavy timber: rotation 120 yrs.); mixed beech and oak 13%; mixed lime, ash, *Carpinus* etc. 25%. Beech on lower slopes. Oak on upper slopes and plateaux.

Ground veg. Grass/herb (*Melica* spp. *Poa* spp. *Festuca* spp., *Carex* spp. *Galium; Luzula; Geranium*

Regeneration

Difficult areas cultivated by hoe and spade to improve tilth. 3–5 fellings depending on seed years—Regeneration period 6–12 yrs. Group size variable ½ to 2 × the overstorey height in diameter. 15 yds–30 yds. Results were generally good with a seedling stocking of 50–150 plants/sq. yd. (est.)

2. *Mihaiesti Station Park*

A forest garden containing 91 species plots some dating back to 1896 *Tsuga canadensis* and *Carya ovata* were particularly good. Plot size varied from 1/10th–¼ acre (approx.)

Due to lack of time the visit to the Upper Catchment areas of the Dumbovesta River was cancelled.

Night at mountain resort outside Brasov.

Wednesday, 9th June

1. *Postavaru Forest (Mountain Zone)—Assisted Regeneration*

Elevation, 650–1,700 metres; Soils, podzolic; Rainfall, 800–1,100 mm.; Slopes, 20–40°; Species composition, Norway spruce 26%, Beech 36%, *Abies alba* 36%, Other Hardwoods 29%.

Regeneration by the group system is practised in the production units and selection fellings in the protection areas.

The area had carried a 105-year-old crop of Beech (70%) and fir (30%) and group fellings were made in 1951 and 1957/58. As a result satisfactory regenera-

tion was obtained on 75% of the area. To increase production sycamore and Douglas fir had been introduced in groups to give a final stand composition of Beech 30%; fir 20%; Norway spruce 20%; Douglas fir 10%; Sycamore and Scots pine 10%. Weeding and removal of competing undesirable species e.g. *Salix caprea* and *Carpinus* has been necessary, along with regeneration damaged during extraction operations.

2. *Piatre Mare Forest (Mountain Zone)—Assisted Regeneration*

An area of spruce and fir regenerated by the group method in 1952–58. The final felling took place in 1963. Damaged trees were removed and Douglas fir introduced. Stocking was 10–20 seedlings/square metre and seedling heights 15–120 cms. Final crop is 40% Norway spruce; 20% fir; 20% Douglas fir and 20% mixed Beech and Maple. Treatment has been similar to that at Postavaru.

On a second area the seedlings were very dense and up to 5,000 per hectare had to be cut out—still leaving 5 seedlings/square metre!

Night at Predeal.

Thursday, 10th June

1. *Limbasel Forest (Mountain Zone)—Artificial Spruce Stands*

An area of beech (60%) and fir (40%) clearfelled in 1919 and sown with Austrian Norway spruce seed (a few Beech and European larch stems still in the crop) now 1,754 trees/ha; Mean Annual Increment 15.4 cubic metres per hectare—i.e. a QC.II site cleared and thinned in 1938 & 1946, 1951 & 1958. A thinning in 1965 will remove 58 cubic metres per hectare.

This was a first class stand with excellent stem form—totally unlike most Norway spruce stands of Austrian origin we know in Britain. Stem swellings around the bases of branches and 'muscling' of the stem wre completely absent; would make a good seed source. Cone crops occur every 3–4 years. 1966 should be the next one although the 1964 crop appears to have been heavy by U.K. standards. A torrential storm cut this visit short.

2. *Piatra—Arsa Forest, "Urlatoarea" Selection Forest*

An excellent example of 'virgin' forest (Beech 35% and fir 65%) from which only mis-shapen, dead and diseased trees have so far been removed. Current Annual Increment is 11.6 cubic metres per hectare, further cuttings will be made to increase the productivity. Regeneration in clearings is excellent—particularly of fir. Other similar areas which are extensive in area in the East and South Carpathians are to be preserved as 'national reservations' for scientific purposes.

Visited the Royal Palace near Bran (now a museum).

Night at Sinaia.

Friday, 11th June

1. *Bogdan Valley—Torrent Control*

This valley drains into Prahova river and in the late 19th and early 20th centuries caused serious disruption of the road and rail services, running in the Prahova valley, during flood periods. A series of 12 stone dams have been built across narrow sections of the valley and as these have silted up they have been raised to provide a uniform compensation slope. A protection forest has been established to cover 73% of the valley sides. The remainder is either under pasture or is unplantable. A certain amount of terracing and wattle fencing was used to assist in stabilising the erodable slopes of sandstone, limestone and marl-clay schists. The banks and alluvial streamside deposits have been planted with alder.

2. *Ploiesti Forest Nursery.* (established 1961/62)

Size, 175 acres; Soil, Deep alluvial, Sand loam, pH 6·5; Water table, 35 ft.

Rotation 3 years. (2 yrs. under plants 1 year green crop (leguminous); 20 tons compost/hectare once every 6 years. 100 Kg superphosphate every 3 years. No potash or nitrogen used at present. Artificial irrigation is essential and is given when the soil moisture falls below 20%. Production is almost entirely hardwoods (poplar, lime, ash and *Robinia*). All very clean and tidy. Plants of high quality. Research plots of Douglas fir seedlings virtually a failure.

Night in Galatz.

Saturday, 12th June

Danube Delta—Willow and P. euramericana willow stands

We sailed down the Danube on a '*hydrofoil*' type boat to Tulcea and transferred to the Forest Service Boat. Spent the whole day looking at willows and poplars from a boat at fairly long range (P.48 onwards). The Danube was in flood (highest level for 20 years) consequently inspection on foot was out. Interesting bird life seen in the reeds and trees: pelicans, spoonbill, egret, ruddy shelduck, common shelduck, eagles and hawks). The delta is extending annually at the rate of 100 yards p.a. and some 65,000,000 tons of alluvium are deposited yearly. The delta occupies some 1,125,000 acres of which 80% is covered by water all the year round. The area of reeds is 650,000 acres—these are harvested for paper making etc. in Braila. 25,000 acres are under natural or artificial woodlands.

Sunday, 13th June

Morning: Black Sea beach at Mamaia

Afternoon: Comorova Forest. (South of Constanta) Steppe Region

Established in the late 1800's. Mainly *Robinia* (30%) and mixed oak and other hardwoods 40%. At present it is defective on account of poor coppice management and general neglect. Under a new plan the area is to be developed for tourists and the forest managed for game and sport (up to now the main shooting parties are senior government officials and visiting diplomats!). In the new re-afforestation works Pedunculate oak and *Juniperus virginiana*, *Pinus nigra* and *Robinia* are to be extensively used. To ensure establishment trees and shrubs have to be hand watered four times during the first year. Mulches are applied in the second year.

Night at Mamaia.

Monday, 14th June

1. *Buiasca Forest—Silvosteppe Region*

Return to Bucharest across the steppe. Long delay at the ferry across the Danube reduced the time available at Buiasca forest.

This forest consisted of degraded oak (70%) and *Robinia* (20%) and native poplar (5%) which has been mis-managed by bad harvesting and handling the coppice and grazing. (Mean Annual Increment, oak 80 years 2·7 cubic metres per hectare; *Robinia* (30 yrs.) 10·7 cubic metres per hectare and Poplar 13·9 cubic metres per hectare. Experimental work on regeneration is promising. The experiments (trials) consist of

1. Clearing and replacement with *Robinia* (used for posts and fuel)
2. Clearing and replacement with 2 rows oak and 3 rows of mixed trees and shrubs e.g. middle row *Acer tartaricum* and pear trees, outside rows shrubs such as *Crataegus*, *Cornus* spp. and *Ligustrum*.

In both cases stumps from the old crop were grubbed out for fuel (at no cost

or charge) by the local peasants. The ground was then mechanically scarified to a depth of 35 cms and sown with a fodder crop. After harvesting the ground was ploughed and planted with the tree and/or shrub crop.

2. *Rogoz Forest—Forest Steppe Zone*

An area of defective stands of oak, native poplars, elm and *Acer tartaricum*. Work began in 1961 to replace the forest with Euramerican poplars along similar lines to those described for Buiasca.

The forest lies near the Lalomita River and the water table is at 10 ft. After cultivation 1 yr. rooted cuttings are planted in holes 60 × 60 × 60 cms in size and a maize crop is raised for two consecutive seasons between the lines (3m × 3m). After three seasons the poplars are up to 25 ft. tall.

Night Bucharest.

Tuesday and Wednesday, 15th and 16th June

At the Ministry of Forests. Presentation of National Reports. Preparation of 4 special reports on Natural Regeneration, Assisted Regeneration, Artificial Regeneration and Economic Aspects. I was asked to act as coordinator of the English-speaking 'quintet' and to draft the report on Assisted Regeneration. The quintet was composed of Brunig, Schwartz, Overbeek, Balanica and myself. The report was completed and discussed before leaving Bucharest.

To brighten the proceedings in Bucharest 3 films, out of a selection of about 12 to 15, were shown. All colour and with sound. The first was excellent and demonstrated torrent control work; the second showed research into timber uses and building and furniture design and the Rumanian equivalent of Forest Products Research Laboratory—not terribly good—furniture design rather heavy, almost late Victorian; the third was on the natural history of the deer. Some good shots but inclined to be repetitive in action.

Thursday, 17th June

Only the two Belgians, Anderson and myself remained. Paid a brief (2 hour) visit to the Research Institute and after an address by the Director (in French) little time was left for inspections. Sections covered were:

'Soils'

A very comprehensive collection of 'Lilliputian' profiles—soil analysis equipment and facilities—(seem well equipped and with a lot of new apparatus of Russian and East German manufacture)—4,000 analyses (mechanical and chemical) done each year.

Radioactive Isotopes

In the absence of a translator the terminology was too much for me. I gather that most of the work is concerned with tree nutrition (some of which we saw at Stefanesti) and the use of radiations in the veneer cutting industry for controlling the cutting machine.

Game Museum

An excellent collection of species and variants of birds and mammals. The increasing mortality of field birds (damaged by mechanical harvesters) was apparently causing some concern and the stuffed specimens of legless birds were obviously highly prized trophies! !

General Observations on the Tour

1. The tour adequately fulfilled the objectives and excellent examples of all the main types of regeneration were seen.
2. The Rumanian Forest Service is certainly not backward in its outlook. All the forests are now managed and with a yearly increment of 22 million cubic metres (7½ million softwoods) it is obviously no mean undertaking. The staff we were with were keen, enthusiastic and embarrassingly knowledgeable on technical matters. The lower grades of field staff seemed to be much less active and well trained. At present there are 850 men in the universities training to be forest officers on the 5-year course and in the pipeline are 50 other men working for the equivalent of an M.Sc. diploma (7 years in all). In the forest service are at present 13 men with an M.Sc.
3. The tour was well organised, but by British standards the hospitality meted out by the Forest Service was positively lavish even to the point of being wasteful—not only from the point of view of food and drink—but, and more important still, from the time aspect. This, however, may be customary in east Europe.
4. The research field techniques, and experimental design, gave the impression of being dated and most research work appeared to be copied from work which went on in western countries 3 to 5 years ago. The staff did not appear to have much flair for inventiveness and the fact that nothing was seen which was really new was disappointing. Things are, however, changing very rapidly, money is available for new buildings and expansion is everywhere very apparent in the cities, but not nearly so obvious in the peasant communities; since these communities account for 80 per cent of the country's population, this could be attributed to dilution.

REPORT on FOUR WEEKS VISIT to HANNOVERSCH-MÜNDEN SEED TESTING STATION, WEST GERMANY

31st May to 25th June, 1965

By

Lynne McMillan

Senior Scientific Assistant, Seed Research

The Seed Testing Station in Hann. Münden, West Germany, is part of the Institute of Forest Botany and Genetics which again is part of the Forest Faculty of the University of Göttingen. It is worth mentioning that this University was founded in 1737 by George II, King of England and Elector of Hanover. Hann. Münden is a small town beautifully situated where the Rivers Werra and Fulda meet to form the Weser. The Institute is housed in a large old building overlooking the Werra. It is planned to transfer it to new premises in Göttingen in the near future.

Although its function is primarily the testing of seed for commercial purposes, the Seed Testing Station is an integral part of the Institute, and about half its work is devoted to research.

Staff

The whole Institute has a staff of approximately thirty, headed by Professor Lange. Directly under him are Dr. Bartels, who is responsible for the Seed Testing Station, Dr. Bertsch, Dr. Lineman, Dr. Kappen, and Herr Kanzow. Each of these persons has one or two assistants who are trained Laboratory Technicians similar to our Scientific Assistant grade. As their training is

comprehensive, the assistants can move from one section to another if pressure of work demands it.

In the Seed Testing Section there is an experienced Seed Analyst. In the Winter, during the busy routine time, she has the help of two Laboratory Technicians but during the summer she works alone.

Co-operation and relationships between the different grades of staff and between sections appear to be excellent. There is an annual staff outing when a day is spent partly on forestry and partly on places of historic or botanic interest. The State encourages the outing in the interests of good staff relations and grants 5 deutschmarks for each person towards expenses.

Regular lectures given for forestry students can be attended by any member of the staff wishing to do so.

Status of the Seed Testing Station

West Germany has eleven official Seed Testing Stations of which two are entirely for forest tree seeds.

1. In Munich for Bavaria under Professor Rohmeder.
2. In Hann. Münden for Lower Saxony under Dr. Bartels.

Both are attached to Universities.

The charges made for particular tests are similar to those in Great Britain. There are no private stations in West Germany.

Species Tested

In Hann. Münden about 600 routine samples are tested each year. The main species tested are those of:—

Pinus sylvestris
Picea abies
Abies alba
Other *Abies* spp.
Larix spp.
Thuja spp.
Tsuga spp.
A few *Robinia* and usually several samples of *Quercus* and *Fagus*.

Equipment

It consists of:—

6 Rodewald Incubators,
2 Jacobsen Tanks,
3 Balances (electric—but old design),
1 Oven (use of others in other Labs.),
1 Incubator for 'sand' tests,
1 Vacuum seed counters.

Rodewald Incubator

This is a traditional German apparatus which has a base of damp sand on which square filter papers 9 × 9 cm. are placed carrying 100 seeds, about the size of Scots pine or smaller. Each incubator can take 70 replications. The temperature can be controlled at 20°C and 25°C constant, or 20–30°C alternating.

Jacobsen Tank

This is large and of modern design. The water-bath is sunk into the structure. The water is piped straight to the tank entering by way of an aperture in the

side of the water-bath where there is also an overflow outlet. Water can be added or removed simply by turning a handle.

Each Jacobsen tank can take 120 replications. The filter papers are 6.5 cm. in diameter 1 mm thick and each takes 100 seeds roughly the size of Scots pine or less. The filter papers are placed on a circular plastic grid through which a filter paper wick passes to make contact with the water.

The grids are placed on glass strips so that each wick falls between two strips. Plastic bell jars 6.5 cm. in diameter at their base protect the seeds and subsequent seedlings.

The tanks are run at 20–30°C alternating temperature, the change-over having to be operated manually.

Incubator for 'Sand' tests

This is a recently introduced piece of equipment. It is of fairly simple design and is quite adequate for the 'sand' tests. There is no lighting inside and has to be placed facing a window so that light can shine through the glass doors. There is no humidity control and is usually run at 25°C.

Oblong glass dishes 20 × 10 cm. are half filled with very fine water-saturated sand. Two of the square filter papers holding the seeds are placed on the sand and a glass lid is placed on top.

The incubator can take 320 replications.

Vacuum Seed Counters

They are of the standard type but with square heads only and so their use is restricted to tests on square filter papers.

Testing Techniques

The West German Seed Testing Stations have their own Seed Testing Manual which they use in conjunction with the International Seed Testing Association Rules and some of their techniques are a little different from those in Great Britain.

Purity Test

The minimum weights of the submitted samples and the weights for the purity test are those listed in the International Seed Testing Association Rules. The test is carried out on two replications (half of working sample).

The percentage of the components is calculated on the original weight before separation. Since some material is usually lost in the process of separation, this method is not particularly accurate.

Included in the "inert matter" component are complete seeds which by their colour appear to be empty, and small complete seeds less than half the size of the main bulk of seeds.

Germination Test

Generally each kind of seed is given two tests:—

1. At an alternating temperature, normally on the Jacobsen apparatus.
2. At a constant temperature, normally on the Rodewald apparatus.

The species with expected dormancy are tested additionally by a third method with pre-chilling.

Each test consists of 4 × 100 seeds and in the case of larger seeds 8 × 50 seeds. The assessments are carried out after 4th, 5th, 7th, 10th, 14th days and then every 7th day up to the end of the test.

When a sample is given a pre-chill test then the tests without pre-chilling are carried on as long as the pre-chilling test.

i.e. 21 + 28=49 days.

Seedlings are removed, having been assessed as normal, much earlier than in Alice Holt. Here at Alice Holt we follow the International Seed Testing Association rule that the radicle should be at least four times the length of the seed.

At the end of the tests the remaining seeds are cut and the number of dead, empty and fresh are recorded The fresh seeds are not tested with tetrazolium for viability, but are said to be viable if the embryo is sound (normally green).

Two kinds of reports are issued to the seed owners:—

1. Interim after every 7th day.
2. Final.

The reports contain the results of all methods performed.

Excised Embryo and X-ray tests

These methods of testing have not yet been introduced in Hann. Münden.

Tetrazolium Test

The tests are carried out according to the International Seed Testing Association recommendations using 2, 3, 5—Triphenylretrazolium chloride.

Moisture Content Test

Exactly the same method which is used at Alice Holt except that glass dishes are used in the oven instead of aluminium.

Special methods of testing particular kinds of seeds

Robinia spp.

At the end of the germinating period the hard seeds are chipped and left for a further 12 days when the number of these which have germinated are recorded.

Quercus spp.

Normally only the tetrazolium test is employed.

Fagus sylvatica

The testa is not removed. The seeds are mixed loosely with damp peat to allow the presence of air and kept at 3°–5°C until germination has begun but not longer than 3 months. They are then moved to room temperature (approx. 20°C) for 8–10 days. The germinated seeds are removed and recorded, the rest returned to 3°C for a further 14 days. This procedure is carried out until all the fresh seed have germinated.

Seed Storage and Extraction

There are several large seed stores in West Germany run by the State and approximately twenty small private ones.

Normally the seed stores and extractories are together while the Seed Testing Stations are completely separate from these.

There are no facilities for storage of the samples sent for testing, at the Institute. They are simply kept in a cupboard, at room temperature, for $1\frac{1}{2}$ years before being discarded.

Conclusion

The time spent at Hann. Münden was very useful for me as I became acquainted with the German Seed Testing techniques and organization. It was a little unfortunate, however, that my visit came at a time when most of the work was devoted to research. This was interesting but I regretted not being able to participate in more routine Seed Testing.

The number of routine tests carried out in a year is almost the same as at Alice Holt. The number of submitted samples is smaller there, but more duplicate tests are performed. Their research programme is larger.

Alice Holt generally appears to be better equipped and seems to attach more importance to detail and accuracy. The Germans however work harder and longer hours than we do.

THE CZECH FORESTRY AND GAME MANAGEMENT RESEARCH INSTITUTE

By

R. Kitching

Senior Scientific Officer, Soils, Research

Although behind the Iron Curtain, the Czechoslovak Republic is much nearer Great Britain than is generally supposed. Prague is situated just about in the centre of Europe and can be reached comfortably in two days by road from London. Czechoslovakia is about the same size as England but with a population of only 14 million, made up of 66% Czechs, 28% Slovaks and a few Hungarians, Germans and others. The country is divided into ten administrative regions. The summers are warm but the double windows fitted to all the buildings warned of conditions to be expected in winter. Prague, the capital, with a population of one million, is known as the city of a hundred spires spread on both sides of the river Vlatava. Hradcany castle, dating from the ninth century dominates the city of Prague.

The Czechs were well fed and prosperous although luxury consumer goods such as cars and television sets were very expensive and not yet for the majority, but there was no apparent poverty. Church worship appeared to be allowed and the old synagogue in Prague has the names of thousands of Jewish victims of the Fascists inscribed upon the walls and is deliberately placed upon the itinerary of German tourists. Our hotel was very difficult to locate being situated in a road formerly known as Stalinova and now erased from maps and without street signs.

About one-third of the land area of Czechoslovakia is forest and I was fortunate in being able to visit the Czechoslovak Institute of Forestry and Game Management Research at Zbraslav near Prague. The majority of the forests are state forests and only a very few small private forests exist. Conifers form 71% of the area and broadleaved 29%. There is a greater proportion of conifers in the Czech region than in the Slovak region because of the greater industrialisation of the Western region and the consequent rapid use of timber and replanting of fast-growing conifers. The major species in the country as a whole are Norway spruce 49%, Scots pine 16% and Beech 15%.

The organisation of the state forests is based upon the "forest enterprise" covering approx. 25,000 acres. Each forest enterprise is made up of about ten districts all sharing some of the centralized services maintained by the enterprise. A district is managed by a senior forester with about six assistants.

The Research Institute at Zbraslav has a total staff of 332 and an annual budget of about £200,000. The institution also owns about 12,000 acres as Research Forests and it is backed by a smaller research station at Banska

Stiavnica in Slovakia. The primary aim of the research programme is to increase wood production over the country as a whole. The Research Institute is divided into the following sections: Forest Ecology (soil and climate), Radiobiology, Tree species Biology, Establishment, Protection Techniques, Forest Economics, Game Biology and Information. I was able to visit the Forest Ecology, Radiobiology and Information Sections.

The Forest Ecology Section has a staff of thirty-two and covers the following fields: atmospheric pollution, nutrition, microbiology, climatology, soils and soil analysis. Instruments have been designed to monitor atmospheric pollution by sulphur dioxide and compare with the short-term effects upon growth. Elementary X-ray Diffraction and Differential Thermal Analysis equipment was in use in this section.

The Radiobiology Section, recently formed, deals with the use of ionising radiation and radioactivity as tracers in forest research. A cobalt field operates near the research station where the effect of gamma radiation upon growth and production of mutations is investigated.

The information division covers documentation of world forestry literature in card catalogues and the maintenance of a central library. The card index is an important international bibliographical tool covering nearly 300,000 references. The library contains 50,000 books.

TREE PRUNING: INTERNATIONAL LABOUR OFFICE COURSE AT ARNHEM, HOLLAND, 6th–10th SEPTEMBER, 1965

By

J. R. McNeill

Forestry Department, Ministry of Agriculture, Northern Ireland

This five-day course took place at Bosbouwpraktijkschool (Forestry Training Centre) which is situated in the grounds of Sonsbeek Park, within the city of Arnhem. The modern city of Arnhem, largely rebuilt from the devastation of the second world war, lies south east of Amsterdam, not far from the German border. Accommodation was provided at the home of Mr. and Mrs. Mik, where I was made very welcome, and well looked after. Mrs. Mik's command of English very quickly removed any initial fears I had of language difficulties.

The scope of this course provided for the study of roadside pruning in all its aspects. Training was given by means of lectures, slides and practical instruction. I was very impressed by the high standard of theoretical and practical knowledge shown by the Instructors, who, under the leadership of the very capable Director Mr. Van Hattem, conducted the course in a highly satisfactory manner, and obviously with much forethought and preparation. This was the twentieth course of this particular type, and I am honoured to have been the first representative from the United Kingdom. Thus, on this basis, I was made especially welcome and every effort was made to ensure that no language problems were encountered.

Roadside pruning was studied from several points of view. These were timber production, amenity and windbreaks. Naturally, it frequently happens that one of these cannot be considered independently without relation to the one or two other aspects. However, by study of individual requirements, depend-

ing on species, it is possible to provide for combinations. The Dutch generally limit themselves to hardwoods, poplars and willow for roadside planting, so therefore my studies were confined to these species.

It was made very clear that, irrespective of which aspect is considered, the golden rules are prune early, prune little and prune frequently. In fact, it was emphasized that, where necessary, pruning should take place immediately after planting. Although pruning can take place at any time during the year, it is recommended that with the exception of *Acer*, Birch and *Prunus*, which should be pruned from July to December, all others should be pruned in summer. The former species should not be pruned in early or late spring because of the excessive sap flow which will result. Summer pruning provides better conditions for the workmen and also reduces the tendency to prune too heavily because of the presence of foliage.

The theory of pruning is that only the larger branches be removed, leaving the smaller ones. Where several large branches occur, it is not desirable to remove them all, as it would leave too many large wounds. In these circumstances, only a minimum should be removed, and the remainder progressively removed in future pruning at three-year cycles. Any wounds over 1½-inch diameter should be painted with red lead paint, with an additive to tone down the vivid orange (i.e. amenity). Crown pruning should take place where undesirable branches occur. Where a double leader has formed, one of these should be removed as soon as possible. Contrary to the general theory of pruning, where a leader is removed, it should be cut not flush to the stem, but about ¾ inch out. A double leader is strong, but when one is removed at the exact point of division, the other is weakened and liable to be broken by wind. Normal pruning cuts should be flush. Any deviation will result in the wound healing from one side only. It should be remembered that with summer pruning, healing will start to take place at once.

When a tree is pruned the balance between roots and foliage is upset. To counteract this, the tree produces shoots all over the stem and crown. It is important that these be removed the following year, particularly where production of timber is concerned. If these are left until the next pruning (i.e. three years) the wounds will be much larger. Where it is apparent that with a large branch the possibility of splitting into the trunk is likely, two cuts should be made. The first a foot or so out and the second one flush.

With roadside pruning the disposal of branches has to be considered. In Holland the practice is to pile these at convenient intervals for collection by council lorries.

Beech is an exception to the general rules of pruning, due to the fact that it will not thrive if sunlight (heat) is allowed to come in contact with the bark. To this extent it is therefore necessary that trees (for roadside planting) retain all their branches, and are allowed to retain the cover normally provided by their foliage. However, with judicious pruning, this cover can be provided in the early stages by removing only the larger branches, leaving the smaller ones to provide the cover. At a later stage, the crown itself will provide adequate cover, and the bole may then be progressively pruned up. Particular attention should be given between the south and west side, as the sunlight (heat) is at its peak. Between north and east it is not important, but for amenity it is best to treat all sides the same. In this connection, beech should be planted well back from roads, as sun causing heat reflection from the road on to the stem is also undesirable.

When amenity is the only criterion, with particular reference to roadside planting, it is felt that as much as possible the trees should be allowed to develop into their natural form. Branches should only be removed when they interfere with traffic, either physically or where view is obstructed, also pedestrians,

cyclists, telephone lines etc. have to be catered for, otherwise the general principles of pruning may be applied.

In Holland, windbreaks are formed mainly from poplars and willows; this makes for a better climate where agriculture is concerned i.e., growing of crops, orchards etc. The poplars are planted 6 to 7 metres apart, with an eye to timber production, and the intervening spaces planted with willows. The poplars are progressively pruned up, allowing a two-level canopy to form, thus developing an effective windbreak and at the same time producing commercial timber.

Production techniques are similar to those employed in this country, except that there is something to be learned from crown pruning to develop the most desirable timber length. Poplars feature largely as a timber production species in Holland and are widely planted on roadsides and as windbreaks on field boundaries. They aim for an eight-metre timber length, leaving 66% crown in the earlier stages, and gradually reducing to a minimum of 50% crown. Wounds are not painted (poplars and willows) to avoid timber staining (veneers—cricket bat willow). They do, of course, heal over much more quickly than other species.

Great importance was given to the use, selection and maintenance of tools and equipment necessary for pruning. These included extra lightweight aluminium manganese alloy extension ladders and a variety of hand and extension pruning saws, secateurs etc.; the handles of the extension type being composed of aluminium to reduce the weight of the tool. Excellently equipped workshops were provided to maintain the tools, and instruction was given in the sharpening and setting of the various items.

Special emphasis was laid on maintaining a very high standard of safety, and every possible precaution is taken to ensure that workers are protected in every way. To this extent, they are provided with gloves, safety helmets, goggles, safety belts and road signs. Gloves are worn to protect the hands generally and specifically for pruning, to prevent the black stain from aluminium handled tools staining the hands. Goggles are worn to prevent sun glare reducing production and to prevent sawdust getting into the eyes. Safety helmets and belts are worn to prevent the pruner from falling or being struck on the head by falling branches. Signs indicating falling branches etc. are provided to give adequate warning to traffic and so avoid any accident claims. Workmen are taught to use the correct tool for their work, the correct safety precautions and the avoidance of touching electric cables. Pruning in windy conditions is undesirable as the falling branches can be blown some distance and also there is more likelihood of damage to the bole of the tree.

In conclusion, I believe we have a great deal to learn from the Dutch techniques of roadside pruning. However, this is putting the cart before the horse, and we really need to have a reappraisal of roadside planting and establish a co-ordinated national policy. Not enough thought has been given to this subject and all too often trees are planted too close to roads, and on the inside of bends, thus making future treatment difficult, if not impossible. With the advent of more sophisticated dual carriage motorways, more thought should also be given to leaving a sufficiently wide centre belt, where low-growing shrubs can be planted for amenity, while at the same time preventing blinding by headlights.

There are several ways in which the information I have obtained at this course can be passed on to others and put into practice. Firstly it can be put into practice to a limited extent in my own forest, and secondly in the advisory work to the public, which I am frequently called upon to do. In addition, I could also pass the information in the form of lectures etc. to interested bodies, such as The Preservation of the Countryside Society.

Finally I would like to express my appreciation to the I.L.O. for providing the Fellowship which made it possible for me to attend the course. I have learned a great deal and consider it very much worthwhile.

A WORKING VISIT TO GERMANY

by

T. Buchanan

Forest Worker, Launde Forest, North-west England

I was invited to go and work in Germany by Martin Stübler, a Student of Forestry whom I worked with in Launde Forest in the summer of 1964. After receiving the 'go ahead' and two months' leave of absence, I set off for Germany on the 28th February, 1965; my mode of transport being a 1938 Morris Ten Four which I bought for £15. I was very eager to see something of German forestry and the following weeks proved to be very interesting and enjoyable.

On my route to Germany through Belgium and Luxembourg, the weather grew steadily worse and by the time I arrived at Enzklösterle in the Black Forest it was very cold and the snow lay to depths of three to four feet. It was my intention to work at Enzklösterle where Martin Stübler is a Referendar, but due to the snow this was impossible. In the winter it is sometimes impossible for the men to work for up to three months if there is heavy snow. I spent two full days at Enzklösterle and managed to have a brief look at the woods despite the deep snow. There was some good *Pinus sylvestris* (Scots pine), and also *Abies alba* (Silver fir), *Abies grandis* (Grand fir) and *Picea abies* (Norway spruce). I did not see any work in progress but would have been interested to see how they manage on the steep mountainous terrain.

I then travelled to Ochsenhausen near Biberach where I was to begin work, but here also the snow was preventing work in the woods. After spending four days working on the farm of family Stübler I was directed to go to Mochenwangen which is about thirty kilometres from Lake Constance in the "conservancy" of Südwürttemberg-Hohenzollern.

Till this time it had not been necessary for me to speak much German, as Martin speaks good English. But now I was faced with the problem. No one in Mochenwangen could speak a word of English; the forester a little, but only a little and my knowledge of German was limited to say the least. I had been under the common illusion that most foreigners speak English and, as I soon found out, this is just not true.

Another surprise came when the forester took me to my lodgings. In Germany it is rare to have lodgings as we know them in this country, where the boarder has his meals prepared by his landlady. Mostly the Germans rent a room with coffee in the mornings and all other food and drink has to be bought by oneself. This I found very strange at first but soon I came to enjoy it. There is the advantage of eating just what you like and my evening meal I had in a restaurant, which made a pleasant change.

In the south of Germany the predominant species is Norway spruce and some very valuable timber is grown. Sulpach Wood, the "beat" of Oberforster Fiderer contained some 800 hectares,* nearly 2,000 acres and in addition to Norway spruce was Silver fir; a small amount of Scots pine, Lawson cypress, Grand fir, Douglas fir, and European larch. Of the broadleaved species, there was oak, beech, alder, birch, sycamore and ash, but these were only in small quantities usually bordering the rides. There was some good beech but the price at present in Germany is very low. The beech and alder are mainly planted for soil improvement.

I began work on the 11th of March and my first day was spent peeling Norway spruce and Silver fir which had been clear felled to make way for a proposed autobahn to be built from Lake Constance to Ulm. Peeling was a new job for me and I soon found it to be a back-aching task. Because the snow was still covering the ground, I went the next day to help feed the roe deer with hay

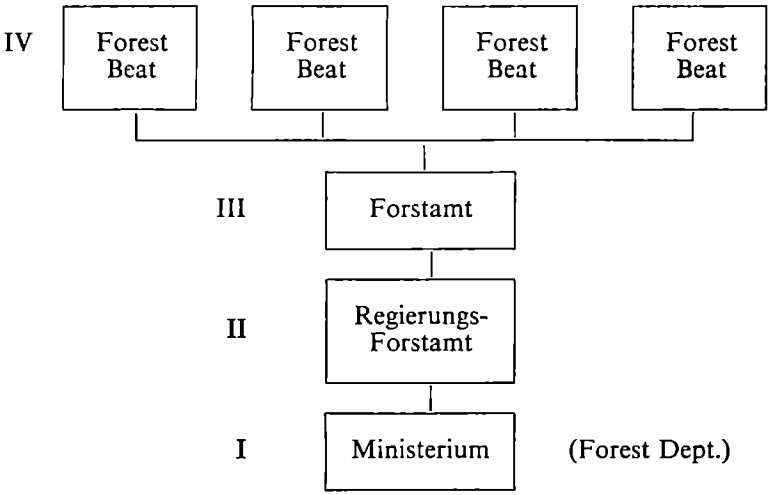
* 1 Hectare = 2½ acres approximately.

and a mixture of oats and cake. This was an interesting job as occasionally you would catch a glimpse of the deer darting across the ride in front of you and disappearing deep into the forest again. In Germany, the foresters are responsible for controlling the number of deer and on visiting a forester's home you will be astonished at the number of trophies hanging on the walls. Each one has the date and place where it was shot and many I saw dating from the early 1930's.

The organisation of German Forestry differs from ours and I have set it out as follows—I must mention that in Germany there is no National Forestry Commission and each region controls its own policy and administration. This is because Germany is a federation of independent States.

	Class	*Qualifications for Most Junior Rank in Class*
1.	Forest Worker	Primary Education (Until 14 years of age)
2.	Haumeister (Foreman)	(*a*) Primary Education (*b*) Day release and short period in Forester Training School
3.	Forstwart (Forest Warden)	(*a*) Primary Education (*b*) 3 years practical time (*c*) 6–8 months F.T.S. (*d*) 2 years assistant *and* learning time (*e*) 2–5 years assistant time
	Oberforstwart Revieroberforstwart	(*f*) *By later promotion*
4.	Revierforster (Forester)	(*a*) Primary School education (until 10 yrs. of age) (*b*) Grammar School (until 16 yrs. of age) (*c*) 2 years practical time (*d*) 2 years F.T.S. (*e*) 3 years assistant *and* learning time (*f*) 2–5 years assistant time
	Oberforster Forstamtmann	(*g*) *By later promotion*
5.	Forstmeister (District Officer)	(*a*) Primary School Education (*b*) Grammar School (Until 19–20 yrs. of age) (*c*) 1 year practical time (*d*) 4 years University (*e*) 3 years Referendar (Learning Time) (*f*) Assessor (assistant District Officer)
	Oberforstmeister Landforstmeister Oberlandforstmeister	(*g*) *By later promotion*

Small forests of from 300–500 hectares can be managed by a *FORSTWART*, who is not a qualified forester; over 500 hectares a *REVIERFORSTER* is in charge. A *FORSTAMTMANN* is a forester having special duties at a *Forstamt* or Forest Office. The *LANDFORSTMEISTER* resides in what is known as a *Regierungsforstamt* and the department above this, the Federal Government Department, is known as *Ministerium*. It is simplified as follows:—



The working week is 5½ days, a total of 44 hours and work begins at 7.30 a.m. and finishes at 5.0 p.m. This applies to the winter months and in summer the week is 5 days but work finishes at 6.0 p.m. The basic wage is low but piecework can bring a *Haumeister's* wage up to 800 deutsch marks (gross). This is approximately £73 for the calendar month. For the man with a large family the Kindergeld (family allowance) is very generous in Germany.

Not surprisingly with Norway spruce, there was a considerable amount of snow-break and wind-blown trees and some weeks were spent felling, peeling and converting the timber into lengths. There is still a small market for pit-props but this is disappearing fast and most of the small timber is used for fence posts. A large proportion of the Norway spruce goes to the local paper pulp mill and some is cut into one-metre lengths for firewood. Most of the hardwoods are utilised for firewood. Incidentally, in the south of Germany, I never saw any coal, only coal briquettes, and the main source of fuel is in fact wood.

March and April are very wet months in Germany as is the case in Britain and consequently, I was soaked to the skin on several occasions. The men would only stop work when the rain became very heavy and a form of sleeveless waterproof coat was worn for protection. But German forestry does have its compensations; namely beer and women! In the southern forests, it is common for a man to drink one or two litres of beer a day (approximately 2–4 pints) with the knowledge and consent of the forester. When I told them we don't drink beer in the woods in England, they could hardly believe it and declared that beer gives you strength for work! Certainly, they did not appear to suffer from any side effects, although I did to begin with. And the women; quite a few still work in the woods planting and weeding although the number is steadily decreasing as they find easier and better paid jobs in factories. The two women I worked with only worked from April until the end of October, remaining at home during the winter. We were planting Norway spruce on small areas of recently felled woodland and no method of sighting up was used. The planting tool employed was a mattock and plants were carried in a basket. This I thought, was not very

good as it had to be lifted each time a tree was planted. The plants were big, probably 2+2's; all over one foot and some nearly 18 inches high. The planting distance was 1 metre square but as no sighting rods were used, these measurements were often infringed. Much of my work involved taking out dead and dying Norway spruce, mostly under 25 years of age which had been attacked and damaged by the beetle *Ips typographus*. Sometimes quite large groups of spruce were affected and had to be removed leaving ugly gaps. The dry summer of last year (1964) was thought to be the main factor attributing to the increase of this beetle.

I finished work at Mochenwangen on the 22nd of April and the following day I travelled to Adenau, 50 miles south of Bonn to visit Hermann Jacoby another German friend working in forestry. He is also a *Referendar* and is specialising in afforestation of open-cast mining sites. He took me to see first, the brown coal being extracted from one of the huge mines. A machine with buckets on a revolving wheel moved gradually forward eating into the coal. The coal is transferred onto a conveyor belt and taken to waiting wagons which then go straight to the nearby brickette factory where it is dried and transformed into briquettes. I then saw the way in which they deal with the ugly hole left after the coal has been removed. Excavated soil from another mine being worked is used to fill, or partly fill, the hole. Sometimes a small lake is incorporated and this adds to the beauty of the wood especially after the trees are established. The trees planted are mainly hardwood; much poplar and beech, and they appeared to me to be growing well. The oldest open-cast afforested site which I saw was 30 years old and I had difficulty trying to imagine it in its former ugliness.

Now regretfully my visit was coming to an end. It had been made very enjoyable by the hospitality and sincerity I found in the people of Germany wherever I went.

I would also like to thank the Forestry Commission for granting me 'leave of absence,' so making this trip possible.

The Woodland Stile

Where honeysuckle blooms and briar embraces
Young birch and sallow at the forest edge,
An ancient track is barred by post and railings
Linking a dry wall with hawthorn hedge.
Here ramblers halt to trace their further journey
From canvas map unfolded on the ground.
Here horse and rider leap the lichened palings,
Whilst huntsman sounds his horn to tiring hound.
Here squirrel frisks and cuckoo calls in April,
And vixen thrills to fox's high pitched bark.
Here sweethearts whisper secrets in the moonlight,
And poachers plan their mischief after dark.
Here hiker raises thumb to speeding Daimler,
And looks footsore while lorries thunder past.
Here picnic parties eat ice cream and chocolate,
And throw the cardboard cartons in the grass.
Here school boys scribe their names in wood with pen knife,
And aged pensioners sit and rest awhile.
Here forest rhymer gains his inspiration,
And writes a verse nearby the woodland stile.

R. J. J.

TOURS AT HOME

SOCIETY OF FORESTERS' ANNUAL EXCURSION, NORTHERN IRELAND, SEPTEMBER, 1965

by
J. M. B. Brown

District Officer, Silviculture (South), Research

Monday, 20th September

On the day preceding the start of the Society of Foresters' excursion, Mr. G. N. L. Coates (Divisional Officer) and Dr. W. H. Jack (Research Officer) kindly took me on a short tour of part of the interesting and difficult Rostrevor Forest, in the south-east corner of Co. Down. I had a particular wish to see Rostrevor, which was not included in the tour, because I spent a couple of days there in 1952, examining the locality factors and the early results of afforestation.

Rostrevor is one of several N. Ireland forests where *Abies procera* has been planted on certain exposed heathery places, where Sitka spruce was considered a doubtful starter. Though variable in early growth, the Noble fir has generally shown itself ecologically fitted for the sites on which it was used (at least to the present stage of growth); but doubts about timber quality and markets have discouraged any extensive use.

Another development since my earlier visit has been the swing away from European larch, regularly planted pure on slopes with much bracken. Sites with bracken are commonly free from spring frosts, or excessive wind, and the soils are adequately drained: except, therefore, where shallowness or rockiness may deny the trees enough soil moisture, Sitka spruce is a sound alternative to the larch. Meantime the western hemlock is being used for underplanting the larch stands after thinning, as it has been used for underplanting oak lower down.

In early planting at Rostrevor, Norway spruce was used a good deal on lower valley slopes (ca. 400 to 750 ft.). Now, at 30 years, these plantations still look well, despite the general maritime environment. The other species deserving mention are Scots and Lodgepole pines, both widely planted on relatively dry heather slopes, usually in positions much exposed to wind. At altitudes up to 700 feet Scots pine has grown satisfactorily, but it was evident already in 1952 that the ecological conditions above about 750 feet were very adverse, causing poor increment and needle retention and a complete failure to suppress the heather quickly. I suggested then that a West of Scotland provenance of Scots pine might prove more suitable: but this suggestion does not seem to have been followed up and present practice in N. Ireland is to renounce the species altogether on upland sites. (See plate 4, central inset).

Rostrevor Forest shows extremely well the superiority of the coastal provenance of Lodgepole pine on exposed hill sites.

Dwarf mountain pine, *Pinus mugo*, was widely used as a protective fringe at and near the upper margin of the forest. As in Britain, such employment of mountain pine in the afforestation of western hill lands was later given up in N. Ireland: I have never been convinced that its possibilities were fully examined, but it was perhaps felt that what the mountain pine could do, a coastal lodgepole pine could do better.

This visit concluded with a look at some manurial and herbicide trials on checked Sitka spruce on the nearly flat crest of a ridge. Fertiliser treatments included some trace elements, among which copper appeared to cause browning of *Calluna*: spruce showed little response yet to treatment in 1964.

Tuesday, 21st September: Beaghs and Ballypatrick Forests (Co. Antrim)

For each of the four days comprised in the Society of Foresters' excursion, there was a distinct topic or theme, today's being the afforestation of upland blanket peat. In Beaghs ("birch") Forest the altitude ranges from 500 to 1,676 feet (not all considered plantable) and the depth of peat (8–16 feet) is noteworthy: Ballypatrick is a little lower (500–1,300 feet, mostly below 1,000 feet) and sampling of peat depths provided these figures:—

Depth in feet	0–2	3–5	6–10	11+
Per cent of 493 samples	16	33	48	3

I have not come across such depths of climatic, ombrogenous, or blanket peat on sloping ground in Britain, though it may occur in W. Ross. Did Co. Antrim escape the effects of the last glaciation, or is this great depth of peat a consequence of post-glacial climatic and vegetation history? Rainfall appears to be in the range 50 to 70 inches yearly. Mr. N. Deveria, Divisional Engineer (formerly in W. Scotland Conservancy), stated that exposure of the peat to weathering resulted in only a very slow change from its initial wet, plastic, coherent state.

The deep ploughing practised results in much too thick a ribbon for convenient notch planting and we saw two modifications of Cuthbertson ploughs designed to overcome this difficulty. One, a Stinson sock, designed by a N. Ireland forester, cuts a step in the ribbon: the other has the effect of cutting the peat horizontally to give two thinner ribbons side by side (incidentally with improved vegetation suppression). The other machines seen were:—

(a) Bombardier Muskeg tractor, with a fertiliser-spreading attachment—used in the now general broadcast application of ground mineral phosphate before ploughing. (See plate 5, central inset).

(b) County Super-4 tractor, with mounted Wolseley Jungle-Buster Swipe.

The three other halts in the Beaghs Forest experimental area of 316 acres at 900 to 1,000 feet concerned (1) drainage intensity; (2) fertilisation; (3) climatology.

(1) There are eight drainage treatments, six being Type P Cuthbertson ploughing, with 2 feet or 4 feet deep cross drains at 25, 50, 100 feet spacing, respectively: no. 7, the same without cross drains; no. 8, Type F Cuthbertson complete ploughing without cross drains. Cultivations were done 13 months before planting of Sitka spruce (P.65, after spreading of 4 cwt./acre ground mineral phosphate) and bore holes show water levels in certain treatments.

(2) The fertiliser treatments were comprised in two experiments, of which 2/62 examines the long term effect of phosphate on Sitka spruce with and without N and K; and 3/62 the effect of form, dosage rate and placement of phosphate applied to spruce at planting. These and other manurial experiments are described in Jack's article in *Forestry* (1965), but some further trends may be detected now. Nevertheless the effects of fertiliser on spruce growth are very small—too small for useful statistical examination at present. The most interesting interim result is the effect on the vegetation of the broadcast application of phosphate (superphosphate, G.M.P. or basic slag) just before ploughing. (Application on top of the ribbon, and below the ribbon, were the other treatments.) The natural vegetation is the mixed association characteristic of western blanket peat on flat ground, or very gentle slopes: stunted *Calluna*, diffuse *Molinia*, *Erica tetralix*, *Narthecium ossifragum*, *Trichophorum caespitosum*, *Sphagnum* spp.: on more sloping ground *Eriophorum vaginatum* and *Molinia* are more important and conditions for afforestation better. The main changes in vegetative cover three years after broadcast application of phosphate were the decline in *Ericaceae* and the rise of the *Gramineae*, principally *Des-*

champsia flexuosa, but with some *Agrostis*): as a whole the plant cover was taller and more vigorous.

Worth notice too is the apparent effect of manuring on damage by winter cold in the early months of 1963. There is a belief, backed by some Scottish evidence, of beneficial effects of potash, harmful effects of nitrogen manuring, in relation to damage by winter cold. On the Beaghs hill peat there were indications that plots given both N and P suffered more damage than plots given one or none; and it was suggested that subsequent difficulty which spruce roots experienced in extracting water from cold peat was made worse by increase in osmotic tension in manured plots.

(3) Dr. Jack had carried out a wind survey of the main forest area, using tatter flags, with a few cup counter anemometers as standard of reference and means of calibration in terms of run of wind. The area was divided into blocks of 100 acres, with three flags randomly placed in each. Wind contours drawn on a topographic map as a result of these observations showed some, but not a very close, correlation with altitudinal contours. The range in total run of wind for 199 days mostly in winter (October, 1964 to April, 1965) was from about 32,000 to about 42,000 miles, representing a mean wind speed of ca. 7 to 9 m.p.h. (ca. 3 to 4 metres per second)—not a large range in view of the variation in altitude and aspect, but on these gentle rounded hillslopes no place is sheltered. It may be surmised that an average value for a sequence of years would show a greater run of wind; the past winter was relatively storm-free. Jack explained how he operated the flags.

Of his other observations, it may be mentioned that air and "grass minimum" temperatures showed the general coolness of the summer and the frequency of frost during the growing season; peat temperatures at 5, 20, 60, 120 cm. illustrated the delayed maximum (about 2 months at 120 cm.), with reference to the maximum air temperature; rainfall has not been recorded long enough for a reliable estimate (?60 to 70 inches yearly).

The picturesque seaside village of Cushendun, where lunch was taken, was acquired some years ago by the National Trust (in N. Ireland a regional member of our National Trust), which has taken steps to arrest the threat of damage and disfigurement on the foreshore.

Ballypatrick, where the afternoon was spent, is another upland peat forest, rather older than Beaghs (first planting 1948) and so giving some index of early results, though it must be remembered that in the first two years or so the peat was not ploughed. Although Sitka spruce is by far the most important species, it was commonly mixed with lodgepole pine in the early years. Phosphate was given on all areas and there are several current manuring experiments, that seen first bringing in ground limestone, basic slag and a special potato manure, which showed the best response.

In another experiment, paraquat (at 1 gallon per acre) was used, in September, 1963, to control *Calluna*, with a view to bringing P.56 Sitka spruce out of check: some further treatments (mulching with drain spoil, phosphate, or ammonium sulphate, application, alone, or in combination) were applied to parts of the area. At present it seemed that the simple heather destruction was as good as any elaborated treatment; so that I was left pondering whether rainfall interception by vigorous *Calluna* in dry spring or early summer may be significant, or whether there is some bio-chemical antagonism between heather and spruce.

At the last halt, Dr. Jack demonstrated a sample plot in a P.50 mixture of spruce and Lodgepole pine, one of the 154 stands of 10 years and over in N. Ireland measured in 1965. Percentage distribution of plots among Forestry

Commission yield classes is:—

Yield Class	<60	60	80	100	120	140	160	180
S. spruce	21	28	18	13	11	5	3	1
L. pine	94	6	—	—	—	—	—	—

These data are reflected in the emphasis on Sitka spruce in current upland afforestation throughout the province, in particular in the Ballypatrick Working Plan, due to take effect this year. An incidental problem, arising from slow early growth and the wish, after acquisition, to help in a relief scheme for unemployed men, is how to keep the present force of keen regular men occupied until thinnings begin: a network of roads was built in advance of the planting.

Before leaving the forest, members were led into a discussion on the main features of today's excursion by Mr. K. F. Parkin, the Chief Forest Officer. The questions he put were; (a) does growth to date justify planting such poor land as an economic proposition? (b) how far does growth to date give a true picture of the potential of the land? M . Parkin drew attention to some improvements in techniques since the first planting at Ballypatrick 17 years ago: better ploughs; broadcast application of 4 oz. G.M.P. per acre, replacing a donation of 2 oz. per tree; and heather suppression by herbicides. The striking effect on the peat vegetation of the broadcast fertilisation had been clearly seen on an extensive slope ploughed and planted in F.Y.1963: but here the heather had been burnt two years before planting and the present dominance of grasses (*Deschampsia flexuosa* the most prominent) owed something to fire as well as to phosphate.

It was almost inevitable that the discussion centred on the choice of species and the current rejection of Lodgepole pine in favour of Sitka spruce. The case for a reconsideration of this policy was stated cogently by Mr. Paterson, with experience in the west and north of Scotland, who stressed that, given a suitable provenance of Lodgepole pine, Ulster foresters would find it much easier to establish on blanket peat: even where Sitka spruce yielded more, the gain must be weighed against the greater initial costs. Manuring and heather control may augment considerably the final cost of a mature stand of spruce, especially where, as in some parts of Ballypatrick Forest, *Neomyzaphis* and spring frost (the frosts about 19th May were widespread this year) are injurious. Parkin, however, stood firmly behind present practice, which is based on sure markets (at present) for Sitka spruce of all sizes; the difficulty or, practical impossibility just now, of controlling the origin of *Pinus contorta* seed and, I would add, the evidence of general climatic suitability of N. Ireland for Sitka spruce.

Wednesday, 22nd September: Cam and Springwell Forests

The main theme of this excursion was the management, in face of changing markets for produce, of two somewhat older forests in which storm damage had proved a recurrent menace. Both Cam and Springwell were acquired by the Ministry at a time when certain types of poor land at low altitude were available for forestry: Cam extends from 500–1,200 feet, Springwell from 300–1,000 feet in altitude. Accordingly there is very little deep peat; the underlying rock is Tertiary Basalt but the soils are derived from boulder till with high clay content and a covering of shallow peat. Annual rainfall is about 45 ins. (1,100–1,200 mm.) and exposure is great, especially at Cam.

Cam Forest comprises about 3,000 acres in northern Co. Londonderry: the first acquisition was in 1929 and most of the plantable land was afforested between 1930 and 1952. Norway spruce, Lodgepole pine and the larches are subsidiary to the main species, Sitka spruce, which occurs sometimes pure, sometimes in mixture with pine. The oldest stands had become vulnerable to

gales by 1957, when a storm in early February overthrew 43 acres: in October, 1959 an additional 298 acres suffered the same fate. In view of this situation, the Working Plan, prepared soon after, recommended discontinuance of thinning, but this policy was modified insofar as, to meet short-term market commitments, stands which had already been thinned were subjected to a special "Cam" thinning. This involves removal of some of the largest trees (amounting to not more than 400 hoppus feet per acre per triennium), with all the small trees left to maintain the canopy and grow on to marketable dimensions in their turn.

140 acres fell in the great storm of mid-September 1961, which overthrew 700 acres at Baronscourt Forest in Co. Tyrone, just when B.B.C. Television cameramen were present to film a tree-felling competition. Since then there has been no more serious wind damage in Cam Forest and it is probable that, in the revision of the Working Plan in 1966, the no-thinning policy will itself be overthrown in favour of the Scottish eclectic method, seen today in P.43 Sitka spruce, where a comparison of eclectic, low, Cam and "no thinning" was instituted at the first thinning in February, 1961.

In the detailed summary of measurements attached to the tour notes, the "Cam" treatment showed very poorly in this comparison with the others; but the comparison is not entirely fair, inasmuch as the initial measurements in 1961 before thinning showed an appreciably lower mean height and substantially lower basal area for the Cam plots.

There was, as expected, a good deal of controversy about the thinning practices and their probable influence on susceptibility to storm damage. The question was raised whether the occurrence of three destructive storms in one five-year period was a very rare phenomenon, or something not very far from ordinary and meet to be given due weight in planning. Drainage intensity also came up for discussion in this context. At the first halt in P.45 spruce, c.30 feet tall and now due for first thinning, it was agreed by forest staff and visitors that the initial depth and intensity of drains, on a clay soil with painfully slow fall, was quite insufficient.

In another part of the forest the spectrum of current practices in Cam Forest was completed by the demonstration of extraction and conversion in an area of P.32 Sitka spruce, where storm damage had resulted in a large clearing. A Garrett Tree Farmer was collecting the poles and taking them a short distance to a central ride, where cross cutting was effected by a chain saw conversion unit designed by a N. Ireland Forester, Mr. J. W. R. Devenney, who put it through its paces. While members were impressed by the operation, some were of opinion that a circular saw might handle more efficiently the fairly large volume of produce involved. Mr. Deveria agreed, but he pointed out that it would be uneconomic for a small forest such as Cam to maintain chain saws and a circular saw (with its ancillary equipment): Devenney's simple mobile installation meant that the Danarm could be switched from felling to conversion and back again as circumstances required.

While beating the bounds of the clearing, I observed the symptoms of a decline in growth in adjacent stands, particularly near the exposed edges: reduced height increments, some loss of foliage, occasional bent tops. When I drew Dr. Jack's attention to this, he said he had been concerned about it himself, but was satisfied that there was no associated fall off in diameter increment.

In Springwell Forest, visited on Wednesday afternoon, acquisition and planting of the main areas had just been effected in 1946, when a blaze, originating in a peat-cutter's fire, destroyed 360 acres. This area was replanted during the next three years, while planting of later acquisitions has continued until 1962. The three main storms of the past decade, particularly that of October 1959, when 152 acres fell, have taken their toll. The Working Plan, which came

into operation in 1961, divided the forest into Saw-timber and Pulpwood Working Circles, the pulpwood circle comprising compartments which appeared incapable of yielding saw timber (because of slow growth, or risk of storm damage), or from which extraction of thinnings would be very difficult. No thinning was at first prescribed for these compartments, but this was changed to "Cam", then to low, thinning, for the sake of meeting market demands. When the Working Plan was prepared, the growth of stands at the thinning stage showed a wide range between yield classes 120 and 260 for Sitka spruce, the main species: for Norway spruce the range was 100 to 160.

At the first halt there was more evidence of spring frost damage this year on young Sitka spruce, planted after the clearance of storm damage. The adjoining mixed P.33 stand of Sitka spruce and Lodgepole pine in the proportion 2:1 was interesting in showing complete suppression of spruce by vigorous pine, unfortunately of unrecorded origin. The main features of the tour were, however, the measures taken by intensified drainage to prevent further storm damage; and the impact of the wind factor on the management of the forest. My attention was captured by two things in particular. One was a belt of Sitka spruce, about 25 feet in height, on an exposed ridge: having miraculously survived the 1959 storm, it was evidently giving valuable shelter to a young plantation of white spruce in its lee. It occurred to me that the maintenance, in very exposed forests, of similar shelter belts, either of the main tree, Sitka spruce, or perhaps of some species more fitted to the task, might be of such benefit to the rest of the forest as to justify exclusion of relatively small areas of protection forest from normal economic exploitation.

The other interesting area was a patch of P.61 Sitka spruce surrounded by 18-year-old spruce and making extraordinary rapid growth. It replaces a part of the original P.35 planting which escaped fire in 1946, but was blown down in 1959. Once again the benefit of shelter from taller surrounds was manifest.

Thursday, 24th September

An hour's journey by road from Portstewart brought the party to a point on the Lower Bann near Kilrea, where the cruising launch *Maid of Bann* was boarded. During the journey up the river (unfortunately in light rain) to Toome on Lough Neagh two stops were made for the purpose of examining plantations of trees on the "Dumps" and, at the second stop, of seeing the end stage of river transport of forest produce.

The Bann drainage scheme, which resulted in these dumps, was effected between 1930 and 1940. The dredged material was spread, after the building of a low bank, or bund, on numerous small pieces of river bank land (up to 70 acres in area), which the Minister of Finance acquired by voluntary sale. The land is flat and the material, being semi-fluid on deposition, settled down to form a level surface. It was, however, of very variable texture, from coarse gravel to silty clay, with fine material preponderating: one dump might comprise patches of material of different sorts.

Complaints about the unsightly look of these barren areas of spoil soon prompted the project for planting trees, which the Ministry of Agriculture undertook between 1936 and 1942. The work was supervised by Messrs. Stewart (later Chief of the Forestry Division) and Burn, who took much care in matching the species used to the texture of the spoil. Mixed broad-leaved trees,or Japanese larches, were planted on the retaining bunds and immediate surrounds fronting the river. Elsewhere spruce (mostly Sitka), often mixed with alder, was used on spoil with much fine silt and clay; Japanese larch on sands and silty sands; Scots and Lodgepole pines on coarse sands and gravel; Norway spruce and Scots pine on spoil of varying texture. Of broad-leaf trees besides alder, we saw oak, ash, sycamore, and some poplar of unrecorded variety, mixed with Sitka spruce.

Apart from the very variable physical composition of the spoil, the main environmental factors of these sites are the moderate exposure to wind, good ground water supplies and rather frequent frosts in the growing season. The frost risk probably dictated the extensive use of common alder nurses on the moist sites: alder is well suited by the condition, making fast growth to yield large, but rather coarse, stems. Alder is not accepted for process wood, while other markets are hard to find, so it has often had to be cut out at considerable cost for the sake of the associate tree.

For the most part the stands of spruce, pine and larch have done very well and some of the Norway spruce, Scots pine and Japanese larch stands seen were distinguished by excellent stem form, in addition to good height growth. This probably reflects the relatively fertile soil and, in particular, the assured water supply to the roots: though provenance and, in the case of Scots pine, relative freedom from insect and squirrel damage, may have played an important part too. At any rate the experience left some members with the thought that good ground—in particular well watered ground—may be a condition of good stem-form, no less than of good increment.

River transport of produce in a converted ship's lifeboat (capacity 17 tons) is still in the experimental phase and no accurate costings are available. Fitting its own motor to the scow would doubtless reduce the cost.

Drumcairn Forest, Co. Tyrone. In contrast with the forests seen on Tuesday and Wednesday, Drumcairn, where a short tour was made in rain on Thursday afternoon, is at low altitude (100–400 ft.) and on mineral soil, derived from fine-textured boulder till. Very little more comparable land is likely to be acquired for forestry, partly for this reason, the Department is creating mixed stands, aiming usually at final stands of broad-leaf trees, even where conifers preponderate in the initial planting. The theme of this excursion was the establishment and treatment of hardwood-conifer mixtures.

As to the environmental factors, exposure to wind is nowhere severe, but spring frosts and drainage impedance on flat areas of clay soil work hand in hand to make establishment rather slow and troublesome in parts of the forest. Broad-leaf trees include oak, beech and ash, with an emphasis on beech; conifers, Norway spruce, Japanese larch, Lawson cypress, Western red cedar and Scots pine. All the early mixtures consisted of alternate strips, but some twelve years ago a group arrangement of the hardwoods (group centres 20/25 ft. apart) was resorted to. It chanced that the change coincided with a move from flat clay-covered land to a ridge of somewhat lighter soil and so Scots pine was chosen as the conifer nurse. Because of its tendency to coarse branching, this species is probably least suited, among the conifers used, as a matrix for small groups of five ash, oak, or beech.

Ash was seen growing vigorously on the moister sites, but the forms were poor, presumably because of frost, and it was evident that few groups of five would provide a tree qualifying on account of both vigour and shape. On the ridge, where frost was less damaging, the poorer soil was reflected in poorer growth, particularly where the trees experienced grass competition. Subsequent treatment of broad-leaf trees involves spotting with paint about 100 selected stems per acre when about 12 ft. tall. Trees interfering with the élite are removed, or, more usually, beheaded and pruned. J. E. Garfitt later commented favourably on this beheading treatment, which frees the crowns of the chosen dominants, while retaining the benefits of full cover (cleaning of lower boles, grass suppression). On attaining about 25 ft., the chosen trees are reduced to about 50 per acre, similarly favoured.

Friday, 25th September

Tollymore Park, where this morning was spent, is the first, and at present the only forest park in N. Ireland, though a second will soon be opened at Lislap. An area of 1,184 acres on the north-east flank of the Mourne mountains, administered, for silvicultural purposes, with Newcastle Forest on the south flank, was opened for public access in 1955. Mountains (with Slieve Donard, the highest in N. Ireland, not far away) and the sea afford splendid views from many vantage points, while within the Park, the Shimna Glen, flanked by old oaks and beeches, offers delectable rambles to the less adventurous visitors.

At the outset many foresters expressed misgiving about public response to the effort and the considerable allocation of resources. But these fears were soon allayed and, from small beginnings, the annual total number of visitors has risen steadily to the embarrassingly large figure of 163,000 in 1964. During summer weekends, the car park, restaurant and camping sites were quite inadequate for the thousands of motorists and the time of forest staff was taken up with directing drivers to ancillary parking places, or answering other enquiries. An additional responsibility of the local forest staff was the provision of guides for organised parties from schools, Natural History Societies and the like. It was never envisaged that there would be so many requests of this kind when the facilities were offered: it is clearly impracticable to accept certain parties, while turning others away. There are three small camp sites and a caravan site: these also would have had many more patrons had they been larger. It is quite evident, therefore, that there is a great demand for the kind of facilities which the N. Ireland Forestry Division has provided in Tollymore Park and it may be presumed that, within the next ten years, the public will be admitted, subject to appropriate restrictions, to several others among the scenically attractive forests in the province. There, as in Britain, an important question will be how far the Department should go in the direction of providing the additional facilities (in particular caravan and camp pitches) now so widely sought by the tourist.

After a short tour of the forest in lorries, the Society of Foresters party assembled in the car park, for a short discussion about forest parks and similar contributions to public access, amenity and recreation. The main speakers were Mr. C. S. Kilpatrick, the Divisional Officer, who answered general enquiries and provided a summary account of the result of a questionnaire to a large sample of Tollymore visitors in 1964; and Mr. John Workman, of the National Trust. One outcome of the questionnaire, which of course comprised a wide range of items pertaining to the park, was that (as most people probably expected) visitors appeared more concerned about car parks and camping facilities, teas and toilets, than about natural history, fine views and exhilarating mountain air. My own feeling was, however, that, as people saw steps taken to provide a modest measure of comfort and convenience, and learnt to value the natural beauty of the surroundings, they would set greater store by this beauty, and protest strongly were it damaged or threatened. A similar view was expressed by Workman, who deprecated any suggestion that considerations of amenity could be forgotten beyond the small amenity working circle and stressed that the Forest Division held a great responsibility to preserve this beauty spot and conduct its silvicultural operations so that no large clearances or stark edges were evident. In fact there is now one such large clear fell on the steep slope south of the Shimna, in full view of car park and café, but this arose by accident. A heavy thinning in a stand of mature larch, with a view to underplanting, was followed by severe storm damage.

There is some very promising Douglas fir in Tollymore Park and in recent years several species of *Abies* have been planted, by a method of group regeneration, or under a heavily thinned overwood. The present District Officer

has considerable faith in *Abies procera*: in the few places where it has been tried, Sitka spruce has disappointed, probably because of excessive site drainage and heather competition. Emphasis is on shade bearers, partly because of the desire to regenerate as far as possible under cover, without a clear fall; partly because of the almost ubiquitous cherry laurel. This was the priority problem when I visited Tollymore Park with the British Association in 1952: it is now being dealt with piecemeal, as compartments come up for regeneration, by means of some cutting, application of brush killer and suppression of any regrowth by the shade of the successor trees.

Tollymore Park had been in private ownership for nearly 200 years before acquisition by the Ministry of Agriculture in two parts in 1930 and 1941. The small area of agricultural land in the park is farmed by the Forestry Division, the oats being thrashed and used for feeding horses employed in local forests. There was not enough time to see the valuable Arboretum in the park, but only a few miles away on the Castlewellan Estate of Mr. G. Annesley, there is the finest Arboretum in N. Ireland. Here, by kind invitation of Mr. Annesley, who conducted one of the groups into which the party was split, the last two hours of this exhilarating excursion were spent.

Concluding General Observations

Modern forest history in Northern Ireland may be said to begin in the very unsettled times at the end of the sixteenth century, of which the ruins of Dunluce Castle, perched on a cliff near Bushmills, was a reminder to those who took part in the excursion. Cutting down of forests for military purposes, during the stubborn resistance of the Ulster Chieftains against English invaders, culminated in the Plantation of Ulster in 1609, when the land of the chieftains banished or slain was made over to Scottish settlers, who soon applied themselves to the task of forest clearance for agriculture. An additional spur was that standing woodland and scrub, which might screen native guerillas, was a liability, while the produce was useful for fuel, fencing, construction, or sale. Further destruction accompanied fighting during the Civil War, ending with the settlement of 1642. After that there was peace in N. Ireland, but there was little security of land tenure, when grants were often made at the whim of the English sovereign; so that an occupant was tempted to convert his woodland into ready cash while he could. For these reasons, mainly, forest destruction in N. Ireland had been fairly thorough by the late seventeenth century.

The second "Plantation of Ulster", initiated in the next century on the demesnes of the aristocracy and continued in the present century by the Forest Division of the Ministry of Agriculture, provided the magnet attracting some 50 temporary immigrants from Britain in the latter part of September, 1965. Tollymore Park proved a good example of a 200-year-old demesne: Beaghs and Ballypatrick, at the other extreme ecologically, showed the manner in which Ulster foresters are responding to the challenge to recreate forest on the wastes of millennia in a country where the livestock industry is of first importance, so that land which will grow good grass must remain in the farmer's hands.

There is very naturally a marked contrast in species between the oak, beech and larch, combining use and amenity, favoured in the early planting in Tollymore Park, and the spruces and pines now being planted on the barren hill lands, Average figures for recent years show Sitka spruce easily heading the list (64%), followed by Norway spruce (12%): the rest consists of ca. 12% pines, 2% larches, 5% other conifers, 5% hardwoods. The reasons (mainly unsatisfactory seed supply, uncertain markets) behind the reluctance to plant Lodgepole pine here have not deterred foresters in the Republic; so that in several localities one may find the political boundary neatly marked by an abrupt change in composition of the forest. Time, and some economic studies, will throw light

on the prudence of these decisions. Meantime the N. Ireland Forestry Division is persevering with measures to improve the growth, health and stability of its Sitka spruce plantations and with the search for ways of streamlining and cheapening such ameliorative treatments. Some general aspects of forest work, not touched on in the tour notes, call for brief comment.

(1) **Roads.** Formerly road metal was quarried as near as possible to the forest where it was used, but it has been found more effective to establish large central quarries, employing experienced workers and up-to-date techniques, and supplying several forests. Steep rocky hillsides and deep blanket peat present the main problems. For the peat a mixture of large and small stones, with some earth or clay from the quarry top, is found most suitable, as it usually binds well under the pressure of traffic. Roads are 12 feet wide and a thickness of two feet is commonly enough; but in wet bogs up to six feet may be needed.

(2) **Employment.** The present conditions in the province ensure that in most forests there is much less difficulty in securing labour than in England and Wales and nearly all the work is done by the forest staff. In the current re-forestation programme, the size of field staff has risen from 260 in 1946 to about 1,200 now: there will be substantial further increase when existing plantations come into full production and further land comes under the Cuthbertson. Forest workers, who are offered permanent employment, may receive training, particularly in the more specialised jobs, at the Forestry School at Pomeroy, Co. Tyrone, which Research Officer Jack also supervises.

(3) **Markets.** Nearly all State Forests are young and so most of the present produce is in the form of thinnings: creosoting tanks have been installed at five forests, so that creosoted fencing posts are readily available in all parts. I regretted seeing so many concrete posts near Belfast, replacing traditional dry stone walls, or thorn hedges, along road improvements and the like. Doubtless the high pressure salesmanship of the Cement Manufacturers kept the forester out. Elsewhere, however, wood seemed to be in considerable demand for fences. I cannot resist drawing attention to some superb examples of dry stone walling which I saw in the granite country on a private journey through the Mourne mountains. I suppose these walls testify to the very thorough destruction of forests in the past.

Export of mining timber to Wales has declined in quantity in recent years, but considerable quantities of wood for pulping are exported to Britain and will continue to be until rising output makes it worthwhile to build a wood pulp factory in N. Ireland. Meanwhile there is a chipboard factory in Coleraine and a wood-wool factory in Belfast. Most of the saw timber produced comes from the 27,000 acres of private woodlands heavily cut over during the war. In this land without coal, 11 per cent of the produce of the forests is sold as firewood. In the past few years clearance of storm damage accounted for well over 50 per cent of gross production in State forests.

(4) **Research.** Although the official connection with the Forestry Commission lasted only from 1919 until the Home Rule Act of 1921 that divided the country, the N.I. Forestry Division, as a very small enterprise with limited resources, continues to rely on the British Forest Service for much technical advice and the results of forest research. The current emphasis on afforestation of upland blanket peat has meant that the research effort is largely directed to a study of the special characteristics of these sites and methods of improving them. Hence the local climatic studies undertaken by Dr. Jack at Beaghs, the adaptations of implements for fertiliser distribution and better cultivation in charge of Mr. Deveria, and the co-operation with Queen's University and Imperial Chemical Industries in a wide range of manurial trials on peat. An interesting development has proceeded from the interest aroused in the

Meteorological Office, resulting in the establishment of many more observation stations (there are now 43 rainfall and 15 climatological observers) at many of N. Ireland's forests.

During the excursion I heard several times the phrase "out on a limb", when Ulster foresters spoke of their work. I saw no evidence that the limb is not richly supplied with sap from the main stream of European forest practice and forest research: while it is vigorously putting on increment with materials derived from the local atmosphere. With plentiful humidity and negligible industrial pollution, the Irish atmosphere is by no means unfavourable to growth of trees.

Arrangements for the excursion were undertaken jointly by Dr. Jack and Mr. Simpson, who fully earned the grateful and appreciative remarks of the incoming President, Mr. J. Maxwell Macdonald, before our departure from Tollymore Park. The strong Working Plans unit which Mr. Simpson leads is an indication that Forestry in N. Ireland is moving with the times: if current plans are prepared with as much care, good judgement, flexibility and imagination as his plan for the Society of Foresters' Excursion, the prospect before Forestry in N. Ireland is good.

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Elegy To a Squirrel Killed by a Car in The Forest of Dean, with a Chestnut in its Mouth

"Some seeds fell by the wayside".
St. Matthew. XIII.

You could have played and gambolled as you pleased
Amongst the crowns and branches of the trees,
Then in the spring perhaps in early May
Have raised a family in a cosy drey;
To cross the road you had no real need
The woods are full of mast, for winter feed.

You should have had a very happy time
With all these ancient oaks and beech to climb,
Instead of which you chose to sport and leap
Across the public highway robbing sheep
And pigs of chestnuts . . . now through foolish greed
You've fallen by the wayside with the seed.

R. J. J.

ROYAL FORESTRY SOCIETY OF ENGLAND, WALES AND NORTHERN IRELAND

NORTHERN IRELAND EXCURSION

9th to 14th May, 1965

by

H. O. Armstrong

Head Forester, South Scotland

Sunday, 9th May

We commenced our excursion at 2 p.m. with a trip to Rowallane Gardens. Rowallane lies 12 miles south of Belfast, near the village of Saintfield, and is owned by the National Trust.

With bright sunshine and perfect weather the gardens were looking their best, especially the rhododendrons and azaleas, which were at their peak. The collection of exotic shrubs and trees in these gardens would need a book to describe. I thoroughly enjoyed this outing and to crown the afternoon we were entertained to sherry by the Governor of Northern Ireland at Rowallane.

Monday, 10th May

Our first place of call today was at Castlewellan. This estate is owned by Mr. G. Annesley who kindly escorted us round.

The main interest here is the wonderful collection of conifers probably one of the best in the British Isles, certainly by far the best I have ever seen. There are approximately sixty different species, well grown, ranging from 8 ft. to 106 ft. in height and all growing in a plot about four acres. This truly was a forester's paradise, also the way these trees were expertly tallied deserves a mention.

In the afternoon we visited Slieve Donard Nurseries. These nurseries are 30 acres in extent and are solely used for raising shrubs and heaths. We were escorted round, and the various techniques explained, which were very interesting. The weather remained fine and this made a very pleasant day.

Tuesday, 11th May

Our first stop today was at Rostrevor Forest belonging to the Department of Forestry.

Rostrevor Forest is in County Down on the shores of Carlingford Lough and on the Western slopes of the Mourne Mountains. Across the Lough lies Co. Louth and the Carlingford Mountains in the Irish Republic.

The total area of land belonging to the Forestry Division is about 4,500 acres, but only half of it is planted, owing to elevation and soil conditions.

The main species used in planting were Douglas fir, Sitka spruce, Japanese larch, Scots pine, Lodgepole pine and Norway spruce. Everything had done fairly well except Lodgepole pine and Scots pine, at an altitude of 600 ft. to 1,000 ft. they had failed miserably. Out of this failure I saw the best example of the use of Norway spruce to replace these failures. The way this species had been used and had grown and taken over from the initial species planted, would have to be seen to be believed. This example will always stick in my mind.

800 acres of this forest are in the thinning stage producing 1,350 tons of material per annum.

Our second and final stop of the day was at Tollymore Forest Park, Tollymore was the first Forest Park opened to the public in Northern Ireland. and is situated near Newcastle, Co. Down. It covers an area of some 1,200 acres and in 1964 was visited by approximately 140,000 people. Caravan parks,

camping sites and a café have been provided and a system of planned walks laid out. A recent addition is a nature trail and museum.

Most of this forest is in the production stage and all operations are carried out by forest labour, between 50–60 men are employed. Some very fine timber of various species was seen. The outstanding feature here was the lovely stands of Grand fir. This species really thrives in this area. Due to no roe deer in Ireland, it has no vermin to speak of, to hinder the growth.

To end a very pleasant and useful day we were entertained to dinner at Stormont, by the Rt. Hon. H. W. West, M.P., Minister of Agriculture, and afterwards escorted through both Houses of Parliament.

Wednesday, 12th May

Today we moved our headquarters from Belfast to Omagh, on the west side of the province. On our way we visited the Bann Dumps in Portglenone Forest, belonging to the Department of Forestry.

During the draining of the river Bann in the 1930's many areas on both banks of the river were taken over for the dumping of dredged material from the river bed.

On completion of the scheme in 1935 the dumps and certain other land was handed over to the Forestry Department for planting. At that time more for amenity reasons than for commercial timber growing.

We travelled up river by pleasure boat to Gortgoole where we disembarked and saw a demonstration of horse and barge extraction and loading and unloading from the barge using a Hiab Hoist.

Sitka spruce, Lodgepole pine, Norway spruce and Scots pine were all used in the planting of these dumps; Sitka spruce being the main species. The bulk of this area is now in production and is far from being just amenity value as was first the intention. Here I saw the best example of the Scottish eclectic method of thinning I have ever seen. I would say the Forester here had the method off to a fine art.

Again in fine weather the sail up the River Bann and down again, a distance of some 30 miles, was very enjoyable indeed.

Our next stop was at Ballinascreen Forest, Derrynoyd Block, where we were shown areas of parkland and arable fields which had been planted in mixture, with oak and Norway spruce. The Norway spruce had done reasonably well, but the oak had failed badly. Lengthy discussion followed at this stop on what was the reason for the failure of the oak crop which in the end was put down to bad seed and a not too favourable site for this species.

Here we were also shown a small forest village consisting of some 16 houses, nicely situated and laid out, which supplied labour to this and other surrounding forests. We arrived at our hotel in Omagh about 7 p.m., after another fine and most interesting day.

Thursday, 13th May

Our first stop today was Lough Braden Forest, owned by the Forestry Department.

Lough Braden lies on the border between County Tyrone and Counties Fermanagh and Donegal. It is fairly typical to some of the areas of Galloway and is about 5,000 acres in extent. Planting first commenced in 1959 and is progressing at the rate of 200 acres per year. Sitka spruce being the main choice of species, Lodgepole pine being used also fairly extensively but never in mixture, which rather surprised me.

The approach to preparation of ground was completely different to our techniques. First of all the heather and rough vegetation was completely swiped

off instead of burned and the whole area was manured by tractor and manure spreader before ploughing. Most of the ploughing was at 17 ft. and double furrowed in between. Tine ploughing was being done by a County Sea Horse Tractor, and doing a good job. This demonstration gave me the impression of an abundance of machinery, equipment, labour and money for doing the job in Northern Ireland.

Our next stop was at Baronscourt Estate owned by His Grace the Duke of Abercorn, President of the Royal Forestry Society.

The Duke and Duchess graciously escorted us round the grounds and part of the woodlands and entertained us to Lunch in Baronscourt House.

In the afternoon we travelled to Baronscourt Forest owned by the Forestry Department. This forest covers an area of 3,000 acres of which since 1957 half of the timber has been blown down by severe gales in 1957, '59, '61, '65. The reason for the blows were given that practically the whole area initially was agricultural land and over generations of shallow ploughing with horse or donkey, a plough pan had formed. The upturned roots of Sitka spruce would support this theory, I have never seen such shallow rooting. I was rather shocked to find that in the replanting of this area no tine ploughing had been attempted. This would have been difficult due to the mass of roots, but by no means impossible.

Various types of extraction equipment, tractors, loaders, saws, chain saws and hoists were at work, again no scarcity of equipment. I left Baronscourt with the feeling that as no attempt to get better rooting of the crop, 30 years would be the rotation of timber on this area.

Weather again fine and an enjoyable and interesting day had by all. A great deal of diverse opinions voiced on the way by bus to Omagh and into the late evening in the hotels.

Friday, 14th May

This is the last day of the tour and our first stop was at Pomeroy Forestry School. The principal object of this school is to provide foremen and leading workers with a basic knowledge of silviculture and a practical training in the proper care and use of tools.

The school is residential and normally 16 men are accommodated on each course.

Some of the methods and tools used are outdated by our standards, for example the 7 lb. axe which must be ground down by a grindstone and honed by a round flat carborundum stone is the order of the day. As there are no piece-work operations in Northern Ireland, time and money does not greatly affect people here. Apart from this the quantity and quality of work seen was as high as our standards.

Our last call of the day and final call of the tour was at Shanes Castle the home of Lord O'Neill. Here we saw some lovely timber of Ash, Beech, Oak, Larch, Douglas and Spruces.

Shanes Castle is situated on the shore of Lough Neagh and is steeped in history, as late as 1922 part of the dwelling was burned down by Sinn Feiners. Lord O'Neill is himself descended from the old Kings of Ireland. Forestry on this Estate is systematic and well planned, and the brand new saw mill was envied by even the timber merchants in the party. At the close of the tour we were very kindly entertained to tea by Lord O'Neill.

The courtesy and kindness shown by all I met was everything that could be desired. A word of praise must be mentioned about Mr. Parkin, Chief Forest Officer for Northern Ireland and his staff who left no stones unturned to make our stay with them as comfortable and interesting as possible. Also to have the opportunity of meeting and making so many fine friends both in the party and amongst the Foresters in Northern Ireland was a great privilege indeed.

REPORT ON ROYAL FORESTRY SOCIETY'S TOUR OF NORTHERN IRELAND — 9th to 14th May, 1965

by

T. L. Jenkins

Head Forester, North Wales

On the 8th May, I boarded the *Duke of Rothesay* at Heysham and, complete with stabilisers, crossed the Irish Sea on a calm night and awakened at 7 a.m. to find the ship moving up the lough to dock at Belfast. All the riverside paraphernalia which are so exciting to a landsman were displayed. Cranes of odd shapes and sizes, ships with exotic names, buoys with names like *South Queen*; but before I could let my imagination dwell more on these things, an ever so slight tremor through the ship, and the running out of the gangplank told passengers that we had arrived.

Belfast is like any other big city in the United Kingdom, standing as it does in near contact with the mainland; however, one has but to travel a few miles inland to find the 'fringe benefits' disappearing, and as the party proceeded westwards and the smell of burning turf grew stronger, so I found those aspects of Ireland, and in particular Irish forestry, that I was so anxious to see. I found it a land of contrasts. Everywhere I was told that agriculture was the most important industry, yet in our itinerary fields of gorse and rush were common, to be interspersed at intervals with other areas of extremely good husbandry. There is, of course, much poor land that a forester would say should be growing trees, yet there is only 1.8 per cent of the land area under forests. There are certainly difficulties regarding land acquisition for forestry which do not stem from the people's opposition to forestry as such, but arise from such things as turf-cutting rights—an important matter in a land of no other readily available fuel—which afforestation might jeopardise, although in fact need not. The effects of the Irish Land Acts of last century and since, which divided large estates into small holdings of 20 to 30 acres which became the property of individuals. One can visualise the difficulty of trying to purchase, say, 500 acres of marginal agricultural land on these terms. Also in this small country of a million and a quarter people, religion assumes an importance in things secular unintelligible to people not brought up in these circumstances, and I think warrants mentioning since it affects all aspects of Irish life, including forestry.

The object of the tour was not only to visit areas where trees were grown strictly on economic terms, but also to include estates where arboriculture and amenity planting had been practised for a long time, and the effects were now achieved for all to enjoy. To this end we had the pleasure of visiting the National Trust property at Rowallane near the village of Santfield in Co. Down. Here in an area of great climatic advantage, sheltered from high winds, the gardens as we see them today were commenced in 1903. The Sunday afternoon and early evening quickly passed in this most skilfully blended conglomerate of shrubs and rare forest trees from many parts of the world.

On Monday we journeyed south again from Belfast, this time to see the famous collection of conifers at Castlewellan, which was begun about 1870 by the 5th Earl of Annesley. We had the advantage of being instructed by Mr. Annesley the present owner, whose description of how the collection was evolved, ready identification of trees of all species, and particularly advice on regeneration, was gratefully received. All species were most tastefully distributed to gain the best scenic effect, and *acers* and rhododendrons of many colours added beauty to the scene. A most attractive shrub called *Pieris forrestii* was seen here and on other estates in Ireland and could, under the proper conditions, be a useful plant to beautify our housing projects here.

The afternoon was spent at Slieve Donard nurseries, a private nursery of

about 30 acres specialising in shrubs and ornamental trees, and holding a stock of great variety suitable for most climatic situations found in these islands. The nurseries are not far from the sea and suffer little from frost, but are subject to blasting east winds which caused damage last winter as they did to our own nurseries in western Wales. Propagation is merely by cuttings in mist frames, and from thence to cold frame and nursery bed.

Rostrevor Forest is on the western slopes of the Mourne Mountains in Co. Down, and on Tuesday morning we gazed up at the rock silhouette of the Irish giant Finn McCool lying sleeping (Irish patriots would deny in a haze of Guinness) across a mountain top. The area is State owned and is 4,500 acres in extent, of which something over 2,000 acres have been planted, the remainder being unplantable due to exposure or difficult soil conditions, and whilst the use of European larch, Douglas fir, Scots pine and Lodgepole pine could be almost classed as traditional. Japanese larch, which had not grown in a manner generally found in home forests, had been superseded by Noble fir. This species was found growing well up to 1,200 ft. elevation in conditions of considerable exposure, and on these terms I believe there are many places in Wales where it might be profitably grown, where Scots pine and Lodgepole pine have been planted in the past, and are far from thrifty. Extraction was difficult at this forest due to steep slopes and many boulders; so much so, that certain areas were scheduled as 'no thinning' areas with no extraction visualised until clear felling took place. It would seem that clear felling would need to be carefully planned to avoid unsightly areas in this district of considerable tourist attraction.

The afternoon was spent in Tollymore Forest Park which is part of Newcastle State Forest. Lying on the northern slopes of the Mourne Mountains, and traversed by the Shimna river, its development into a forest park has been carried out in a most enlightened manner. Although only 1,200 acres in extent, walks are laid out and views encountered that give the impression of a much larger area, and visitors are catered for by the provision of a large macadamed car park, café, lavatories, caravan and camping sites and, in addition, a small nature museum in which a most instructive half hour can be spent. Our efforts at home in this respect are not nearly so comprehensive.

On Tuesday evening we were invited to dine at Stormont, after dinner speeches being made by the Rt. Hon. H. W. West, M.P., Minister of Agriculture of Northern Ireland, and His Grace the Duke of Abercorn, the President of the Society. The Duke is an enlightened forester whose council many of us were to seek during the week's tour, and I gratefully remember his instruction, and the kindness with which he dispensed it. His stirring speech at Stormont during which he pointed out with some force that the area under forests in Northern Ireland was very small indeed, will long be remembered by those present for its candour and sincerity.

Wednesday morning found us at Toomebridge on the shores of Lough Neagh where we embarked on the M.V. *Maid of Antrim*, which took us up the River Bann which flows from Co. Antrim into the Lough. During the dredging of this river in the 1930's dredged material was dumped on the river banks which were later afforested. These 'bunds' as they are called, now carry good crops of Japanese larch, Scots pine, Lodgepole pine, Sitka spruce and Norway spruce, albeit showing signs of delayed thinning here and there, no doubt due to extraction difficulties mainly. Electric thinning was now in progress in the wood we saw, and this was skilfully done, but I am not so sure about the economics of the extraction which was by horse/tractor to river bank, mechanically loaded and unloaded into and out of boat, and onto lorry trailers which took timber to destination. Forest workers were observed carrying out several operations connected with conversion and movement of timber, and at this point I became aware of another feature of Irish State Forestry which it is difficult for foresters

from Britain, with their training and background, to accept. It is that no piece-work nor bonus schemes are practised in Northern Irish State Forestry, nor being employed on day work only, this declared policy being part of the general campaign against unemployment which is running at 6 per cent in Northern Ireland. But the general effect of this policy would not seem to be to the national weal in the long run, because jobs tended to be overmanned and/or machines underworked—in effect it reduced the horse-power at each man's elbow, and this is unfortunate since State forestry is well mechanised in the areas we visited, and the staff we saw at work, of high quality.

The afternoon was spent in the Dennyhoyd block of Ballnascreen State Forest. The area of the block was 200 acres, and much work had gone into the establishment of pure oak here, but with indifferent results, which now call for some bold change of policy if these areas are to become viable economically. The forest village is centred on this block, and we were able to inspect Forest Workers' bungalows which were well built and set most attractive to the eye. They are rented to forest workers at 4/- per week, and in return the worker performs standby fire duty when required, for which no payment is given, and this arrangement seems to work very well, but I fear would be fraught with difficulties if applied here.

Thursday was a particularly memorable day for foresters from Britain since a great amount of information and demonstration was packed into the visit, this being effected by split second timing controlled by radio! At Lough Braden (State) Forest on the Co. Tyrone, Fermanagh, Donegal borders we were given demonstrations of preparation and fertilization of deep and shallow peat areas by a variety of machines all being skilfully employed, and producing the type of moorland preparation with which we are familiar. Hard roads of a quality (and price) we would consider high for the terrain (£5,000 to £6,000 per mile), traverse the area, but the roading density was low—1 to 4 miles of road per square mile of forest, this density being to the estimated production class of the forest in making.

In a rapid switch from land preparation to harvesting a timber crop, we were transferred to Baronscourt Forest, Co. Tyrone, an area on which a series of heavy windblows of standing timber have occurred between 1957 and '65, the total area being involved reaching the figure of almost 1,300 acres. The methods of extraction ranged from horses (Ministry owned) to a couple of 'Tree Harvester' machines, and numerous 'traditional' tractors, all fitted with safety frames which are a great advance in operator protection. Conversion was by McConnell and by a most ingenious adaptation of chainsaws whereby the saw was mounted on a swivel whilst the timber was fed to it on rollers. In addition, a locally designed and manufactured mobile twin-saw bench was employed on ripping and pointing stakes for which there is a large market in Ireland, and this was a splendid example of a particular machine meeting a local requirement. It was a full day packed with 'meat' for forester thought, whilst the variety of equipment and ingenuity of adaptation in some cases, left me with a high opinion of Irish labour and supervision.

The last day of the tour—Friday, 14th May—commenced at the Dept of Forestry's Pomeroy Forestry School in Co. Tyrone, which exists mainly to provide foremen and forest workers with a basic knowledge of forestry, and training in the use of tools, and thereby seeks to do, broadly, what is done in Britain by the travelling Tool Instructors. The courses are given in periods of one week with a two months period back at the 'house forest' between, since some courses take three weeks to complete. The main advantage that this possesses over our own system is that good facilities for instruction exist at Pomeroy which are not to be found at all forests by an itinerant Tool Instructor in Britain, and this system too particularly suits Northern Irish conditions

where no great amount of travel is needed from any point to the school, which is centrally situated. From the cross section of the instruction we were shown, it seemed well geared to provide the service it was designed to achieve.

We bid our adieus to N.I. on the Shanes Castle Estate in Co. Antrim which is part of Lord O'Neill's estate in this region. The estate of 1,050 acres, 690 acres of it being woodland, was a War Dept. dump during the last war, but we saw little effect of this period on the estate generally. Since little market existed for round timber in the locality, Lord O'Neill has erected a modern Cordmill to deal with all timbers felled on the estate, much of the converted timber being made up into pallets. The output of the mill was given as 30,000 cu. ft. per annum, and this is no doubt geared to the demands made upon it by the forestry branch, since I am sure output is potentially much higher. The woodlands on the estate carry a high amenity value, of course, and much of the timber seen would, from the standpoint of pure forest economics, be better felled, but it is nevertheless attractive to see large trees still standing, net discounted revenue notwithstanding, and no doubt a gradual feed of this timber into the mill suits the estate's plans from a number of standpoints.

One evening in a small town in North-West Ireland I called in a pub, with several other people, for refreshment. It was, it transpired, five minutes after closing time, and the following conversation took place:

Us: "Sorry, we see you are closed". LANDLORD: "Well, we are not exactly closed sir, we are sort of half open. What'll you be having?" I think I'll be having some more of this hospitable place at the first opportunity.

ROYAL SCOTTISH FORESTRY SOCIETY
68th ANNUAL EXCURSION TO WEST SCOTLAND 1965
10th to 14th May

by
J. Lee
Forester, Dean Forest

The party assembled at Kingscleve Hotel, Helensburgh, on Monday evening for dinner and afterwards were addressed by Mr. J. W. L. Zehetmayr, Conservator, West Scotland, on statistics of his Conservancy. It was interesting to note the growth in forest units and production since 1947. Acreages have increased threefold to a total of 153,000 and production from 150,000 hoppus feet to 1,820,000 hoppus feet.

Perhaps the most startling increase is the proposed production during the next two years. Volumes for F.Y.65 being 2,750,000 hoppus feet rising to 3,610,000 hoppus feet in F.Y.66. Pulp production for the Fort William Mill is the prime cause for this expansion. The Conservancy is now geared up for the pulpwood operations. Supplies are being obtained from clear felling of the poorer Norway spruce and Sitka spruce supplemented by thinnings. Whilst appreciating the difficulties in organising an even flow of supplies one feels that the preparation of produce comprising of 25% saw logs and 75% pulp will be relatively easy. Extraction is another matter. We were to see later in the Excursion the difficulties to be encountered.

A cruise of the lochs was organised for the whole of Tuesday, with a brief visit ashore to inspect the Kilmun Arboretum. Unfortunately the weather on this particular day was far from obliging. Low cloud, rain and almost arctic conditions, spoiled, to a certain extent, what would have been a most enjoyable trip.

We sailed from Craigendoran up Holy Loch to Kilmun, thence to the Arboretum. Time restricted any intensive tour and inspection was confined

chiefly to the Eucalypts. The possibility of growing these species commercially was discussed and it is clear that climatic conditions are against any such venture. These species afford one of the best examples in Britain of exotics severely limited by low temperatures. A wide range of varieties were seen. One, *Eu. vernicosa* had been coppiced in the previous year resulting in a single year's growth of 5 ft.

A small stand of *Nothofagus procera* attracted attention. Planted in 1935 it has reached a top height of 37 feet. Although this species is susceptible to severe climatic conditions it was suggested that it would be a possible tree for planting in temperate zones as a mixture with conifer blocks, giving amenity and possible pulpwood or timber. The latter, imported from Chile, was described by a timber merchant present, as having a considerable reputation.

After lunch ashore we re-embarked sailing via Loch Long, Lochgoil and Arrochar. The low cloud restricted any really good views of the forest. Even so enough was seen to appreciate the considerable difficulties to be encountered when production operations commence. It was pleasing to note the successful endeavours to landscape the hill planting. The breaking up of pure conifer blocks with hardwood, larches etc. gives a pleasing effect.

After dinner talks were given by Mr. Best, Conservator, North Wales, on aesthetic roles played by the Forestry Commission, and by Mr. Palmer, Curator, Glasgow Museum, on wild life conservation stressing the importance that the formation of new forests play in the increase of wild life.

Wednesday was Open Day. Our party, greatly increased by local members were welcomed to Boturich Estate by the owner Robert Finlay, Esq.

He was followed by Mr. W. D. Macgregor, Forestry Consultant, who gave an introductory talk on forest policy on the Estate. Although only amounting to 437 acres some very active forestry is now being practised.

A severe gale in 1912 utterly destroyed this well-planted estate of maturing conifers. From that time until 1958 apart from a few scattered acres forestry was neglected. Since then the woodland areas have been brought under a planned system of management with the help of the Scottish Woodland Owners' Association technical advisory service under the approved scheme of the Forestry Commission.

The ground runs from almost sea level to 600 feet. Soil and climate denote a high yield potential. Conditions are so good that the choice of species is wide. Hardwood plantings are of oak, ash, sycamore and poplar and conifers being the spruces, pine, Douglas fir, *Tsuga* and *Abies procera*.

Our first stop was Knockour Wood comprising:—

(*a*) 100 acres of scattered mature oak with extensive large scrub. This was coppiced in the last century on a 27-year rotation. Value at present time being assessed at £100 per acre.

(*b*) Site of 30-year Sitka spruce felled in 1960.

An analysis of financial return of this wood which may be compared with (*a*) above follows:—

Volume and Cash Yield from Sample Felled.

		£	s.	d.
Timber 8 to 14 ins.	97 hoppus feet @ 2/7	12	10	0
Timber 6 to 8 ins.	113 hoppus feet @ 1/11½	11	1	0
Pulpwood	81 hoppus feet @ 1/7½	6	11	4
Stakes	9 hoppus feet	1	3	3
Other	4 hoppus feet		3	8
	304	31	9	3

Average return per hoppus foot (equivalent standing value)=2/0¾d. per hoppus foot. Calculated total yield per acre to age of 30 years=4,303 hoppus feet valued at £424 17s. 2d. per acre.

Treatment of an area as described in (*a*) above was seen at the next stop. The old oak had been removed and partial clearance of the scrub in an acre or less plots. This was planted with selected species. Whilst appreciating the amenity and shelter purposes I thought these small plots would be a problem fo future management when the trees were in the thinning plus stages. Possibly the memory of the devastating gale has influenced this policy and stabilisation of crops was more important than difficult management.

A variation of planting through scrub was seen later. A heavier removal had been effected with planting in strips of species varying in growth rate. With exception of one or two of slower growing trees very little attention will be needed to get this crop through the shelter scrub. This area has all promise in forming an attractive mixed forest.

After lunch the Annual Business Meeting was held at Boturich House. On completion the day finished with a demonstration of transplanting mature trees by Scottish Land Development Corporation.

The following day saw our visit to the Ballochyle Estate. On route Mr. Zehetmayr gave a commentary on the Ardgartan, Ardgoil, Glenfinart and Benmore Forests seen in turn on the journey.

We were met at Ballochyle by Mr. T. D. Cotter Craig, Director of Economic Forestry Group.

The estate comprises 1,700 acres of coniferous forests with 300 acres of planting reserve. Altitude of ground planted runs from 20 ft. to 900 ft. with steep slopes in places. Rainfall is 70 inches p.a. Soil is mica schist with boulder clay and peat.

First plantings were made in 1921 when Bryant and May bought the estate. Aspen was tried at first but abandoned because of failure of crops. One still sees the occasional survivor scattered in existing crops.

A stand of Sitka Spruce P.37 Qual. Class II was our first inspection.

Crop figures in April 1964 were 320 stems/acre. Basal area 115 sq. ft., volume 3,328 hoppus feet and top height of 65 feet.

The last thinning (Eclectic) produced 552 hoppus feet per acre. This was in 1964. It was felt generally that some of the suppressed trees left would not respond sufficiently to warrant their retention and removal in the thinning would have been better.

Another stand of Sitka spruce P.29 Quality Class II/III was visited. A mill-wood thinning had been carried out in January 1965, when 1,045 hoppus feet p.a. had been removed. Object of this type of thinning was to obtain maximum saw logs periodically with the remaining crop to grow on forming a further volume of saw logs thus delaying a clear fell and replanting.

A very open crop has resulted from this thinning and whilst personally I think the remaining trees will respond rapidly I should welcome the opportunity to see if my opinion is confirmed in about five years' time.

A very fine stand of *Tsuga* P.27 of Quality Class I was seen. Crop figures in April 1965 were 350 stems/acre. Basal area 129 sq. ft. volume, 4,620 hoppus feet and top height of 80 ft.

It was interesting to note the complete absence in past felling of butt rot. It is apparently a first crop on the area.

A most interesting day finished with tea being kindly provided by the management.

Friday morning was spent at East Kilbride Development Corporation Woodlands.

The Corporation has been at pains to preserve existing timber wherever

possible and to produce additional plantings from the outset of the new town development. At present there are some 450 acres of woodland under the Corporation's control.

P.55 plantations of Japanese larch, Sitka spruce and Lodgepole pine were inspected and it was interesting to note the difference in growth on made-up soil with the growth in other parts.

Following an inspection of the nursery and plantations of P.64/5 planting of Sitka spruce/Lodgepole pine mixture on peat moorland site the Party returned to Torrance House for dispersal.

In conclusion I should like to express my appreciation for the hospitality shown on the estates visited and trouble taken to make the excursion most interesting and pleasant.

68th ANNUAL MEETING AND EXCURSION OF THE ROYAL SCOTTISH FORESTRY SOCIETY; WEST SCOTLAND

by

W. T. Roe

Forester, New Forest

By arrangement with, and through the kindness of private woodland owners, the Economic Forestry Group, the East Kilbride Development Corporation and the Forestry Commissioners, the 68th Annual Excursion of the Royal Scottish Forestry Society consisted of visits to private woodlands, township and state forests in West Scotland. The headquarters for the excursion was Helensburgh, Dunbartonshire, the members taking part being 68.

The following is a report of the excursion, which I have the honour to submit.

The meeting commenced on Monday, 10th May, 1965, at 8.30 p.m. after dinner. The excursionists were welcomed to Helensburgh by the President of the Royal Scottish Forestry Society, Major Jardine Paterson. The meeting was then addressed by Mr. J. Zehetmayr, Conservator for West Scotland, Forestry Commission. In his address, Mr. Zehetmayr presented a series of statistics comparing the years 1946 and 1964 as they affected the West Scotland Conservancy. These showed that F.C. forest units had increased from 23 to 51, an increase of 103,000 acres (50,000 in 1964 to 153,000 in 1964). The planting programme in 1946 was 1,000 acres, in 1964 7,500 acres. The thinning area showed a staggering increase from 412 to 3,637 acres and the total production from about 150,000 hoppus feet in 1946 to 1,820,000 hoppus feet in 1964, an expected 2,570,000 hoppus feet in 1965 and an estimated 3,610,000 in 1966. Staff also showed increases 1964 being about double on the 1946 figures.

In Private Forestry in 1947 there were about 130,000 acres suitable for economic management. Of this 20,000 have been transferred to F.C. and 1,000 to agriculture. 9,000 acres of bare land have been added bringing the current acreage to 118,000.

Of this, 113 estates, total acreage 43,000, is Dedicated and Approved Woodland. 17,000 acres is deemed to be efficiently managed, 26,000 not managed at all, and a further 36,000 acres is scrub land, 19,000 acres of which is suitable for forestry. It would seem, therefore, that there is plenty of scope for expansion.

To this end Mr. Zehetmayr spoke of the need to bring new ideas into force and remarked on two points which had revolutionised nursery techniques in Scottish Forestry. The use of weedkillers on nursery seed beds had freed the labour force for such jobs as late lining out; and the use of cold storage of seedlings and transplants had made it possible to line out in the nursery and plant out in the forest when conditions are right even to the extent of late planting in May and early June.

The use of machinery in preparatory ground operations e.g. ploughing up to 75 per cent of the ground available, laying in drainage furrows as preparatory ground continued, to cut the cost of preparing ground, planting and weeding, was another example quoted of forestry enlightenment.

In the production stages, specialised gangs were envisaged, production being geared to the use of power saws, and Isachsen winches, in which only two classes of produce, viz. pulpwood and saw mill timber, would be handled. Figures of 75 per cent pulpwood and 25 per cent timber were quoted of which it was expected that more than 50 per cent would be handled by contractors and the rest by F.C. gangs.

Before any of this production could be brought to fruition, however, a good road system would have to be laid down. It was estimated that 1 mile of road to every 100 acres would be necessary and the fact that this could very well cost up to £5,000 per mile had to be squarely faced. This constituted the big problem in South-west Scotland and was to form one of the big discussion points of the tour as a whole.

The second day of the excursion, Tuesday, 11th May, was devoted to a cruise of the sea lochs near Helensburgh, with a landing at Kilmun on Holy Loch to view the Arboretum and Eucalyptus gardens at Benmore. Unfortunately the brilliant sunny weather of the previous day was not repeated and we embarked on the *Countess of Breadalbane* at Craigendoran in a thick mist with drizzle. By the time we had reached Holy Loch the cloud base had lifted from about 20 ft. to 800 ft. above sea level. The party were conveyed by lorry and "Workabus" from Kilmun Pier to Kilmun Gardens where a word of welcome from Mr. T. A. Robbie, Forestry Commission, Glasgow, preceded a tour of the gardens and eucalyptus plots.

The gardens are situated at the head of Holy Loch with an elevation range from sea level to 1,200 ft. and enjoying a maritime climate. Mr. J. Atterson conducted the tour of the gardens, which started at the higher elevations where plots of red oak and *Nothofagus procera* were most outstanding. Planting of the gardens had commenced in 1946 and were continuing. The eucalyptus plots were limited to those elevations below the 800 ft. contour. Most of the plots were in extremely good health, varying of course in their rates of growth. Some had reached 30 ft. in height and average breast-height quarter-girth was around 4 inches. The form of the trees in all of the plots was extremely good, the poorer specimens having been cut out. The timber of these was surprisingly heavy. An example of coppice growth shown had reached a height of 3 feet in one growing season, and it was intended that growth rate experiments be carried out with these shoots.

An example of *Eucalyptus peniniana* was shown which in its native Tasmania rarely exceeds 5 ft. in height. This specimen was already more than 30 ft. high and still in good health and vigour. A plot of *E. gunnii* was in flower, and there was ample evidence of old seed pods. Experiments were afoot to see if the seed is fertile in Great Britain.

The arboretum plots are arranged by genera making detailed study easier. Gaps between the species have been planted with smaller groups of ornamental hardwoods—maples, limes etc.—to improve the amenity of the hillside.

After lunch the cruise was continued from Holy Loch to Loch Long and Loch Goil by way of Ardgoil and Arrochar taking in the Forests of Glenfinart, Ardgoil and Ardgartan and the magnificent scenery of the Argyll National Forest Park. It was obvious to all that a great deal of thought and planning had gone into the establishment of these forests. The interests of amenity have not been forgotten: the blocks of Sitka spruce, Norway spruce and Douglas fir have been broken into irregular patterns by the intelligent use of larch, birch and

scrub oak, creating a patterned hillside pleasing to the eye, but ever mindful of the soil pattern of which it is composed.

We were welcomed back to Helensburgh by a burst of sunshine which set the seal for the rest of the tour.

The evening of Tuesday was devoted to a talk by Mr. Best, Conservator, North Wales, who spoke on the amenity and aesthetics of the Forest. In pointing out that the Forestry Commission was obliged to make the forests available to the general public at large he stated that it was both sensible and essential to the safety of the Forests to have camp sites and picnic sites where the general public could be safely concentrated. This had been done in many parts of the country and examples of this had been pointed out during the day's cruise.

The visual aspects of amenity and aesthetic landscaping were not always pleasing to the forester. The general public's views had been sought on many occasions to ascertain their feelings on tree species, shapes and colours and the field of view was indeed vast. It is a matter of educating the public to appreciate the variety of species available for planting, their colour and shape, both in summer and winter, which make or mar good sites and bad; this is a basic necessity in planning amenity and landscaping. For example, in flat or rolling countryside the choice of species is not apparent except at the edges of the plantations, so it is on the outsides of the blocks where amenity considerations must be concentrated. Similarly, hard lines of boundaries and straight planting rows are not evident. The reverse is the case on steep hillsides viewed from a distance. The colour and shape are always visible and the outlines very evident.

The remedies are obvious; in uniform country uniform forestry is acceptable. In broken hilly country vary the species to soil types, following nature and good silviculture. Large blocks of dark conifers can and should be broken by use of larch and hardwoods to please the eye. Strips on hillsides should be avoided, preference being given to groups. On the better soils beech, Norway maple, cherry, sycamore and red oak all have their use, taking colour into account.

In conclusion Mr. Best pointed out that planning in Forest Parks was very strict and it is usual to submit felling plans and planting programmes to the planning committees before work commences.

Mr. Best was followed by Mr. Chapman of the Scottish Council of Recreation, and Mr. Palmer of the Scottish Wild Life Trust who gave enlightened lecturettes on Orienteering (an international outdoor activity based on the intelligent use of map and compass) and Wild Life in Scotland (with particular emphasis on the birds and animals seen during the cruise) respectively. In response to questions from the audience Mr. Palmer built up a fascinating picture of the changing pattern of birds and animals one would expect to find in converting a bare unprotected hillside, into an enclosed thrifty forest.

On Wednesday, 12th May, the excursionists were entertained at Boturich Estate by Mr. and Mrs. R. Findlay. After a brief intrduction by Mr. Findlay in which he outlined the work which he had had carried out, the meeting was conducted on a tour of the Estate by Mr. W. D. Macgregor, who has been in charge of the forestry operations. The area involved is one of 437 acres rising from sea level to 600 ft. on good soil and with a good climate. There is the risk of windblow due to exposure. The acreage breakdown is as follows:—

Bare ground	91	acres	(20%)
Heavy scrub	34	,,	(8%)
Recent plantings	247	,,	(57%)
Young conifers (29–34 yrs)	22	,,	(5%)
Predominantly mature hardwoods	43	,,	(10%)
	437	,,	(100%)

Mr. Macgregor outlined the history of the estate since 1912 when the entire standing crop was blown down in one night. Between then and 1958 little, if any, forestry had been undertaken with the exception of some small plantings of conifers. In 1958 a planned system of management was brought into being with the help of the Scottish Woodland Owners' Association. Planting is now carried out in groups on strips under light shade conditions. The choice of species is wide; hardwoods being planted are oak, ash, sycamore and poplar. Conifers are selected from spruces, pine, larch, Douglas fir, Western hemlock and Noble fir.

All thinning and felling operations are carried out by Estate workers. The produce resulting from these operations is sold direct to appropriate markets. To facilitate extraction earth roads have been laid out, and where appropriate these have been surfaced to carry 20-ton loads.

The first stop in the tour of the estate woods was an area of mature oak and birch which had had an undercrop of rhododendrons. This undergrowth had been cleared by schoolboys earning 2/6 per hour on piecework. The stumps were then treated with ammonium sulphamate. Total cost £880 for 10 acres. Discussion took place as to whether this job was really necessary at this stage as no plans were ready for any further treatment. It seemed to most of us that this was an unnecessary expenditure. The oak was of a reasonable size and quality standing at about 40 stems to the acre with large birch standards in between. The general concensus of opinion was that the oak could very well be removed now, thin out the birch and replant with *Tsuga heterophylla* or *Abies procera*, or Douglas fir.

The next stop was at an area of Oak standards with very heavy undercrop of large scrub. The majority of this wood was being cleared and the ground replanted under very light shade. The financial returns from this type of ground was calculated at £424 per acre, comprising mill timber, paper pulp, stakes and linoleum pulp. Again the choice of species was wide. This area was the last to be treated in this way, all future operations on the estate being done on the "dapple-shade" principle. The results proved the value of this change of policy, as an area of 100 acres of exposed hillside, which had been blown down in 1912, colonised by birch, and planted from 1958 onwards using some of the birch as shade showed great promise with most of the species available having been planted. This will produce a wind-stable mixed wood of economic importance, and will be an area of high amenity value. The owner was finally convinced that this is the way to deal with his woods, accepting as a natural hazard the dangers of windblow.

Following lunch, the Royal Scottish Forestry Society held its Annual General Meeting in the grounds of Boturich Castle, and later the Scottish Land Development Corporation demonstrated their tree moving machinery and techniques. These large, cumbersome machines seemed out of place in these surroundings and proved difficult to manage on soft ground. I, personally, felt that the lighter equipment used in the New Forest last year did a better job.

On Thursday, 13th May, the party was split into two sections. Landowners, land agents and forest officers were entertained by the Forestry Commission at Glenbranter, while Foresters and Head Foresters were taken to Ballochyle Estate near Benmore. The journey by coach emphasized the value of amenity as we travelled via Glen Finart, Arrochar, Rest-and-Be-Thankful Pass, Loch Fyne and Loch Eck to Benmore. The planted faces of the hills were broken by outcrops of rock, by pockets of larch and hardwoods, and in some places by flowering trees also. A shrub similar in appearance to Snowy Mespilus was much in evidence. This is *Stransvesia davidiana* and helped to fill corners too small for tree planting.

Ballochyle Estate is managed by the Economic Forestry Group. It is an area

of some 1,700 acres of coniferous plantations on ground rising from 20 ft. to 900 ft. above sea level with steep slopes in places. Average rainfall is 70 inches per annum. The soil comprises rock mica schist, with boulder clay and peat. The estate was bought by the Economic Forestry Group from Bryant and May in 1960 and is now owned jointly by 4 owners, which complicates the management. The Economic Forestry Group was set up in 1955. Its aim is to acquire financial help from clients in places where forestry is not possible, e.g. the large cities, and divert this to the development of forestry in the areas where it is possible. The main policy is the production of the maximum amount of sawmill timber. Thinnings were marked with this aim in mind and we were conducted around the estate to see some of the results of this policy.

The first stand visited was a 3-acre block of quality class I, P.37 Sitka spruce. Normal thinning practice had been exercised up until 1962. In April 1964 large trees only were removed to provide sawmill timber leaving on the ground 320 stems per acre, volume of 3,328 hoppus feet. It was hoped that the small stems left would fill out in time for the next thinning in 1967. This seemed very unlikely as the majority of the standing stems, average height of 60 ft., only had about 10 ft. of narrow crown. The chances of any large development of volume in these conditions seemed remote. Local foresters were fearful of snow damage and the effects of gales bending the stems over.

The next stop was in a stand of quality class II, P. 26 Norway spruce. The stand was being thinned to the available markets for the produce and again large numbers of sub-dominants were being hopefully left to increase in stature. Extraction by horse to the saw bench in the estate yard was being carried out. All sawing and sorting was done there.

Nearby a P.27 quality class I stand of *Tsuga heterophylla* was visited. This was last thinned in 1963. The standing volume now is 4,620 cu. ft. per acre from 350 stems/acre. This is equivalent to quality class III Sitka spruce which was in an adjacent plot. The sawmillers liked the timber, which was free from any butt rot.

Two further plots of quality classes II/III and III Sitka spruce on opposite sides of a ride were then visited. The removal of the largest trees for saw milling had again been practised giving the standing crops a lean look.

Our visit concluded with a marking competition on a one-fifth acre sample plot. Most of us were surprised at the results achieved in comparison with the markings that the Economic Forestry Group foresters had agreed upon. Our average final crop trees numbered 60 to the acre. The Economic Forestry Group were only leaving 15 to the acre, and some were of inferior quality to those selected by the excursionists. The visit had been a very interesting and highly controversial one. We all voiced the opinion that very soon decisions would have to be taken as to the outcome of the crops as we could foresee there being nothing with which to form a final crop.

As this was the last evening of the excursion a ceilidh had been arranged. This was enjoyed by everyone, and afforded an opportunity for people to let themselves go.

On Friday, 14th May, the party was again divided into two, this time on a territorial basis. Those travelling north went to the Duntreath Estate near Strathblane. For those of us going south a visit to the New Town of East Kilbride had been arranged. Of the party of 18 who set out from Helensburgh to visit the New Town only four of us managed to find our way to Torrance House, the headquarters of the East Kilbride Development Corporation. This was due to the very complex road system leading from Glasgow to East Kilbride, involving negotiating ring roads and numerous roundabouts. The defaulters loss was our gain, however. We were welcomed to Torrance House by the Managing Director of the Corporation who outlined the 1946 New Towns Act

with the aid of maps and charts to illustrate the connection with the New Town at East Kilbride.

To enlarge on this introduction we were taken to the model room, where models of the shops, offices and houses were on view, and a complete scale model of the New Town in relief. It was easy to see from this how the Town planners had incorporated in their schemes the natural contours, the streams and existing woodlands and the existing trunk roads. These latter have been linked with neighbourhood roads to divide the town into communities, each one self-contained with shops, schools and churches. No child has to cross a motor road to get to school, and no family needs to go more than a quarter of a mile to the shops. The main feature of the New Town is the Town Centre, where shops, offices and civic offices are arranged in a traffic-free zone. The Town Centre is accessible to all parts of the town by bus or foot way. The natural streams have been incorporated into "greenways"—footpaths beside the streams, tree lined, and paved. The paved ways have electric heating systems beneath the surface to obviate icing in the winter months. Where necessary these foot ways are carried under the roads by means of subways or over foot bridges, thus completely segregating pedestrians and vehicles.

It was interesting to learn that the money required for setting up these New Towns is borrowed from the Central Government at commercial rates of interest, repayable in 20 years. Industry and commerce—shops and offices—buy their factory, shop and office space at an economic price and pay to the Development Corporation a share of their profits. Housing is mainly for renting, and at present is below the economic level. However when the population reaches 70,000 it is expected that rents will be increased to the economic level of £200 per annum for a 3-bedroomed house, with dining room-lounge, kitchen, bathroom and lavatory, garden and garage space. The upkeep of the fabric of the houses rests with the Development Corporation, the upkeep of the gardens and verges on the communal roads is the responsibility of the tenants.

After this introduction to the New Town we were taken on a tour of the town by the Development Corporation staff. The first stop was at the eastern side of the town where some wet ground and steep slopes had been planted with spruce, and larch respectively. These crops were thriving and it is the intention to retain some old beech in the area for amenity. This would form an effective screen between the industrial areas to the east of East Kilbride and the new town itself. We were then taken through some of the roads of the town where amenity plantings of flowering shrubs and trees had been carried out on the banks adjoining some of the roads. The variety of plants used was large, with berberis, forsythia, mahonia, species roses, poplars, cherries, birches, all being widely used. These had been kept in distinct blocks, which seemed to miss the point of amenity planting. I felt that by intermingling the shrubs, a better effect would have been attained. The quality of the labour force at pruning time apparently had led to this arrangement, it being easier to put an unskilled man into a block of shrubs of one type and show him how to prune that type than to put him in a mixed block requiring different treatments and expect him to remember every type as he goes along.

We were taken to a 3-acre nursery where trees and ornamental shrubs were lined out for future use in the town and for sale. The bulk of these ornamentals are imported from Holland at highly advantageous prices. The aim is to line these out early in the year and use them the following autumn. Any remaining in the lines are then sold off and new stock bought, rather than keep them in the nursery lines. The forest trees used, mostly spruce and larch, are from local sources. Ornamental standards come from Holland and include birch, cherry, horse chestnut, whitebeam and sycamore. These 8 ft. to 10 ft. trees are costing 12/6d.

each—cost of plant and carriage, lining out, and replanting at site, a most economic figure.

The rest of our tour of the town was devoted to seeing the uses to which these trees and shrubs are put, and included a visit to the Town Centre to see the shopping centre, to visit the offices being erected, and to go over one of the houses being offered for rental, and one for sale. These vary little in design, the main difference being in their siting with relation to the road systems. The industrial areas on the outskirts of the town are sited so that the prevailing south-west wind would clear away all smoke without inconveniencing the inhabitants. This was a most stimulating and fascinating tour which rounded off a most memorable week.

Throughout the week our attentions had been focused on amenity, aesthetics and access, in varying degrees to meet the local needs. At East Kilbride all three were demonstrated to the full.

In conclusion I would like to thank all those who made it possible for me to join this 68th Excursion of the Royal Scottish Forestry Society at Helensburgh.

The Horse

"In the long term, say over ten years, new machinery will probably be developed that will carry out successfully the extraction at present carried out by horses."

Forestry Commission Booklet No. 11
1964

It seems in Nineteen seventy-four
Our woods will see the horse no more
For experts say in time to come
An Isaachsen with double drum
Equipped with steel wire rope and cogs
Will very simply haul our logs
From stump to road. And then again
A Hovercraft with blocks and chain
May cheapen and improve extraction
And give the greatest satisfaction.
To lift five tons will be a cinch
With modern hoist and powered winch
For foresters; or so it's said
But these odd thoughts are in my head.
A finch's nest would look quite bare
Without a lining of horse hair
Or Giles' garden rather poor
Minus a load of short manure
Old Diesel fumes and black sump oil
Will not enrich a sandy soil
And will the haulier for good luck
Nail a rear wheel from his old truck
Above the garage double door
When blacksmiths make horse shoes no more?
Will foresters require a horse
In Nineteen seventy-four? . . . Of course!

R. J. J.

STUDIES OF PARTICULAR TREES

CONIFERS IN ALASKA

by

J. P. Anderson

(*From the book "Flora of Alaska", Iowa State University Press*, 1959)

contributed by

R. Lines

District Officer, Silviculture (North), Research

Introduction

Naturally in such an extended area, climate varies. The Pacific Coast districts are characterized by mild winters and cool summers. Zero temperatures are rare and in some places unknown, while the average summer temperatures are between 50° and 60° F. Precipitation is heavy, and there is much cloudy weather. The eastern part of this region, from Cook Inlet eastward, is largely covered by a heavy forest growth, some trees reaching very large size. Along the Alaska Peninsula and the Aleutian Islands, summer conditions are unfavourable to tree growth, probably due to the excessively cool summers.

Following up the Bering Sea Coast we have a tundra-like formation merging into the true tundra farther north. These formations are treeless, covered in summer with a growth of low shrubs, grasses and sedges with intermixture of other herbaceous plants. In the true tundra the soil is permanently frozen, thawing a few feet at the surface each summer. The woody growth on these so-called barren lands consists mostly of dwarf birches, willows, and members of the Heather Family.

The interior districts are characterized by short, warm summers and long, cold winters. Summer temperatures are higher than in the coast districts, and and the precipitation is comparatively light with long hours of sunshine. January temperatures in most places average below zero Fahrenheit. This region is largely covered by forest of moderate growth. Some limited districts, such as the head of Lynn Canal and Cook Inlet with the Matanuska Valley have climatic conditions intermediate between those of the coast and the interior.

From what has been said it can be perceived that there are three main types of vegetation in Alaska: 1. The heavily forested central and eastern Pacific Coast districts dominated by Sitka spruce and western hemlock. 2. The more lightly forested districts of the interior characterized by birches and white spruce. 3. The tundra and tundra-like districts of the Alaska peninsula, Aleutian Islands, Bering Sea littoral and Arctic slope. This latter type is also found in the other regions above timberline on the mountains, the alpine meadows occurring at successively lower altitudes until they meet the tundra. In types 1 and 2 are found muskeags or peat bogs. These are areas of a few square metres up, characterized by a surface covering sphagnum moss underlaid with moss and other vegetation in various stages of decay, merging gradually into black muck, and the whole saturated with water. This mass of water-logged material may vary from less than one metre to many metres in depth. The surface usually is dotted with small ponds, and growing in the moss are very much stunted trees and characteristic shrubs and other plants, the whole having somewhat the appearance of tundra.

Pinus contorta Loud. **Lodgepole or Tamarack Pine, Scrub Pine**

Usually a low scrubby tree or shrub growing in and around muskeags in the coast region. Leaves in two's, 3 to 5 cm. long; staminate aments orange-red, about 8 mm. long; cones oblique-ovoid, 3 to 5 cm. long, usually persisting for several years; wood hard, light reddish-brown, coarse-grained.

Distribution: Glacier Bay to California. The form in Yukon Territory is the var. *latifolia* Engelm. (var. *murrayana* Engelm.), an upright-growing, slender tree up to 25 m. tall and distributed in the mountains from the upper Yukon Valley to Colorado to California.

Tsuga heterophylla (Raf.) Sarg. **Western Hemlock**

A large tree up to 60 m. tall and 1½ m. in diameter; branchlets yellowish, pubescent; leaves flat, rounded at the apex, deeply grooved, 8 to 20 mm. long; staminate aments yellow; ovulate aments purple; cones 16 to 22 mm. long; scales puberulent; wood pale yellowish-brown, light, hard and strong. Comprises fully 70 per cent of the forest stand in south-eastern Alaska.

Distribution: Kenai Peninsula to Idaho to Oregon.

Tsuga mertensiana (Bong.) Sarg. **Mountain Hemlock**

A small or medium-sized tree up to 30 m. tall and 9 dm. in diameter, but a mere shrub on muskeags and at timberline; leaves convex or keeled below, grooved above, narrowed toward the base, rounded at the apex, 12 to 22 mm. long; staminate aments purplish; ovulate aments deep purple; cones sessile, 4 to 6 cm. long; wood fine-grained, soft, and light.

Distribution: Cook Inlet to Idaho to Montana to California.

Picea mariana (Mill.) B.S.P. **Black Spruce**

A small tree, often scrubby, with pubescent branchlets; leaves stout, generally curved, glaucous, quadrangular, with blunt tip, 6 to 10 mm. long; cones oval or ovoid; the scales usually with slightly erose margins.

Distribution: Muskeags and hillsides, south-west Alaska to north of the Arctic Circle to Ungava Bay to Newfoundland to North Carolina to Wisconsin and Alta.

Picea glauca (Moench) Voss **White Spruce**

A medium-sized tree up to 28 m. tall and nearly 1 m. in diameter; branchlets glabrous, leaves rather slender, acute, 12 to 20 mm. long, bluish-green with more or less bloom; cones cylindric or oblong-cylindric, 3 to 6 cm. long, the scales thin, entire.

Distribution: South-western Alaska to Noatak River to Ungava Bay to Newfoundland to Maine to Wisconsin and Alta. Larger trees of this species furnish most of the lumber sawed in interior Alaska.

Picea sitchensis (Bong.) Carr. **Sitka Spruce**

Alaska's largest tree, reaching a height of 50 m. and a diameter of 2½ m. or more; branchlets glabrous; leaves acute or acuminate, 15 to 25 mm. long, keeled on upper surface, rounded or slightly keeled on lower surface, with two narrow bands of whitish stomata above and two wide bands below; staminate aments dark red; cones cylindrical or narrowly oblong-oval, 5 to 10 cm. long; scales thin, denticulate above the middle.

Distribution: Coast region, Kodiak Island and Cook Inlet to California. Alaska's most valuable tree. Besides furnishing construction lumber and woodpulp it is used in aeroplane construction and for piano sounding boards.

NURSERY WORK

SOIL REACTION AND TREE SEEDLING GROWTH

by

J. Atterson

District Officer, Silviculturist (North), Research

A demonstration of the effect of soil reaction on tree seedling growth was laid down in 1954 at the Forestry Commission Research Nursery on Bush Estate, Midlothian. The average pH value of the Bush Nursery soil at that time was between 6·0 and 6·5. Initially, sulphuric acid, then aluminium sulphate and, in recent years, flowers of sulphur, have been added biennially in amounts calculated to lower the pH values of two sq. yd. plots to 3·0, 4·0, 5·0 and 6·0. Calcium carbonate has been added to other plots to increase the pH value to 7·0 and 8·0. All the soil testing has been done by the Edinburgh School of Agriculture whose assistance is acknowledged.

Although calculated quantities of these chemicals were added, it was many years before the desired extreme pH values were reached and only then by applying up to three times the quantities originally prescribed. Maximum quantities applied at any one time were equivalent to 1,250 gallons concentrated sulphuric acid and 7·25 tons calcium carbonate per acre.

Species shown in this demonstration are Sitka spruce, lodgepole pine, Scots pine, Douglas fir, Japanese larch, western hemlock, common birch and common alder. All these species reach their best development as second year seedlings on plots where the pH value is between 4·5 and 6, with pH 5 generally being optimum.

Two other interesting and important lessons are also demonstrated by these plots: one is the dependence of the weed and moss population on the soil reaction, the other is the occurrence of magnesium deficiency in the seedlings growing on the soils with low pH values, The species with the most marked symptoms is lodgepole pine although all the others show similar symptoms, i.e. lack of chlorophyll. The weed population at Bush dislikes soils with a pH value of less than 6 and disappears almost completely on soils where the pH value is 5 or less. Moss, on the other hand, reaches its maximum development on soil with a pH value between 4 and 5.

The obvious conclusion to be drawn from this and similar demonstrations and trials is that the pH value of forest nursery soils must be kept between 4·5 and 6, and preferably around 5, as at this pH value conifers and some broad-leaved species reach their maximum development and most weed species are retarded or fail completely.

The appearance of magnesium deficiency on such soils cannot of course be corrected by applying Dolomitic limestone unless the soil pH value falls below 4·5. Such a deficiency can be prevented and even cured by foliar sprays of magnesium sulphate. The new Scottish Agricultural Industries, fertiliser "Kenmag", which is at present being introduced for field use, is excellent for such forest nursery soils as, in addition to nitrogen, phosphorous and potash, it contains magnesium.

TABLE 1. MEAN HEIGHTS (INS.) OF TWO-YEAR-OLD CONIFER SEEDLINGS

Species	Soil pH values					
	3·25	4·1	5·0	6·2	7·0	7·9
Scots pine	3·0*	3·5	5·0	5·0	3·25	2·5*
Lodgepole pine	3·0*	5·5	4·0	3·0	3·0	1·75*
Douglas fir	Failed	4·5*	6·0	7·5	4·5	4·5*
Japanese larch	6·0*	7·0*	15·0	10·0	6·5	6·0*
Western hemlock	0·75*	4·5	2·5	2·5	1·25	Failed
Sitka spruce	2·0*	4·25	7·0	4·75	3·25	1·75*

* Stocking very poor.

TABLE 2. MEAN HEIGHTS (INS.) OF TWO-YEAR-OLD BROADLEAVED SEEDLINGS

Species	Soil pH values					
	4·5	4·75	5·2	6·4	7·0	7·75
Common alder	1·5	1·6	1·65	}	Failed	
Common birch	13·9	16·25	12·25	}		

MACHINE LINING OUT THE SUPER-PREFER TRANSPLANTER

by

J. H. Nicholson

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Many methods of hand and machine lining out have been used in our nurseries, each method having some advantages. While not suggesting that the Super-Prefer Transplanter is the answer to the nursery forester's prayer and the ultimate in nursery mechanization, it is suggested that it goes a very long way to providing a reliable, quick method of lining out seedlings and transplants in a medium or large-size nursery.

Basically the machine is a five-unit transplanter completing one bed of five rows in a single operation, drawn by a suitably high-powered, low-geared tractor. The following notes relate to the machine which has now been used at Roudham Nursery, East England, since 1962 with complete success.

The Super-Prefer Transplanter is of French make, the present design first appearing in this country in the late 1950s. The parts are made in France and assembled in this country by the distributors, Nu-Way Benson Ltd., Droitwich, Worcs., from whom spares and various attachments can be obtained. One of the great features of this machine is the range of adjustments that can easily and quickly be made, affecting depth and width of furrow, spacing between plants in the row and changes due to different soil conditions such as stony sections or sections that may have settled since preparation or alternatively, sections that have been prepared for lining out only just previous to being required and therefore resulting in much loose soil. Fitted to the three-point

linkage of the tractor, the machine rests on four land wheels that are adjustable for height and give a maximum furrow depth on the five units of eight inches. Each operator provides the weight for compressing the soil around the roots of the plants. Each unit, three at the front and two at the rear, rides on two pressing wheels, the left-hand wheel driving, through a series of gear wheels, the transplanter distributor. The distributor consists of a vertical wheel with six, eight, 16, 24, or 36 pairs of spring-loaded grippers equally spaced round the circumference. Each pair of grippers acts like a finger and thumb, and when a little pressure is applied to one of these, the other is released and the plant is gripped between rubber pads and held in position on the distributor, with the roots on the outside, the shoot pointing towards the centre of the distributor wheel. The distributor rotates in the same direction as the land wheels. At the lower part of its travel, the plant enters a furrow opened by the share unit and while the soil is falling around the roots of the plant, a cam opens the gripper fingers, releasing the plant which is firmed by the two pressing wheels.

The front rows are spaced at 20 inches apart and the two rear units divide this, giving five rows at 10 inches apart, the minimum distance that can be obtained with this machine. Spacing between plants can be varied from two inches to six inches in seven stages with the 36-gripper distributor and from 3½ inches to 9½ inches with the 24-gripper distributor, the latter being more suitable for larger plants, e.g. two-year-old seedlings or transplants. A distinct advantage with the machine is that the five rows are all parallel even if perhaps not quite straight and this makes for easier and more accurate after treatment with sprays, particularly simazine. At present the machine leaves small ridges of soil between the rows and this is levelled with the Ferguson Rod Weeder before the simazine spray is applied. Trials are being carried out to fit hoes to the transplanter to level these ridges.

Adequate ground preparation is as necessary as correct machine adjustment for first-class results. If possible the ground should be prepared well in advance and the following system has been found satisfactory. On ground that has previously been ploughed, hop-manure is spread, then rotovated in, preferably several days before the ground is required for lining out. Just before lining out the ground is harrowed several times to give a firm level surface and it is essential that this should not be too loose and even a rib roller may have to be used to get the desired consolidation. This is the procedure used on the heathland nursery at Roudham where the average rainfall is 24 inches per year. The soil is very stony in places with flints, and ranges from black heath sand to light heath sand which is liable to blow in dry seasons. The underlying chalk is very close to the surface on some of the poorer sections.

A large tractor with a reduction gear is necessary for the slow speed required by the machine (about an eighth of a mile per hour). Two types have been used at Roudham, a Fordson Super Major with Lucas Hydrostatic Drive and a Fordson Major with County Commercial four-wheel drive conversion. The County crawler with large section tyres and four-wheel drive has been found to give the best traction.

A somewhat larger area of ground is required than with the same number of plants lined out by other methods. The width of the paths depends on the tractor used but may be in the region of 24 inches. A six-yard headland is required at each end of the section for turning as the transplanter is lifted on the three-point linkage after the operators have dismounted, though if the section is in line with another the turning room may need to be only four yards, using the other pathways to give more room. As long a section as possible is a great advantage, thus giving a considerable saving in turning time. 100 yards should be considered a minimum and this may necessitate a little re-organization in existing ground utilization. A nursery line is only needed for the first bed,

thereafter the tractor keeping as close to the previous bed as possible to give a reasonably straight line.

Some prejudice may have to be overcome with regard to machine lining out particularly with regard to bad root formation, or sweep on the roots which can occur if there is insufficient depth of furrow. This can of course happen with hand lining out but the Super-Prefer has been found to give a perfectly straight root and this can be verified by digging up any plant that has been lined out or by watching the plant on the machine, as it enters the furrow and as it is firmed by the pressing wheels.

The operators must be interested in the work to give good results, effecting adjustments as soon as necessary. All should be of comparable nimbleness to fill the grippers because the speed is that of the slowest and it will take some little practice to become adept at this. In this nursery of 30 acres the gang of six will do all the lining out by machine also lifting all the seedlings they require for this, which has been in the region of 3–3½ million per year. The best results have been obtained by the gang lifting their seedlings and lining them out the same day. The percentage survival of lined out plants at 1+1 is 95 per cent.

It is difficult to quote potential output figures as conditions vary considerably. At Roudham an average of 45 to 50 thousand seedlings per day can be lifted and lined out by the team of six quite easily. 80 thousand have been lined out in one day and in a timed hour, 16·5 thousand has been achieved. The team keep an occasional check on their "stroke" against the watch and regard 41 one-year seedlings per man per minute a minimum, 43 being an average rate. Instructions regarding speed, etc. are then flashed to the driver by means of a warning device that has been fitted. The piece-work price must vary according to the size of seedling, or transplant and the spacing, as this affects the amount of ground covered and turning time at the end of the run. For 1½ ins. to 3 ins. one-year seedlings at 2 ins. spacing, 7/6d. per 1,000 has been paid and for 3 inch, 1+1 Corsican pine transplants at 4 ins. spacing, 12/– is considered a fair price. The earnings are split equally between the team and the rate covers all minor adjustments and stoppages, etc.

This brings us to the transplanter's reliability and our experience has been that very few breakages occur in spite of our misgivings on first seeing the machine. A range of a few spares is held and can be fitted in a very few minutes. After three seasons' service, and approximately eight million plants, the machine was overhauled by replacing the share units, driving gears, springs and gripper pads, some of these being retained in case of need though this is not anticipated.

As delivered the transplanter is not equipped with a shelter for weather protection and this is very necessary, particularly against the wind. A light alloy frame has been constructed from material as used for high pruning rods. A small length of ordinary hoe handle was inserted in the tube where the frame cross-members were drilled and fitted. The whole shelter can be fitted to the main transplanter frame in a matter of seconds by six "U" clamps. The ridged roof is detachable and can be removed by undoing four "U" clamps. As the entire shelter and transplanter is attached to the three-point linkage and lifted on the hydraulics, it is essential that the frame should be as light as possible. A "tailor-made" tarpaulin cover was made locally for the shelter and the roof part is fitted with heavy-gauge polythene skylights. The sides have roll-up door entrances and the back also can be rolled up if required.

Occasionally the team require the tractor driver to stop, if, for example, an operator gets in a muddle with his plants or if a stone gets stuck in the unit, so to draw the driver's attention to this in his cab there is a warning light which can be flashed from the transplanter. Also spotlights in the transplanter shelter can be switched on for working in the winter when normally it would be too dark to see, early morning or late afternoon. Because of the frame affording

complete weather protection, lining out can be continued in rain or cold winds when normal hand lining out would be out of the question and only impossible ground conditions will bring the machine to a halt. The shelter and lighting are of local design and manufacture and are not supplied by the distributors of the transplanter. Spring cushion seats are a great aid to comfort and it goes without saying that the inevitable transistor radio is on a shelf in the corner.

Finally it cannot be stressed too strongly that this is a team operation whose skill and pride in their work must be encouraged and fostered to get the best results from what has so far proved to be a highly successful machine, increasing output, cutting costs, taking the hard work out of lining out and also at the same time increasing the earnings of skilled workers.

THE DELAMERE WIRE NETTING ROLLER

by

E. Waddelove, *Forester i/c Delamere Forest, North West England*
and P. P. Davis, *Forester, Delamere Forest, North West England*

In 1964 at Abbott's Moss Nursery, Delamere Forest, Cheshire, extensive bird damage was experienced on conifer seedbeds resulting in an almost complete failure of the crop.

It was decided, therefore, that in 1965 the seedbeds would be protected by galvanised wire netting 42 in. wide by ½ in. mesh. The laying down of the netting over the seedbeds presented few problems. A centre wire some 6 in. above the bed was erected; the netting was then rolled along the wire and bent downwards on either side, making a 3-inch wall.

Taking up the netting, however, is more difficult. Rolling up by hand is slow and may damage the seedlings. To carry the netting away from the beds unrolled, would require at least eight men as the rolls are 50 yards long. Rolling without tension would give a bulky roll difficult to handle and store. After much thought we decided that the problem could be solved by using a two-wheeled machine spanning the seed-bed which would pick up the netting and roll it at the same time.

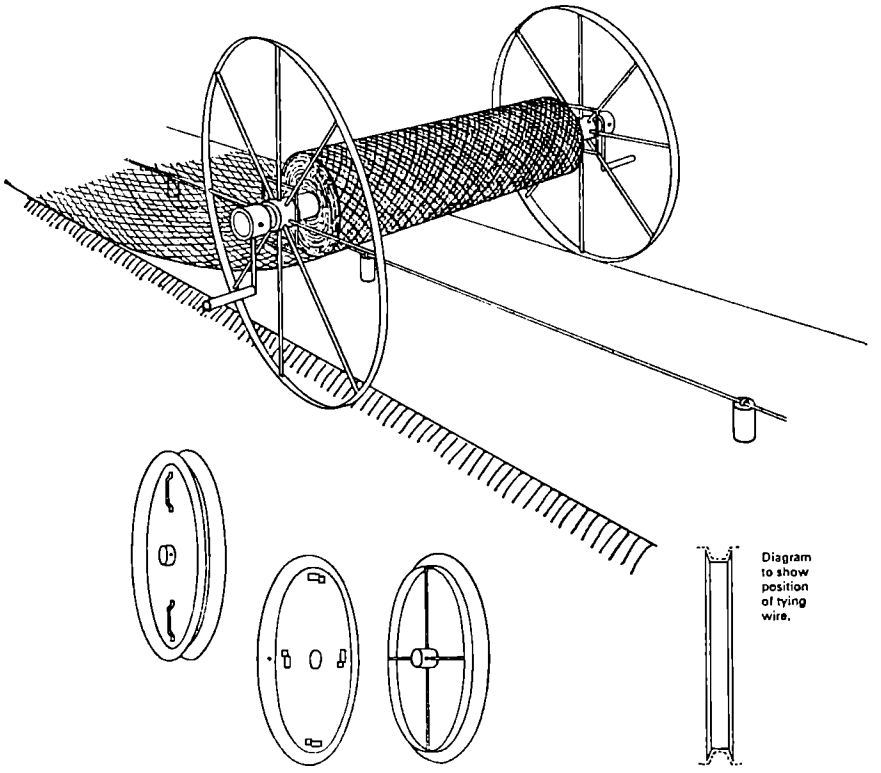
We then presented the problem and proposed solution to Mr. A. Walker, who has an engineering workshop at Hatchmere near the forest. He has frequently given valuable assistance in such matters and in this instance he suggested the principle of the "Wheeled Winch" which has been found very suitable for the purpose. The roller has been used to roll up 6,000 yards of netting this year and it produces a roll which is, if anything, smaller than the original. This simplifies storage problems and ensures that the material can be easily handled and unrolled the following year.

Description

Two wheels 4 ft. in diameter are mounted on an axle 5 ft. 6 in. long. The axle protrudes approximately 3 in. through each hub and is free to move within these hubs. A handle is fixed outside each wheel on the protruding 3 in. of axle and is bolted on to the axle by small bolts which can be easily removed. On the axle two holes are drilled at a distance slightly wider than the width of the netting. The netting is fastened to the axle by means of two pieces of thin wire which are threaded through the holes and can be cut with pliers when the rolling is completed.

To roll up the supporting wire neatly, a drum can be attached to the axle. This drum is 2 ft. in diameter and 2 inches wide, with sides made from mild

steel plates 2 ft. 6 in. in diameter, and is bolted onto the axle at a point approximately 2 ft. from one of the wheels, so that it does not foul the stakes which carry the supporting wire. The edges of the plates are dished outwards slightly so that the wire is led on to the drum. One of these plates is removable and is provided with cleats which fit under four bars welded onto the drum. There are two opposed handles on the plate which are used either to remove or to lock it in position. A hole to attach the wire to the drum is drilled in the plate.



The Delamere wire netting roller.

Method of Operation

An operator is required for each handle and, while winding, they hold back on the wheel in order to give sufficient tension to wind the netting tightly. The netting should remain anchored at the end of the seedbed until it is rolled up. It is advisable to flatten the bent down edges of the netting before commencing to roll it up. This can be done very quickly by using two pieces of board, one held on top and one underneath the edge of the netting, and running the boards along the netting. Mr. J. Crawford, one of the nursery staff, suggested this method after suffering considerable wear and tear on his hands by doing it without boards.

When the rolling is completed the loose end is tied in the roll to prevent its springing open and the machine wheeled to the end of the seedbed. A handle and one of the wheels is then removed,the thin wire attaching the netting to the axle is cut and the roll slid off the axle.

When using the drum for winding in the supporting wire, two or more pieces of tying wire are placed in the drum in the position shown in the sketch. The loose ends of these wires are twisted together to secure the coil before the side plate is removed.

MORE NOTES ON NURSERY UNDERCUTTING

by

J. T. Fitzherbert

Assistant Conservator, South Wales

In last year's *Journal* I reported jointly with Head Forester E. G. Hollowell on our undercutting work in South Wales. You may recall that the bulk of our work appeared to be with Douglas fir though we showed a photo print of undercut Japanese larch.

During the year we have been experimenting further and this time at Tair Onen Nursery under Chief Forester F. A. Slatter. I feel the results are worthy of record.

Up to now we have concentrated on the tap-rooted species and in last year's paper I mentioned that we often undercut the plant two, three or even four times in the year. I also mentioned that the second and subsequent operations were more like extensive cultivations than undercutting. These were our findings but we had nothing to show that there was a difference.

Austrian Pine

We chose this species chiefly because we had one small isolated seedbed of the species. We could see that the germination was going to give us far more than we expected or needed. Unfortunately we forgot that the site was rather too stony for the Marsh Undercutter (in fact we damaged the blade in trying it). However, we have got other types of heavier undercutters, mostly home-made on the Gunn Principle, and these went through the soil and produced quite a good job. The experiment was to see the different root formations after one, two and three undercutting operations. The undercutting had quite a useful effect on retarding shoot growth as well as improving the roots. With each cut the shoot was shorter, the root collar sturdier, and the roots bushier.

I have no doubts at all that the small plants with bushy roots will quickly outgrow the others even though they may need weeding in the first or perhaps even the second year. They will certainly not require staking in later life as the long ones undoubtedly will.

I think the Austrian pine have shown that our opinion on several undercuts was justified.

Sitka Spruce

We know these have not got tap roots but we now wanted to justify our statement that subsequent cuts were more like extensive cultivations. Again there is slight check in the height growth but not quite so marked as with a tap-rooted species, but the soil cultivation has certainly encouraged more fibrous rooting.

Conclusion

I think we can safely say that all species benefit by undercutting and the subsequent soil cultivations resulting from these underground operations. In fact, are we now getting nearer the day when there will be no lining out of plants raised by seed in the home nursery? We cannot abolish lining out completely just yet, as some nurseries are better suited to certain species than others and there are bound to be surpluses and shortages across the country.

However, I am quite convinced that very soon each nursery will be able to raise its quota of plants by undercutting at half the present price of transplants.

PLANTING

A TECHNIQUE FOR PREPARATION OF PEAT MOSS FOR PLANTING, ACHRAY, LOCH ARD FOREST

by
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Achray beat takes its name from Loch Achray in the Trossachs, but extends to the south taking in ground in the vicinity of Aberfoyle, on the Menteith Hills and in the valley of the river Forth, where at one time there were about 12,000 acres of basin-raised moss peat, between Stirling and Aberfoyle, though only about 4,500 acres now remain.

The first small area of moss peat was acquired as part of a larger acquisition in 1956 and was classified as unplantable. This moss was planted on an experimental basis and its apparent immediate success made it worth while to acquire other peat areas in the vicinity. Following are notes on the development technique and the underlying reasoning, leading up to the methods used on West Flanders Moss (900 acres) which was acquired as an economically plantable proposition, and is to be planted between FY 64 and 66.

Equipment and Technique Used

P. 57 Cardross Moss (50 acres)

Equipment—Platypus tractor and standard Cuthbertson plough with extended rims.

Technique—Drains mainly at 11 ft. spacing, about 15 inches deep with one row of turf spread between.

The area was very wet and the whole operation was only accomplished with difficulty. Leaders were deepened by hand, but a main ditch, proposed to cut across the plough drains through the centre, was abandoned due to the cost. It was completed in FY 61 by a Priestman Cub.

Cost—FY 65: Drains 11 ft., 5d. per chain (labour only) plus (powered vehicles and machine charges) probably about 10d. or 11d. per chain.

P.59 Rednock

The Priestman Cub excavator equipment with side boom and drag-line bucket was used to clean, deep, wide ditches that were nearly impossible by hand. The work done was so successful that the machine has since been used as standard equipment for similar work. Although somewhat expensive (£3+ per chain total direct charges), its flexibility makes it invaluable.

P.61—Cardross and Whitehill Mosses (120 acres)

Equipment—Long-wide County and standard Cuthbertson plough with extended rims and the Priestman Cub.

Technique—The intention was to differentiate between drainage and cultivation, but the purely practical difficulties of completing the work in the very soft and wet conditions pertaining, together with pressure of programmes, resulted in the area merely being plough-drained at 6 ft. intervals. Old ditches, and some new including the one started by hand in the P.57 area, were done with the Cub.

Cost—FY 60: Ploughing 5 ft., P.61: £5 5s. per acre.

P.61—Parks of Auchentroig (113 acres shallow peat)

Equipment—Standard County tractors and Cuthbertson plough with, in addition, prototype fully mounted single mouldboard cultivation plough.

Technique—Drains 18 in. deep were drawn at 27 ft. intervals across the line of the old sheep drains wherever possible. Some months later cultivation was complete, throwing turf 6 to 9 in. deep. In most cases a line of hand-spread turf was necessary adjacent the drain turf because of the use of a single mouldboard plough. The sheep drains-being deeper than the cultivation, effectively cut off any moisture in them and provided a 'seepage' drain into the plough drains.

Cost—FY 60: Plough 27 ft. (P.61)=26/6d. per acre.
FY 61: Plough 5 ft. (P.61)=33/6d. per acre.

P.62—Parks of Auchentroig (350 acres shallow peat and mineral)

Equipment—Standard County and Cuthbertson plough, also double mouldboard Cuthbertson and twin plough on Cuthbertson frame.

Technique—The same method of draining was used as for P.61. As a prototype *mounted* double mouldboard plough was not ready in time, the cultivation was completed with the *trailed* ploughs with surprisingly little damage to the existing drains. Damage would undoubtedly result using trailed equipment in moss conditions.

Cost—FY 61: Plough 27 ft. (P.62)=22/- per acre.
FY 62: Plough 5 ft. (P.62)=38/6d. per acre.

P.63—Gartur Moss (80 acres) and Parks of Auchentroig (70 acres)

Equipment—Standard County and Cuthbertson plough for drainage with 'Long-wide' County fitted with Ede linkage and prototype double mouldboard cultivation plough.

Technique—As for P.62 Parks, with the addition that on Gartur Moss an attempt was made with alternate drains, not to throw the cultivation turf closer than 4 ft. to the drains. By this means, and not planting the turf from the drain, such drains could be deepened at a later date by mechanical means, without damage to trees.

Cost—FY 63: Plough 5 ft. (P. 63)=22/- per acre.

P. 64 and 65—West Flanders (300 acres)

Equipment—Two 'Long-wide' County tractors. Standard Cuthbertson plough deep-draining Cuthbertson, prototype double mouldboard deep-draining plough; and Ede linkage, with double mouldboard turfing plough. Cuthbertson plough frames fitted with 'skid-floats' in place of wheels.

Technique—The compartment boundary/roadlines were laid to intersect with the drains at a wide angle, the preparation of ground being carried out in the following stages:—

(i) Seepage drains—(Standard Cuthbertson and single 'Long-wide' County) 15 inches deep at 90 ft. intervals, at wide angle to main drainage pattern. Cost is negligible.

(ii) Compartment drains—(Prototype double mouldboard deep-drainer and two 'Long-wide' tractors in tandem) 28 inches through seepage drains, the plough being lifted out to cross the roadlines and compartment boundaries. Spoil from alternate drains to be left unplanted. Productivity—50 to 60 chains per hour. Drainage cost 1/- per chain or about 20/- per acre, for a total of 6,045 chains including leaders in FY 64.

(iii) Leaders—(Single mouldboard deep drainer and two 'Long-wide' County's) 30–36 inches deep, linking ends of, and as required, across compartment drains. Costs included with (ii) above. The highest piece-rate was 1/- per man per chain.

(iv) Cultivation—(Double mouldboard plough fully mounted by Ede linkage on 'Long-wide' County) 8 to 12 inches deep, two runs between 30 ft. main drains, keeping close to, and away from the spoil from alternate drains (Double mouldboard). With an output of 15 to 20 acres per day, the cost in FY 64 was 18/4d. per acre, for 559 acres. The tractor driver was on a piece-rate of 5/– per acre.

(v) Burns and Ditches—(Priestman Cub complete with side boom drag-line) 4 to 6 ft. deep, the former are probably best done before the other operations, the latter afterwards, as they may form an unnecessary obstruction to the movement of equipment.
FY 63: Cub: £3 5s. per chain
FY 64: Cub: £3 7s. per chain
N.B. All costs quoted are taken from the Progress Report figures and include total direct charges (Labour and P.V. & M.)

Considerations Affecting Development

Within two years after planting the P.57 area, it was obvious that establishment of Lodgepole pine (7117) (2 oz. ground mineral phosphate at time of planting) was assured. The response of scrub Scots pine to drainage was striking also, but even more encouraging since, has been the success of Western hemlock planted under cover of a group of naturally seeded Scots pine. After seven growing seasons some have closed canopy at ground level. No weeding and virtually no beating-up has been necessary on any of the moss plantations.

On Cardross Moss, the surface vegetation, once sparse *Calluna*, *Erica tetralix*, *Eriophorum vaginatum* and *E. angustifolium*, nearly choked by a fast-growing mat of *Sphagnum*, is now largely vigorous *Calluna* with *Hypnum schreberi* as the predominant moss. From observation of the vegetational response to drainage on this moss, and the initial success of the planted tree species, together with observations of the growth of birch and Scots pine on Collamoon, East Flanders, Ochtertyre and Blairdrummond Mosses, mostly without benefit of drainage, but protected from fire, it appeared that it was nutritionally quite possible for any of the mosses in the Flanders system to grow a reasonable tree crop of the least demanding species, but to establish such a crop over a reasonable period, drainage and cultivation would be necessary. The indications being that the limiting factor to successful afforestation was not available nutrient but the practicability of carrying out mechanical operations from the point of view of physical possibility in relation to the limited bearing capacity of the moss surface, and the cost, the two being closely related.

During the autumn of 1959, conversations with Anders Tomter of Peat Utilisation Research and Forestry Commission Research staff, primarily Mr. M. V. Edwards, and the consideration of the latter's paper *The Development of Planting on Deep Peat*, together with observation of the Forth basin peats and other areas, e.g. the moss north of Hartwood Hospital, Shotts, led one to be impressed with the probability that the eventual pattern of drainage under forest conditions should be based on drains 3½ to 4 ft. deep, spaced at 50 to 60 ft. apart.

With this objective, the problem then resolved into the means whereby it could most satisfactorily be attained, it being obvious that drains of this sort, having regard to the retaining nature of peat, would only be of minimal assistance to the establishment of a plantation. Alternatively any excessive drainage and cultivation would be wasteful, indeed the former might even be damaging in drought conditions.

P.57 trees on the continuous Cuthbertson turf have been marginally faster than those on the spread turf. After seven growing seasons, the difference was rarely more than 15 to 18 inches, and frequently indeterminate, and with progressive drain deepening, the difference is likely to be further obscured, so that,

in terms of rotation, it may be considered as insignificant. Bearing this in mind it would then appear to be adequate merely to provide sufficient drains to remove excessive water from the surface and to initially lower the water table enough to allow establishment and closure of the canopy. The intensity and depth of these drains must remain a matter of conjecture until experiment has produced clear evidence. But it does appear likely that it may be directly influenced by the intensity of cultivation between the drains, since the retentive capacity and consequently the lateral drainage effect on the surface layers of the moss, are possibly related to the presence of living sphagnum. The ultimate answer may well be complete cultivation with mounted multi-furrow ploughs working outwards, from the centre of the strip between drains (30 ft. apart), and so producing a ridge effect. Rotovators might also be used. Drainage would be facilitated if the spoil from the drains could be broken up and spread over the intervening 'land'.

The formation of the above as a possible objective for initial preparation of ground, results from further conversations with Research staff, and various records left by the 'land improvers' of the Agricultural Revolution, who had considerable practical experience of the physical properties of peat.

The techniques at present in use have evolved from a combination of what was thought to be theoretically desirable and the actual equipment available.

With the P.61 area, it had been intended to differentiate between cultivation and drainage, and proposals were drawn up envisaging 'seepage drains' 12 to 15 inches. Sheep drains in the Parks of Auchentroig suggested the use of 'seepage drains' to cut off shallow cultivation; these to be cut across by Cuthbertson drains, two or three of which were to be held on the winch rope at 9 to 12 inches, and the third dropped to maximum depth (24 inches). Apart from one small area, the purely practical difficulties of completing the work in the very soft conditions prevented this being done.

The small area where this system was completed successfully is at the side of the moss. It was drier and consists of more humified 'dead' (irreversibly dried) peat from a low level. It demonstrates the free lateral drainage of 'dead' peats, in that the drains carry water when the cultivation channels are dry. The wet area of Cardross Moss also demonstrated the desirability of advance drainage, because of the difficulty of linking ends of 6-foot ploughing; and the effectiveness of the 'Long-wide' County tractor. The P.61 area on the Parks of Auchentroig showed the economy of advanced draining and the practical possibility of the use of mounted equipment between drains.

Since then, developments have been concerned with improvements in detail. In particular, the Ede linkage for direct mounting of equipment, as yet mainly the Double mouldboard turfing plough, but recent experience with a prototype draining plough has demonstrated a considerable potential, possibly as an alternative to Cuthbertson equipment. Other items that have been adopted as standard include the double mouldboard deep drainer, although only a prototype with certain design defects; the single mouldboard deep drainer with a long landside for linking ends in soft peat; the use of 'skid-floats' instead of wheels; and lastly, throughout these operations the 'Long-wide' County tractors which have demonstrated their serviceability in all weathers on soft sites where no other tractor has been able to work.

The spoil from alternate drains (30 ft. apart) is not planted, leaving a 10- to 15-foot lane at 60-foot intervals to facilitate the use of mechanical drain deepening and cleaning equipment at a later date. The present intention is that deepening should take place just before canopy closes, which on the evidence of our P.57 planting, a poor Fraser River provenance of Lodgepole pine, should be before "P.+10 years".

SOIL PREPARATION AND TREE GROWTH ON HEATHLAND SOILS
THE RIGG AND FURR SYSTEM

by

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During the past thirty years or so, ploughing has been the accepted method of soil preparation for large-scale tree planting on degraded soils in the British Isles. In particular, this has been so on heathland such as that of the North Yorkshire Moors, where mechanical equipment capable of operating in soils undisturbed for long periods has been in constant use and development. It is from these heaths, within Allerston Forest, that the observations and hypotheses in this paper have been deduced.

On these Allerston heaths, where much work has been done on a podzolised and compacted silty grit, four distinct phases have been involved: the shallow (4 to 7 inches) ploughing of the 1920's, which was largely investigatory, the moderately deep (8 to 11 inches) ploughing of the early and middle 1930's; the shallow single-furrow ploughing with deep (12 to 16 inches) subsoiling of the later 1930's and early 1940's; and the deep (12 to 16 inches) ploughing which commenced in 1943.

The justification in the 1930's for the acceptance of ploughing was based on experimental findings such as those quoted in Fig. 5 of the Forestry Commission *Bulletin* No. 32 (page 43). In brief, these results show that shallow three-furrow ploughing as well as shallow complete ploughing each had an outstanding effect on survival and height growth of Japanese larch and Sitka spruce, and that growth of Scots pine and Corsican pine was somewhat accelerated when compared with plantings on unploughed ground. Shallow (4 to 5 inches) single-furrow ploughing produced no observable response in the Allerston experiments.

Many systems of ploughing have been tried over the years, such as single, double, and treble-furrow, the former at varying depths, whilst complete ploughing was often advocated and used experimentally, again at varying depths. Subsoiling in combination with shallow single-furrow ploughing made for easy planting, but did not always suit species other than pine. In more recent years a double mouldboard type of tine plough throwing to the left and right simultaneously has become popular in some areas, as also has a single mouldboard version.

It should be noted that the deep ploughing initiated at Allerston in 1943 marked the introduction of a plough, the R.L.R., designed for, rather than modified for, forest use. The current basic system involves the making of a furrow, the excavated material forming a ridge over undisturbed soil, ridges being approximately 5 feet apart. The significance of the resultant micro-topography will be dealt with later.

Observable effects of ploughing on a site include:—

(1) The inversion or partial inversion of all or part of the upper profile, the natural vegetation being wholly or partly buried.

(2) The loosening of a proportion of the soil mass, thereby improving aeration and drainage.

(3) The breaking of the surface skin of peat, thereby exposing mineral matter to weathering.

(4) The rupture of the pan, where present and not too deep.

(5) The creation of drainage channels.

(6) To a greater or lesser extent to alter the micro-topography.

Whilst a thorough understanding of these and their indirect effects is necessary for an ideal method of soil preparation to be determined, measurements of tree growth will, at any given age, compare the merits of types of ploughing already tried. Early data, of necessity restricted to height growth, usually pointed towards complete ploughing as the most effective method of soil preparation.

Some of the older experimental plantings, covering the first and second phases of ploughing in the Allerston district, have, however, reached the stage when volume data are available. It must, nevertheless, be made clear that the ploughing comparisons available are confounded with different planting years and provenances, i.e., no single experiment exists which compares the essential states of ploughing developments in units large enough and old enough for measurements of timber yields. The comparisons available are, therefore, between experiments. Plots of Japanese larch and Scots pine scattered within the experimental area have provided similar yields on comparable ploughing for different years of planting, see Table 2. It is, therefore, assumed that the data quoted in Table 1 provide reasonably valid comparisons. The absence of Sitka spruce, a much used species for pioneer afforestation, is due to its inability to form canopy in this area without the use of a nurse and its further liability to enter a form of pole-stage growth fall-off. Neither the reason nor the remedy for the latter have yet been resolved.

Table 1 RESPONSE TO METHODS OF SOIL PREPARATION

Mean Annual Increment at 30 years in hoppus feet.
Increases (%) due to ploughing are in brackets.
Original experiment number and planting year included, later incorporation under a collective experiment number.

Ploughing Treatments	*Scots Pine* *Not manured*	*Corsican Pine* *Not manured*	*Lodgepole Pine* *Not manured*	*Japanese Larch* Basic slag at planting on mod. deep ploughing*
Not ploughed	37 No. 2, P28	64 No. 2, P28	71 No. 2, P28	Failed
Shallow (4″–7″) three-furrow	48 (+30%) Nos. 7 & 9, P29	66 (+3%) No. 9, P29	72 (+1%) No. 9, P29	Plots too small for volume assessment
Mod. deep (8″–11″) double-furrow	63 (+70%) No. 13, P31	74 (+16%) No. 45, P36	83 (+17%) No. 13, P31	85 No. 14, P31
Mod. deep (8″–11″) Complete	52 (+40%) No. 26, P33	69 (+8%) No. 26, P33	73 (+3%) No. 26, P33	81 No. 14, P31

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*Separate trials gave successful Japanese larch on moderately deep ploughing without slag. Plots too small for volume assessment.

Table 2 COMPARISON OF YIELDS BETWEEN EXPERIMENTS

Tests of site homogeneity in the Allerston Experimental area

Mean annual increment at 30 years (hoppus feet)

Species	*Ploughing*	*Experiment*		
Japanese larch	Mod. deep (8″–11″) complete	No. 14, P31 81	No. 26, P33 82	No. 33, P34 76
Scots pine	Shallow (4″–7″) 3 furrow	No. 7, P29 49	No. 9, P29 46	

Basic slag applied at planting to all plants in Nos. 14 and 26, to 50% of the crop at planting in No. 33. No fertiliser to Nos. 7 & 9.

Relevant points in Table 1 are:—

(1) Shallow three-furrow ploughing has had a marked effect on the yield of Scots pine, little or no effect on Corsican pine or Lodgepole pine.

(2) Moderately deep double-furrow ploughing has had an appreciable effect on each of the pines, Scots pine in particular, and an outstanding effect on Japanese larch.

(3) Moderately deep, complete ploughing has been less effective than has moderately deep, double-furrow ploughing for the pines and somewhat less effective for larch.

In seeking to determine the precise function of ploughing relative to the increased yield in this collective experiment, it is clear that volume of soil disturbed is not in itself a critical factor; complete ploughing would, for instance, disturb twice the amount moved in double-furrow ploughing. The clue probably lies in the comparison of the three-furrow and double-furrow results, where a correlation with depth of ploughing exists. The ridge and furrow effect of these ploughings does, in fact, create drainage channels, and the deeper the furrow, the greater becomes the volume of drained soil in the ridge. Support for the drainage theory can be found in the results for Japanese larch which is known to abhor conditions associated with poor drainage. Similarly, Corsican pine has been known to fail on obviously wet areas. Scots pine under such conditions is a little more tolerant in survival, but lacking in vigour. Winter waterlogging on the so called "dry heaths" of the eastern side of Britain is common enough, due to the seasonal surplus of precipitation over evapotranspiration, while many of the common plants *Eriophorum* spp., *Trichophorum caespitosum*, *Erica tetralix*, *Juncus squarrosus*, are indicators of wet acid conditions. The lower yields associated with complete ploughing could be due to a lack of drainage channels, aggravated by a reduction of pore space due to re-consolidation of the soil mass. In the early years, the ploughed zone was undoubtedly loose enough to be free-draining and well aerated, hence the good height growth of that period. It is, however, significant that the pines have been affected to a relatively greater extent than has Japanese larch by whatever adverse factor is associated with complete ploughing within 30 years after planting. Observation during dry periods indicates that some soils under Japanese larch can be dust dry, whilst similar soils under pines remain somewhat moist. If, therefore, Japanese larch transpires relatively large amounts of moisture, the species might well, at least for a time, help to drain its own site following the excellent start afforded by freshly disturbed soil.

The rupturing of pan by the plough is an undoubted aid to vertical drainage,

though possibly not directly essential for root penetration. Excavations in the 1930's and later, yielded evidence that pine roots from young trees were baulked by pan. Recent windblown 35-year-old Lodgepole pine on unploughed moor have revealed the presence of root activity below the pan. It might well be that trees, where growing successfully, will ultimately penetrate pan. This could mean that rupturing of the pan is only necessary in respect of drainage, i.e., on the assumption that impeded water causes the pan to become an effective barrier to root development. The deep (12 to 16 inches) ploughs in current use usually manage to rupture the pan at intervals or continuously, but do not necessarily penetrate the entire B layer where deposition of fine soil particles from the A horizon has helped to produce a horizon through which water appears to pass very slowly. This suggests a need for even deeper mechanical penetration, but before considering such, it is desirable to examine other problems associated with current methods of soil preparation.

The introduction of single-line, deep ploughing in 1943 created a problem of where to plant. The furrow side adjacent to the ridge provided for cheap planting, gave some shelter from desiccating winds, and ensured adequate moisture during the critical period after planting. Experimentation confirmed that such planting gave a higher rate of survival and better early growth than ridge planting. Some doubt was expressed at the idea of positioning trees 12 inches or so below the original surface, and much of the experimental planting of this era involved the cutting of a step into the ridge and placing the plant only slightly below the natural surface level, on the edge of the furrow. In the early 1950's this so-called step position was abandoned on account of the additional hand-work involved and because the furrow planting appeared entirely successful. During this era it was considered desirable to plant the tree in the vicinity of soil disturbed by the plough, a view not necessarily held to-day.

During the early 1960's considerable concern has been caused by the instability of young trees on deep, single-furrow ploughing. Examination of rooting systems has revealed unbalanced spread and development: namely, a marked tendency for roots to exploit the furrows with restricted entry into or below the ridge. There is a further tendency for roots to ascend during any development away from the furrow. Recent examination of rooting systems in some of the experimental plantings of the early 1930's, where the trees were notched into the natural surface between the furrows and where reasonable stability has been achieved, reveals a different type of root pattern and structure.

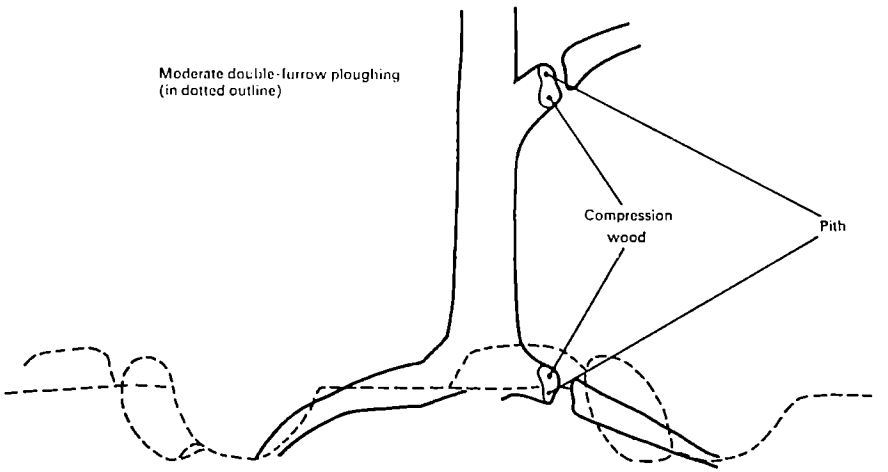

Fig. 1. A resistance root system straddling an unploughed "land" between furrows.

A typical example is given in Fig. 1 where it will be seen that a thickened root system straddles the unploughed strip between furrows, and that such roots in cross section are pear-shaped, the pear being upside down. Further examination shows that the root pith is near the base of the root, cambial activity being much more developed on the upper side. The extra activity is almost certainly due to the formation of compression wood, in which case it can be assumed that such thickened roots are the result of pressure induced by stem sway, just as thickening on the lower side of a branch is a reaction to the weight of the branch. The slightly descending nature of such thickened roots is possibly vital to their development as resistance roots; no roots of this form have been located in an ascending plane. Thus there appears to be a case for adopting some form of ridge planting in the interest of stability. A possible position is given in Fig. 2 where shelter for the newly planted tree would be afforded by the ridge, roots would be in a moist unploughed medium and the expected somewhat slower shoot growth in the early years would be advantageous in giving the root system time to develop and so resist early stem sway. Even so, there are disadvantages. Apart from the proximity of competing vegetation, effective resistance root length, at right angles to ploughing spaced at 5 feet, would not be more than half that distance and resistance roots longer than 2½ feet could be more than desirable. Double mouldboard ploughing at its 7-foot spacing offers the chance of resistance roots 3½ feet in effective length, still possibly on the short side, and not every forester would accept wider tree spacing.

No precise data are available for soil moisture above and below ploughing depth. On clays and clay loams, observation suggests that in the drier months conditions can arise when ridges are moisture-deficient, whilst furrows and the soil below remain decidedly moist. Some form of compromise appears desirable since in winter the ridges are probably ideal for root survival, whilst the lower levels are water-saturated. Examples of restricted rooting of a type recognised as being due to waterlogging have recently been located in leached Passage-bed sand over a compacted silty B horizon, double-furrow ploughed (8 to 11 inches deep) and planted 30 years ago. The restricted rooting occurred as bunches of short, fine, descending roots, mostly dead, emanating from a major lateral at the depth level attained by the plough. Depth of ploughing thus appears to be a factor likely to determine rooting depth limits in a soil which is not free-draining.

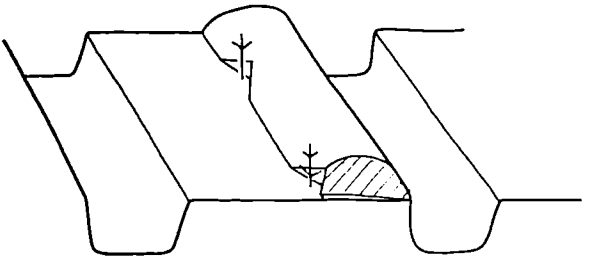

Fig. 2. Planting position on conventional single-furrow ploughing to give the root system shown in Fig. 1.

A further serious disadvantage associated with the undulating micro-topography of line ploughing is the resultant difficulty of access. Examination of data already given shows that for every 5 feet of lateral traverse across line ploughing there is a rise and a fall of 2 feet or thereabouts. One of the reasons for the introduction of the tine plough was an attempt to reduce this excessive rise and fall. Movement on foot among such ridges and furrows is tiring and time-absorbing, thus adding to the cost of operations, and early thinning experience on such terrain indicates that an appreciable length of butt will be left to rot due

to the difficulty of manipulating a saw below ridge top level. Apart from loss of revenue, the presence of such butts will add to extraction hazards and increase the *Fomes* danger.

Complete ploughing has often been advocated as an alternative to line ploughing, not only for its expected production of a balanced system of root-spread as an aid to stability, but also for the relatively unchanged topography. The failure of complete ploughing (in the absence of proper drainage) to produce higher yields at 30 years of age, whilst perhaps somewhat unexpected, does form a parallel with the results of pioneer efforts by agriculturalists to convert marginal land into pasture. (2). Their interpretation is that the burying of surface peat and humus, coupled with the absence of intensive drainage, leads to anaerobic conditions. This view is to some extent supported by an observation in 1949 for Broxa Experiment No. 19, involving an area of heathland, completely ploughed, and planted with 1-year seedlings in 1946.

The observation was that the area had been invaded by large patches of *Juncus squarrosus* within 3 years of ploughing. If, therefore, anaerobic conditions are liable to develop on afforested areas of complete ploughing, it is hardly surprising that yields are relatively low.

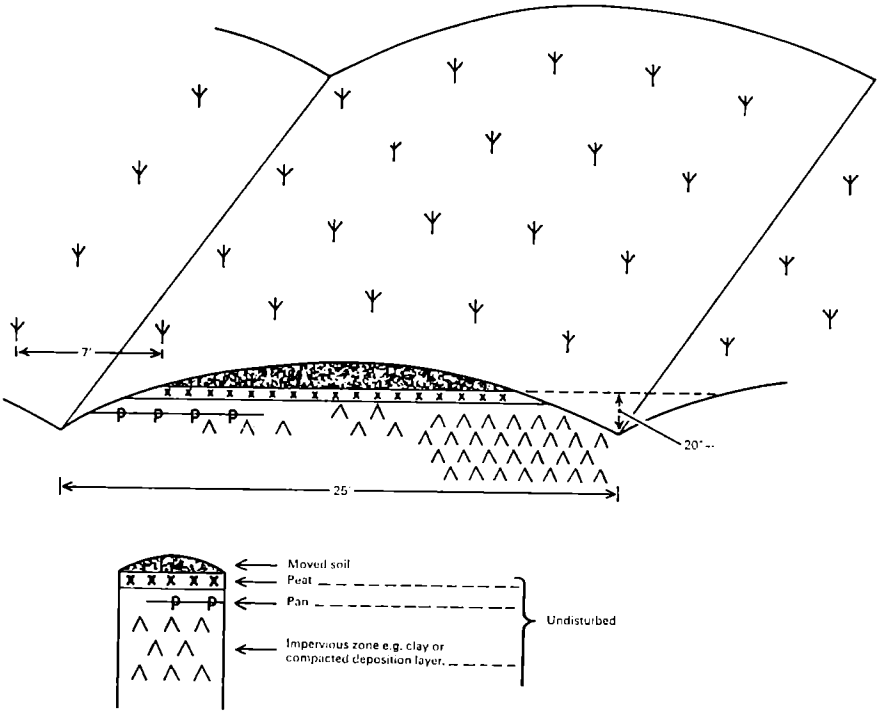

Fig. 3. A diagrammatic representation of rigg and furr.

Soil types are seldom constant over large areas, and it is significant that in recent years foresters at Allerston have become involved in soils of a much heavier texture than those previously dealt with. The higher clay content will aggravate drainage problems which will somehow need to be solved. The use of conventional open drains is not wholly acceptable on account of initial cost, need for maintenance, and the resultant hindrance to access.

Summing up, it would appear that what is needed is a revised method of soil preparation for tree planting designed to fulfil three requirements:—

(1) Adequate drainage to provide a rootable depth of at least 2 feet.
(2) The resultant topography must be such that balanced, wind-firm rooting systems can develop, and that access by men and machines is not appreciably hindered.
(3) Natural vegetation must be suppressed to avoid any need for weeding, and to preclude, or at least minimise, the chances of heather "check" during the establishment period.

Data in Table 1 indicate that timber yields have increased relative to depth of ploughing rather than to volume of soil disturbed. On this basis, any revised method of soil preparation should follow the advantageous principles of deep line ploughing, eliminating, as far as possible, its disadvantages. Since a transverse section of deep single-furrow topography consists of a series of 2 in $2\frac{1}{2}$ gradients or thereabouts, the simplest method of reducing the undesirable gradient is to widen the horizontal, and this, if done sufficiently, would allow deeper-than-normal furrows, thereby achieving the desired depth of drained soil. Suggested configuration and dimensions are given in Fig. 3. It will be seen that the base of each furr lies at least 20 inches below the original soil level. The top of each rigg is therefore 20 inches above the original soil level, and the total "rise and fall" is thus at least 40 inches in 25 feet. Therefore, though the furrows are deeper than normal, 20 inches instead of 12 inches, the pitch is much less—only 4 in 30 instead of 4 in 5.

There are other ways of arriving at the same solution, e.g., if drainage, crop stability and unrestricted access are the vital factors involved, "rigg and furr" topography as originally known and practised in agriculture appears likely to solve the problem.

The functioning and features of such amended terrain are expected to be:—

(1) The convex surface of the rigg will, according to soil permeability, shed a greater or lesser proportion of the rainfall into the furrs, which are in effect closely-spaced drainage channels.
(2) The convex rigg surface and associated drainage by lateral seepage is expected to provide conditions eminently suited to the formation of a stable deep-going root system. The type of root system envisaged has been well illustrated elsewhere (3).
(3) Excessive drying-out during droughty periods is less likely than with the narrow ridges of line ploughing. In any case, the expected deeper penetration by sinker roots, consequent on deeper drainage, will compensate.
(4) No "drainage" maintenance of any sort is envisaged. The amended topography should be sufficiently stable to last for several rotations.
(5) Access by men and machines would be easy.
(6) Whilst the burying of peat by debris moved to form the crest of the rigg simulates a feature of complete ploughing, it is thought that anaerobic conditions will be much less likely to develop in the rigg because of its unrestricted drainage features. Further, the mycorrhizal equipment associated with coniferous roots might well, in the absence of excess moisture, be capable of absorbing from the peat and so hasten its breakdown.
(7) The free-draining nature of the rigg will allow tree roots, sooner or later, to penetrate any undisturbed pan.
(8) The concentration of top soil at the rigg centre is no long-term disadvantage. Trees planted into or near to subsoil adjacent to the furrs could be at some disadvantage, though this is precisely the horizon into which most of our trees have been planted in the last 20 years. Final crop trees would almost certainly occur on or near the rigg centre, in which case some less sensitive species could be used along the furr edges.

(9) Effective suppression of vegetation appears likely, at least during the establishment period.

A limited amount of field work was done in the spring of 1963, with more detailed trials a year later (Rosedale Compt. No. 11), putting the foregoing theories to practical test, in comparison with conventional methods of soil preparation and planting. A variety of conifers have been used as test species, but unless fundamental workers can produce a quicker answer, 30 years or so must elapse before yield data become available. Information on stability could begin to be apparent much earlier, as will more precise data from relatively young experiments comparing the merits of conventional types of ploughing.

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Starlings

The starlings journey everywhere
From Ailsa Craig to Leicester Square
These chattering mimics may be seen
In coats of irridescent green.
When listening to them in the park
You might mistake one for a lark
Until you heard a bubbling squeak
And saw an open yellow beak
Pecking at insects on the ground
Running in circles round and round
Chasing an ant. But where they nest
I'm told they are a frightful pest.
The Min. of Ag. down in the South
Believe they carry foot and mouth
Bringing the virus into Kent
On visits from the Continent.
They roost in cities overnight
And when they leave the stones are white.
I know the sky is often black
With flocks of them as they fly back
They swerve and bank and cut a dash
But unlike aircraft never crash.
I watch with untold admiration
Their perfect flight and navigation.
One point however puzzles me
When starlings think it's time for tea
And turn to earth to eat a meal,
Who takes command and says "Right Wheel"?

R. J. J.

PROTECTION AGAINST FIRE AND WILD LIFE

CAN GLASS AND METAL CONTAINERS START FOREST FIRES?

by

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Most forest fires are related to the activities of man—industrial operations (milling, logging, and rail-roading), careless smoking, indifferent use of fire by the camper, and arson. Natural causes include lightning and spontaneous combustion. A few even have started by falling aircraft, rockets, and guided missiles. But are there less obvious causes of ignition in the forests?

Glass jugs and cans have been found at the source of forest and grass fires. Could these glass and metal containers start a forest fire by simply concentrating sunlight? The answer is definitely "yes"—but not in the manner most commonly supposed.

Broken kerosene and gasoline jugs occasionally found near the origin of forest fires have led to speculation that the volatile liquids were directly heated by the sun until gas pressure broke the container, and the liquid spontaneously ignited. This explanation is unsatisfactory because these volatile liquids cannot be heated to their autoignition point by direct sunlight. Besides, water jugs also are believed to have started fires. *However, another physical explanation is plausible: the capability of any transparent container, full or partially filled with a clear liquid, to form an optical lens and focus the sun's rays on to combustible materials.*

Forest fire researchers have long wondered whether containers could start forest fires. In 1946, Gisborne attempted to cause ignition in grass by scattering bottles and bits of broken glass in an open field. Apparently he was not successful. MacTavish (1960) recently reported that a Canadian forest fire research party, after finding several exploded cans in burned areas, examined the ability of aerosol cans to ignite light fuels. The cans originally held ether for starting cold engines. The Canadians decided that the cans were not heated to the point of explosion by direct sunlight after they found they could ignite punky wood by reflecting sunlight from the shiny concave bottom of an aerosol can. However, Dempewolff (1964) reports that aerosol containers, especially those for the new highly volatile ether engine-starting sprays, have exploded in closed automobiles under a hot sun, where temperatures readily soar above 150° F.

We repeated the Canadian's tests by igniting woody fuels with solar energy reflected from the bottoms of common aerosol cans. We also ignited various woody fuels and pine needles by using glass containers filled or partially filled with water to concentrate the sun's rays.

A can ignites a fire differently from the way a bottle does. The spherically concave bottoms of cans *reflect* and focus the sun's rays at a point near the centre of curvature of the reflector. Nearly all cans can be bent or deformed to make a similar reflector. Light rays passing through a bottle containing a clear liquid are *bent* or *refracted* so that they focus beyond the bottle. The effect is similar to that produced by a common reading glass. Because of the compensating effect of refraction at the four air-glass interfaces, there is very little convergence of sun rays that pass through an empty glass container. To focus sunlight, a vessel must contain a reasonably clear liquid having an index of

refraction approximately the same as its own. Water, kerosene, gasoline, and many other liquids meet this requirement.

We used aerosol cans to start fires by reflecting sunlight from the bottom of a can on to a piece of woody material about one inch away. Cans with shiny surfaces invariably started smouldering fires within a few seconds. The ignition capabilities of liquid-filled containers were examined by holding fuels near the focal point of the refracted light. The concentrated sunlight from some of the bottles caused ignition of dry pine needles within a few seconds. The needles smoked, but no open flames were observed between ignition and complete degeneration to ash. Cans and bottles both started smouldering fires in punky wood.

After determining that cans and bottles could start fires, we used the following laboratory method to determine the relative ability of each container to concentrate light rays. A collimated beam from a 16-mm. motion picture projector simulated parallel light rays from the sun. A type B2M photocell measured the intensity of light falling on the container and the maximum intensity near the focal point. The relative intensity factor was defined as the ratio of the maximum refracted or reflected intensity to the incident intensity. The results are summarized in Table 1.

Table 1. RELATIVE INTENSITY FACTOR AND IGNITION ABILITY OF CONTAINERS

Container	Maximum relative intensity ratio (lab. test)	Caused ignition in sunlight		
		Yes	No	Not sufficiently tested
1. Glass jug	28	X		
2. Pressure can (bright) ..	22	X		
3. Pressure can (bright) ..	20	X		
4. Rose bowl	14	X		
5. Fish bowl	12			X
6. Pressure can (dull)	11		X	
7. Syrup bottle	7		X	
8. Syrup bottle	6			X
9. Dressing bottle	6			X

The gallon jug (number 1) and aerosol cans (numbers 2 and 3) ignited pine needles in less than 10 seconds on a clear summer day. In sunlight passing through a Thermopane window in late October, bottles 1 and 4 and aerosol cans 2 and 3 ignited punky wood. The ignition ability should be much greater in direct summer sunlight. The ignition occurred whenever a container had a relative intensity ratio greater than 14. A coloured glass gallon jug and aerosol can with a dull concave surface (number 6) failed to ignite woody fuels in direct summer sunlight; the intensity ratio of this can was only about one-half that of a similar can with a shiny surface.

We concluded that aerosol containers and liquid-filled jugs and bottles can start fires in forest fuels by concentrating sun rays. When bottles or cans are found in burned areas, the fire may have been started by refraction or reflection of the sun's rays; rupture of containers is the result of fire, not the cause. The

probability of any given glass jug or metal can starting a fire is almost impossible to predict because of the interaction of several factors: container location and orientation, fuel distribution and condition, and weather.

Fires from these sources could be reduced by putting a dull finish on cans or by allowing only coloured glass jugs in forested areas. One thing is certain—the absence of glass and metal containers from woods and grasslands would lessen the probability of fire occurrence.

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NORTHERN IRELAND FOREST FIRE STATISTICS FOR FOREST YEARS 1962–1965

by

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The following tables give an analysis of fire reports submitted during the last three forest years. Unfortunately in F.Y.62 the fire reports were not so detailed and some of the information was rather vague.

Tables 1 and 2 summarise the outbreaks of fire by months and hour of day. It can be seen that April tends to be the peak fire month and that the worst time of day for fires is the period 4 p.m.–8 p.m.

Table 3 summarises the main causes of fire. In F.Y.62 the exceedingly large number of unknown fires tends to be misleading and it can be reckoned that the majority of these should be classified under "Suspected Heather Burning".

Table 4—A large proportion of the fires reported under the heading "Forestry Staff" were reported from the fire towers now covering the forests.

Table 5—This indicates the amount of money spent on protection in relation to the planted acreage covered by protection costs. Number of fires causing damage and their relative costs are also shown.

New techniques of protection and the fact that foresters have become more cost-conscious all contribute to lower costs, and this will eventually lead to a higher financial yield from the forest crop.

Table 1. OUTBREAKS OF FIRE PER MONTH

	F.Y.62	F.Y.63	F.Y.64	F.Y.65
October	1	0	1	0
November	1	0	0	0
December	3	1	1	1
January	1	3	1	0
February	5	14	8	7
March	11	8	9	16
April	84	13	13	35
May	39	5	5	7
June	31	18	4	1
July	2	0	4	1
August	0	1	1	1
September	0	1	0	0
Total	178	64	47	69

Table 2. HOURS AT WHICH OUTBREAKS WERE REPORTED

	F.Y.62	F.Y.63	F.Y.64	F.Y.65
Midnight–4 a.m.	5	0	3	2
4 a.m.–8 a.m.	0	0	0	0
8 a.m.–noon	26	5	0	3
Noon–4 p.m.	44	17	16	16
4 p.m.–8 p.m.	66	27	18	26
8 p.m.–midnight	37	15	10	22
Total	178	64	47	69

Table 3. CAUSE OF FIRE

	F.Y.62	F.Y.63	F.Y.64	F.Y.65
Unknown	126	28	18	23
Suspected heather burning ..	20	13	15	22
Children and youths	1	1	4	5
Hikers/picnickers/public ..	19	12	4	6
Malicious	4	3	3	7
Peat cutters	7	6	2	6
Forestry Staff	1	1	1	0
Total	178	64	47	69

Table 4. DETECTION

	F.Y.62	F.Y.63	F.Y.64	F.Y.65
Forestry Staff	No records	49	31	45
Public	readily available	12	9	21
Police		3	7	3
Total ..	—	64	47	69

Table 5. AREAS BURNT AND PROTECTION COSTS

	F.Y.62	F.Y.63	F.Y.64	F.Y.65
Area protected/acres	62,600	67,172	71,827	—
No. of fires entering plantations ..	19	6	7	4
Acreage burnt	18	*26	†7·5	5·7
Damage	£1,523	£2,693	£625	—
Damage/acre	5¾d.	9½d.	2d.	—
Total protection cost	£13,602	£14,079	£10,654	—
Protection cost/acre	4/4d.	4/2d.	2/11d.	—

* One fire 23 acres. † One fire 7 acres.

FOREST PROTECTION AND WILD LIFE CONSERVATION (MAMMALS AND BIRDS)

by
G. B. Ryle
Deputy Director General

General Aims

Protection

The Commission has a primary duty to prevent damage to forest crops; it has also a responsibility to prevent as far as possible damage to neighbour's interests by mammals and birds whose habitat at some stage includes Forestry Commission land.

Absolute prevention of damage is an impracticable aim, both financially and physically. Careful assessment must always be made of cost of damage and of alternative methods of preventing it, before deciding the action to be taken, which may vary from wood to wood.

Indiscriminate destruction of most of the species which cause damage is both wasteful and ineffective. In many cases some form of selective control is preferable; i.e. control measures should be exercised by selecting the season, location, individual or group to be killed of the species concerned, to effect damage prevention most economically and humanely.

Conservation

The growing importance of our forests as natural wild life reservoirs gives the Commission a responsibility for conservation and enlightened wild life management.

This involves liaison at every level with the Nature Conservancy and with such bodies as the Council for Nature, County Naturalist Trusts, local Natural History Societies etc. It will normally be the Commission's policy to continue to manage areas of forest subject to agreements with such bodies, only exceptionally leasing areas for direct management by them, under the special form of agreement.

The active encouragement of beneficial and harmless species of mammals and birds is a desirable subsidiary aim of forest management and can be achieved by small and inexpensive modification of normal procedure, for example the retention or creation of suitable wild life habitats in new planting operations.

The protection of rare animals is another responsibility, whether such animals have legal protection or not. For example, the Pine Marten and Polecat are beginning to increase in our property and should not be molested. The Pine Marten, like the Badger and Otter, is protected in the standard sporting lease.

The measures taken for conservation need not be costly; in many cases they involve only small modifications in normal forest management. Nevertheless they must be estimated and accounted for.

Recreation

There is an increasing demand for the use of forest land for various forms of recreation, some of which may be mutually conflicting, and all of which affect the wild life of the forest in different degrees.

These forms of recreation can broadly be separated into sporting (shooting, stalking and fishing), natural history study, and general access for walking, camping, climbing, riding, boating and sailing. Only sporting can be expected to yield a cash return, though the other forms can create an asset of equal importance from the national point of view.

The relative importance of each of these activities and their impact on other objectives, *especially the primary one of growing timber*, must be discussed in chapter 20 of the *Working Plan*, and summary prescriptions given in chapter 21, and detailed in chapters 33 and 34. Our current policy in respect of sporting, which cannot be divorced from forest management, will need to be reviewed systematically.

Where the sporting is let or reserved it is not the Commission's responsibility o control predators in the interests of game. It is the Commission's responsibility to undertake such supervision as is necessary to ensure that the tenant does not kill any protected mammals or birds, or any not permitted under the lease; and that he does take action to destroy such harmful mammals and birds as required in the terms of the lease.

Where the sporting is in hand, but not let, the Commission is responsible for controlling predators such as rats, crows, foxes (in non-hunting country) and mink which are at all times harmful to agricultural neighbours. Other species, if they become so numerous as to affect neighbours' interests or the populations of more desirable species such as song birds, may similarly have to be controlled.

Transfer of Animals

It is not the Commission's policy to permit either the capture of any species of mammal or bird for transfer elsewhere, or the collection of eggs of wild birds, for the purpose of introducing the species elsewhere. Exception may be made on H.Q. authority for scientific studies in co-operation with the Nature Conservancy, Research Institutes etc. The distribution of pheasants, partridges

and wild fowl and their eggs may be arranged in conjunction with recognised game management organisations, but Conservator's approval must be obtained.

Bonuses for Killing Animals

Under the policy outlined above the payment of bonuses or bounties for any animal killed is prohibited, except in the case of the fox in non-hunting country. Bonuses for killing foxes in non-hunting country are being continued at Conservator's discretion, but every effort will be made to evolve a more appropriate method of convincing the farming community of the Commission's determination to control foxes.

"Vermin"

This is an imprecise and inappropriate term capable of individual interpretation, and traditionally includes many species now fully protected by law, and others which from a forest management point of view are beneficial. It is not to be used in future. Instead, in conformity with usage now adopted by the Nature Conservancy, the Ministry of Agriculture and the Game Research Association, the terms *pests* and *predators* will be used to denote respectively those species directly harmful to tree or farm crops, and those that feed on others.

Records

With the cessation of bonuses, the annual return of numbers of animals for which bonuses have been paid will in future be confined to the *fox. Squirrels*, both grey and red, are the subject of a comprehensive questionnaire from Director Research each year, and this will continue. A new record form is being brought out to give details of deer killed on each forest to substitute for the questionnaire used hitherto.

Records are not required at H.Q. of other animals killed, but local records may be maintained at Conservators' discretion.

Training Aids

The establishment of *Field Museums* at appropriate forests is of value not only for training Commission staff in the wild life aspects of forest management, but also for demonstrating to the general public the broad range of true forest management and thereby gaining their co-operation and active interest.

Simpler aids to the same purpose are *Forest Walks* and *Nature Trails* designed for various age-groups and interests.

The development of a sane wild life policy will call for the expenditure of time, patience and (some) money. Expenditures and revenues must be included in budgets, and any major items, such as the formation of a forest museum, will call for a reasoned explanation and H.Q. approval.

Notes for Guidance

Introduction

Fuller accounts of the feeding habits and status in forestry or agriculture of many of the species listed can be found in the following official publications.

Wild Birds and the Land. *Bulletin No.* 140, *Ministry of Agriculture, Fisheries and Food.*

Wild Mammals and the Land. *Bulletin No.* 150, *Ministry of Agriculture, Fisheries and Food.*

The Grey Squirrel	*F.C. Leaflet No.* 31
Badgers in Woodlands	*F.C. Leaflet No.* 34

Crossbills	*F.C. Leaflet No.* 36
The Capercailzie	*F.C. Leaflet No.* 37
The Crested Tit	*F.C. Leaflet No.* 41
Woodpeckers in Woodlands	*F.C. Leaflet No.* 42
Voles and Field Mice	*F.C. Leaflet No.* 44
The Roe Deer	*F.C. Leaflet No.* 45
Titmice in Woodlands	*F.C. Leaflet No.* 46
Birds and Woodlands	*F.C. Leaflet No.* 47

It is rarely possible to assert that a species of mammal or bird is wholly beneficial or wholly harmful. Much depends on the numbers present, local circumstances, time of year, food available and a whole complexity of conditions.

For the purpose of this paper animals are classified as follows, but it must be recognised that some species could be placed in more than one category.

(a) *Pests.* Animals directly injurious to forest or farm crops.

(b) *Predators.* Carnivorous animals, normally beneficial or neutral to forest crops in that their food includes pest species and other predators, but which may have to be controlled for the benefit of farmer neighbours or other reasons.

(c) *Game and wildfowl.* Some species, e.g. deer and blackgame, can do extensive damage to trees. Game management can affect forest management in varying degrees and cannot be divorced therefrom.

(d) *Beneficial and harmless animals.* The vast majority of birds and some mammals fall into this category. Many of the birds are protected under the *Protection of Birds Act* 1954.

Pests

Damage can be prevented or reduced in the following ways:—

(a) *Protection*: methods applied to the crop to protect it while vulnerable, e.g. fencing, silvicultural measures, use of smears (doubtful).

(b) *Control*: destruction of the pest species by the most appropriate means—this may include biological control.

Both in methods of crop protection and in direct control of animals, it is becoming increasingly apparent that selective action is the most sensible and effective. Only vulnerable parts of the crop need full protection and only for the period that they are vulnerable. In using direct physical control measures it must be emphasised that extermination of an animal is seldom or ever a realistic aim within the boundary of economic practicability. Such control must therefore be selective, i.e. applied to that part of the population when and where it will do the most good. Control of pests by virus infection and by other means, e.g. sterility, still in the experimental stage, are not dealt with in this paper.

The following brief notes on pest species are not intended to be a summary of *methods* of control, but of the policy for control.

Rabbit. Continuous action is necessary to reduce numbers by all legal means. Young plantations may need fencing against rabbits, but the justification for incurring this cost needs proper economic assessment in each case. It is the Commission's policy to support all effective Rabbit Clearance Societies in whose area F.C. land lies. Predators such as stoats, weasels, buzzards and badgers help to check rabbit numbers.

Hare. Local and periodic control necessary.

Grey Squirrel. A predator on the eggs and young of game and other birds as

well as a pest of trees. Annually protect vulnerable crops just before and during the damage period. Universal extermination is not a practicable aim by present available methods.

Red Squirrel. Damage can be severe, especially in pine woods; vigorous control is necessary. Any major increase in Red Squirrel population might make it a more serious pest than the Grey Squirrel.

Rat. Though not so common in forests as in farm land, the rat must be ruthlessly destroyed whenever it appears. It spreads disease as well as doing vast damage to stored foodstuffs. Also a predator of poultry, game and beneficial birds.

Voles and Mice. Periodic control necessary in young plantations.

Edible Dormouse. Vigorous control necessary in the limited range of this animal.

Coypu. Vigorous control in the interests of agriculture. M.A.F.F. must be informed of occurrence in new areas.

Pigeon. Local co-operation to control near vulnerable farm crops may be called for. Organised mass shoots have proved ineffective and have been discontinued by the Agricultural Departments and all subsidies for them dropped.

Starling. Roosts occasionally damage plantations and must be dispersed.

Finches and other Passerines. Nursery seed beds, especially of pines, must be protected.

Predators

The policy regarding predators needs careful consideration and sensible selective application. Predators do not as a class directly damage trees and many of them have a beneficial effect by feeding on pests of forest trees. In so doing a single predator participates along with a number of other predators. It is doubtful if predators control their prey; it is more likely that the number of prey "controls" the number of predators.

It has also been found that if one species of predator is eliminated from an area, another species may very quickly establish itself to seek out and kill the same prey. This further emphasises the need to be selective in predator control; the elimination of one species might "let in" a less desirable one. This possibility must be remembered when the Forestry Commission is urged to take action to control certain predators which are thought to be damaging sporting or farming interests.

There are generally only a few species that we are justified in destroying by every possible means at every opportunity in our own and our neighbours' interests. These are Rats, Carrion and Hooded Crows, and the Mink.

All other predators are to be controlled selectively, i.e. at the most appropriate season or place to achieve the object of control. This planned control will vary in intensity in different local conditions, and from year to year as natural populations of both predator and prey fluctuate. In some cases it may be only an individual animal in a local population that needs dealing with, e.g. a "rogue" badger.

The following notes on species of predators must be interpreted in the light of local conditions and the Commission's general policy.

(a) *Fox.* In the main hunting counties, control is left to the local hunts supplemented by direct action by the Commission, by agreement with the hunt when damage to sporting and farming interests justify it.

In hill farming areas and where no adequate hunts operate, vigorous control of the fox is necessary. Even so, it is probably most effectively and economically carried out selectively by intensive operations just before and during the lambing season.

Mapping of all fox earths on Commission property is a sensible and

worthwhile measure to provide information on which to base control; it has also great value in discussing fox control with neighbours.

(b) *Badger.* Beneficial to the forester and farmer and not to be molested. Badger gates avoid damage to fences. The sporting lease prohibits the tenant from molesting badgers. Occasionally an individual rogue proved to be doing persistent damage may have to be shot.

(c) *Otter.* Food includes pests such as rabbits, mice and voles. Even in preserved fishing waters the number of eels and cannibal fish killed by otters probably offset the game fish taken. It is the Commission's policy to permit otter hunting on F.C. property only where it has been traditionally carried out hitherto; but not in new territory. There is no reason for the Commission to take any direct action against otters, and a sporting tenant has no right to do so.

(d) *Stoat and Weasel.* Powerful allies in the control of rabbits, rats, mice, voles, and other pests, it is only near poultry farms and pheasant-breeding pens that control is necessary. It is not the Commission's responsibility to control stoats and weasels in areas where the shooting is let or reserved. F.C. staff should only take direct action in other areas if neighbours' interests are seriously threatened.

(e) *Rat.* Both as a predator and a pest, the rat must be ruthlessly destroyed.

(f) *Mink.* The feral population of this animal, arising from escapes from mink farms, is extending its range and may now be firmly established locally as a highly undesirable addition to the fauna of Great Britain. A riverine species, it is a serious predator of fish and water fowl, as well as poultry, and its destruction wherever found is essential. Wherever mink are discovered the Agricultural Department or the local Pest Officer *MUST* be informed at once.

(g) *Wild Cat.* Action by Forestry Commission only necessary in cases where lamb or poultry killing has been proved.

Feral domestic cats can occur anywhere and can do damage to game interests, but they can also be useful in killing squirrels and voles. When control is necessary care must be taken to distinguish these from wandering family pets.

(h) *The Crow Family.* Apart from the Carrion and Hooded Crow, all the other members balance their predation on eggs and young of game birds and poultry by feeding on many of the worst pests of tree and farm crops. Where the sporting is let it is the tenant's responsibility to control magpies, jays and jackdaws and occasionally rooks as necessary. It should be rare for the F.C. to have to take direct action against them.

(i) *Gulls.* Occasionally in some forests near the sea coast, it may be appropriate for the F.C. to co-operate with farmers or the Nature Conservancy in the control of Black-backed gulls, and Herring gulls.

(j) The only other groups of predatory birds commonly occurring on F.C. property are the birds of prey and the owls, all of which are fully protected under the Protection of Birds Act 1954.

Game and Wildfowl

By "Game" is meant those species for the killing of which a Game Licence is required, i.e. deer, pheasant, partridge, grouse, blackgame, capercailzie, woodcock and snipe. "Wildfowl" includes all species of wild geese and duck and some of the waders.

Forestry Commission land, both planted and unplanted, provides habitats

varying from ideal to poor, for many species of game and wildfowl. A sporting value additional to that arising from the growing of trees is a desirable asset. Terms and conditions of acquisitions, however, vary widely, even within the same forest, and give the Commission varying degrees of control over this resource and the benefits deriving from it.

Deer. The forest forms an ideal habitat for deer of all species which have increased and spread with the expansion of forests in this country. Uncontrolled, deer multiply rapidly, and do great damage to trees and farm crops. The Commission's policy regarding deer control is set out in SM 125 (originally issued as WLM 1). Since that memorandum was issued the sporting value of deer stalking in woodlands has increased as it has become better known. The development of deer stalking under licence is one of the main recommendations of the report *Land Use in the Highlands and Islands* issued in October 1964 by the Advisory Panel on the Highlands and Islands.

Blackgame and Capercailzie damage plantations in the early formation stage and local action may be neccessary to prevent damage. As both these species are protected by close seasons and are highly prized by sportsmen and naturalists damage must be prevented as far as possible by cultural methods. Direct control, which can only be locally effective, must not infringe the legal close seasons or involve the destruction of eggs.

Other Game. Pheasants and partridges occasionally do damage in nurseries when seed is germinating; otherwise they are generally beneficial in eating harmful insects, particularly cockchafer grubs.

The carrying capacity, and hence the sporting value of a shoot, can be improve d greatly by thoughtful forest management. Appropriate modifications, small but important, to normal forest management to create a favourable habitat for game can enhance the sporting value very greatly. These modifications will have an insignificant effect on the main objective of timber production, though current sporting values are such that substantial production losses could be offset by increased sporting rentals. Distribution, size and timing of fellings, provision of flushing points, use of firebreaks for growing game food crops and care and understanding of the needs of game in day-to-day management are examples of positive action that can be taken to provide additional revenue from this resource.

Much research and observation are needed on the conditions in big conifer blocks for increasing game potential. But one thing is certain, the right type of habitat is the dominant factor in holding game and is of greater importance than the killing of predators which may in fact, in reasonable numbers, have a beneficial effect in preventing disease and maintaining a satisfactory balance. Stoats eat rats and rabbits as well as pheasant chicks.

Wildfowl. None of the wildfowl can harm the forest, and there is much that can be done to improve or create habitats for this group of birds at very little expense or effort.

The introduction of their natural food plants into ponds and lakes; the creation of new ponds in low-lying marshy areas unsuitable for commercial tree growth, by simple dredging, dozing or damming (which will also provide water for fire protection); the provision of nesting baskets and rafts; these are some of the simple operations which can convert a "lifeless" forest to one of continual interest to a very wide public and of enhanced sporting value. The traditional habitats of wildfowl in estuaries and tidal waters are diminishing yearly by developments of various sorts; the forests can help to restore the balance.

Beneficial and Harmless Species

The encouragement of these can contribute directly to the health of the

forest and also to its attractiveness and amenities, and can be achieved in a number of inexpensive ways.

The distribution of bird nesting boxes to increase the population of insectivorous birds is a simple operation and can often be done by arrangement with a local Natural History Society, school or individual, prepared to take over responsibility for maintaining records and observations. Many of the new conifer forests represent a vacant niche as far as birds are concerned, and there is every advantage in encouraging birds to breed in them.

In addition to providing nesting boxes, the preservation of belts of natural vegetation and trees, particularly along water courses, is a simple management device to attract and hold birds. Such belts provide food and breeding sites and can often advantageously be left under natural scrub when the rest of the area is planted. Their loss to the forest area is negligible and their contribution to wild life conservation, amenity and, in many cases, fire protection, is great.

A BIG STAG FROM THETFORD

by

Ian King

(from the "Shooting Times")

Along the edge of the conifers, pheasants fluttered up from among the tangled grass and adjoining sugar-beet. George cursed to himself and slipped the heavy Westley Richards ·350 big-game rifle into a more comfortable position. He and his two companions walked silently on thin rubber-soled boots. At the junction of each ride which cut deep into the timber they stopped and scanned with binoculars the grassy avenues before moving on. The light was fading fast, and even the telescopic sight mounted on the ·350 was now of no value. The three men turned off at the next juncture and were soon swallowed up in the darkness.

The place was Norfolk, the date 2nd October, 1965, and the quarry was a stag. George Swenson, an American who has hunted big game in many parts of the world, had been lucky. He was the first in the draw for the three stags which were to be culled this season. The second to draw was Herr Kraemar, who had flown over from Frankfurt that afternoon to join the party.

Members of the St. Hubert Club of Great Britain have had the stalking in Thetford Chase by arrangement with the Forestry Commission for ten years. Each season at the beginning of October the party assembles in a small forester's cottage let by the Commission. Maps are consulted and information, obtained through the foresters and local gamekeepers, is discussed. Heading the stalking team each year are Group Captain D. Wenham of the St. Hubert Club and Rex Whitta, Forestry Commission stalker, both of whom spend much time walking the forest, checking the location of the parcels of hinds and forever on the look-out for the spoor of the big stags before the first stalker arrives.

Stalking stags in Norfolk has little in common with stalking in the Highlands. It is, in fact, akin to Continental stalking. Indeed, German terms have been adopted to describe antler growth, etc.

The stags generally appear at the commencement of the rut in mid-September and on a still morning, when there is a touch of frost in the air, their roaring travels far. During the summer they disappear, wandering for miles among the surrounding farmland, feeding on growing corn, lucerne and roots and lying up during the day in some shady spot. They feed off some of the best farmland in the country, and as a result they reach a size which is quite unknown in the Highlands. Similarly their antler growth is correspondingly greater and some of the best heads in the country have come in recent years from Norfolk.

Through the Forestry Commission it is now possible for experienced stalkers to stalk in many counties from the massive Kielder forest in Northumberland to the smaller plantations in Surrey. It is, indeed, part of the Commission's much-enlightened policy to provide these facilities. Deer whether red, fallow or roe are culled according to age, which is reflected in their antler growth and according to their condition, in order to improve the stock. The basis of this is that the Commission is firmly of the opinion that it has a duty to conserve deer in its forests, although inevitably it can mean that some damage is caused to the plantations, but where deer are stalked an additional source of revenue is obtained. Their numbers must be controlled, therefore at Thetford, like other forests, the Commission states the number and sex of each species which are to be shot.

On this basis deer-stalking requires not only an ability to recognise and appreciate the meanings of signs of deer but also a knowledge of their biology, coupled with, of course, a high degree of patience and skill with the rifle.

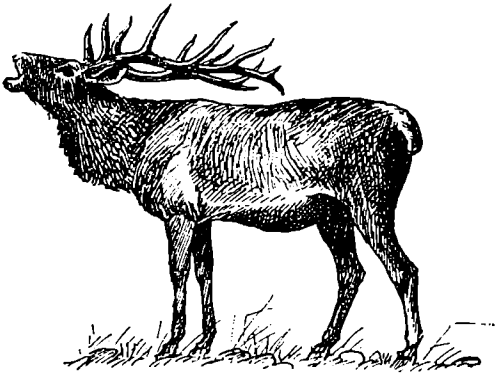
George was keen to get a good stag and was prepared to spend a week at it if necessary, and it was not unexpected that the first evening's stalk had proved unsuccessful.

On the following morning the party were in the same part of the forest, half-an-hour before dawn, hoping to hear the stag roar. Fresh spoor, similar to that made by a young buffalo, was found, and a small parcel of hinds were seen but the stag was not located. Fred, the local gamekeeper, confirmed that he had seen one frequently near his cottage. Indeed, two minutes after leaving, the stag slipped across, a mile in front of Fred's cottage. His excited message on the telephone was received with mixed feelings.

I spent that afternoon in a high seat with the camera. From my perch I had a superb view of the wallow below. After watching red squirrels collecting cones in preparation for the winter and pigeon coming down to drink, the boom of a rifle shot provided an adequate reason to quit my excellent perch.

The stag lay at full stretch on the pine needles, its antlers sweeping up into crowns, great brown lines flowing upwards above the forehead, and the beam was as thick as a man's wrist. Few Highland ponies could carry this beast, for he weighed 450 lb. clean, the heaviest stag to be shot in Thetford.

At £5 per point his 16 points cost George £80. The stalker's work had started. The gentleman from Germany was ready and waiting at 5.30 the following morning. And, when I left, an elated George was still puzzling how to fit 450 lb. of prime venison into his small motor-car. (See plates 12 and 13, centre inset).



THE THETFORD HIGH SEAT

by
R. Chard
District Officer, New Forest

Introduction

The Thetford High Seat is designed and produced by the staff of Thetford Forest, where it is found to be satisfactory for the observation of wild life and the safe use of rifles in the control of deer.

A complete set of parts is listed below and the timbers may be obtained from Forestry Commission, Santon Downham, Brandon, Suffolk. (Tel. Brandon 271). The ironmongery is not supplied by the Forestry Commission but is readily available from any good ironmonger.

The Thetford High Seat is constructed from creosoted pine so that it will remain sound and safe for at least 10 years without repair, and during that time it can be moved and re-erected as required.

The 24-hour creosoting process used ensures deep penetration of creosote, but also expels surplus creosote so that the timber is not heavy and is *clean to handle*.

The High Seat will accommodate two persons with room to spare, and provides a completely steady, well-screened platform at a height above ground level of 10½ feet. The creosoted timber makes it very inconspicuous, although in appearance it is not unattractive, and is completely in keeping with woodland surroundings.

Special attention has been given to providing a safe construction (complying with the *Agriculture Regulations*, 1959), whilst at the same time simplifying design so that erection can be quick, and well within the competence of average handymen using simple tools.

It has been found that observers prefer to use their own canvas stools or other types of folding seats, when using a high seat for a long period. The Thetford High Seat has a solid floor on which such stools can be firmly placed. The hand rail below the 9-inch aperture in the screening is at a height of 3½ feet above floor level.

A useful addition is a simple roof which can be made from a 5½-foot square of waterproof canvas secured with cord to the corner poles, and supported in the centre by a 4½-foot rod passing from side to side.

Materials for Construction

1. Selected pine, machine-dressed, and well creosoted

	Length (*feet*)	*Width* (*inches*)	*No.*
Round poles	17¾	2½/3 top 4/4½ butt	4
	16	2½/3 top 4/4½ butt	1
Half-round poles	8	3/4	3
	7½	3/4	3
	7	3/4	4
	6	3/4	6
	5	3/4	4
	3½	2½/3	3
	5	2/3	24
	4½	2/3	31
	3	2/3	11
	2½	2/3	9
	5½	5/5½	2
1-inch boards	5½	5	10
	5½	3½	3

A complete set of timber parts is supplied for £12 10s. 0d. collected from:—
Forestry Commission Creosoting Plant,
Santon Downham,
Brandon, Suffolk. Telephone Brandon 271.

Delivery at an extra cost can usually be arranged. A 10 per cent discount is given on orders for eight or more complete sets.

(These terms are as at September 1965 and are subject to review from time to time).

2. Coach bolts (with washers)

6½ in. × ½ in.	4
6 in. × ½ in.	14
5 in. × ½ in.	8

3. Ring-bolt

3½ in. × ½ in.	1

4. Nails and wire

4 in. nails		2 lb.
3 in. nails		4 lb.
1 in. staples	galvanised	½ lb.
No. 10 gauge wire	galvanised	24 ft.

The total price of the ironmongery is about £2 15s. 0d.

A refinement is to have two ring bolts, one on each side of the entrance, but at different heights to give easier hand holds to persons entering or leaving. If difficulty is experienced in obtaining suitable ring bolts addresses of suppliers will be given on request.

Tools and Equipment for Construction

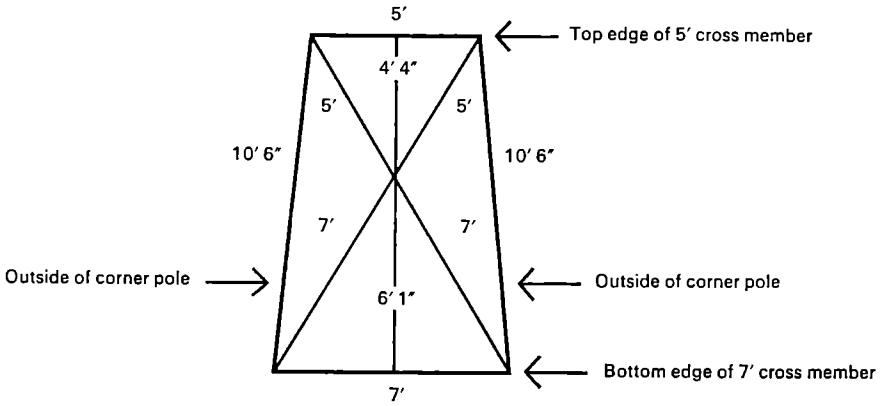
Grease for bolts.
Linen tape, 2-foot rule, or steel tape (a long linen tape is convenient but should be checked for accuracy against a rule).
String for marking out construction diagram.
Brace and bit for drilling ⅝-inch diameter bolt holes (to take ½-inch diameter bolts).
Hammer for driving 4-inch nails etc.
1-inch spanner (or adjustable spanner).
Saw for cutting bracing timbers to fit, trimming off surplus length on screening pieces, recessing for ladder steps etc.
Chisel for making recesses for ladder steps.
Spade to dig corner holes and level the ground between them.
Light axe, billhook, or plane may be required to shave floor bearers and screening pieces to fit.
Creosote and brush in case any untreated wood is exposed during construction.
A rope to enable the front and rear sections to be pulled up so that they stand in the corner holes.
A ladder is not essential, but may be a help when the side screening is being nailed.

Instructions for Construction

(Use the drawing below as a guide)

(It is recommended that the instructions be followed through carefully, step by step in the given sequence, otherwise difficulties may arise, and strong construction may not be achieved).

1. Check that all the parts required are to hand. Grease all bolts, washers and nuts.
2. In the four corner poles drill all 16 bolt holes required to fix the cross members to the two *sides* of the high seat. Number the poles 1, 2, 3, 4, and measure the distances accurately starting from the butt ends of the poles:—
   Poles 1, 2, 3—1 ft. 10¾ in.: 5 ft. 1¼ in.: 4 ft. 10¾ in.: 4 ft. 0 in.
   Pole 4—1 ft. 10¾ in.: 5 ft. 1½ in.: 4 ft. 10½ in.: 4 ft. 0 in.
3. Insert the appropriate size of bolt into each of these holes, and put the washers and nuts on to the bolts to hold them (loosely) in place. (6½-inch bolts at the base, 6-inch bolts for the centre and floor supports, and 5-inch bolts for the handrail). These bolts remain in place during the nailing and bolting of cross members in the construction of the front and rear sections.
4. With these poles rolled through 90°, drill in them the 8 holes required to fix the bolted cross members to the front and rear of the high seat. The hole for the centre rear cross member must be drilled so that it misses the bolt already inserted at right angles to this second hole at this point. Drill the hole to take the ring-bolt. The distances starting from the butt ends of the poles are:—
   Poles 1, 2, 3—12 ft. 1½ in.: 3 ft. 8½ in.
   Pole 4—6 ft. 11¾ in.: 5 ft. 1½ in.: 3 ft. 0 in.
   Pole 4 is for the right hand corner of the rear section.
5. Construct the complete front section of the high seat using pieces three to four inches wide for cross members and braces up to floor level, and pieces two to three inches wide for the handrail and screening. The nailing of the pieces 3/4 in. wide should be with two four-inch nails at each point, the nails to be driven at an angle to one another. It is important to ensure that the construction is symmetrical, and an aid to this is to mark out the following diagram on the ground (4-in. nails and string can be used), within which to place the pieces:—



After bolting on the handrail, nail the screening from the top downwards leaving at least a 1-in. gap at the bottom to take the ends of the floor boards.

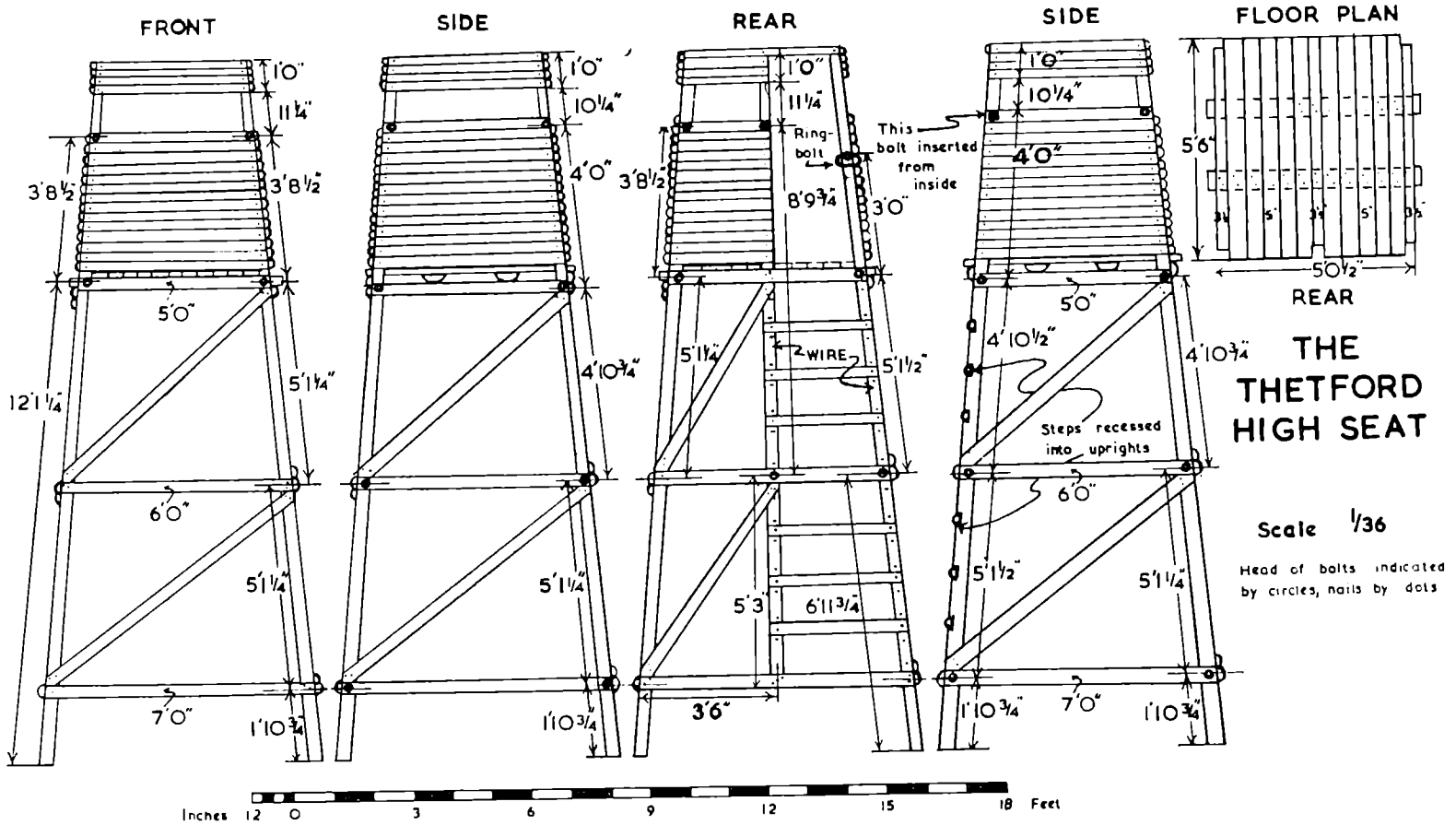
By alternating the screening pieces so that the thick end of one is next to the thin end of another, a close fit can be obtained, and if desired this can be made even closer by a little planing.

6. Construct the complete rear section taking care to obtain symmetry as before. The centre pole requires two bolt holes only, the first at 5 ft. 3 in. from the butt end, the second at 8 ft. 9¾ in. beyond the first. The six ladder

rungs (from 3 pieces 3½ feet by 2½/3 in. wide and 3 pieces 3 feet by 2/3 in. wide) are recessed into the corner and centre poles, and wire is stapled over them down the whole length of both sides of the ladder. The nailing of the screening should be from the handrail downwards, to leave at least a 1-in. gap at the bottom.

N.B. *If the thickness of a pole and a cross member are too great for the appropriate bolt, the curved surface of the cross member should be shaved down. Poles should not be cut into at all except to take the ladder rungs.*

7. Level the ground along the sides of a 7-foot square where it is proposed to erect the seat, and dig four corner holes 2 feet deep. Raise the front and rear sections so that they stand in these holes, leaning in towards each other. Beware of gusts of wind at this stage. Bolt the six side cross members (3/4 in. wide) into place. All four lower cross members on the front, rear, and sides should rest on the surface of the ground.
8. Push the structure as necessary to get it to stand squarely and upright before firming in soil around the corner poles and tightening bolts. Make a final adjustment if necessary before nailing the side bracing pieces, after which the structure will be rigid. The two nails at each end of the bracing pieces should not be driven at an angle to one another, otherwise dismantling will be difficult.
9. Place the floor bearers in position after shaving their curved under surfaces if necessary, until they are the right thickness to allow the floor boards to rest on the front and rear cross members as well as on the bearers. Cut the three floor boards of 3½ in. width to the required length, and double nail all floor boards to the flat surfaces of the two bearers, and not to any other part of the structure, the nails to be driven at an angle to one another.
10. Bolt the side handrails into place, inserting the bolt near the entrance from the inside to prevent any obstruction to persons entering. Nail on the remainder of the screening.
11. Check all nailing, and the tightness of bolts. Check that the exposed parts of bolts are greased. Creosote any untreated wood exposed during construction.


FRONT
SIDE
REAR
SIDE
FLOOR PLAN
1'0"
11¼"
3'8½"
5'0"
12'1¼"
5'1¼"
6'0"
7'0"
1'10¾"
10¼"
4'0"
4'10¾"
11¼"
Ring-bolt
8'9¾"
This bolt inserted from inside
3'0"
2 WIRE
5'1½"
5'3"
6'11¾"
3'6"
4'10½"
Steps recessed into uprights
5'6"
50½"
REAR
THE THETFORD HIGH SEAT
Scale 1/36
Head of bolts indicated by circles, nails by dots
Inches 12 0 3 6 9 12 15 18 Feet

WILD LIFE CONSERVATION

FORESTRY, FISHING AND FINANCE

by
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Introduction

During the past year or so more emphasis has been given to the aesthetic, recreational, and sporting aspects of our forests. National Parks have been created, with picnic sites and camping grounds becoming more numerous on forest areas. Deer control has become established, and research into bird and mammal life is increasing; but one of our great forest assets, our water, remains comparatively undeveloped. While most foresters realise its importance in event of fire, very few consider its use as a public amenity and as a source of revenue. In short, the use of our lakes, ponds, rivers and streams for fishing.

Fishing

Fishing today has developed into a national pastime; there are approximately three million anglers in this country, and the numbers are increasing rapidly. Due to its increasing popularity, coupled with availability of transport, waters for all types of angling are becoming more difficult and expensive to obtain. The waters around our large cities and towns have become overcrowded and overfished, therefore, development of existing facilities and creation of new waters in more remote areas is of vital importance if the full potential of our forest estate is to be realised.

The Modern Fisherman

It is not uncommon today for an angler to travel 100 miles or more for his sport. His equipment may be valued at as much as £80/100 and his day's fishing can cost £5. His devotion to the sport may border on the fanatical and if he is a specimen hunter he will spend days or even weeks finding his quarry, hours planning how to catch it and days and nights on end concentrating on the actual capture. Usually anglers are pleasant, reasonable and intelligent people, mindful of property and well behaved.

Improvement of Waters

The lake or pond, that the Forester regards as a reserve of water in case of fire, can become as remunerative as the forest crop he wishes to protect if it is properly stocked and managed. The marshy or boggy area he regards as unplantable and unsightly could become, with a little thought, and a modest outlay, as valuable and pleasant as any of his forest areas. The small stream that wanders through his area, probably too shallow to be of use in case of fire, could, by damming and excavation, be converted into a stream of deep pools and shallow runs, thus creating at once a reserve in case of fire, and conditions for fish to thrive. The financial returns from the fishing would more than pay, over a period, for the initial outlay. One of the finest examples of dual exploitation of water is the group of lakes owned by the Bristol Waterworks, Blagdon, Chew, etc. Used primarily as reservoirs, their fame as trout waters equals that of any of the famous chalk streams. It is admitted that we cannot all have Blagdons on our areas, perhaps some of the Scottish lochs could equal them, but it is possible to have fishing as good as any in the locality. A local farmer who required a large volume of water for irrigation had in the front of his farmhouse a marshy area of approximately five acres, fed by springs and small streams, which made cultivation impossible. A geological survey showed gravel beneath the surface.

He obtained permission to excavate the area to form a reservoir for irrigation and sold the gravel to an interested company. The conditions of sale stipulated the depth to which removal would take place and provided for the retention of two future islands. The sale of the gravel, excavated by the company, paid for an adequate stocking of trout, a number of wild fowl, also trees, shrubs and bulbs to be planted on the islands and around the edges of the lake. The trout fishing was let to a syndicate, the owner retaining a rod for himself. The shallow end of the lake, incidentally, is used as a swimming pool by his family. Thus he created a water supply and a sporting amenity. He improved the value of his house and his bank balance from what most people would regard as a liability. This is an example of what we foresters can do if we have potential fishing waters on our area.

Game and Coarse Fish

Freshwater fishing is divided into two main groups, i.e. game and coarse fishing; seldom are the two groups allowed to occupy the same water, one usually becoming dominant. The game fish group consists of Salmon, Sea Trout, Trout and Grayling. Game fishing is expensive to establish and maintain, that is, of course, artificially; where there is a natural run of Salmon or Sea Trout then the costs are lower. The amount of water suitable is relatively limited in England, mainly because of pollution. Constant re-stocking is necessary because game fish are highly valued for the table and those caught by the fisherman are therefore retained. This can be controlled to some extent by limiting the numbers retained. However, the financial returns are high. In southern England £80 per annum per rod, is an average price and there are no shortages of applicants, rather the reverse. In the Highlands good Salmon and Trout fishing is by no means cheap and will rapidly become more expensive. The coarse fishing group consists of all other fish except game fish, e.g. Roach, Pike, Perch, Carp etc. Coarse fish of one species or another will thrive in most waters, still or flowing, shallow or deep, small or large. Coarse fishing is comparatively inexpensive to establish and maintain. Constant re-stocking is usually unnecessary as most coarse fishermen return their catch, after weighing and perhaps photographing, although specimen fish are usually retained. Returns will not be so high as for game fishing. The average for private waters in southern England would be £5 per rod per season. In Wales and Scotland coarse fishing is cheap, but because coarse fish grow to a large size and are usually more plentiful in these areas, this will not remain so.

Predators

As with mammals and birds, fish can be divided into two main categories, predators and non-predators, although in some species there is no sharp division. Classification depends on age and type of food available, e.g. trout when young normally feed on insects and flies, with the occasional small fish, but in old age may develop into true predators, feeding solely on fish of any species, including their own. They are easily recognised by the pronounced hooked lower jaw. The true predators, however, are Pike, Perch, large Chub, Old Trout and that scourge of all fish, Eels. Where mixed coarse fishing is required the numbers of these species should be rigidly controlled, and on game waters they must be exterminated in so far as is possible.

Choice of Species

Choice of species will depend mainly on the type of water available. Game fish will thrive in rivers and lakes of an alkaline nature providing pollution is not present. Salmon and Sea Trout must have access to the sea. Coarse fish will

thrive in almost any water providing the water is not too acid or heavily polluted. Some coarse fish, such as Tench and Carp, prefer still water and will thrive in lakes or ponds heavily silted with mud and with deep layers of vegetation on the bottom. The Pike and Perch will thrive anywhere, but will grow to the extreme limits of their weights on the wider rivers and deep large lochs or lakes. The best guide to the correct species is either existing stocks or stocks on similar water in the neighbourhood. When stocking a water from scratch, advice could be sought from the nearest River Board or equivalent Authority.

Density of Stocking

Density of stocking will depend mainly on the amount of natural food available, and it is as well to remember that it is better to under stock than to over stock, which will result in a large number of small stunted fish, with a great risk of disease. One of the arguments for retaining predatory fish is that they control the number of other species, and eliminate sickly fish. Another is that predatory fish, unlike most mammals or birds, will feed readily on the smaller members of their own species, thus, to a limited extent, controlling their own numbers.

Fish Management

The management of both game and coarse fishing is an exacting and complicated business, but with expert advice, which can easily be obtained, and I am certain willingly given, not an impossible one, especially if a keen and enthusiastic manager can be found. Text books are plentiful and expert advice from most River Boards and Research Units easily obtainable at little or no cost. It may be possible that in the near future men could be trained for these duties, as they are now for deer control and wild life management. The development of our waters, within the forest boundaries, is surely as important as deer control or game shooting rights, and would serve a far larger section of the community.

SOME PROBLEMS ON FISHERY IMPROVEMENT ON SMALL STREAMS

by

K. Fryer

Assistant Forester (Research), West Scotland

Although there is an increasingly serious over-fishing problem on many waters in this country it is mostly confined to the major rivers and their more important tributaries, while many miles of fishing in less significant streams lie neglected and offer such indifferent sport that they very often escape the attentions of anglers completely. Their neglect stems from the fact that, before anglers became so numerous, there was enough fishing on the larger waters to cope with the demand, and consequently there was no urgency to maintain the smaller streams in good condition, so the effort required did not seem necessary or worthwhile.

The situation now, however, demands that there should be a reappraisal of these waters and that they should be opened up, where practicable, to absorb some of the pressure from the more popular fisheries. Since the Forestry Commission own a fair share of these smaller streams it is perhaps worthwhile considering some of the problems that arise when development of such waters is undertaken, and possible solutions to them.

Small streams can be divided broadly into two classes:—Lowland streams and Upland streams, the latter making up by far the larger part of those owned by the Forestry Commission.

Lowland Streams

These are the streams and brooks of the more fertile parts of Britain. They flow, for the most part, through agricultural ground of low acidity or alkaline nature. Their flow can be sluggish, where coarse fish thrive, or streamy, where trout will flourish, but in no case is their flow very swift.

The angling potential of such waters is high because, by their very nature, they are capable of providing a food supply that will support a good head of sizable fish. However, in most cases, neglect has caused any natural spawning facilities to fall into disrepair, so that their spawning potential is very much lower than it could be and fish stocks are much reduced.

The manifestations of neglect are usually all too apparent in these streams, and the picture is often one of an overgrown, silted-up trickle of water which is in danger of losing its identity as a water course. Even when the situation is not as extreme as this, the stream can still be of little value to angling in its neglected state because there is so little clear, unobstructed water in which to fish.

The start of the trouble often lies in the aquatic weeds that grow so profusely in such fertile conditions, particularly Canadian waterweed, *Elodea canadeniss*, if present. Weed growth can be so heavy that it dams up the stream, which has the effect of raising the water level and slowing down the flow still further, so that in times of flood particles of silt and organic matter tend to settle more readily and are trapped by the weeds, and what was once a clean, gravelly bottom is rapidly reduced to a muddy ooze, with a subsequent change in the ecology of the stream.

Another case of deterioration arises when river side vegetation is allowed to grow uncontrolled and gradually encroaches into the water, collecting silt in which other plants, particularly water-cress and yellow flag, become established until only a narrow channel is left meandering through a quaking bog.

The biggest job will be in clearing the choked-up parts of the stream; this can be tackled by hand although the more stubborn bits may require the attention of a bulldozer or dragline. However, in winter when the weeds have died down, a lot of hard work can be saved by utilizing the winter floods with the intelligent use of scour-boards. These are temporary structures, used to direct the flow against an offending silt bed and removed as soon as their purpose has been achieved, in case erosion of the bank takes place. Further and more permanent effects can be gained by the careful siting of groynes, which are protrusions from the bank that can be so constructed that they concentrate the flow of water at one point, so that it flows faster and prevents the silt from settling quite so readily, leaving the gravel below scoured and clean.

Once the stream has been cleared of all obstructions the annual growth of weed must be kept in control, bearing in mind that aquatic plants serve the very important purpose of aerating the water by their process of synthesis, which uses up the carbon dioxide in the water and gives off oxygen under the influence of light, although some of the valuable oxygen is lost when the process is reversed during the hours of darkness. The other important function of weed is that it provides shelter for the fish and many of the creatures they feed on; therefore sufficient must be retained to fulfil its useful role without becoming a nuisance.

A scythe or long-handled sickle can be used in shallow water to cut the weed, and a chain scythe for the deeper parts. The weed can be left in clumps or better still in bars, with stretches of clear water between them which will facilitate angling without depriving the fish of their larder. Chemical control is unfortunately not practicable because, even though an effective weed-killer could be found that is not toxic to the fish, the amount of dilution that would immediately take place would render it ineffective.

Trees and other riverside vegetation should be cleared away to an extent that will make casting easier, without denuding the river bank; any eroded

parts of the bank should be repaired, making sure that the cause of the erosion is also attended to.

Having made a suitable habitat for the fish and their food supply, attention must be paid to the stocking. If the stream is more suitable for trout, and the gravel in the pools is now clean and free of silt, any fish that are already present will gradually take care of the restocking themselves. The stocks will be further augmented if the stream is a tributary of a larger river containing trout, for these will be encouraged to move up at spawning time to take advantage of the improved spawning facilities and some will stay, as will many of their progeny. Some artificial restocking may have to be resorted to, however, especially if the stream is likely to be subjected to heavy fishing. Still, good spawning conditions in the stream itself will save a lot of expense, and it is worthwhile raking over the gravel in the autumn to dislodge any silt that may have settled there, and so leave it in good condition for the fish to make their redds.

Where the stream is sluggish, with a muddy bottom that cannot be altered, coarse fish will find the conditions perfectly suitable. To make the fishing more interesting other species not already present can be introduced, as long as care is taken not to upset the natural balance too much. It is often worthwhile introducing a few trout, which can grow to a considerable size in such waters, although the stock will have to be maintained artificially. The coarse fish will find no difficulty in reproducing themselves, as the owners of trout fisheries with an unwanted coarse fish population will testify!

On the whole, Lowland streams require more care and attention than any others to keep them in good order, but the rewards are greater and they are capable of providing some grand fishing, plus the satisfaction of seeing them brought to life again.

Upland Streams

These are the streams of the moorlands and mountains, ranging from fell becks and hill burns to the somewhat larger spate streams, which are to be found in such places as the west coast of Scotland, from their source to the sea.

Here we have a very different problem, for although they have the clean gravelly or stoney bottom so desirable in lowland streams, the flow of water is so swift, especially in times of spate, that weed can gain little or no foothold, and the aquatic creatures must rely on stones and the moss on them for shelter. The fact that the water is usually acid further inhibits the presence of many types of weed and the more valuable food organisms that fill the larder so abundantly in the more alkaline water of the lowland streams.

This means the trout usually have a lean time of it and, because there is no shortage of good spawning grounds, there are too many mouths to feed and the fish cannot grow to a reasonable size on what little food there is to go round. The situation is further aggravated if migratory fish, i.e. salmon and sea trout, use the stream to spawn in, for their progeny increase the competition for the food supply. Because anglers prefer size as well as quantity of fish, and a combination of the two is obviously the ideal, this overcrowding results in the angling potential being low for brown trout, although it can be good for migratory fish.

There are some small measures however, that can be taken to make improvements, and the first essential is to try to slow down the pace of the flow, where possible, by constructing small weirs or dams to create new pools, or make shallow ones deeper. This would have the effect of making conditions more suitable for weed to grow in, and rather than wait for natural regeneration to take place, the process of colonization can be speeded up by planting clumps of weed in suitable places, providing, of course, that a supply can be found within reasonable distance of the water being developed. These clumps would quickly spread and provide shelter for fish and other aquatic life. If the stream

is fairly alkaline by nature such plants as Water Buttercup (*Ranunculus fluitans*), and Water Milfoil (*Myriophyllum*), will be worth planting, but in more acid waters Starworts (*Callitriche* sp.) or some of the Pond Weeds (*Potamogeton* sp.) may be better established. However, it is a good rule to be guided by the types of weed that may already be present, or make small experiments before any introduction on a large scale is tried.

It is sometimes possible to introduce some forms of invertebrate life in order to improve the feeding, but this must be given careful thought or it could prove a waste of time and effort. It is no use, for instance, introducing freshwater snails to an acid water, even though they are such rich food for the trout, because these molluscs require calcareous salts for the formation of their shells, so they cannot survive where these are not present in the water. Many of the better food forms among the *Crustacea*, (freshwater shrimps, water fleas etc.), *Ephemeropterans*, (May flies etc.) and other invertebrates, prefer more alkaline conditions; but experiments can be made again on a small scale, although the best course is to improve conditions for the plant life which is their food and shelter and leave nature to do the rest. Natural colonization of the newly-formed pools by aquatic fauna will normally take place fairly rapidly because creatures are continually being washed downstream by the swift w ter, and they will gratefully take advantage of any shelter they find, so that the quieter pools, with clumps of weed, will soon be teeming with life.

Streamside bushes and trees, although a nuisance to the angler, provide a valuable subsidiary larder for the fish in the way of caterpillars and insects which drop on to the water from the foliage. A good instance of this occurred in the summer of 1956 when the oak trees overhanging a part of Loch Faskally, Perthshire, were badly infested by a looper type of caterpillar. When these had totally defoliated the trees and lowered themselves towards the ground to pupate, those that landed in the loch provided a sumptuous feast for the trout which congregated in large numbers to partake of it. Trees also provide shelter for the fish, especially in hot, sunny weather when they keep the pools shaded and cool, so the very minimum to make angling possible should be cleared away. This question of shelter is an important one, for the larger fish particularly will not lie in places where there is no shelter. I know a place on a small Highland river that is only a small depression behind a large stone, but heavily overgrown by trees, which is nearly always good for a sea trout, when a more attractive looking pool below may produce nothing.

It may be more worthwhile developing some of the poorer trout streams primarily as salmon and sea trout fisheries, where these fish have access. To do this, the brown trout population would have to be reduced drastically, which would leave more room and food for the young of the migratory fish, who only make their demands on the hospitality of the stream during the first few years of their existence and do most of their feeding at sea until they return to freshwater to spawn. Increased spawning facilities of a suitable nature for both salmon and sea trout should be provided where possible; each species requires a different size of gravel for their redds, and access over difficult obstructions should be improved to open up new spawning grounds. The larger runs of migratory fish which should result will make the work and expense well worthwhile.

Not all upland streams are poor larders. Some of the burns in the North East and South of Scotland, for instance, hold some good-sized trout and it only requires a little work and attention to make these into productive fisheries. The conclusion must be, however, that great improvements cannot be expected on the majority of upland streams, but their hard-fighting little trout can make a refreshing change for those anglers grown stale from fishing the more sophisticated and over-crowded waters. Many a small boy had his initiation into the wonder and excitement of angling when he caught his first trout in a Highland burn.

These then are some of the main points that arise when improvement of small streams is undertaken. The results may not be spectacular and in some cases the work may be ineffectual, but in these days of increasing pollution, water abstraction and other depredations on our rivers and streams, any waters that can be reclaimed and turned into productive fisheries will make a valuable asset on the credit side of the account, with the added advantage of keeping unspoiled one of our most vital amenities, clean, running water.

PROTECTION FOREST FOR FISHERY IN JAPAN

from "*The System of the Protection Forest as seen from the Technical Point of View*", published by the **Japanese Department of Forestry**, 1926.

There are in Japan Protection forests for fishery numbering 23,368 and 41,239 hectares in area, as indicated in the yearly statistics. Having the coast line extending for about 29,000 km., and annual aquatic products amounting to 251 million yen (taking only the Japan proper), the fishery in our country is one of the most important primitive industries for the national life, and so its relation to the forests seems to have been considerably studied and experienced from the past. (Annotation: the system of the *mountain for netting, the small fish sheltering forests* and others in our feudal age was intended for the increase of aquatic animals.) Therefore at the time of enactment of the old forest Act, the system of protection forest for fishery was introduced, by which certain restriction was put on the management of the forests, necessary for fishery, situated at the mouth of or along a river or on the sea shore, and the policy has been succeeded in the revised Forest Act, 1907.

Annotation: in our country from the old time attention has been paid to the relation of forests to fishery, for instance the system of the *Breed River* or artificial breeding of salmon in the river of Miomote in the Niigata prefecture. The system of the *Breed River* means an enterprise establishing a preserve for spawning places of salmon and paying attention to the management of the forests on the banks of the neighbourhood.

In our country the protection forest for fishery, literally called "fish-attaching forest", was understood to have function to attract aquatic animals to the sea shore. As our fishery, until the recent development of the pelagic fishery, was mostly carried out along the coast, forests for the fishery was considered most important.

The function of the protection forest for fishery to attract the fish to the shore was understood in the old time as the effect of its *shadow*. But as the result of the scientific research it has been found out that, besides the effect of the *shadow*, the influence of the plankton has an important meaning. However, as the increase of the plankton near the sea shore comes not only from the materials flowing out of the forests for fishery but largely from those of the forests on the spacious inland through rivers, we can hardly believe that the utility of the protection forest for fishery in our country was mainly in this respect.

According to a recent study of the effect of shadow of forest to the fishery, there are theories stating that the utility of the shadow for the fish is not so great. (Annotation: according to the study of Fuchino, Bachelor of Forestry, light coming to the surface from the point less than 5 degrees of angle cannot be recognized within the water; even in greater degrees recognition is rather difficult owing to the scarcity of light, the object being pressed down and growing in the circumference a rainbowlike colour, that is observed the more in the greater distance. According to another study of Takeyasu, Bachelor of Forestry, pine stands covering the flat ground on the shore, however green and fine may be, have no effect to lure the fish in the open sea). Nevertheless it is clear that, if the

coast is destitute of forest, every rain would wash away the ground, making thus main cause of injuring the life and spawning of the fish and increase of plankton as well. Thanks to the study of Fuchino, professor of the Kagoshima High School of Agriculture and Forestry for several years, comparatively detailed materials in connection with the relation between the fishery and the forest-for-fishery have been given to the officials of the protection forest administration.

Annotation: According to Fuchino, B.F., protection forest for fishery is divided into three classes;

(1) *Sheltering forest for fishery.* Existence of this kind of forest along the bank and border of rivers, ponds and lakes is beyond question. As to the sea a similar condition can be observed, if not to the same degree as the fish coming under the blinds in the pond. Some kinds of fish, especially when young, are said, living always in the upper side of water, not to be afraid of sound and fond of shadow. Although in the case of the sea, trees are seldom found directly covering over it, a special attention must be paid to their relation to the tide-stream in the sea. The tide-stream, an important factor in the fishery, is the running of water in the sea, caused by the tide accordingly to the condition of land. In case a shadow should be thrown on the surface, where is a tide stream near the shore or alongside an island or owing to a special movement of tide, the trees on the shore, how sparsely they may be, may have a great effect upon the fishery as deep as 50 to 60 metres below the surface. Forests in such a condition should be preserved prohibitively.

(2) *Attraction forest for fishery.* The migration of the fish is influenced by the conditions of tide, temperature and quantity of salt as well as plankton in the water. Even the pelagic fishes come near the shore at the spawning season. On the whole most marine fishes lay pelagic eggs, fed with plankton upon their hatching, that seems to necessitate to have a place for spawning with calm water, plenty of food and without a sudden change in the temperature of water. Such a fish as the yellow tail towards the spawning season comes near the shore especially when the shore stands high and green of trees is reflected on the water. The effect of the attraction forest can be acknowledged here for the first place for these pelagic fishes as well as the fish living in the upper side of the sea. Therefore as for this kind of protection forest, an investigation must be done into the location of the tide-stream, its distance from the forest, height of the forest, distinction of colouring from the environments and the class of the fish. Prohibition of felling of the trees is not necessarily wanted; it would suffice if evergreens should be retained in the underwood, making a high forest with two storied stand. However, there may be some cases where a certain position of the tide stream would require preservation of the standard trees too.

(3) *Promotion forest.* There are cases where forest has an indirect effect on the fishery:

(*a*) Breeding. In the shallow waters along the coast there abounds, besides plankton, mollusca-like shells and many other substances feeding the fish. If on the slope of the coast exists forest, it will prevent lands from soil denudation, and thus protecting the bottom of the sea as well, will promote the rearing of the sea-weeds, shells and others, especially when a brook flows in. This is the good condition for the fish to live. As to such kind of forest, though it is not required to be preserved, care must be taken for the protection against soil denudation and thus minimizing the change in the flowing condition of the rivulet.

(*b*) Protection against wind and waves. Wind and waves interfere badly with fishery in the way of obstructing navigation, influencing the water temperature and producing muddiness in the water acting to the tide stream, and so forth.

From the above mentioned, we can nearly decide how to deal with the protection forest for fishery from the view point of the system of forestry. There are many examples in our country from the past showing that fishery was affected badly by the felling down of forests on the coast or showing that fishery, once declined owing to the devastation of the forest, was again revived by the success of sylviculture.

WILD LIFE STUDIES BY THE NATURE CONSERVANCY'S UNIT OF GROUSE AND MOORLAND ECOLOGY

1. BLACK GROUSE

by G. W. Johnstone

A three-year study of black grouse was started in autumn 1964. The aims are to assess the extent and possible economic importance of their damage to forestry, and to study social structure and control of numbers in a local population. The main study area occupies about 15 square miles at Glen Dye estate, five miles south of Banchory. It is mostly moorland, but the river valley in the centre contains mature coniferous woods, birch scrub, hillsides with good natural regeneration of pines, and arable land. A subsidiary study area is on Forestry Commission land on the south side of Loch Rannoch in west Perthshire. This contains the Black Wood (one square mile of natural pine forest), large young conifer plantations, with moorland above and very little agricultural land.

The work at Glen Dye so far has concentrated on the distribution and numbers of blackgame, and trapping them for marking. An accurate census has not been made as no method has been devised for counting scarce birds that will fly up to two miles when disturbed; but approximately 100 birds live on the study area, apparently in three distinct home ranges. In autumn and early winter some birds fed on stubbles and on corn put out for livestock, and 33 were caught in one field and marked with rings and plastic back tabs. These were 13 adult and 8 first-winter cocks, and 6 adult and 6 first-winter hens.

Field observations showed that the winter diet consisted mainly of ling heather, bell heather, blaeberry stalks, birch buds, birch twigs and catkins, buds of young pines and small amounts of other foods. Sometimes young pine plantations were frequented during the day, and at dusk the birds flew to the moor to roost in heather. Others stayed on the moor all day. Blackgame were occasionally seen perching on tall trees, and in spring some were seen feeding on the young shoots of larch. However, in general, they are not birds of mature forest.

Blackgame damage young pines by eating buds in winter. Severe damage is widespread at Rannoch where there is also a considerable population of capercailzie. These cause heavy damage to young pines in plantations at the edge of the Black Wood. Capercailzie occur throughout the mature woods at Glen Dye, but are not so abundant as at Rannoch, where a count indicated a spring density of one to 15 acres in the Black Wood. Damage by blackgame and capercailzie can be distinguished in the field. Blackgame normally take only individual buds, and occasionally nibble a few needles. Capercailzie sometimes do this, but often take a complete terminal cluster of buds and strip off many needles. This was confirmed by giving young pines to captive birds and recording the state of the trees afterwards. Preliminary work suggests that planted trees were 2½ times more liable to damage than naturally regenerated ones.

PLATE 1: Dermot Bevan and T. G. Winter sorting Douglas fir needle litter from the forest floor, to assess the proportion of seed infested with Douglas fir Seed-fly, *Megastigmus spermotrophus*, in the Entomology Section at Alice Holt Research Station.

PLATE 2: Mr. Buszewicz and Miss Lynne Macmillan inspecting seeds in standard germinators where they germinate under controlled conditions of temperature, light and humidity. The Seed Research Laboratory at Alice Holt Research Station.

PLATE 3: Don Phillips supervises the preliminary sorting of discs cut from conifer stumps which have been treated with a range of experimental substances immediately after felling. Chemical treatment of stumps is the main control method used against the fungus *Fomes annosus*, the most important butt rotting agent in Britain. Infected stumps transmit infection to the root systems of adjacent trees. The Pathology Section at Alice Holt Research Station.

PLATE 4: A mixed plantation of Lodgepole pine and Sitka spruce on the hills of Rostrevor Forest, Northern Ireland.

PLATE 5: A Bombardier Muskeg tractor used at Beaghs Forest, Northern Ireland, to broadcast ground mineral phosphate on peat bogs, prior to ploughing for afforestation. It has a fertiliser-spreading attachment.

PLATE 6: New foliage on larch trees forming the letters "E R" on Panpunton Hill, Mortimer Forest, Shropshire. The light-green foliage of Japanese larch shows up clearly against the dark green of Douglas fir. The trees were planted in 1953 to mark the Coronation.

PLATE 7: A remarkable relic of a forgotten forest industry. This furnace on Loch Awe-side, near Taynuilt, used charcoal from the Argyllshire oakwoods to smelt iron ore in the early nineteenth century. Contributed by Tom Weir, well-known climber and photographer.

PLATE 8: Putting the finishing touches to one of the new timber trains that are now operating a shuttle service between Crianlarich, Perthshire, and the Scottish Pulp Mill at Corpach, Fort William, which uses timber from the forests of Argyll.

PLATE 9: Lifting Japanese larch with a converted potato lifter at Tair Onen forest nursery, South Wales. This machine can lift 10,000 trees a minute whereas a gang of 20 men with forks could only lift 200 a minute.

PLATE 10: Mr. John Dickson, Commissioner for Harvesting and Marketing, plants a tree to mark the start of landscaping at the new Thames Board Mill at Workington, Cumberland.

PLATE 11: Mr. A. O. Dixon, Paper-keeper at Headquarters, adds exotic interest to the Forestry Commission exhibit at the Shropshire and West Midlands Agriculture Show in May 1966.

PLATE 12: A 16-point red deer stag shot in Thetford Chase Forest, Norfolk, in October 1965. Mr. Rex Whitta, Forestry Commission stalker, is on the left.

PLATE 13: A close-up of the 450 lb. stag, the heaviest ever to be shot at Thetford.

PLATE 14: Forest masts for the schooner *New Endeavour* from the Forest of Dean. The two Douglas fir poles are for main masts and measure 58 feet long by 10 inches top diameter and 16 inches diameter butt; the Norway spruce poles are 28 feet long by 5 inches top diameter and 8 inches diameter butt, and will be used as topmasts. The timber, which was planted in 1906, was delivered by road to Ramsgate Harbour where it was used to convert a windjammer into a top-sail schooner. The *New Endeavour* sailed for Australia in June 1965.

PLATE 15: Progress in the erection of the Thames Board integrated pulp and board mill at Workington, Cumberland. This part of the building will be the machine house and will be some 765 feet in length.

PLATE 16: The giant Machine-glazing Cylinder, weighing 103 tons, being unloaded for the Thames Board Mill at Workington. The cylinder will be used to put a highly smooth, machine-glazed finish on the surface of paperboard.

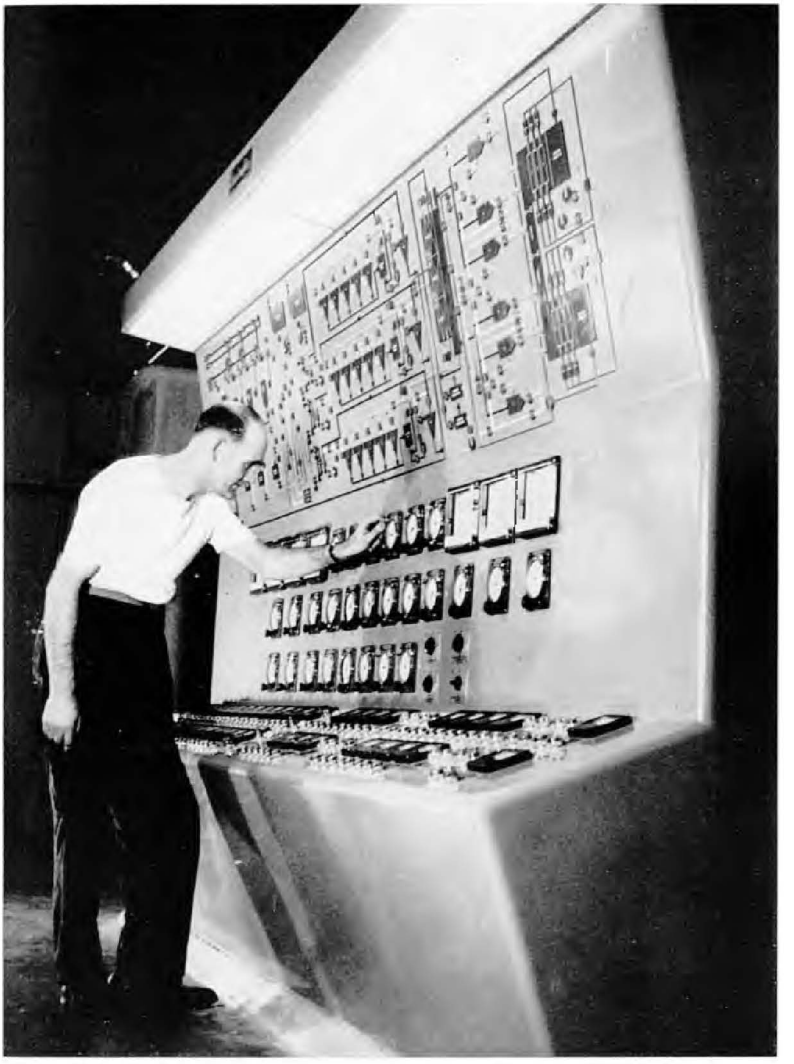

PLATE 17: Before board can be manufactured, the raw materials must undergo thorough cleaning. Our photograph shows the complex control panel whereby the operator can keep a continuous check on all processing conditions.

PLATE 18: A view of the Abreshwiller Forest Tramway in the Vosges Mountains, France.

PLATE 19: A French sawmill by the side of the Abreshwiller Forest Tramway.

PLATE 20: Abbot's Wood Pond at Friston Forest, Sussex. After recent improvements the pond is now used as a source of water for fire-fighting and as a wild life sanctuary.

PLATE 21: Another view of Abbot's Wood Pond, Sussex. The area is becoming very popular with the public.

PLATE 22: Looking towards the dam at Abbot's Wood Pond.

PLATE 23: The spillway at Abbot's Wood Pond.

PLATE 24: The "Three Brothers" Oaks in Russell's Enclosure, Forest of Dean.

PLATE 25: The Lord Robinson Oak, Highmeadow Woods, Forest of Dean. This fine tree is between 150 and 180 years old and over 80 feet tall.

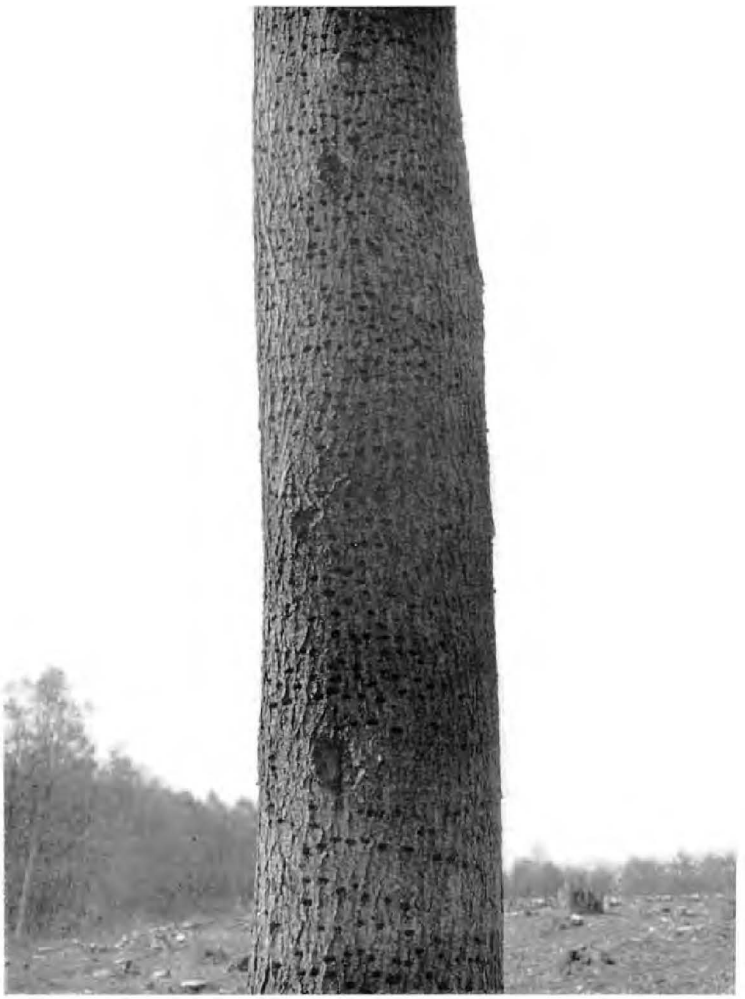

PLATE 26: Evidence of sap sucking by the Greater Spotted Woodpecker in the Forest of Dean.

The social organisation of blackgame populations is being studied. In autumn the birds were mostly scattered singly or in small groups, but in early winter packs of up to 30 were seen. These consisted mainly of cocks with a sprinkling of hens. Smaller parties of 6–12 were more usual, with cocks generally predominating. As spring approached, the parties tended to be of one sex only, though hens were commonly seen singly or in two's. In winter, blackgame were usually found on the moor or in woodland. In spring, with the new growth of grass and herbs, cocks returned to the fields to feed, while most of the hens stayed on the moor. In one part where there were no fields, the birds fed on the young shoots of larch instead.

Three cocks visited one lekking ground daily through the autumn and winter. On the other leks there was no display till early March. The distribution and size of leks are being studied, and nine cocks have been caught there with cannon nets and marked. Marked birds will be observ d during the rest of the breeding season, and in subsequent years, to try to discover the function of the lek and its possible role in population regulation.

2. PTARMIGAN

by

Adam Watson

Ptarmigan have been counted on a 1,220-acre on the Cairngorms since 1951, and in some years on smaller areas at Cairnwell and Lochnagar. These areas lie above 2,500 ft. in the deer-forest country of western Aberdeenshire, near Braemar. Unlike the fairly uniform heather moors lower down, the vegetation is much more varied, consisting mainly of a mixture of heaths with some grassy or mossy places. Much of the ground is stony or gravelly and the vegetation averages only two inches high. No burning has been done on these areas, and hardly any ptarmigan are shot except in some years at Lochnagar. Golden eagles are not shot and their numbers have stayed steady over the years at about one pair per 10,000 acres. The fox population has remained steady over the years, with at least one breeding pair per 3,000 acres, and about the same number killed each year by deer-stalkers. However, each stalker's beat covers up to 30,000 acres of rugged boulder-strewn ground with unlimited places for dens, and many dens are missed. Fresh fox droppings are seen on every visit, and a live fox on average every 4 to 5 visits. Foxes and eagles are both much commoner than on most grouse moors in north-east Scotland.

Ptarmigan feed mainly on the leaves and stems of crowberry, blaeberry and heather, with some dwarf willow, berries in autumn, and small amounts of various other plants. Although the highest red grouse nest up to 1,000 feet above the lowest ptarmigan, the two occupy different places. A few grouse occupy sheltered places in the alpine zone where the heather is more than two inches high, while ptarmigan occupy more barren ground where the heaths consist mainly of crowberry or blaeberry. Ptarmigan are commonest where the ground is well covered by heath and where groups of boulders or rock outcrops provide good shelter and cover. There are none on grassy or mossy places, and very few on gravelly ridges.

Ptarmigan defend territories in a similar way to red grouse. Each territorial cock has a favourite look-out place on a rock or stone, where many droppings and feathers accumulate and where the vegetation is often richer. The cocks make song-flights from these places and meet their neighbours in aggressive disputes along the boundaries. Territories vary from 3 to 25 acres in years of high numbers to 20 to 75 acres when numbers are low. At low densities, cocks often fly $\frac{1}{4}$ mile to meet each other at territory boundaries. They pair up and defend their territories during fine mornings in September-November every

year, but form flocks in the afternoon in snow or in windy weather. In some hard winters they stay in flocks from October till late April, but in mild winters they are territorial on fine days in every month. In spring, they pair up and defend territories all day long. The hens lay in late May, and the chicks usually hatch in mid June. The young are full grown in late August and soon afterwards the families break up as flocking begins again.

Ptarmigan in white plumage were counted on the study areas from October to May on days when there was no snow. The four methods used were walking to and fro over a given area with or without dogs, visual surveys from good vantage points, and detailed studies of territorial behaviour. Because the white birds were very conspicuous, these methods provided censuses of all birds present until they moulted in spring.

In several years when winter counts were done, numbers stayed steady from August till the following spring, and then decreased suddenly by 18% to 47% within a few days. These decreases happened soon after the birds occupied their territories all day long in spring, and consisted mainly of surplus birds which did not have territories. Some of the birds, presumably surplus, were seen on lower ground below 2,500 feet and some kills were subsequently found there. These observations suggest that many displaced birds died off the breeding area. Similarly some grouse kills were found at this time on the ptarmigan breeding ground.

Nearly all ptarmigan found dead had been killed by foxes or eagles, but a few had hit ski-lift wires. Apparently hardly any died uninjured. Post-mortem examinations showed ptarmigan have similar parasites to red grouse. The proportion dying from predation appears to be much higher than in red grouse, but perhaps any ptarmigan in poor condition is soon killed by a predator. The decrease in spring could not be attributed to predation, since territory-owners shot experimentally after the decrease were replaced, presumably by birds which had previously been surplus. Clearly more birds of both sexes were in the area than were able to take territories and settle. Moreover the number of territorial birds did not change much from October, when territorial behaviour was first seen, through the winter and breeding season.

Ptarmigan have maintained breeding densities of a pair per 4 to 5 acres on three study areas at Cairnwell and Lochnagar in the last few years. Breeding densities in the more barren Cairngorms have been lower than this, but have reached a pair per 8 acres on 100-acre areas and a pair per 5 acres on much smaller areas. These peak densities are as high as any figure recorded for red grouse on well-burned moors in north-east Scotland where foxes and eagles are scarce or absent. This lends support to the view that predation is of no importance in the regulation of spring numbers of these two species.

Predation in summer was potentially more serious, since foxes and eagles killed breeding hen ptarmigan at the nest and later killed both adults and young. However the loss of adults from all causes between May and August averaged only 9 per cent. In addition, breeding success was almost as good over a number of years as in protected red grouse populations, and the slight difference may be attributed to the fact that ptarmigan on average lay a slightly smaller clutch. It is clear that predation did not appreciably diminish breeding stocks or breeding production.

Breeding production varied in different summers from 1 to 25 full grown young per 10 adults. Ptarmigan laid fewer eggs in poor breeding years, but the 25-fold difference in breeding success was due mainly to whole broods dying soon after hatching. Deaths of chicks could not be attributed to bad weather, and in some years they died in good weather, in which they would have survived in other years. Independently of the weather, ptarmigan bred well only in years when the population was increasing, and in early peak years when the population

level was fairly stable. They bred poorly in later peak years, but this did not at first cause a decrease, presumably because of the survival of many old birds. Poor breeding went on throughout the decline.

Breeding stocks in the Cairngorms were low in the mid 1940's and increased to a peak from 1949 to 1953. There was a decrease till 1959, followed by an increase to a second peak from 1961 to 1965. At Lochnagar and Cairnwell the breeding stocks appear to be fluctuating a year or two behind those in the Cairngorms, but many years with high and low numbers have coincided at all three places.

Population declines are expected on all the study areas in the late 1960's. Declines follow summers with poor breeding, but why chicks die in some years and not in others is not understood. Possibly the ultimate cause may be changes in the winter food affecting breeding success, as in red grouse, but work on measuring food has only just begun.

3. GOLDEN EAGLES

by

Adam Watson

A population study of golden eagles has been done since 1944 on 180 square miles of deer-forest country in upper Deeside, stretching into the Cairngorms. The main aims were to survey the number of adult pairs every year in the whole area and to study the breeding success of as many as possible, concentrating especially on a small number of the best known pairs. Later aims were to compare eagle numbers with changes in food supply, and to use the population data for the last year or two as a measure of the effect of toxic chemicals on eagles. This last aim is currently being followed by a number of other observers in various parts of Scotland.

The surveys of breeding population showed that there were 10-12 pairs on the study area each year in 1944-1965. On most of this area, eagles were not shot or trapped by keepers, and were often protected. On a similar area of grouse moors east of the study area, eagles were frequently killed and the population decreased through human interference from 7 pairs in 1945 to 4 in 1947, varying from 2 to 4 pairs since 1950.

The easiest time to survey the adult population is on fine days in early winter, when the birds are often seen in wide display flights and when several pairs may be recorded in one day. Different pairs can often be distinguished by their plumage markings. In spring, this information is checked by observing nest sites and especially by noting occupied nests. The birds usually use different nests in successive years and the total number of alternative nests on the range of each pair varies from 4 to 11. Some are in pines but most in crags, varying in altitude from 1,200 to 3,000 ft. above sea level. Each pair seems to breed at about the same time each year, irrespective of whether the winter was very mild or continuously snowy for six months.

Breeding success on the deer forests has averaged slightly less than 1 (0.8) young reared per pair per year. This figure includes cases of egg-robbing by collectors, and other cases of unsuccessful breeding ranging from infertile eggs to disturbance by lumbermen, ornithologists and artists, but human disturbance was not important in these areas. Omitting cases where breeding was known to fail because of human interference, 0.9 young were reared per pair per year. Two young were reared almost as often as one, but some eggs did not hatch and some birds did not lay at all. Non-breeding occurred when one bird was clearly immature from its plumage, but in other cases adult pairs did not breed. Some pairs bred more successfully than others, but the reasons for this were unknown. In this Highland area the eaglets stayed with their parents till September, and

mostly disappeared in October. This coincided with annual appearances of young eagles further east and south on lower moors where eagles seldom if ever bred, and probably most of these emigrants died, often by shooting or trapping. About 16 per cent of the young remained on the breeding areas over the winter and some were often seen near the nests in later years.

Eagles in this area feed mainly on grouse, ptarmigan, mountain hares, rabbits and red deer carrion. In some years there are many game birds and rabbits and hundreds of dead deer from February to May, but in other years hardly any carrion, no rabbits after myxomatosis in 1955, and very few game birds or hares. However breeding success was apparently no better, and the frequency of non-breeding no less, in years when there was obviously more food. The observed fluctuations in food supply occurred at a level above that at which the eagle population or its breeding success is affected.

Studies of eagle populations and food supply on areas in western Scotland by Mr. Leslie Brown and myself have confirmed that differences in food supply do not appear to be related to differences in population. Live prey was much scarcer in the west than in upper Deeside. On the moorland which covered most of each area, counts of grouse, ptarmigan, hares and rabbits showed that in terms of weight they were 4½–130 times scarcer in west Scotland than in upper Deeside. Deer carrion was also less plentiful in the west, because deer were fewer. However sheep were abundant all the year round, with very high mortality and many carcases on the hills at all times of year, even in summer and in mild winters. Eagles in the west depended largely on sheep carrion for food, but there appeared to be an excess of carrion on all the areas, and areas with more carrion did not support more eagles.

Dr. Lockie and Dr. Ratcliffe have shown in the last few years that the breeding success of eagles in Wester Ross has greatly declined, and eagle eggs from this region contained residues of toxic insecticides. Since eagles in western Scotland feed largely on sheep carrion, the birds probably took in toxic chemicals used in sheep dips. Surveys by various observers in 1964 showed that breeding was poor in most parts of the Highlands, and a decrease in eagle numbers can be expected if this continues. The Cairngorms area is particularly important, because there are accurate figures of breeding success from years before organo-chlorine insecticides were used, and because eagles in this largely sheep-free area hardly ever eat sheep. The Cairngorms birds have bred as well in the last few years as earlier. However, a paired hen eagle found dead in this area in 1963 contained organo-chlorine residues, perhaps through eating rooks, crows or other birds that had visited sprayed crops on agricultural land. This suggests that the Cairngorm eagles probably are contaminated, and their future is uncertain.

4. ROE DEER

by

Harold Cumming

The aims of this three-year project are to study food and shelter requirements, population dispersion and density, and individual and social behaviour in roe deer. The major study area at Glen Dye estate is heather moor at 500 to 1,500 feet. Conifers are planted from 600 to 900 feet, mostly about 15 years old but some up to 100 years, and the low ground is farmed. Secondary study areas are at Forestry Commission woodlands at Castle O'er, Dumfriesshire, at 700 to 1,000 feet with conifers about 15 years old; and at Cheddington, Dorset, at 300 to 500 feet, where an oak-ash wood is newly underplanted with conifers.

Recognition of Individual Deer

Although all my efforts to catch roe or mark them with automatic devices

failed, bucks can often be identified from sketches of their antlers. Does can sometimes be identified by the number and sex of their kids, the bucks with which they associate, and, in the sparse Glen Dye population, where they are seen. Groups of roe can be located in winter by tracks in the snow, and numbers in each group can be established by recognizing individual animals. At Cheddington, however, by March 1965, Forestry Commission workers had caught 23 deer by driving them into nets. These deer were marked with ear-tags and collars.

Food and Shelter Requirements

Roe feed mainly on grass and herbs. In May–August 1963 at Glen Dye, 57 to 63 observations of roe eating showed them to be grazing. Winter food includes a large proportion of heather, with some bramble leaves, turnips and pine shoots. Newly green buds of Norway spruce are eaten in spring, and flowers of most plants as they come in bloom.

Shelter is provided either by thick woods or by topographic features. While roe can be found in all woods in summer, they inhabit only young woods in winter. Measurements of wind speed were much higher in mature woods than in young, and this is presumably why the latter are deserted in winter. Roe also winter on open moorland. Even during the severe winter of 1962–63, five out of 16 groups of deer lived on open moor at Glen Dye. Additional groups have been found on the moor in subsequent years, some over two miles from the nearest woods, with other roe groups between them and the woods. One group, which was also followed throughout the summers, raised young and mated on the moor, never entering a wood during 2½ years. Some other groups shelter in woods but feed on to the moor. Clearly roe distribution is not limited by the presence or absence of trees. They are found wherever there is grass for feeding plus adequate shelter, and this may be provided by dense woods or topographic features such as steep-sided valleys.

Dispersion and Population Density

Home ranges of wintering groups are almost exclusive. Summer ranges of adult deer change only slightly from winter ranges and seem to be centred on good grazing areas. Most groups consist of a buck and doe, two kids, and one or two extra adults, possibly young from previous years. The sixteen groups at Glen Dye in winter 1962–63 totalled about 80 deer and occupied about 8,000 acres, i.e. a density of one deer per 100 acres. In seven group ranges studied more intensively during the next summer, the size of the ranges averaged 206 acres. The total spring population there was 31, with a density of approximately one adult roe to 46 acres. There is little evidence of change in density from year to year, despite a recruitment rate of nearly two kids per doe and little loss from predation, disease, or shooting. Possibly some regulation mechanism acts through the behaviour of the animals themselves. The population density at Glen Dye is low compared with Dorset where there was one roe to about 9 acres in spring 1965, with an estimated total of 41 deer in 367 acres.

Fraying

Fraying trees with antlers occurs in three distinct behaviour patterns (a) rubbing off velvet, (b) marking territories, and (c) ritual fighting. Originally, all fraying was ascribed to (a) but I found few trees damaged during the period when antlers were being cleaned. Since 1963, fraying has been ascribed to (a) and (b), but territorial activities leave visible marks only on young trees with soft bark where the antlers accidentally scrape bark off two sides of the trees. Ritual fighting is similar to that described in white-tailed deer. One buck attacked

a young pine tree with vigour, going down on his knees and jumping his hind legs up and down as he thrust at the tree with his antlers. For perhaps a minute, he continued, circling the tree for about 270 degrees. Later examination revealed that all bark had been removed along one foot of the stem. This behaviour was also seen in a tame buck which completely girdled three freshly cut stakes thrust in the ground in his pen within 10 minutes, lunging at them until he knocked two over. Tagging damaged trees once each month revealed that, whether the same buck was doing the damage, or a new buck after the other had been shot, the same tree was seldom frayed twice. The fraying was not along the edge of territories, but in the section most frequented by the bucks.

Social Behaviour

At Glen Dye winter groups are well spaced, due to avoidance of other groups and, possibly, attachment to summer ranges. However, in some districts, groups aggregate in feeding places where as many as 20 deer may be seen together. There is little aggression within the groups and kids may follow the buck instead of the doe during the winter.

Major dispersal occurs through aggression in spring. Bucks become aggressive towards other deer from the end of March to April, as the testes develop and velvet is shed. At first, young of the previous year are chased if they come within about three yards, but for only a few bounds before feeding is resumed. The aggression increases progressively and the length of the chase grows until by the end of May young bucks are not tolerated within sight and even young does are chased at times.

During this same period bucks begin "sentry duty". They pace along poorly defined routes which are not necessarily territory boundaries, stopping at intervals to smell bushes or trees, rub their foreheads and sometimes chins on them, and paw the ground about five times with each foot. Again, they may stop to gaze for periods of several minutes towards adjacent territories, occasionally giving single barks for no apparent reason. If a younger buck comes in sight, it is chased at high speed. No fighting has yet been seen between adjacent bucks but two bucks will bark at each other with lower pitched and more prolonged barks than they make when alone. Such barks may also be directed towards a man if he is not recognized as such.

The effect of this activity is to clear the area of all adult roe except the old doe and sometimes a second doe which is usually a young one of the previous year. Thus by the end of June groups of roe typically consist of three adults plus new-born young. In thick woods, other bucks may persist in the same group range, but out of sight of the dominant buck. Where there is no chance to hide, submissive bucks leave. Presumably any extra does leave also. There is little evidence of mortality within the territory.

When bucks were experimentally removed in Castle O'er forest, the does and kids remained in the same areas. New bucks soon moved in and became dominant. They were shot and were again replaced. This suggests that surplus animals move about the edges of group ranges and may be looking not so much for a vacant area as for a lone doe. This idea will be tested in 1965 by shooting does to see if they are replaced, and by shooting both buck and doe to see if the buck is replaced.

The first does come into heat in mid July. On several occasions bucks have been seen outside their territories at this time, apparently in pursuit of a doe in oestrus, but no displacement of resident bucks has been seen. Courtship begins with the buck following the doe about 10 yards behind. In avoiding him she runs in large irregular circles. As courtship progresses, the buck runs closer behind and the circles become smaller. Eventually, the buck is running immediately behind the doe licking her vulva as they describe a tight circle of

about 3 yards diameter. If they are in a grassy area, a typical roe ring is formed. This procedure has been watched for three days running.

On the one occasion when mating was seen, the doe simply stood to be mounted. This was repeated ten times in a few minutes and definite pelvic thrusts were seen the last time although they may have taken place previously. After mating, they both began to eat grass.

GONE WEST WITH THE RABBITS

by

R. J. Jennings

Head Forester, Dean Forest

"From nature's chain whatever link you strike,
Tenth or ten thousandth, breaks the chain alike"
Alexander Pope.

Just over ten years ago *Oryctolagus cuniculus* was digging, scratching and burrowing his way under every fence, hedge, bank and wall in the forest. Those of us who had charge of woodlands in those days did our level best to keep down the numbers. We snared, netted, gassed, shot, trapped and ferreted and still he nibbled our trees and only when Myxomatosis swept through the British Isles could we relax, yet despite his depredations on farm and in the forest there are still people who mourn his passing. I recently came upon one such person when I called at an inn that I lived near some years ago, close to a forest that I had charge of in the Welsh Marches.

Built of blocks of red sandstone it stands beneath the brow of a long winding hill beside an old drovers' road. A place where men and animals had gathered for centuries. I had last called there at Christmas several years ago. Now, passing through the district on a cold evening I had stopped for refreshment and to renew my acquaintance with one or two of the local characters.

The landlord was sitting in front of a roaring fire with a beagle at his feet on the mat for company. As he rose from his chair to attend to my order he selected a dry log from a pile in the chimney corner and pitched it carelessly into the blaze. The flames lit up his round red face in the smoky room reflecting a glow in the horse brasses and a copper post horn that hung on a blackened beam studded with iron nails across the ceiling.

"Things are particularly quiet here tonight, aren't they?" I said . . . "what's on in the village . . . a whist drive or something?"

The innkeeper picked up another oak fire block and weighed it in his hand . . . then after flicking a woodlouse into space from the rough bark with his fat thumb and forefinger he answered me in a disappointed tone. "Quiet," he said "it's been quiet for a long time in this house . . . ten years ago this was the busiest place for miles around . . . you could have met any of the locals who you wanted to see on almost any night you chose . . . but now" . . . he gestured with his hand . . . "they don't come in here much at all as you can see" . . . he nodded and raised his eyebrows . . . "and do you know what drove them away?" . . . he waited for me to reply. "Television maybe . . . or perhaps cars" . . . I ventured . . . He shook his head . . . "No" . . . he replied . . . "I'll tell you . . . you'd never guess . . . it was Myxomatosis" . . . he dropped the block into the fire and lowered himself carefully into the chair again . . . "It's like this" he said.

"You see all through the winter months, right up to 1954 there used to be a dealer who travelled around this countryside collecting produce for the packing station . . . "he'd be here one night . . . Clun the next . . . then Bishop's Castle,

then Knighton and so on. He didn't buy vegetables in those days . . . rabbits were his line . . . eggs and rabbits".

"Now in those days," he continued "everybody around here was catching rabbits . . . they had to . . . they were eating us up . . . the place was alive with 'em! The farm workers had snares down in the fields . . . the forestry men laid wires along the edges of the woods on their way home from work and picked up their catches in the morning. Then most of the young fellows spent their spare time on a Saturday ferreting . . . good fun it was for them too . . . they'd take the rabbiting off the farmers for a pound or two . . . no guns mind . . . they weren't allowed . . . just long nets and ferreting".

"Well . . . in an average week a man who knew what he was about might average maybe ten or fifteen couple . . . and at half a crown or even two bob apiece that was good money for himself wasn't it? Expenses were low . . . a chap would breed and sell his own ferrets, . . . and nets lasted a long time".

"Then on a Tuesday night . . . when the van came round collecting them he'd stop here for an hour or so . . . you see my house here was the picking-up point for this area and you'd see twenty or more men meeting in the yard to sell the dealer the weeks' catch. My outhouse would be hanging with rabbits . . . hundreds of them would change hands for hard cash".

"Now," . . . he said . . . pressing the table with his fist as if to emphasise the point . . . "most of that cash was spent here in my house on one thing or another . . . and a tidy sum it was I can tell you . . . what those rabbits sold for was clear pocket money wasn't it? . . . no tax on that . . . nothing like it nowadays . . . why . . . all of us made something out of rabbits . . . "

"The farmer had his bit of rough shooting, . . . what's better than a walk around the fields with your gun first thing in the morning to see if you can put up a rabbit? . . . the young chaps got plenty of fresh air and exercise as well as the dough . . . they'd dig for hours if their ferret got blocked under an old thorn hedge . . . it was an outlet for their surplus energy too, . . . Then the folks in town who weren't too well off could get a cheap dinner for a Sunday . . . we country folk used to call a rabbit the poor man's turkey . . . and what was nicer for supper than a leg of cold rabbit and a pickled onion . . . and then, of course," . . . he sighed nostalgically . . . "I got a living out of what was spent"

"Then what happened," . . . he put his hands in his pockets and wriggled in the chair with a look of exasperation.

"Tell me what happened" I said.

"Well," . . . he went on . . ."along comes Myxomatosis and kills off all the rabbits . . . there was a tragedy if ever there was one!"

"So what happens now you say?"

"Well the young chaps sit indoors on a Saturday afternoon watching wrestling and football on the television . . . and if they want a bit of sport they go out at night and smash up somebody's gate for exercise . . . the old aged pensioners lost their cheap week-end dinner . . . the butchers push up the price of meat . . . bang goes the farmer's bit of shooting . . . somebody makes a million out of tinned cat and dog food . . . and what upset me, the locals lost their pocket money and stopped coming here for a glass of cider." A mournful expression came over his features ..."Do you know," he said ... "I have to go out to work now . . . this place won't keep me . . . Yes, I can tell you . . . lots of things went west with the rabbits."

SAP SUCKING BY THE GREATER SPOTTED WOODPECKER IN THE FOREST OF DEAN

by

R. J. Jennings

Head Forester, Dean Forest

The work of the Greater Spotted Woodpecker in trees of various species whilst searching for larvae or a suitable nesting hole is well known to all foresters.

What may not be so frequently seen or easily recognised however are the holes that are bored by the birds in green healthy hardwoods in full leaf in their sap sucking activities.

Sap sucking occurs in spring and early summer in the Forest of Dean and has been recorded on oak, ash, elm, willow, poplar, sweet chestnut and in particular by the writer in lime as illustrated in the accompanying photograph of a tree 12-inch breast-height quarter-girth growing in Flaxley woods near Westbury on Severn at the southern end of the forest.

The birds select certain trees and return to them in successive years, often opening up a hole pecked out in the previous year. The work extends from two feet or so above ground level to the top of the tree and appears to be slightly more concentrated on the western and southern sides of the trunk.

The holes are bored only down to reach the sap and so far cannot be said to have lowered the value of the timber in any way. As this sap sucking occurs when the trees are in leaf it is difficult to observe in a hardwood area. (See plate 26, central inset.)

A Memory

Once in a forest nursery where I stood
Ten acres of green transplants grew like corn
Pale cotyledons thrust aside the earth
And I beheld a tiny fir tree born.

I then reflected, if this seedling lives
Should it survive the winter frost and snow
The pests, disease and scorching summer sun
What might it be . . . where would it chose to grow?

Perhaps on wild Northumbria's rolling moors
'Midst Merioneth's mountain streams and rills
In Scotia's lingering mists, Caernarvon's rocks
The Kentish weald or Devon's coombes and hills?

A wildcats' lair might lie beside its roots
'Neath shady crown red stag and roe deer rest
The capercailzie feed upon its buds
In hanging branch a siskin weave a nest.

As paper pulp its trunk could bear good news
Or yachtsmans' flag as ship's mast tapered thin
A craftsman fashion it into a chair
Its choicest wood might make a violin.

What happened to that tree I cannot say
I know not if it lived another morn
But in the woods I frequently recall
The day I saw a tiny fir tree born.

R. J. J.

FOREST ACCESS AND TRANSPORT OF PRODUCE

THE FORESTRY COMMISSION BUILDS 200 MILES OF ROAD A YEAR

by

D. M. Beaton

Senior Civil Engineer, Scottish Directorate

It is little realised that the civil engineers of the Forestry Commission in Scotland are currently building new roads at the rate of 200 to 220 miles each year at a cost of approximately £1,250,000. In addition there is the responsibility for maintaining the ever-growing mileage of completed forest roads. By the end of 1964 the Commission mileage in Scotland amounted to 2,700 miles.

The growth of civil engineering work is a reflection of the development of the forest enterprise which it serves. Forestry, in Great Britain, and particularly in Scotland, has expanded rapidly since the end of the war. From the inception of the Forestry Commission in 1919 until 1946, the area of land planted, or acquired with growing timber, by the Commission in Scotland amounted to 180,000 acres. By September 1965 the acreage will have reached 719,000 acres representing an average annual post-war planting rate of 28,000 acres or 44 square miles. This rate of growth continues.

Modern, and increasingly mechanised forestry requires roads for a variety of purposes. A skeleton road system is necessary before any development of new blocks takes place so that labour and machinery can have ready access for the initial processes of drainage, ploughing and planting. A second phase in road construction occurs in areas of high fire risk once the plantation reaches the vulnerable thicket stage.

Expensive Stage

The final, and most expensive, spell of road construction activity occurs some 20 years (more or less, depending on species and site) after planting, when the forest has reached the stage of first thinning. From this point onwards access is required for the extraction of timber and its transport to markets. The layout of all roads from the inception of the forest is determined by this ultimate purpose.

The difficulty and hence the cost of construction varies very greatly with the terrain. Generally cost is lowest in the East and highest in the mountainous country of the North and the West.

The standards of construction adopted are dictated by the function of the roads. Since the forests are planned to remain in rotation the roads must be permanent and capable of being maintained at low cost. Timber is, in its raw state, a low-value product in relation to its weight and volume. The future trend is that timber will be sent from the forest to high-capacity processing units—an example is the new pulp mill at Fort William.

This means substantial average haulage distances which, for economy, require the use of the largest possible road vehicles. The best overall result is obtained when the vehicles can be loaded on the forest road giving one-stage transport. Forestry roads are therefore designed, from the aspects of pavement thickness, gradient and curves, to carry the largest vehicles permitted on the public road. Current investigation is proceeding on the effects on Commission road design of the new Construction and Use Regulations.

Single Carriageway

The intensity of traffic is insufficient ever to justify more than a single carriageway width of 10 feet with passing places. Present traffic volumes do not

render the provision of a sealed surface economically justifiable. With increased timber traffic there may, in future, be a case for a sealed surface on a limited mileage of arterial forest roads in a few of the larger forest blocks.

The roads, though to the layman sometimes apparently rough, are strong and scientifically designed for their purpose. It is an interesting sidelight that their use is essential for the conduct of two rallies of international status, the R.A.C. International Rally and the R.S.A.C.'s Scottish International Rally. It is significant that on the forestry road sections an average speed of 50 m.p.h. is demanded and attained.

The design and preparation of estimates for upwards of 200 miles of road every year is a large undertaking. It is vital to the forest enterprise that the expensive element of road construction be carried out at minimum cost. The design of low-cost roads which will adequately serve their purpose through the years is a worthy civil engineering challenge.

The land allocated for forestry is usually mountainous or upland. The subsoil is most frequently rock, peat or soft clay. Being poor land, it is badly drained. Since the roads are immediately, or ultimately, required for the extraction of timber, they must be sited to suit the characteristics of the extraction system appropriate to ground. This last requirement leads the engineer designing forest roads into difficulties of alignment, ground conditions and drainage which his more fortunate colleague on public roads can very often escape.

The preliminary location is a major task for civil engineers and the district forest officers. In difficult country, and there is much of this in Scotland, it is essential thereafter to prepare detailed drawings from which adjustments of line and level can be made to minimise earthworks and prepare quantities from which cost can be determined. The tasks of surveying the more difficult roadworks, preparation of drawings and quantities, and setting out of the work, are carried out by civil engineering assistants under the guidance of civil engineers.

Local Materials

No estimate for roadwork is complete until a source and price for road stone is determined. In early years, roads were bottomed with gravel, but after building some 2,700 miles of road requiring some 8 to 10 million tons, it is understandable that it is increasingly difficult to obtain supplies of suitably graded gravel within an economic haul distance from the road heads!

Low cost construction depends on local materials, so the search for these is a continuous one. Rock, which is never far from, and usually on, the roadline, is being used on an increasing scale. This has become economic not only because of scarcity of gravel, but through the use of more modern techniques now available. These are the use of heavy bulldozers for ripping instead of blasting in laminated rock, of faster and therefore cheaper drilling equipment in harder stone, and of fully mobile crushing plant for the reduction of quarried stone to road-stone size.

The softer stone which is generally considered unsuitable for roadworks is now used with some confidence following the adoption of an empirical field test devised by the Road Research Laboratory and the Commission's engineers in Wales.

It is not possible to build many roads in Scotland without meeting bridging problems. In 1964, for example, 49 bridges were constructed. These are designed to 80 per cent of Ministry of Transport loading. This is considered adequate since they are invariably single lane and carry, relative to public roads, a very low traffic density. Construction is generally of reinforced concrete in the shorter spans and pre-stressed concrete in the longer.

The road and bridge works are almost invariably carried out by direct labour. Since the programme is a continuous one it offers the possibility of

continuous employment of plant on a large scale with corresponding economy. This is not achieved without effort because the programmes of the four Conservancies, into which the Commission in Scotland is divided, consist of a substantial number of scattered projects. This is inevitable because roads are required for different purposes and must be phased to meet forest requirements.

Quick Decision

The timing of the individual projects throughout the year, the preparation of a plant deployment programme, and its subsequent adjustment to meet weather conditions and variation in project progress, is often a challenging task for civil engineers in the Conservancies.

The day-to-day control of road and bridge construction is, under the guidance of an area civil engineer, in the hands of superintendents of works They each have charge of a number of projects. Even with the best planning, unforeseen difficulties arise frequently on road construction in rough terrain. One of the consequences of mechanisation is the need for quick decision when problems occur, and much then depends on the engineering knowledge and experience of the superintendent of works.

In any civil engineering organisation the conduct of operations demands the efficient maintenance and repair of plant. On civil engineering work the Commission in Scotland employs some £800,000 on plant and vehicles. To maintain this, and the fleet of silvicultural vehicles and equipment, the Commission operates a central repair workshop at Chapelhall in Lanarkshire, designed and built in 1962 specifically for the overhaul and workshop repair of heavy civil engineering plant.

Phased Programme

In addition, each of the four Conservancies has one or more workshops for the repair and overhaul of vehicles and lighter equipment. A phased programme of replacing the various *ad hoc* premises by specially designed workshops is in being. The first of these, replacing war-time premises, is now in use in Inverness.

Engineers advise on the more difficult land-drainage problems. They are also responsible for all civil engineering work associated with the Commission's large holding of land. Civil engineering staff in the Forestry Commission are therefore called upon for a variety of services in addition to their primary role of constructing roads and bridges.

THE ABRESHWILLER FOREST TRAMWAY

by

H. Gunston

Scientific Assistant, Soils, Research

To a railway enthusiast with a mania for the antique and obscure, to whom an ancient steam engine winding up a Welsh valley is vastly more interesting than any *Flying Scotsman*, it is a source of great regret that the Commission has never seen fit to operate narrow gauge logging tramways for extraction of timber from the forest. Let me hasten to add that despite the word "tramway", these lines have no connection with the clanking, grinding, electric tramcars which once graced our city streets. A logging tramway is a very crude form of railway indeed with none of the trappings of a main line.

To find examples we must look abroad; to the Pacific Coast of the U.S.A., where these lines were an essential part of the vast logging industry with their own ways of working and fascinatingly complex steam locomotives; or to India, where one little line rejoiced in the name of the Changa Manga Tramway. However, nearer home I was recently able to visit the only line of this type in

France, the tramway *forestier d'Abreshwiller*, running in the area of the Vosges mountains, not far from the Rhine, which, true to the modern spirit of forestry, combines timber hauling with a thriving week-end tourist traffic.

The road to Abreshwiller runs up the valley of the Sarre Rouge, between the pine-clothed foothills of the Vosges; and the village itself lies on one side of the valley, leaving the floor clear for the timber yards and sawmills, clear signs of the part which forestry and woodworking play in the economy of the area. A branch line of the French State Railways runs up to the village itself, where a fan of sidings spreads out, running between the stacks of sawn timber, much of it from the state-owned sawmill. This, together with its own power plant, and the workshops and depot of the narrow gauge tramway ,form a considerable complex, clearly marked as the property of its owners, "Le Département des Eaux et Forêts", the French equivalent of the Forestry Commission.

Entering the yard late on a Sunday morning we found few signs of life. Lying about the yard, scattered along sidings, were the little four-wheeled bogies on which timber was brought down from the woods, and, being France, there were also small children, obviously inquisitive, but far too shy to approach. However, one of their elders, whom we later discovered to be the son of the manager, was keen to try out his English and show us round the whole establishment. Starting in the railway workshops we discovered a delightful little steam locomotive and our guide, who had obviously dealt with the breed before, willingly assisted in moving large sheets of iron which obstructed the view, and watched and waited whilst we crawled round lathes, up ladders, and behind vast heating stoves with our eyes firmly pressed to camera viewfinders.

Our tour continued through the wagon shop where we found a little open workmen's "carriage" under repair. This somewhat rude conveyance, consisting simply of two wooden benches facing one another on a four-wheeled chassis, was obviously of traditional design as an exactly similar vehicle was featured in an illustration to an article on the line written in 1924. The finding of this article was something of a triumph for Alice Holt Library, at least as far as I was concerned. A chance reference in a Guide to French Forests led to a search among the back numbers of a journal rejoicing in the name of *Bulletin Trimestriel de la Société Forestière de Franche-Comté et des provinces de l'Est*, ending in the production of a pile of issues of the 1920's tied up with ribbon and string. Eventually the article was run to earth, despite the fact that in the reference the year, volume number, and page number all turned out to be wrong!

The visit that occasioned the article was a day trip in connection with a congress held by the Société, and in one photograph, titled simply "Le Départ", two of these crude carriages are shown "decorated with flowers and pine branches" in honour of "les congressistes", mainly gentlemen in boaters with very-French beards and one or two ladies draped in furs, just before their departure into the forest.

Continuing our tour, we were shown the hydro-electric power plant and the sawmill itself, and were fascinated by the extent of the saw doctor's "surgery". We then met Papa, who did not seem quite so keen on the guided tours, but who politely informed us that a train would run that afternoon, so we retired to the van to cook tinned rice puddings on camping stoves, an activity found highly diverting by the small children until their own call for lunch came.

Early in the afternoon the starting of a large diesel engine heralded the first signs of life on the tramway, and before long a hefty diesel loco appeared, trailing a large pole which was, apparently, its only method of connecting to its train, which was thus always some twenty feet from its engine. In the week, of course, the pole would allow overhanging loads to be pulled round the numerous sharp curves on the line. However, this week-end running was the result of an agreement between the local Syndicat d'Initiative (or Tourist

Board) and the Département that the line should be run as a tourist attraction, and our train consisted of two long open trucks into which had been put simple wooden benches, a small brake van, and one only of the workmen's "carriages".

After a brief inspection of the train and the inevitable photographs, we took our seats, and in a surprising short time the train was all but full with French families who had suddenly materialised for an afternoon in the forest. We had hardly all settled down and sorted ourselves out when two gentlemen of the Syndicat appeared to collect our fares, one tall and morose handling the money, and one short and rotund, sporting a vast expanse of decorative waistcoat, dealing with the tickets. The tour of the crowded wagon by this pair was not without its difficulties, one being that if a person is sitting on the end of a bench when the other occupants rise *en masse* to sort out their small change, then that person is likely to be slid neatly to the floor. However, the fares were collected, the sides of the truck firmly fixed, and we were away.

Leaving the depot we ran first alongside the swiftly flowing river and then beside a small road where we were chased by a car the driver of which, when it drew level, shook hands with one of the passengers with whom he was presumably acquainted, all the while managing to keep his car on the road. Passing through open fields where nuns were picking flowers we had to slow right down to make our way gingerly through a small sawmill yard, where one line branched off, before coming to rest by a road crossing to pick up some passengers. This turned out to be literally true because the wagon sides had been so well fixed that one girl had to be lifted straight over the end of the truck by one of the trainmen so that she could take a seat.

By now we were really getting into the forest proper. The Abreshwiller state forest is of some 4,000 ha. and is part of a forest area of some 18,000 ha., mostly of fir, but with spruce amounting to about one fifth of the crop. The tramway itself "drains" some 5,000 ha. and was rebuilt in largely its present form in 1892 for steam working, there having been an earlier line worked by animal traction from 1884. At this time the forest, as a part of Lorraine, was under German rule and the gauge of the line, 70 cm., compares with German forest lines elsewhere. In 1924 the total length of track was some 50 km., with four steam locos and over 100 wagons, and the line then gave employment to some 60 men.

As we wound deeper into the forest, running right through a farmyard at one point, the sides of the valley became steeper, and the trees more impressive. With barely room for both the track and a rough road, we followed a stream until reaching a small clearing on the valley floor, which we took to be the end of the line; but on looking back, saw that our line had been joined by a steep spur running up the side of the valley, and with our diesel groaning we proceeded backwards up this line. At the top we once again reversed and set off much higher up the valley side with excellent views down through the magnificent firs towards the stream below.

Finally, we reached a wide clearing and loading point which was indeed the end of the line. Facilities were sparse, a few signs and a table and four chairs which were quickly occupied by a bridge party whilst the rest of us looked at the view across the vast forest, which would have been that much better ten years ago before the trees around had grown so tall. A pleasant quiet spot, but all too soon we had to start the descent. We took our seats this time in the "four-wheeled wonder", perhaps the very same one in which "les congressistes" had so much enjoyed their ride, and by sign language instructed an elderly lady which way to turn the brake handle if all else failed. However, the burly brakeman on the next wagon had things well in hand, despite the teenage couple blissfully ensconced on his brake platform, but in France who would discourage an *affaire de cœur*?

The other passengers seemed more interested in their gardens, bringing down ferns, rockery stone and plants, and when we stopped to reverse, the excitement at the discovery of mushrooms almost threatened to overturn a wagon. At the bottom of the spur our friends were waiting with the van so after farewell waves from almost the entire train, we watched it wind its way down the valley, and concluded that a wooden bench in an open truck could indeed hold more delights than a couchette in *Le Mistral.* (See plates 18 and 19, central inset).

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Nant y Mynydd

Where grey backed heron spears the eel and frog
On misty waste of Mynydd Hiraethog
Spring water rises from a sphagnum bog.

It seeps through peat where cotton grasses grow
Past Nilig, haunt of grouse and carrion crow
Cascading down to Seler rocks below.

Into a pool where brown trout dart and leap
Stone walled with gravel bottom six foot deep
Where shepherds from the hills once washed their sheep.

Now rushing fast with gathering force and speed
To burst into a "pistyll" by the "fridd"
Behind Nant Uchaf where black cattle feed.

A grey stone farmstead built beneath the moor
Gay shrubs and flower beds near the kitchen door
And by the gate a leafy sycamore.

Across the yard wet tracks of muddy feet
Where ducks and geese splash in the shallow leat
That turns a wheel for grinding corn and wheat.

By Capel Corris where the dipper dives
Touring the watercourse with plaintive cries
And yellow wagtail feeds on gnats and flies.

Beside the path through woods of larch and pine
Through Melin Moch where millers once kept swine
To Bont Uchel where anglers cast their line.

Grown to a river following road and rail
Past Llanelwy Cathedral in the Vale
Of Clwyd, where the boats and white swans sail.

By Morfa Rhuddlan flowing fast and free
Beneath the Foryd bridge into the sea
Engulfed with Mersey's currents and the Dee.

R. J. J.

Notes—This is the River Clwyd that rises in Clocaenog Forest.
"Fridd" is pronounced "freeth".
Llanelwy is St. Asaph.

HARVESTING, MARKETING, UTILISATION: PROPERTIES OF TIMBER

WHEN THE BALLOON GOES UP

by

R. M. Burnett

Tool Instructor, South Wales

A new logging technique is being developed in America, involving the use of balloons. An article describing the set-up was published in the *Timber Trades Journal*, 8.1.66.

The economics of the scheme have not been finally assessed but the people carrying out the experiment, The Elkside Lumber Co., Oregon, seem convinced that they are on to an efficient and more economic method of extraction.

Brief details of their findings are:—

Extraction rate of 2,400 per min.
6,200 board feet per hour
equivalent to 500 cu. ft. per hour approx.
or 2 lorry loads of props or pulp per hour.

The balloon in use is specially designed by the Lumber Company and consists of two cigar-shaped hulls fixed in a "V"-shape with a horizontal swing section joining the hulls at the stern. The whole structure is 110 feet long, of 86,000 cu. ft. helium capacity, is capable of a 10,000 lb. lift (equivalent to approx. 140 cu. ft. of fresh-felled conifer) and is manufactured by the Goodyear Aero-space Corporation.

A winch is set up in the off-loading area, with an out-haul running out to the felling area via snatch blocks, and is attached to the balloon. The in-haul is attached to the balloon direct.

The operation is simple. The balloon is hauled into position by the out-haul wire, a tail rope is secured to the tush or load, the out-haul wire slacked off allows the balloon to lift off with the tush on the tail rope, and the whole outfit is hauled to the off-loading bay by the in-haul. Control is by radio at each end of the run, that is, by walkie-talkie.

The idea of the system was first thought of as an alternative to constructing an expensive roadway to reach an otherwise inaccessible area.

The potential of this system is worth serious consideration and its application could open up many areas for development, thinning or felling which hitherto have been shelved or abandoned because of bad road access or expense.

The advantages for a production area are numerous. Consider conversion of felled material at stump. Parcels of pitwood or pulp or timber could be extracted and loaded straight on to a lorry. All the waste material stays in the compartment. No damage to the standing crop, no interference with drains or fences. It would be the most rapid form of extraction.

Coming back to earth! Here is the "rub". The balloon in use in America cost $70,000 (any War-surplus blimps around?) but do we need to lift 10,000 lb. in one operation? The winch and wire! What would 2,000 yards of $\frac{3}{8}$-inch wire cost? There used to be reels and reels of balloon wire sculling around our sheds—any left? Helium—they top up the American balloon with half a cylinder of gas a day. Couldn't we get some of our brass-hats to do breathaliser tests into a blimp. Well the first balloons went up on hot air didn't they?

With a balloon borrowed from the Army a trial run should not cost such a lot.

Editorial Note. The Commission's Engineering staff have already taken a first look at this ingenious method of hauling out timber. Two problems arise at once—balloon logging is only suitable for clear-falls, as in a thinning cables

could not be manupulated through a standing crop; and our gales are much fiercer than any which blow in Oregon—also more frequent!

MARKETS FOR POPLAR TIMBER AND BARK

by

J. R. Aaron

District Officer, H.Q., London

(a) Introduction

This paper presents recent information about the industrial use of poplar in Great Britain. It is based on visits to Bryant & May Ltd., British Basket & Besto Co. Ltd., and to hardwood merchants; and discussions with a poplar specialist in the Commission's research branch. It covers all known consumers of poplar except some plywood manufacturers who occasionally advertise for peeler logs.

(b) The Manufacture of Match Splints

Matches are currently manufactured from imported splints or from veneers obtained by peeling poplar logs. The poplar used is mainly from the eastern seaboard of Canada, but some Swedish aspen is used too. Prior to 1954 some Canadian white pine was also used.

The consumption of home-grown poplar is less than one per cent of the total, but this is because very few logs of suitable quality are offered.

The specification for poplar logs is identical to that given under paragraph (c) for veneer package manufacture, except that the maximum butt diameter for match manufacture is 24 inches.

A few years ago the British Match Corporation Ltd., through their subsidiary of Bryant & May Ltd., introduced a scheme of poplar planting on their own estates which, if continued, would ultimately result in self-sufficiency of poplar logs replacing imported logs completely. The Company, however, is likely to continue to import poplar splints because it owns splint factories overseas. The planting scheme followed earlier attempts in the immediate post-war years to encourage woodland owners to plant poplar for the production of veneer logs; the Company claims that these attempts were not too successful because many plantations received insufficient weeding and pruning to produce logs of the required quality. Although self-sufficiency was the aim of the planting scheme, the Company do not now wish to put themselves in the position of being unable to accept good quality poplar logs from outside sources if offered. It is therefore currently carrying out a survey, using 50 per cent samples, to determine the quantity of suitable timber on private estates, likely to become available in the future. The results of this survey will probably determine the extent of Bryant & May's planting programme. It is not known when this project will be completed.

The following figures of sales of matches in the United Kingdom indicate the downward trend in consumption resulting from increased use of automatic lighting devices, automatic central heating, and the anti-smoking campaign:—

1953	17,600,000 gross boxes
1964	15,500,000 gross boxes

Although there is no substantial export of matches, sales by the overseas subsidiaries of British match manufacturers exceed the total home consumption.

(c) Veneer Packages

Veneer packages (chip baskets and punnets) are thought to be manufactured exclusively by the British Basket & Besto Co. Ltd., and its subsidiaries. This company is a subsidiary of Bryant & May, Ltd., whose parent company is the British Match Corporation Ltd.

Home-grown poplar is used by all branches of the company, but most of the poplar they use is imported from Canada, together with some from France and Germany. Some home-grown Scots pine, lime and willow is also used.

The current specification for poplar is as follows. "Fresh-felled butt and second lengths, clean, straight, free from heart-rot and other disease, both ends well trimmed, and free from flutes. One 4 cm. (1½ in.) knot is allowed per running metre (40 in.). Lengths 7 ft. to 16 ft., over bark, top diameter 12 in. and up, over bark, but diameter 30 in. maximum." There is no price differential for sub-standard material, it is not acceptable. Any intending supplier should ascertain the latest specification and terms from the firm.

The trend of veneer package production has been fairly steady in recent years; 1960 and 1961 were record years. Subsequently there has been a slight falling off on account of competition from pulp containers which are marketed at two-thirds of the cost of a veneer package.

It is thought that the company would be willing to purchase up to 100,000 hoppus feet over-bark of home-grown poplar. While this market, which in 1964 brought a return of 7/– per hoppus foot delivered (less bark allowance) may be remunerative, it leaves the supplier with the problem of disposing of the knotty tops for which there is not always a ready outlet.

(d) Uses for Sawn Poplar

While poplar can be regarded as a general-purpose low-density hardwood, and was marketed as a softwood substitute during the last war and post-war period of softwood consumer licensing; it has few advantages over most softwoods or light tropical hardwoods.

The following may be mentioned as special uses for sawn poplar:—

Waggon bottoms (on account of its resistance to abrasion; it does not splinter like a softwood), cremation caskets, brake blocks (because it does not smoulder), and the flooring of oast houses (where it is preferred to softwoods because it is non-resinous and less flammable). One firm of box and vegetable crate manufacturers converts poplar by a slicing process instead of sawing.

Poplar is not suitable for pallet manufacture because the nails pull through. It is also unsuitable for sea defences because it splits along the bolt holes.

Some timber merchants will only purchase standing poplar when it forms part of a mixed parcel which contains other species which are more readily marketable. It was stated that sawlogs below 12-inch quarter girth have little value.

(e) Poplar Bark

About a decade ago a company of match manufacturers marketed shredded bark for horticultural use. This company peels poplar no longer and consequently does not now produce bark.

Other match companies have investigated this market but consider it to be uneconomic on account of the low cost of other organic residues which are suitable for horticulture.

THE PSYCHOLOGICAL IMAGE OF WOOD

by

G. W. Blomgren, Jr.

Forest Products Research Society, U.S.A.

When a psychologist talks about a product image or a product personality, he means that every product and every object has an image or a personality much like a person. This image or personality can be broken into two levels. One is physical and the other psychological. The attributes of a physical image

are quite obvious. For example, a bar of soap has physical dimensions—a colour and, more than likely, a specific odour. But a bar of soap also has a psychological image.

The psychological image of a product or object goes far beyond its mere physical attributes. It is often partially based on the product's name or its association with other products or uses. For example, Dove soap is seen as feminine by most people, while Borax is a masculine soap. A soap that is gardenia-scented is seen as feminine, while a pine-scented soap would be much more masculine. These examples are rather obvious. But, in fact, product personality can be quite intricate and can include a number of psychological traits that are not readily apparent.

People do not consciously think of things this way, but nearly all the things they buy and use, all the products and objects that surround them are full of psychological meaning. At the individual level, the things we buy, the things we wear, and the way we furnish our home are in good part based on what products and objects mean to us psychologically. The best way to express it is to say that the products we buy and the objects we use are expressions of our personality. Of course, there is the factor of functional utility; that is to say, we purchase a chair because we want something to sit on. This explanation is limited, however, since it tells us nothing about why one individual chooses one type of chair and another chooses another style. The functional reasons involved also tell us nothing about why the individual has chosen a particular time to purchase a new chair.

People state that they buy a car because they need transportation. Yet, this says nothing about why we want cars that have more horsepower than we can use, why some of us want red cars and some want white, or why one person buys a Ford, another a Cadillac, and still another a Volkswagen. Research has shown that specific personality patterns are associated with the purchase of different makes of automobiles. The purchaser of a Volkswagen tends to be a completely different person from the individual who purchases a Cadillac. One represents conspicuous status—the other ostentatious economy. The specific car we purchase is an expression of our attitudes toward life and an attempt to communicate and enhance our own self concept. Possessions have a tremendous psychological importance for us.

Before discussing the image of wood and of specific woods, let us briefly examine the business importance of understanding the psychological image of one's product and related consumer motivations. In good part, people select products in terms of whether they fill psychological needs or not. In many cases, the image of a product can be created by the manufacturer. The manufacturer can create an image that effectively relates to consumer needs, or he may create one that does not effectively relate to them. In the first case, he can anticipate high sales; in the latter disappointing results. What choice he makes will depend on the extent to which he understands consumer attitudes toward his product and whether he relates these to an effective product image.

In discussing the image of wood, Ernest Dichter, a pioneer in motivational research, reports that wood has a number of basic emotional appeals that can be employed to good advantage by the wood products industry.

As a natural resource or product, wood has a basicness or depth of psychological meaning that other products or materials do not. In many countries, including the U.S.A., the tree is a symbol of life. It is associated with growth and life-giving factors; it is a basic symbol of nature in that it grows in the earth and is nourished by light and air. Wood retains life long after its physical death. Subconsciously, people feel that wood itself represents the natural processes of life and growth.

Wood suggests strength and security. In many parts of the world, the

evolution of human shelter is intimately connected with trees and later with forest products shaped by human tools. Metaphors frequently suggest psychological attitudes; for example, "staunch and true as a tall pine tree" or "stout-hearted as an oak."

Wood is sensuous and intriguing; people enjoy feeling and caressing wood. Even the smell of wood is sensuous and suggestive of romantic and idyllic imagery.

Wood suggests productive human activity. Again, this is tied in with the association of vital life forces. It is a man building something, a boat sailing, or a tree growing.

Wood is fascinating, distinctive, and, on this basis, ideally suited for the development of specific images or personalities. People can become quite intrigued by the distinctive subtleties of wood grain. This is heightened by the fact that the personality of a wood product is seen as having been released by a skilled craftsman.

Wooden objects give atmosphere to a room because of their peculiar psychological ability to evoke memories. A worn chair or table sets off memories of its owner; this may be part of the appeal of antique furniture. From a common-sense point of view, it is rather strange that consumers who otherwise want everything letter-perfect and smooth and shiny are willing to pay to have their furniture subtly gouged and marked to make it appear antique.

Generally, people want to avoid what is cold and artificial. Wood is ideally suited toward this end, because it is seen as being natural, solid, and reliable. People frequently mention wood's having a "warm glow". This is associated with qualities of peacefulness and relaxation, a pleasant connotation during a period that has frequently been described as the age of anxiety.

To get more specific impressions of the average consumer's image of wood, we conducted a brief study by means of a questionnaire. Although admittedly limited in scope and size of sample, the survey did produce some interesting responses. The following instructions were given to all survey participants, and a sample check list for one of the nine species studied is shown below.

The type of wood which you are to think about on this page is *PINE*. Go through and place a *check mark* after the five words which you most associate with *Pine*. When you have finished this place an "X" mark after the five words which you associate least with *Pine*.

Feminine	Relaxing	.....
Beauty	Dignity	.....
Old Fashioned	Warm	.....
Cold	Friendly	.....
Elegance	Formal	.....
Durability	Strong	.....
Modern	Rough	.....
Comfort	Practical	.....
Security	Masculine	.....
Sophisticated	Fragile	.....

"On the following pages are the names of different types of wood commonly used in furniture. Below the name of the wood is a list of descriptive words. We would like you to think of the type of wood mentioned and all the impressions you associate with this type of wood. Then, we would like you to go through the list of descriptive words and place a check mark next to those words which you most associate with the particular type of wood mentioned on that

page. Read the whole list before deciding. Place a check mark next to the five words which you think are most closely associated with this type of wood. Next, go through this same list and place an "X" after the five words which you associate least with the type of wood mentioned.

"Do the same on each page for each separate wood. Do not look back at your previous answers. You will have to use your imagination because frequently we do not think of wood in terms of the words which are listed."

Nine different woods, including redwood*, walnut, teak, pine, cherry, maple, mahogany, oak, and pecan†, were rated in terms of descriptive adjectives. Keep in mind that the respondents were rating these woods on the basis of their mental image. This is not to say that they would rate them the same way if they were shown unlabelled samples of the actual woods. Frankly, it is doubtful whether many individuals who have definite mental images of a given wood could recognize it by its appearance. This in itself is an interesting point. It would be interesting to know whether consumers base their decisions on their associations to the name of the wood or whether the actual appearance of the wood is just as important.

The results of the study were broken into two groups, male and female. There were about 75 respondents in all. In many cases, both sexes have much the same image of a given wood, and only separate results where one sex's image differs from the other will be indicated.

Starting with redwood, both sexes agree that it is a very masculine wood, with no feminine properties. Both sexes further agree that it is not an elegant wood; nor is it sophisticated or formal. On the positive side, respondents see redwood as durable, friendly, strong, and rough. Men emphasize that it is practical. This particular image of redwood probably derives from the fact that it, more than the other woods mentioned, is associated with outer, shelter construction. Thus, it might be somewhat difficult to gain consumer acceptance for redwood furniture, except for the outdoor type such as picnic tables and lounges. As interior panelling, it would probably have more appeal to men than women, perhaps as use for their den or private retreat.

Considering pine, both sexes agree that pine is also a masculine wood, and in many respects, it has an image quite comparable to redwood. Both sexes agree that it is warm, friendly, rough, and practical. Women feel very definitely that it is old-fashioned; men, however, seem evenly split as to whether it is modern or old-fashioned. Like redwood, it is not seen as being very elegant, sophisticated, or dignified. It would be well suited for a den or recreation room.

The image men have of pecan is quite vague and ambiguous, and very few specific trends emerge in the data. Men do agree, however, that pecan is feminine and sophisticated. Also, men show great reservations as to how practical it is. Practicality being one of the qualities on which men pride themselves, it might be difficult to sell pecan for many purposes around the home. Men are strangely split as to whether pecan is modern: half the group feels that it is one of the qualities they most associate with pecan, yet the other half feels that it is the quality they least associate. Women have a much more definite idea about pecan. They're strongly inclined to feel that it is beautiful, elegant, warm, and friendly. Women, too, show some reservations about how practical it may be and associate it least with strength. Women also indicate somewhat that it is a fragile wood.

Notes: * "Redwood" implies the Californian redwood, *Sequoia sempervirens.*

† Pecan is a species of *Carya*, allied to hickory.

Both men and women see pecan as more of a decorative, ornate luxury. Pecan is the only wood which the group expresses reservations about its practicality, strength and durability.

Oak emerges as one wood that has the most specific image or personality. To the last man, males indicate oak is a masculine wood, and so do the women, with one lonely exception. To a much greater extent, men see oak as being old-fashioned, while females are evenly split on this point. Both sexes very strongly agree that it is durable, strong, and practical. More than any of the other woods, both sexes associate oak with security, and this more than likely comes about through the identification of oak with flooring. Security here evolves from the actual physical connotation of stability under foot.

Men see mahogany as being beautiful, old-fashioned, elegant, durable, strong, and masculine. Women agree with them, with the exception that they feel mahogany is dignified, but they don't feel that it is quite as practical as men do. Both groups agree that mahogany is not a modern wood, and women seem to emphasize that they don't associate comfort with it.

Both sexes are in very definite agreement that teak is a beautiful wood; both agree that it is both elegant and modern. Women feel that it is a friendly wood, but men do not see this as one of the traits which they particularly associate with it. Strangely, women feel very definitely that it is a fragile wood, while men feel that this is a quality which they least associate with it: this is a rather puzzling discrepancy. Women emphasize that it is a rough wood. The image of teak is probably based on associations with exotic, tropical, or Far Eastern imagery.

There is a great deal of disagreement about cherry. It appears to be a wood that is many different things to different people. More people check more different traits for this wood than any of the others. Women, however, cast the most votes for the following traits: feminine, beautiful, elegant, and warm. Men see it as old-fashioned, but women seem to be equally split on this point. Both sexes agree that it is friendly wood. Within their own group, both sexes disagree about a number of points. Some men feel that cherry is strong; others feel that it is not. The same is true of sophistication. Women also disagree as to whether it is sophisticated or not; the majority, however, do not associate sophistication with cherry. Women are also in disagreement as to whether cherry is or is not strong. Similarly, women disagree as to how durable it is. Men, on the other hand, feel that it is durable.

Unfortunately, results such as these do not have direct application to specific wood products. First, product personalities or images change to some extent in context. Thus, there may be three different images associated with a teak coffee table, eak panelling, and teak floor. Consumers may have completely different attitudes toward using teak panelling in a recreation room as opposed to a bedroom. Also, there would be a great many variables on the side of the consumers. The very limited study that has just been discussed definitely suggests that sex is one of these. There are also many differences which would be found if the sample were large enough to break down in terms of educational level, income level, socioeconomic status, geographic location, and many other factors. For these reasons, studies such as this are best conducted in relation to specific marketing interests or products.

In many cases, the wood products industry faces an obviously difficult problem in its advertising. With the apparent exception of wood that is used as structural material and decorative panelling, wood is rarely sold as such. A wood table is sold as a table and not as a piece of wood. A piano is sold as a piano, and not as a piece of wood. A television set is sold as a television set and not as a beautiful piece of cabinetry. In such cases, one can only go so far in emphasizing the material out of which a product is made or encased. In this

area, some of the institutional advertising of the wood and wood products associations has a definite role. On the other hand, institutional advertising emphasizing wood products per se such as flooring, panelling, and structural use are of questionable value. This may be particularly true where they emphasize the æsthetic, status, or other psychological appeals of wood. It seems as if wood and lumber people are somewhat reluctant to talk about more primary features of wood. Possibly they are reluctant to bring up such features as maintenance, initial cost, and the like for fear that they will compare unfavourably with competitive building and panelling materials.

With this idea, I would like to mention a definite opinion of mine. It can scarcely be argued that convenience and maintenance-free products have a great appeal to a large segment of our consumer market. Yet, this conclusion cannot be carried too far. Despite the stereotyped humour connected with it, there are many men who particularly enjoy working around their house and grounds. Caring for, upgrading and adding to one's home have a great deal of deep-seated psychological meaning in terms of the traditional male role. This is readily apparent in any hardware store on a Saturday morning; men show an amazing attraction to shiny new saws, screw drivers, hammers, and machinery of all sorts. If this is not enough, there are seeds, fertilizers, and chemicals galore for their lawns and gardens. Most men look forward to a visit to the hardware or garden store. A vicarious but similar experience can be obtained with a number of store catalogues. One finds these feelings particularly prevalent in suburbia. A number of psychological needs are involved, such as the mastery of one's environment, the desire to create, and many underlying currents of the old pioneering spirit—the ability to do things oneself. Do not forget that, in many respects, society has greatly limited the opportunities for an individual to be creative, it has also limited the ability or experience of feeling self-sufficient.

It is a psychological as well as common-sense law, that, when needs are thwarted, they seek expression elsewhere. Many manufacturers, including the garden and lawn-supply people, have probably done an admirable job of capitalizing on this. More recently, the tremendous popularity of paint manufacturers' antiquing kits are probably based on some of these same needs. On the other hand, the author feels that the lumber and wood product groups have failed to recognize this or are doing a poor job of responding to these needs. The local lumber yard is a relatively weak link in the marketing of wood, yet this is a store that has the same potential appeal to men as does the hardware or garden supply store. One can scarcely speak of lumber yard merchandise as being displayed effectively, since it is hardly displayed at all. It is only recently that lumber yards have begun to attempt to spell out and offer assistance on projects for which the home owner might use wood.

The wood and wood products industry can be a growing, vital business. Relative to competing materials, it offers a number of unique advantages, the most important of which are its æsthetic qualities and the great range of distinctive individuality that a wood product can assume. Again, the social conditions of an era often form or emphasize consumer needs. More than ever before, our society, in one way or another, has tended to minimize distinctiveness, individuality, and skilfully-crafted, æsthetic beauty. At the same time, the need or the appreciation of these qualities has in no way diminished. The author believes, however, that the wood industry has been somewhat slow in carrying its message to the consumer in an effective way. He also believes that there are a number of different product areas which a psychological reading of the market would certainly suggest as worth while studying.

PLYWOOD, FIBREBOARD AND WOOD CHIPBOARD

contributed by

The Forest Products Research Laboratory, Princes Risborough, Aylesbury, Bucks.

Plywood, fibreboard and wood chipboard are quantitatively the most important of the sheet materials collectively described as wood-based panel products. Statistics of the Food and Agriculture Organisation for 1963 give as the world production in millions of metric tons:

Plywood 12·9, Fibreboard 5·2, Chipboard 3·4.

The three provide a choice of relatively thin materials in large sheets having much more homogeneous properties than ordinary wood. Each needs for its manufacture a complicated and expensive plant which must be fed continuously with large quantities of raw material.

Manufacture of these materials is world-wide and F.A.O. estimate that in the next fifteen years the production will increase by 250 per cent for plywood and fibreboard and by 650 per cent for chipboard.

This paper describes the three panel products, indicates the sources of raw material, and outlines the manufacturing processes and the principal uses.

Plywood

Plywood is made up of at least three layers of veneer (i.e. thin sheets of wood) assembled by gluing, the chief characteristic being the crossing of alternate plies at right angles to improve the strength properties and minimise movement in the plane of the board. If formed of more than three veneers, it is called multiply.

Panels are available in many sizes with 8 ft. by 4 ft. as the most common. Thicknesses range from 0·02 inch to well over an inch. Both soft-wood and hardwood plywoods are manufactured.

Quality is defined by specifications prepared jointly by manufacturers and users, and deal mainly with the two aspects, *Grade* and *Bonding*. The former relates to the quality of the veneers used for the face, back and core of the plywood, each being varied to meet technical or appearance requirements at competitive prices. The tests for bonding ensure both that the glued joints between veneers are of adequate strength and that the adhesive is of a chemical type suitable for the intended conditions of service, i.e. interior or exterior exposure.

Raw Material

Plywood is normally made from round logs rather than from sawn timber. Formerly, only large trees of top quality were acceptable, but methods have been evolved of using relatively small and irregular shaped logs and still producing high-class plywood. Where appearance is of no importance, plywood of adequate technical properties can be made from very low grade logs, a growing practice of great economic significance.

Manufacture

The logs are peeled when green or else treated before processing by heating in water or steam. After removal of the bark and cross-cutting to length, they are fed to the lathe. In this, the billet is gripped axially be revolving spindles parallel to which is a long knife that peels off the veneer. (In an alternative process, used mainly for decorative work, veneers may be sliced from sawn billets—*Editor.*)

Clipping for size and to eliminate growth defects is followed by drying at high temperature and the veneer is graded into face, back and core qualities.

The narrower pieces are glued edge-to-edge to re-make them into full-sized sheets.

Following the coating on both sides of every other core veneer with adhesive, the assembly is bonded in a heated press. The boards are then sawn to size, sanded as required, inspected, and after any minor defects have been repaired, are again graded and marked for quality.

Uses

Building work, including doors and panelling, concrete shuttering, packaging containers and the furniture and radio cabinet industries absorb the bulk of plywood production, with railway waggons, ship fitting, caravans and boats as important secondary uses. Plywood is obtainable for both interior and exterior uses and can be treated against decay, insects, fire and marine borers.

Fibreboard

Fibreboard, more correctly termed fibre building board, is made from wood, the primary bond deriving from the felting of the fibres and their inherent adhesive properties. The term covers two categories of product: hardboard and insulation board.

Hardboard is made in sheets $\frac{3}{32}$ in. to $\frac{1}{4}$ in. in thickness, generally 4 or 5 feet wide and up to 18 feet long. Standard hardboard has a density of about 60 lb. per cubic foot, but other grades of lower density (medium hardboard) and higher density (tempered or super hardboard) are made. The latter are oil-treated during manufacture to give improved properties.

Insulation board is substantially lighter in weight, having a density in the range 15 to 25 lb. per cubic foot, and is thicker than hardboard. Thicknesses from $\frac{1}{2}$ in. to 1 in. are commonly used and sheets are generally up to 4 ft. by 12 ft. in size.

Raw Material

In Britain, fibreboard is made from forest thinnings and other small-sized roundwood, mostly softwood, but some hardwood may be included. In other countries, forest material together with solid sawmill waste is used. Bagasse (sugar cane fibre), groundwood screenings, and repulped waste paper are also utilized, particularly in insulation board manufacture.

Manufacture

Hardboard and insulation board are closely related products, the manufacturing processes being very similar up to the point at which the wet sheet is formed.

The wood is converted into chips which are reduced to fibre under the combined influence of water and mechanical action. Several types of equipment are in use for this purpose. After refining, screening and sizing, the pulp passes to the sheet-forming machine.

In hardboard manufacture the wet sheets are pressed in a multi-platen hot press. The compressed, rigid boards are conveyed to heat treatment and humidifying chambers before trimming and packing. Insulation board is not compressed; instead, the wet sheets are dried by circulating hot air in a tunnel drier. In this way, their low density is preserved.

Hardboard is also made by an alternative process in which the moist fibre is deposited from an air stream on to a moving belt to form the sheet, which is then pressed in the usual way.

Uses

Hardboard has a wide range of uses in building, flooring, furnishing, shop-fitting, vehicle construction, etc. Enamelled, plastic-faced and embossed hardboards are available.

Insulation board is used for heat and sound insulation mainly in buildings. Acoustic tiles are made of insulation board, perforated or slotted to improve its sound absorption.

Wood Chipboard

Wood chipboard is made from particles of wood bonded with synthetic resin.

Panels are mostly 8 ft. by 4 ft. in size but 12 ft. by 5 ft. are available. Thicknesses range from $\frac{3}{8}$ inch to 3 inches with $\frac{3}{4}$ inch as a common gauge. In weight, most of the production lies between 35 and 45 lb. per cubic foot. Some makes employ chips of the same size-group throughout the thickness, others have either discrete layers of finer chips or thin flakes in the outer parts and coarser material in the core. Thicker panels may have a series of holes running lengthwise.

Raw Material

In plywood, the adhesive is spread continuously over the veneer, but in chipboard it is applied to the particles only in spots, and much of the board's strength derives from the interlocking of relatively long particles. Granular materials such as sawdust are of little use except for giving a fine surface to a board.

Chips can be obtained from forest thinnings, pieces of sawn wood too short to be otherwise usable, planer chips and veneer waste. The bulk of wood chipboards are made from softwood but hardwoods are also used.

Manufacture

The general method of making chipboard is described for a three-layer panel with cores made from sawmill waste and faces from prepared chips cut from forest thinnings. The first is hammer-milled to coarse particles which are sieved to remove the dust and the oversized pieces. They are then dried, and conveyed to a storage bin. The thinnings are barked, cut parallel to the grain into thin wide flakes which are milled to the size-range required for face chips, sieved and stored.

From the bins, separate streams in metred quantities, in the correct proportion for faces and core, pass to the mixers, where synthetic resin and wax are added. A layer of face chips is spread on to a moving caul, then one of core particles, and finally that for the second face.

This rough-edged mat is trimmed to length and breadth and its weight checked against density requirements. Cold pre-pressing consolidates the mat, which is put into the multi-deck loader and thence into the hot press for final consolidation and the cure of the resin. Finally comes sawing to panel size, sanding and packaging.

Uses

Most chipboard is bonded with urea resin and is thus suited only to interior applications. Amongst its uses are furniture and kitchen cabinets, doors, partitions and floors in buildings, and as a base for veneer and plastic overlays in panelling.

British Standard Specifications for Wood-based Panel Products

PLYWOOD

1088:1965—Plywood for marine craft.
1455:1963—Plywood manufactured from tropical hardwoods.
3444:1961—Blockboards and laminboards.
3493:1962—Information about plywood.
3583:1963—Information about blockboard and laminboard.
3842:1965—Treatment of plywood with preservatives.

FIBREBOARD

1142:1961—Fibre building boards.

CHIPBOARD

1811:1961—Methods of test for wood chipboards and other particle boards.
2608:1963—Resin-bonded wood chipboard.

THE PRESERVATION OF WESTERN RED CEDAR SHINGLES

contributed by

The Forest Products Research Laboratory, Princes Risborough, Aylesbury, Bucks.

The only shingles now widely used in Britain are cut from Canadian western red cedar. In the past cleft oak has been used, but the production of oak shingles has now practically ceased.

Cedar is a traditional timber for shingles and has a long and successful history. Its value for this purpose was discovered by the early settlers in North America who first used it for roofing their cabins and barns. Later it came into general use all over the American continent for housing and other buildings.

The main advantages of cedar shingles are light weight, high thermal insulation value and attractive appearance. They began to be used in Britain during the early part of this century but not to any large extent until after the 1914–18 war. Because of the recognised high natural durability of the timber and the outstanding reputation it enjoyed in Canada and the United States, a long life of the order of 50 years or so was expected for shingles in Britain. In some instances this has been attained.

Some ten years or so ago, however, instances of premature decay began to be noticed in roofs only 10 to 15 years old, and sometimes even less, and it gradually became evident that the average life of cedar shingles in Britain was far less than had been expected, and most probably only about 25 years. This early decay seems to occur more frequently in western parts of the country, where the climate is generally warmer and damper, and is usually worse on the south and west aspects of the roof than on the north and east.

The Cedar Shingle Bureau recommends certain practices in the laying of shingles—a minimum pitch, and avoidance of impermeable building papers. Factors such as these may have some influence on the incidence of decay in Britain but they do not play a major part, and any departure from recommended practices are not the main reason for the early failure of shingles in this country. There are instances of premature decay on roofs of high pitch and in open barn-type buildings where the shingles are fully exposed to ventilation on the underside.

There is no question that cedar is a durable wood; it is one of the most durable softwoods and is comparable, in this respect, to English oak. It has long been used for a variety of purposes where resistance to decay is required and has given long life, and its rather disappointing performance in Britain for roofing shingles is not so much a reflection on its reputation for durability as a

measure of the exacting performance required of a roofing timber in a mild and rather wet climate like our own.

Cedar owes its outstanding durability to a high content of extraneous material containing a number of phenolic-type compounds which are toxic to wood-rotting fungi. With roofing shingles it is believed that over the years these are lost, to a greater or lesser extent, mainly by leaching, but perhaps also by evaporation and chemical change.

There is support for this in the fact that usually it is only the exposed end of the shingle which decays, and that when the same kind of shingles are used for vertical cladding (a position in which they are not exposed to anything like the amount of wetting they are on a roof) they have a very long life, and it is rare that a case of decay is reported.

There is now sufficient experience to show that cedar should not be used in its natural state for roofing shingles in this country but only after treatment with a wood preservative. By far the best method of treatment for this purpose is by pressure impregnation with a copper/chrome/arsenic preservative. This type of preservative is water-borne but becomes fixed in the wood soon after treatment and is then highly resistant to leaching.

Experience with this kind of preservative in other environments more exacting than on a roof—in contact with the ground or in water-cooling towers, for example—has shown it to be highly effective over long periods, and indicates that cedar roofing shingles, provided they are adequately impregnated, should have a life of 50 years or more. These preservatives are not deeply coloured, and although the treatment gives the shingles a slightly darker shade of brown, it does not affect their attractive appearance. Cedar shingles treated in this way are now on the market in Britain.

Existing roofs of untreated shingles will benefit considerably by spraying with either a light grade of creosote or with one of the organic solvent type preservatives. Experiments at the Laboratory have shown that with new roofs this will prevent the onset of early decay, and will arrest further decay in roofs which have already begun to deteriorate.

It is not yet known exactly how long this kind of treatment remains effective, but for the time being it is advisable to renew it every five to eight years. These treatments do not detract from the appearance of the shingles—in fact it is enhanced because the lichens are killed and removed, giving the roof a more hygienic and durable appearance.

RINGS PER INCH IN CONIFERS

by

J. R. Aaron

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One of the most frequent criticisms of home-grown softwood is that they are fast grown and are consequently alleged to be inferior in quality. This paper examines some of the evidence and concludes that for most purposes a fast rate of radial growth is not necessarily disadvantageous.

The method of assessing the rate of growth in wood is to measure the number of annual rings along the radius, The procedure for doing this has been laid down by the British Standards Institution. *British Standard* 1860 prescribes that "rate of growth . . . shall be taken as the average number of growth rings intersected by a straight line three inches long normal to the growth rings and passing through the centre of the end of the member; or commencing one inch from the pith when this is present . . .".

Compression Wood (reaction wood) is a defect in coniferous timber, which is found typically on the lower sides of branches and of leaning or crooked

trunks. Zones of compression wood are typically denser, darker and less strong than the adjacent wood tissue.

Certain other of the publications of the British Standards Institution place limits on the number of rings per inch in timber to be used for specific purposes, for example softwood for use in joinery is required to have at least eight rings per inch, and a lower limit of four rings per inch is placed on softwood for flooring or for structural use.

While limits on the number of rings per inch serve a useful purpose by excluding some unsuitable material, (although in some circumstances a proportion of suitable material can also be excluded) there has been an unfortunate tendency in recent years for rate of growth, expressed as the number of rings per inch, to be regarded as the main criterion of quality in softwoods. However, when the full range of properties of, and possible defects in, coniferous timber is considered, it will be seen that rate of growth is, for most purposes, less important than certain other features such as the slope of grain, the incidence of knots and of compression wood. In fact, experience has shown that the specific gravity of wood (this is usually taken as the oven dry weight divided by the green volume, in which case it is more correctly termed the nominal specific gravity) is the best index of most strength properties of clear pieces of wood.

During the past decade certain articles in the *Quarterly Journal of Forestry* have sought to establish rate of growth as a major index of the strength of softwood. In one article (Aldridge F. & Hudson R. H., *Quarterly Journal For.* 52(2) 1958) the following data on *Picea abies* grown in South Sweden are quoted:—

	Rings per Inch	*Specific Gravity*	*Compressive Strength* in tons
(i) *Specimen A*	4·5	·358	·125
	*3·5	·319	·095
	*4·0	·381	·110
	*7·0	·444	·127
	*19·0	·464	·112
	25·0	·398	·140
	12·0	·374	·130
	3·0	·333	·095
	5·5	·362	·115
(ii) *Specimen B*	*8·0	·487	·1625
	*8·5	·438	·140
	*18·0	·461	·160
	29·0	·459	·180
	13·0	·398	·165
	13·0	·411	·160
	20·0	·422	·140
	29·0	·480	·175
	11·0	·446	·180
(iii) *Specimen C*	9·0	·418	·157
	3·0	·357	·120
	23·0	·445	·180
	22·0	·442	·195
	18·0	·410	·175
	3·5	·367	·130
	6·0	·363	·120

*compression wood

	Rings per Inch	*Specific Gravity*	*Compressive Strength* in tons
(iv) *Specimen D*	9·0	·392	Not quoted
	20·0	·406	Not quoted
	24·0	·433	Not quoted
	24·0	·443	Not quoted
	*18·0	·435	·115
	*3·0	·362	Not quoted
	4·0	·330	Not quoted
	2·5	·314	·107
	3·5	·315	Not quoted
	4·0	·311	·110
(v) *Specimen E*	7·5	·324	·100
	5·0	·340	·090
	4·0	·285	·075
	4·0	·293	·070
	4·5	·291	·095
	6·0	·294	·100
	7·5	·328	·100
	11·0	·393	·110
	12·0	·406	·130
	15·0	·426	·155
	13·5	·413	·161
(vi) *Specimen F*	9·0	·344	Not quoted
	10·0	·374	·127
	11·0	·380	Not quoted
	11·0	·373	Not quoted
	11·0	·374	Not quoted
	8·0	·367	·118
	9·0	·380	Not quoted
	9·0	·361	·111
	*9·0	·412	·124

* compression wood

When these data are plotted graphically (see graphs) it will be seen that the compressive strength is much more closely related to the specific gravity of the specimen than it is to the number of growth rings per inch.

A recent publication of the Forest Products Research Laboratory "The Compressive Strength of Home-Grown Pitprops" (*Special Report No.* 21) describes the destructive testing of thousands of pitprops of seven species of softwood grown in different areas throughout Britain. An analysis of the results shows that a significant linear correlation between the number of annual rings in the prop and the compressive strength is not always established.

The question now arises, that if the relationship between rate of growth and strength is obscure, why should limits on the number of rings per inch be included on various specifications for softwoods? There are two answers. Firstly, very wide ringed timber is frequently, but not always, weaker than wood with close annual rings. Thus, by specifying a minimum number of rings per inch, some of the weaker material is excluded. Thus, the current *British*

Standard Code of Practice 112 "The Structural Use of Timber in Buildings" and *British Standard* 1297 "Grading and Sizing of Softwood Flooring" both require a minimum of four rings per inch. The exclusion of low density timber would be a more certain way of selecting stronger wood, but in practice it would be both difficult and expensive to compare the specific gravities of pieces of timber required for a particular purpose.

The second reason for limiting the number of rings per inch is that in some species of softwood wide-ringed timber gives a less acceptable finish when processed by woodworking machinery. An annual ring of most temperate zone coniferous species consists of a layer of wood laid down in the spring which has large but thin-walled cells, and a layer of wood formed in the summer which has small thick-walled cells. An increase in ring width, resulting, for example, as a response to thinning, is usually accompanied by an increase in the proportion of spring wood. Thus, in fast-grown timber the proportion of thick-walled summer wood is smaller than in slow-grown timber, and the harder bands of summer wood are more widely spaced. When fast grown softwood is machined, there is a tendency for the wide bands of thin-walled spring wood to be pounded and compressed rather than cut cleanly. Such compressed spring wood subsequently recovers its former dimensions and gives the timber a woolly finish. This phenomenon is particularly noticeable in the spruces, and fast-grown spruce is consequently less suitable for joinery than slower-grown spruce, and less suitable than some other species of softwood, even when these are as fast-grown as the spruce. To exclude wide-ringed coniferous timber which might give an undesirable woolly finish when machined, *British Standard* 1186 "The Quality of Timber and Workmanship in Joinery" requires a minimum of eight rings per inch. It does not follow, however, that a good finish cannot be obtained in fast-grown timber of all species. In Douglas fir, which nearly always has a wide band of summer wood, and in Lodgepole pine which has a low contrast between spring wood and summer wood, quite good finishes are obtainable at three and four rings per inch. In any case it should be remembered that after an inital period of rapid growth some of our species, e.g. Scots pine, are incapable of producing fewer than eight rings per inch.

There is a further factor which to some extent confounds these considerations. Wood which is laid down during the first few years of the life of the tree before it starts to bear cones and is known as juvenile wood, has somewhat different and generally poorer properties than those of mature wood. Thus the wood near the core of the tree is frequently inferior, irrespective of the number of rings per inch.

A further point which is often overlooked, is that different strength properties are attributable to the individual species. For example, fast grown Douglas fir, or Japanese larch, is almost invariably stronger than pine or spruce at any rate of growth. Therefore if a comparison of the number of rings per inch is made in timber specimens it should be kept within a species. No useful purpose would be served by comparing, for example, the ring width of Lodgepole pine with that of Norway spruce.

To sum up, the width of the annual rings is a poor indication of the properties of coniferous timbers. In the words of the late Professor Frank Jane, who was a pioneer of timber education in Britain "At present the usual statement that softwoods are strongest when their rings number six to 20 to the inch, must be accepted as no more than a generalised approximation".

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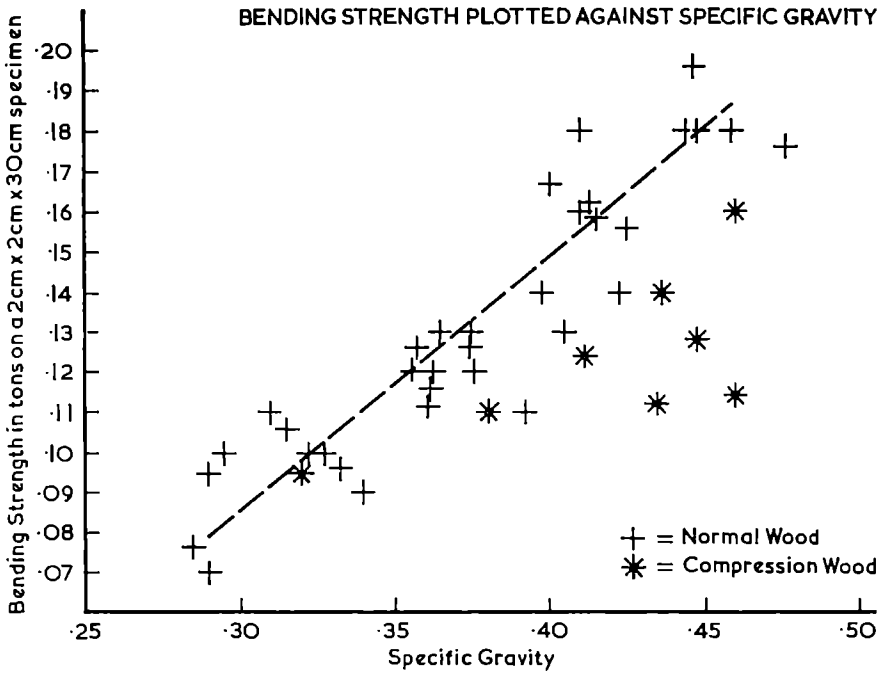
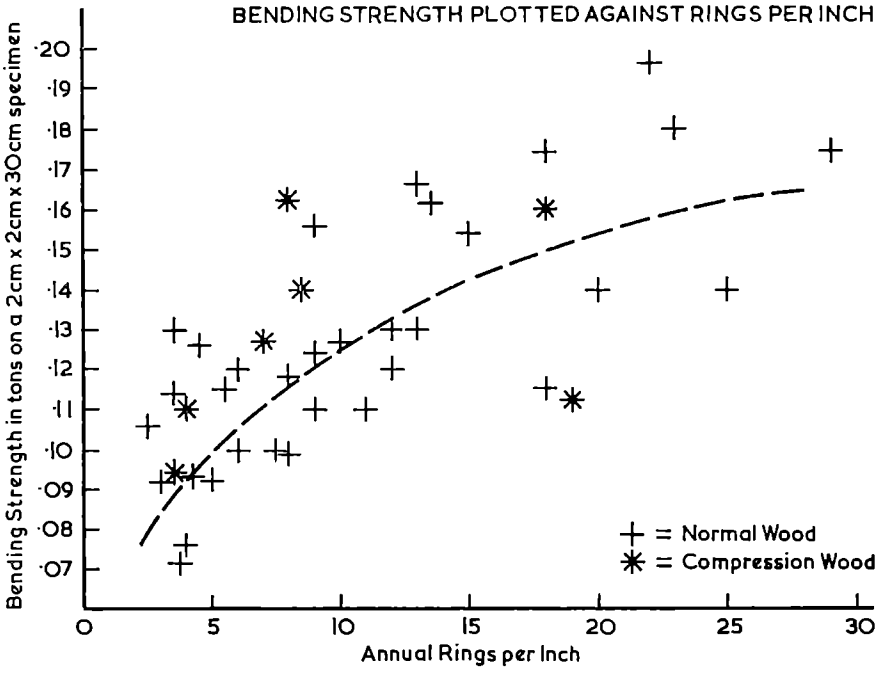


When the Values for Compression Wood are excluded, there is a direct straight-line relationship between the Specific Gravity and Bending Strength



When Compression Wood is ignored there is a suggestion of a curvilinear relationship between Rate of Growth (Rings per Inch) and Bending Strength

Data from Aldridge & Hudson 1958

LAND USE: WORK STUDY: SAFETY

LAND USE POLICY

by

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The decision about land use is an investment decision, the degree to which it is regarded as problematical depends rather on the extent to which the decision once made is irreversible. Thus the decision to change the use of a field from corn to clover gives rise to much less heartburn than the change from corn to council houses, or for that matter from pasture to forestry. Such decisions are inherently difficult because of their long-term nature—the long-term investment decision is subject to uncertainty to a greater degree than the short, and if it is to all intents and purposes irreversible this makes it even more harrowing. Up to this point, the problem of deciding the use to which land is to be put is similar to any commercial investment decision; the case is complicated by the fact that the environment in which the decision is made is not that of a free market. Where land is to be used for building it is subject to the Planning Acts, where it is to be used for government purposes it is subject to compulsory acquisition at arbitrary price levels, agriculture and private forestry are subsidised and the transfer of land to the Forestry Commission is regulated departmentally. The freedom of the market is restricted because certain of the returns from the use of land have value which is not reflected on the market, and the aim of the restrictions and the subsidies is to ensure the production of these returns to some extent.

Table 1. WOODLAND AREA, 1964
('000's *acres*)

	Forestry Commission	*Private*† *Woodlands*	*Total*
Condition of Woodlands			
Productive	1525	1760	3285
Unproductive	65	940	1005
Total	1590	2700	4290
Ownership by countries			
England	590	1530	2115
Wales	280	195	480
Scotland	720	975	1695
Gt. Britain	1590	2700	4290

†*Estimate based on Census of Woodlands*, 1949, *revised to take account of change of ownership, felling and afforestation.*

Optimum land use may be described as that combination of land use and the use of other resources which results in maximum benefit. The question is how can the optimum decision be identified. In the first place it may not be sufficient to find a best use for a particular piece of land since that best will depend on the context in which the choice is to be made; part of the context is the use to which other pieces of land are to be put and the relationship between the chosen use and the call on other resources necessary to that use. This is clearly recognised by the agricultural economists as true within the farm and will surely be accepted

as true of the larger environment of the region and true of other land uses than farming. The optimum land use may then be identified if, for the possible uses of particular pieces of land, the cost or call on other resources of each use and the benefit resulting is found. The optimum land use will be that combination of uses which is both possible, given the level of resources available, and results in maximum benefit. Assuming that the search is for the maximum benefit from the point of view of society at large, among the costs and benefits which have to be considered are non-market ones. In dealing with these one has the choice between evaluating them or nominating certain levels of their production. In the latter case though one is spared the task of evaluation, one is left to question whether the cost—the value of market benefits foregone—resulting from the nominated level of production of non-market benefits, is justified, and whether a higher or lower level of their production would not be more suitable.

Table 2. CONTRIBUTION OF FORESTRY TO NATIONAL PRODUCT, 1964
(*millions of £s.*)

	Forestry Commission (1)	*Private Woodlands* (2)
Expenditure or Gross National Product		
Fixed Capital Formation	2	?
Capital Formation in stocks	8	3–4
"Domestic Expenditure" (Product sold by the industry)	3	7–10
Factor Incomes		
Income from employment	13	8–11
Gross trading profit	1	2–3

Note (1) *All expenditures (interest charges excluded) treated as final product. The estimate given in National Income and Expenditure includes a charge for the use of Capital by the Forestry Commission and is not directly comparable with this estimate.*

(2) *The range of estimates is based on "Private Forestry income and expenditure" and various estimates of the value of timber sold from private estates.*

Taking the specific cases of the choice between forestry and agricultural land use for each alternative, the inputs of labour, materials and machinery have to be identified and the returns. The market returns are those derived from the resulting agricultural or forest crops. Among the non-market benefits we may count the provision of employment, landscape effects—preservation of the open hill under agriculture or the forest scenery provided by the alternative, the roads and shelter resulting from the development of the forest. The social costs associated with the two uses vary. Agricultural use may require the maintenance of extensive communication system, of roads, power lines and telephone lines. Forestry, introducing concentrated use of roads by heavy vehicles may require higher specifications; either forestry or agricultural use may restrict the use of the area for recreational purposes, may detract from the value of the area as a water collecting ground in certain respects. There is interaction between the choices of land use and the development of local communities, their services and manufacturing industries.

I have indicated that in order to make decisions about land use one has to determine the call made by possible uses on other resources and benefits resulting. I should like now to try, in general terms, to indicate the calls made by forestry on resources and the returns to be expected from this activity.

Table 3. EMPLOYMENT, 1964

	Forestry Commission	*Private Forestry*	*Total*
Staff	2750	2250	5000
Industrial Employees	11000	11000	22000*
Industrial Employees			
England	4550	6450	11000
Wales	2650	1350	4000
Scotland	3800	3200	7000

**Ministry of Labour.*
To these should be added a number of men employed by timber manufacturing firms but operating in the woods.

Resources Employed in Forestry

The area of land devoted to forestry (Table 1) is about 4m. acres, of which 3m. acres are in productive management. The total forest area constitutes about 7 per cent of the land area of Gt. Britain. The contribution of the forestry industry to national product (Table 2) is of the order of £25m. per annum, of this about half is capital formation. The number of people employed in the industry is about 27,000, of whom 22,000 are industrial employees and 5,000 professional and administrative staff (Table 3). The average earnings of industrial employees is of the order of £600 per annum. The average volume of timber produced annually is about 100m. cu. ft. (the average for 1960–1964), and is valued at about £13m. p.a. The value added in manufacturing is of the order of £20–30m. The volume of imports to Gt. Britain is 1,250 m. cu. ft. (the average for 1960–1964). Their value in the same period ranged from £400–540m. In the face of population growth, rising income level and in the absence of a commensurate growth in the volume of timber being produced, it is expected that the real price of timber must rise (Table 4). This coupled with increasing tendency for exporting countries to export manufactured goods rather than raw materials, the cost of imports to this country must be expected to rise even faster.

Table 4. DEPENDENCE ON IMPORTS

Difference between consumption and removals of timber
(Millions of cubic feet)

	1960	**1975***	**2000**
Great Britain	1100	1500	?
Europe	600	2100	4000–4800

After European Timber Trends and Prospects. FAO NY. 1964.
**Assumes Europe's GNP will grow by* 104% *between* 1960 *and* 1975.

Land Use in Forestry

Of the Forestry Commission areas much is concentrated in the uplands, one may mention the major concentrations in the Grampian fringe in Scotland, in the Border counties and in Wales. This land is predominantly poor, or very poor land by agricultural standards, 70 per cent consists in upland heaths, moors and bogs, 17 per cent in lowland heaths, chalk downland, 6 per cent is on heavy clay and only the remaining 7 per cent is on comparatively rich soil from all points of view. The average production of Forestry Commission forests is estimated to be 120 h.ft. per acre per annum, this compares with 250–300 h.ft. per annum that may be expected from the very best sites. The distribution of private woodlands is more general, particularly in England, but even here is largely concentrated on land which is of poor agricultural potential. It is probable that the opportunity costs of extending forestry on land of the same potential as that which predominates in the Forestry Commission is very low in terms of lost agricultural production. Investment in forestry on the other hand cannot be expected to earn a very high rate of return on such sites. (Table 5).

Employment of Labour

From the point of view of our examination of the call made on resources it is perhaps of interest to see what the investment involves in labour and materials. the time when these are used and the time when returns are obtained. Fig. 2 shows the distribution of expenditure and returns over the forestry rotation; it is of particular interest to note the disjointed distribution of expenditure over the production period of a stand, major labour inputs being concentrated at the

Table 5. RATE OF RETURN

The potential return from investment in new afforestation from the major site classes in Forestry Commission forests and the distribution of these classes.

Average rate of return	Greater than 6%	5%	4%	3% and less
% of land area	20	35	40	5

beginning of the period. It is important that the implications of this distribution of the work load should be recognised when forestry is being considered in relation to regional employment. The average employment per 1,000 acres over a rotation may be quite high. When a forest is established over a short period it will require a very large labour force during the period of establishment, but the size of force required will drop sharply when the establishment phase is completed and will only rise again when the forest comes into production. A long-established forest with crops at every stage of development will tend to require a more stable labour force equal in size to the average for a whole rotation, (this apart from changes which result from technological advance). Local labour is the major resource used in forestry but the proportion its cost bears to the total expenditure varies with operation. On current methods of operation, the purchases of materials and the use of machinery amounts to 10–15 per cent of the direct cost of establishment operation, 60 per cent of the cost of road building and 40 per cent of the cost of harvesting.

Table 6. EMPLOYMENT EXPENDITURE AND REVENUE OVER A FOREST ROTATION

Years	*Operation*	*Average No. Employed per 1000 acres*	*Expenditure (£ per acre)*	*Revenue (£ per acre)*
1	Establishment ..	70	50	
2–5	Maintenance & Weeding ..	10	6	
6–60	Maintenance & Protection ..	1½	·6–·9	
15	Brashing	12	10	
20	Roading	12	25	
25–59	Thinning	6	7–5	7–14
60	Felling	150	150	400
1–60	All Operations ..	10		

Benefits from Investment in Forestry

The revenue expected from timber sales is related to the volume and to the 'quality' of the timber. A most important determinant of quality is the size of log, but other factors such as the species and the form of the log, its straightness and freedom from defect, may be important characteristics for particular markets. An average distribution of revenue from thinnings and fellings is shown in Table 6. It should be noted that the main return is obtained at the end of the rotation, a peculiar disadvantage when one considers forestry as an investment proposition. A number of non-commercial benefits are derived from an investment in forestry, among these may be numbered the following:—

(i) Forestry provides a fairly high rate of employment per unit area in areas where the alternative is extensive pastoral agriculture.

(ii) Expenditure on forestry operations is largely on staff and labour living in the forest area. 60–70 per cent of the current expenditure of the Forestry Commission on commercial forestry is spent locally.

(iii) Once the stands reach the productive stage they contribute raw material which may form the basis of local manufacturing industry, making a further contribution to the multiplier.

(iv) Employment in forestry does not require that the worker lives remotely or in isolation. He can live in the local community and travel to work daily.

(v) Maintenance and production operations require the construction and maintenance of a network of roads which may be of value to the local community and provide access routes for visitors.

(vi) Afforestation contributes in a major way to the landscape. This contribution is complementary to amenity and recreational use in general, though in some circumstances and for some forms of use it is competitive. The effects on sporting use of the land are similarly varied.

(vii) The landscape and recreational benefits contribute to the use of the area for tourism. Contribution to an employed community is a contribution also to the infrastructure necessary to accommodate tourists and it has been suggested that as we become more and more urbanised it may be increasingly necessary to maintain the rural areas for the benefit of the urban dweller at some cost to the urban dweller. The use of the land in forestry means that some financial return is obtained as a result of that maintenance.

Conclusion

I have suggested a framework for land use decisions and by indicating the extent and nature of forestry activity in this country have suggested the cost in resources and benefits which may be obtained from an extension of forestry. Forestry has been advanced as a form of land use which contributes to the stabilisation of rural populations. Its contributions are, through providing employment and income locally and supporting the infra structure, necessary for other economic acitivity. If it were to be the only form of industry in the rural areas then in order to stabilise populations it would have to be undertaken on a massive scale. As an industry supporting other investment in these areas, it has the particular merit that the rate of employment is high in the establishment phase and the employees can belong to the developing community to which their income will contribute. The value of the contribution to amenity and recreational use may be expected to be increasing as the wealth of the nation increases and with it the leisure and mobility of the population.

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To a Trespassing Sheep in the Forest of Dean

You woolly vagrant, always on the run
From angry gardeners and barking tykes
Chased round the village on a Sunday morning
By shepherds who can watch their flocks on bikes.

You've never known the flavour of good hay
The taste of mangold swede or fodder beet
Your meagre diet bramble from the hedgerow
And crusts of bread from dustbins in the street.

When lambing down no bales of golden straw
Were stacked to shield you from the North winds blow
Your twins were dropped nearby a colliery slag tip
Upon a bed of shale and frozen snow.

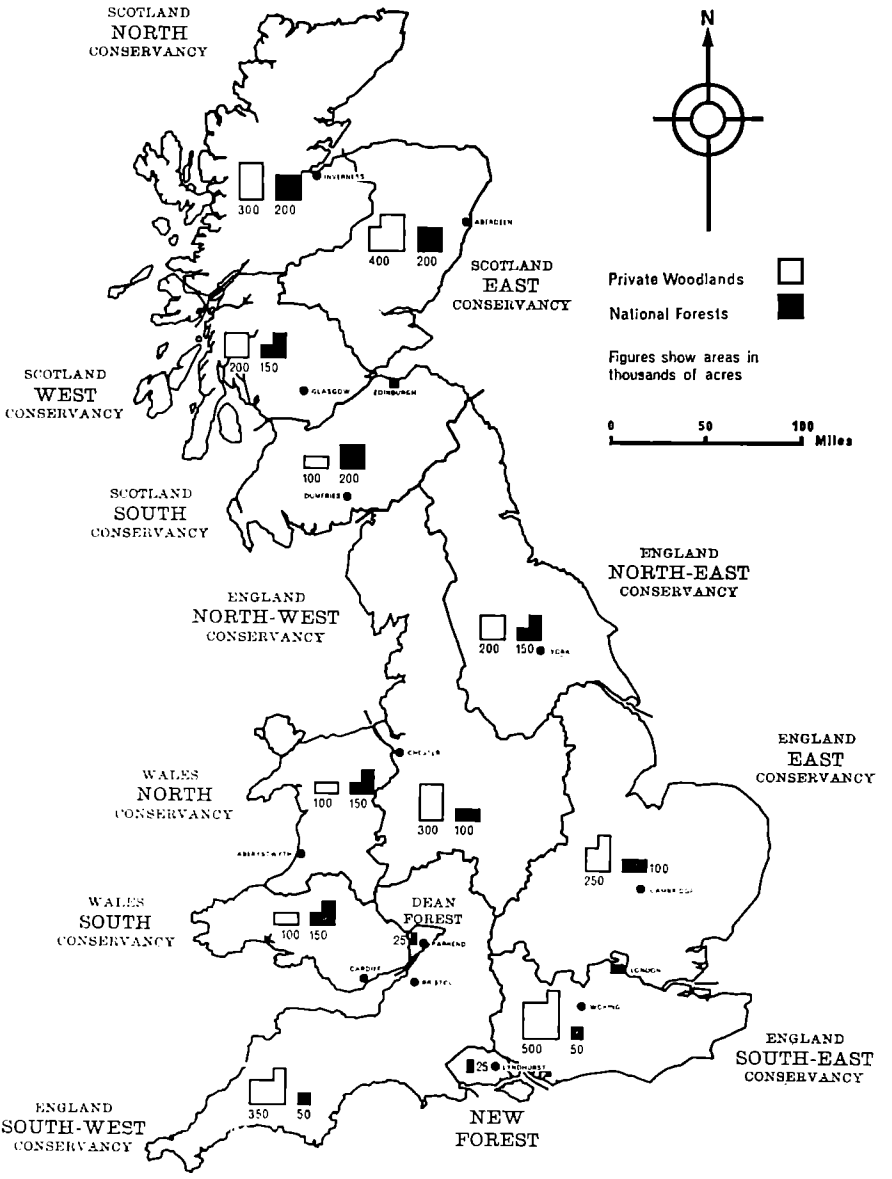
Oft I have seen you standing in the bracken
On Speech House hill your favourite abode
And when you see a car or van approaching
Give plaintive bleat and stroll into the road.

Then speeding motor cyclists swerve and crash
Avoiding you they run into a 'bus
The R.S.P.C.A. and Police complain
And Motor Insurance Companies make a fuss.

The Commoners Association claims that
Sheep have grazed the Dean since 1634
But Statute Chas. II (1668)
Makes it quite clear you've no right here at all.

Be that as may I've caught you browsing trees
Where wicket gate is closed and fence is sound
So come with me and be my paying guest
My charge is low . . . ten shillings in the pound

R. J. J.



PRIVATE WOODLANDS AND NATIONAL FORESTS IN ELEVEN FORESTRY COMMISSION CONSERVANCIES, 1965

(Compiled by H. L. Edlin)

Round figures in thousands of acres. Altogether there are 2,800,000 acres of private woodlands in Britain: England 1,600,000, Scotland 1,000,000, Wales 200,000. Also 1,550,000 acres of national forests: England 500,000, Scotland 750,000, Wales 300,000.

Totals for all woodlands are thus:—

England 2,100,000, Scotland 1,750,000, Wales 500,000. Great Britain 4,350,000 acres. This is 7½% of the whole land area.

WORK STUDY IN FORESTRY

by

L. C. Troup

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Before turning to Work Study matters it may be useful to present a few figures which will help to indicate the scale and likely rate of growth of the forest industry in Great Britain. This is best done by quoting current production figures and the forecasts which have been made for 1980. In 1965 our forests, privately and State owned, will yield about 50 million hoppus feet of softwoods from thinnings and fellings; by 1980 this will rise to some 115 million hoppus feet. In other words production will more than double over the next fifteen years, with the sharpest increases taking place from 1970 onwards. Whilst softwood volumes are rising, those of hardwoods will decline slightly: thus in 1965 production will be about 45 million hoppus feet but, in 1980, 40 million hoppus feet. Taking hardwoods and conifers together, the forests of Great Britain will be capable of yielding 160 million hoppus feet in 1980 and increases will continue thereafter. These figures are not easy to grasp, although in terms of need and in comparison with volume produced by other countries, it would be bending the truth to call them astronomical. However, a homely illustration may help understanding a little: over 530,000 lorries, each of ten-ton capacity, would be needed to hold this material. If it all became available on the same day in 1980, this number of lorries would require 3,000 miles of road on the supposition that they were travelling bumper to bumper—a conjectural nightmare which need not trouble either Professor Buchanan or budding Ministers of Transport. In real terms over 1,000 lorry loads of timber are likely to be abroad each day in 1980.

However population and per capita demands for wood products grow yearly and the effect is likely to be this: at present we produce about 10 per cent of our timber needs but by 1980, despite relatively high increases in our total production, we may not produce a very much higher proportion. It seems to follow that home-grown supplies will never come within a mile of dominating the market and that the prices we can hope to get will not exceed those for material which we import. Nor can the producer feather-bed himself in the comforting ambience provided by those who forecast world-wide timber shortages by the year 2000. Being of infinite ingenuity men, will no doubt contrive to use alternatives to cellulose and we should wish them well; it would seem that anything which can be done to relieve pressure on the forests should be welcomed rather than deplored.

Having given some idea of the scale of the industry in Great Britain and indicated that there is likely to be a real need for what we produce, it is time to turn to the application of Work Study to forestry and, although I am not an ergonomist—a flatulent word with which we should hesitate further to molest our suffering language—I shall have a little to say about some of the factors which influence forest work.

Formal work study in forestry is a comparatively recent innovation—at least in this country where it began in 1956. The Swedes started in the middle 1930's but we need not feel too despondent about that for forestry is, for them,

a major industry and problems which are now only beginning to emerge here were with them thirty years ago. I say that *formal* work study is a recent innovation because it is only just to recognise that very valuable work has been and continues to be done by foresters who would make no claim to be work study experts.

It is our good fortune that these splendid people, who come in all shapes and sizes, have in common an enormous interest in their work and, in general, a wish to effect improvements. Thus management and workers alike have, over the years, altered methods of working for the better, devised new machines and generally applied themselves with interest and enthusiasm. Nevertheless, the contributions which work study has to make towards improved methods, job evaluation and control have been generally recognised and relationships between its practitioners, management and men are good and fruitful, even though our path is not always bestrewn with roses.

Any work study man who pursues his activities in factories would immediately be struck by three factors which differentiate forestry quite sharply from those conditions with which he will be familiar. In the first place the work has a high manual labour content, much of it demanding physical effort which is at once more continuous and heavier than in almost any other industry. Secondly, working conditions are capable of infinite variation unlike the controlled surroundings of a factory. And thirdly, the raw material, that is the trees, has one main characteristic: a distressing lack of uniformity. It is worth looking a little more closely at these factors.

It is almost a truism to say that one of the prime objectives of work study should be to reduce heavy physical work to the current minimum, that this minimum should constantly be whittled down still further and, certainly, sandwiched between periods of lighter work. The key to success lies, of course, in increasing mechanisation. Valuable contributions have already been made by power saws which are well on the way to eliminating hand saws. Indeed all our felling studies are based upon the employment of power saws which in recent years have become ever lighter and more effective. There are now available saws whose laden weight scarcely exceeds 17 lbs. and although these lightweights have not been in use for long enough for us to pronounce upon their ultimate reliability, the indications are extremely favourable. These machines, which have reduced the effort needed to fell trees, are now beginning to find another application in snedding, that is, the severing of branches from felled trees. This poses a problem of its own, for power saws are noisy instruments and increasing usage carries with it the danger of damage to the hearing. Research workers are giving this problem detailed attention but, meanwhile, it seems that the dangerous high frequencies can effectively be combatted by the use of ear valves which, whilst reducing the intensity of these frequencies to below the generally accepted danger levels, permit the wearer to hear normal conversation or warning shouts.

Another aspect which concerns us is that heavy lifting operations shall be reduced to the minimum. According to records, backs are injured in about 11 per cent of all accidents to forest workers and this is materially less than the figure of 18.5 per cent for one coalmining region reported by W. B. Roantree in a Medical Officer's Broadsheet. However, the proportion is not insignificant. J. D. G. Troup notes, in *Lancet* dated 17th April, 1965, that out of 110 cases of back injuries to forestry workers, 40 were associated with heavy manual work, 35 with falls, 10 with falls whilst handling heavy weights and 25 with other causes. We all know how difficult it is to lay down precise weight limitations but the following recommendations were published by the Ministry of Labour in 1958 in a booklet "*Lifting and Carrying*":—

	Maximum Weight (lbs.)	*Type of Work*
Men	130	Continuous
Women	65	Intermittent
„	50	Continuous
Boys, 16–18 years	60	Intermittent
„ „ „	45	Continuous
Girls, 16–18 years	56	Intermittent
„ „ „	40	Continuous
Young people under 16 years	35–40	—

These weights were considered by the writer(s) of the booklet to be *maximum* loads for different categories of *experienced* workers based, excepting for young persons, on the average build of those employed in industry. This all sounds a little dubious and the term "average build" is not very precise. Again, if maximum loads are based upon persons of average physical capacity one must presume that "below average" persons should lift less. The same booklet records that the risk from loads approaching or exceeding 50 per cent of an individual's body weight is real since balance may be lost. Now 50 per cent of the average man's weight is probably about 80 lbs.—a figure greatly exceeded by that suggested in the first line of the table. Furthermore Cathcart and others suggest, in *Report No.* 44 of the Industrial Fatigue Research Board and *Report No.* 71 of the Health Research Board, that 50 per cent of the body weight is the limit for intermittent lifting and 40 per cent for continuous. These figures are quoted in J. D. G. Troup's paper in *Lancet*. Professor Sundberg, who presented a paper to the British Association at its York meeting, seems to have come to somewhat similar conclusions but, meanwhile, we understand that the Agriculture (Lifting of Heavy Weights) Regulations, which come into force this year, permit lifting weights of up to 180 lbs. From all this it seems that you pay your penny and you take your choice. Let me add to the confusion by suggesting that as an interim target we should attempt to eliminate the continuous lifting of weights exceeding 100 lbs. and that the general aim (not to be realised this year or next) should be to expunge these strong-arm tactics altogether.

We have been greatly helped towards this worthy aim by the advent of a multitude of loading devices varying from simple, boom loaders to highly efficient hydraulic cranes. More and more of our lorries are being equipped with hydraulic cranes which not only take the backache out of loading but achieve notable savings in labour. A so-called 2-ton hydraulic crane is capable of comfortably loading one ton of pulpwood on to a lorry in ten minutes or less; the same quantity requires about thirty minutes for manual loading. Nevertheless, we cannot yet see our way clear to avoiding manhandling of material *within* the plantations. Such equipment as the Isachsen double-drum winch demands adequate pre-piling of billets, if it is to extract on a competitive basis, and this pre-piling, into loads of 8 or 10 hoppus feet, can only be done by hand. In fact this operation is considerably aided by moving the lighter pieces to the heavier and by tipping rather than clear lifting; handling-aids such as light tongs have also been provided.

Moving on now to working conditions, the first comment must be that forestry is an open-air pursuit, conducted winter and summer alike beneath the vagaries of British skies. To those work study men who conduct their enquiries under nothing more menacing than a factory roof, the conception of a washed-out study will be an entertaining abstraction. Climatic interference is a very real problem to the forest industry and one to which it is almost im-

possible to find a satisfactory solution. Furthermore terrain conditions vary both within and between forests, so that working methods which apply at one point may be quite valueless only a couple of hundred yards away. We are confronted by soils of all types from dry sands, clays and rock to deep, wet peat; by slopes which vary from zero to the near vertical; by obstacles such as boulders, tree stumps, ploughlines and deep ditches.

As if terrain variation itself were not enough we commonly grow about a dozen commercial tree species in Great Britain, usually pure rather than mixed, but each having its own characteristics which, in one way or another, may affect the work content of a job. Nor can we go the whole hog on "variety reduction" as it is termed. Silviculturists attempt to choose the most profitable tree species based upon careful site assessments. These assessments have their own logic with which we would not wish to interfere excepting to enter a plea for the avoidance of micro-silviculture; this not only takes up a lot of time at the planning and planting stages, but can also lead to harvesting difficulties. In any event, we can have some control over the differences between tree species by sensible planning so that we create reasonably-sized, uniform blocks rather than small aggregations of diverse species.

All this leads naturally to a consideration of the differences *within* a tree species which affect the work content of a given task. Consider harvesting where we see differences in tree volumes, in shape (conveniently reflected in tariff number) and in branch coarseness: all these affect harvesting operations. And, superimposed upon these differences, is the factor generally termed "economies of scale": thus, the bigger the average tree, the greater the volume cut per acre, and the more considerable the gross programme for the forest, the lower is the work content per hoppus foot. Luckily, forest managers have now been provided with tables which indicate the volumes which should be removed for a given cycle and, when these come fully into use, we should see the final demise of the few remaining protagonists of ultra-cautious, low thinning—a synonym for the wastage of everybody time and money.

Enough has been said to indicate that job evaluation in forestry is by no means a simple exercise and that infinite variations may be played upon the theme of climate, terrain and tree factors, but, of course, it is possible to pick out the main factors—those which in the words of the statistician—have most "explanatory power". For example, in thinning, we are able to explain most of the variation in tree times by referring to three factors: species, average volume and tree shape (tariff number). If we now specify the conditions to which our tables of standard times apply, we are able to allow for changes in terrain or relatively minor crop factors by a series of stated, permitted variations to the standard times: these normally take the form of percentage additions or subtractions. Thus, where undergrowth seriously increases the difficulty of thinning and hand extraction, managers may add up to 10 per cent to the standard times. There is no doubt in my mind that variations to standard times, carefully documented and clearly presented to forest managers, will always remain a feature of our tables. If we attempted to present an individual table for each set of circumstances, then twenty thousand would scarcely suffice and, as I said, we do not feel that a man should be asked to lift much more than half his own weight!

It remains to add that both in the planning stage and during the working-up of results we co-operate closely with the statisticians and that all major studies are put to our computer for analysis. Much painful working-up by hand has thereby been eliminated.

Although, in this paper, I have dealt with work measurement before turning to method study we do, of course, look most carefully into method improvements before we attempt to evaluate the work in terms of time. We are

also rightly conventional in attempting to study first those aspects of our work where, prima facie, the greatest savings are likely to be made. Thus we have one whole team which will spend the next two years, at least, in an intensive study of weeding methods—hand, chemical and mechanical—with a view to reducing the costs of this very expensive operation. We are soon to approach brashing in a similar way in an attempt to equate the undoubted, immediate savings which are to be had from reduced brashing intensities with the extra marking and harvesting costs which may result.

Also starting up this year is an experimental team whose main, initial task will be the study of clear-felling systems, with special reference to modes of extraction. We shall be trying to evolve the best methods for differing terrain and crop types, and the study will include work on double-drum winches, light skylines, frame-steering skidding tractors and half-tracked tractors equipped with hydraulic cranes and ram-controlled trailers. Apart from all this we are continuing work on supplies of pulpwood to the new mill at Fort William, the new board mill at Workington and to Bowaters. We also provide, within the limits of our resources, a general service to management.

It is usual to conclude lectures on work study with a general call to arms. I will avoid the temptation, merely drawing your attention to the business pages of the more creditable newspapers and suggesting that our own particular industry can derive substantial benefits from applied work study.

ACCIDENTS IN FORESTRY WORK IN THE NETHERLANDS

by
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from "Nederlands Bosbouw Tijdschrift"
translated by
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Introduction

In 1951 Professor Kools expressed the opinion that in comparison with other types of work, forestry is more dangerous than mining; felling trees is even worse than general forestry work.

Following on this and because the question of accidents in forestry work was also causing concern in other countries the Committee of Forest Safety was set up in the State Forest Service in 1959 and it was decided that one of its first tasks would be to work out a uniform system of statistics for accident reports in forestry in order to use these as a basis for the prevention of accidents. In December 1960 forms were sent out to 20 forest undertakings and they were asked to keep a report of each accident as from 1st January in the form prescribed. The term "accident" is defined by Lateiner as an involuntary happening resulting from a dangerous action and/or situation. When the forms were sent out, it was requested that *every* accident—no matter how unimportant —should be registered.

In 1962 all the accident reports made in 1961 were sent to the secretariat of the Forest Service and statistically analysed.

The results of the investigation and statistical work were published by the Committee of Forest Safety in a comprehensive report: *Accidents in forestry work in the Netherlands in* 1961. The most important results are dealt with below. It should be noted that in the official report a distinction is made between State Forests and other forests. However, there is no significant difference between the two groups and there is no logical reason for the division. The following figures therefore apply to the State Forest Service and 19 other large forest undertakings; it may be assumed that these figures are representative for all forests in the Netherlands.

Number of Accidents and Number of Working Days Lost

A total of 272 accidents was registered for the State Forest Service and 19 other forest undertakings. As a result there was a loss of 3,669½ working days.

Table 1. PERCENTAGE DISTRIBUTION OF THE NUMBER OF ACCIDENTS ACCORDING TO THE PART OF THE BODY AFFECTED AND THE NUMBER OF WORKING DAYS LOST AS A RESULT OF THE INJURY.

Injuries to	*Accidents in % of the total*	*Working days lost in % of the total*
Head and neck	14·1	10
Trunk	7·6	6
Arms	8·3	4
Wrists and hands	26·0	21
Legs	22·0	41
Ankles and feet	22·0	18

Table 1 shows that injuries to the legs and feet are responsible for 60 per cent of the total working days lost. Since accidents are expensive, it is essential that legs and feet should be better protected and wherever possible working methods should be adopted which reduce the dangers to which these limbs are exposed.

Date and Time of Accidents

Most accidents occur between 10.00 and 12.00, 14.00 and 16.00 hours.
N.B. The impression obtained from this that the period between 16.00 and 18.00 hours is less dangerous is probably incorrect. It is more probable that this is due to the division of the working day into 2-hour periods: in the group 16.00–18.00 hours only 1 hour is actually worked.

The distribution of accidents over months and seasons shows no special tendencies. No explanation can be given for certain variations (increase or decrease in the number of accidents in one or more months) without further detailed investigations.

Table 2. NUMBER OF ACCIDENTS CAUSED BY DANGEROUS ACTS AND DANGEROUS SITUATIONS

Dangerous Acts	*Accidents* No.	%	*Dangerous Situations*	*Accidents* No.	%
Working without proper skill and training	—	—	Dangerous structure	4	2·4
Working at a dangerous speed	7	3·4	Unprotected	3	1·8
Not making use of protection	2	1·0	Insufficient protection	5	3·0
Not using personal protective clothing, etc.	26	12·8	Defective material	5	3·0
No warning of danger	—	—	Unsafe set-up	139	83·8
Use of dangerous implements	4	2·0	Insufficient light	3	1·8
Incorrect use of implements	14	6·9	Noise	1	0·6
Using implements which have not been kept in good order	6	2·9	Air contamination	—	—
Dangerous placing, loading, stacking	6	2·9	Inadequate clothing	6	3·6
Standing in a dangerous spot or working in a dangerous position	132	64·7			
Incorrect use of dangerous implements	—	—			
Distracting, teasing each other, etc.	7	3·4			
TOTAL	204	100		166	100

Table 2 shows that 65 per cent of the accidents were due to taking up an unsafe position or posture. Attention must be paid to this when considering work methods.

About 13 per cent of the accidents were caused by the workers not using personal protective articles. The use of such articles, clothing, etc., should be prescribed, as a matter of urgency, both for workers and overseers.

In examining the cause of accidents a distinction was made between "dangerous acts and dangerous situations". In the second group about 84 per cent of all accidents were attributed to "unsafe set-up". It is thus clear that by working in an unsafe place or position the worker has placed himself in a dangerous situation!

Table 3. RELATIONSHIP BETWEEN THE NUMBER OF ACCIDENTS, YEARS OF SERVICE AND AGE

Years of service and number of accidents			*Age and number of accidents*		
Number of years of service	*Accidents No.*	*%*	*Age groups*	*Accidents No.*	*%*
0– 4 years (inclusive)	101	39	Up to 25	70	26
5– 9 „ „	77	30	26 to 35	49	18
10–14 „ „	28	11	36 to 45	60	23
15–19 „ „	20	8	46 to 55	49	18
20–24 „ „	11	4	56 to 65	41	15
25–29 „ „	10	4			
30 and over	11	4			
TOTAL	258	100		269	100

The figures in Table 3 show quite clearly that—irrespective of age—the greatest attention must be paid to safety in the training period.

The Dangers of Felling Work

It was not difficult to get an idea from the accident reports about the connection between the number of accidents and the type of work. If we assume that felling, lopping, barking, hauling, sorting, stacking and chopping together make up felling work it is seen that about 46 per cent of accidents fall into this group.

Can we conclude that felling work is so very dangerous? Not at all! To decide this we must compare the number of hours worked with the number of accidents. This was possible for the State Forest Service.

Table 4. COMPARISON BETWEEN THE NUMBER OF ACCIDENTS AND THE NUMBER OF WORKING HOURS PER MAIN GROUP WITH THE STATE FOREST SERVICE.

Type of Work	*Index figure for the number of accidents per man year=2,000 working hours*
Afforestation (Planting)	0·042
Care of trees	0·102
Harvest work (felling etc.)	0·246
Transport (incl. transport of implements)	1·134
Nursery work	0·076
Material and livestock (horses)	0·258
Miscellaneous	0·554

The index figures in Table 4 indicate that felling (harvest work) is not as dangerous as might be supposed, while other types of work seem to be more dangerous.

Connection between the Number of Accidents and the Implements Used

From the investigation date it appears that about 26 per cent of the accidents were caused by the axe. It was not possible to compare these figures with the number of working hours during which the different implements were used. However, it can safely be assumed that incorrect working methods and uncontrolled movements while swinging the axe result in a large number of accidents and the loss of a large number of working days.

Comparison of the Accident Index Figures for Forestry with those of Other Kinds of Work for the Same Year.

In calculating the index figures use was made of the ideas and definitions which are set out in the standard bulletin for accident index figures No. N.3.047 (June 1956, U.D.C. 658.3) which is also used in the Institute for the Prevention of Accidents. On this basis the following index figures were calculated:

1. I.F. (index of frequency)=the number of accidents per 100 type of workers.
2. I.E. (index of seriousness)=average number of working days lost per worker.
3. I.V. (index of the average time lost)=average number of working days lost per accident.

The number "type" workers is obtained by adding the number of days or hours for which wages are paid in the undertaking—omitting head foresters and office staff—and dividing by 300 or 2,400.

Table 5 gives a comparison of the accident index figures for forest work and those of other types of work.

Table 5. COMPARISON OF ACCIDENT INDEX FIGURES FOR FOREST WORK AND THOSE OF OTHER TYPES OF WORK

Total of different industries (No. of undertakings)	*Total*			*At Work*			*On the way between home and work*		
	I.F.	*I.E.*	*I.V.*	*I.F.*	*I.E.*	*I.V.*	*I.F.*	*I.E.*	*I.V.*
Metal work (29)	9·3	1·3	13·8	10·4	1·0	9·3	1·6	0·3	20·2
Chemical (14)	5·8	0·9	15·2	4·7	0·6	13·6	1·1	0·2	22·1
Food and provisions (8)	10·3	1·7	16·7	8·3	1·3	16·0	2·0	0·4	20·0
Electricity (4)	5·7	0·8	13·5	4·3	0·5	11·7	1·4	0·3	19·2
Utility (5)	8·3	1·6	18·8	7·1	1·0	13·6	1·2	0·6	49·2
Miscellaneous (14)	10·6	1·5	13·7	9·2	1·2	13·3	1·5	0·2	16·1
Total general 83.753 workers (74)	8·6	1·2	14·2	8·7	0·9	10·6	1·5	0·3	20·3
Forestry 1.657 workers	14·0	2·3	16·8	13·0	2·2	16·8	1·0	0·2	16·6

An examination of the figures in Table 5 shows quite clearly that more attention should be paid to improving safety precautions than has been done up to now.

The Costs of an Accident

These were only calculated for the State Forest Service. The calculation was based on the amount of accident money paid and wages. These amounted to:

for officials—workers	f.33. 287, 82	(=£3,329)
for other officials	+f. 1. 050, —	(= £105)
Total	+f.34. 338, —	(=£3,434)

Number of accidents 148. Cost per accident approximately f.232 (=£23)
Number of days lost 1,869. Cost per working day lost f.19 (=£2)

N.B. In these calculations social insurance charges are not included.

These costs are actually much higher since we would also have to take into account the indirect losses and the social charges. This again serves to emphasise the need for safety precautions. The results of this inquiry show quite clearly that the prevention of accidents by improved safety measures is very much needed. Employers and workers must both co-operate in this work.

Summary

By means of a new forest accident reporting system it was possible to determine accurately the toll of forest injuries in 1961 in the State Forest Service and 19 other large forest undertakings. The result of this investigation has proved the fact that in the Netherlands forest work is the most dangerous occupation. This is shown by the index figure for accidents which are very much higher for forest work than for other occupations.

Of the total number of lost working days 60 per cent is caused by injuries to hands and feet. Roughly 60 per cent of all forest accidents are caused by the axe. Most accidents occur during felling but if related to the total number of working hours some other forest activities seem to be more hazardous.

The direct costs of an accident are very high: f.232 (£23) per accident and f.19 (£2) per lost working day, not including social charges.

The results of this investigation have proved without any doubt that effective accident prevention measures are of foremost importance; the increase of forest work efficiency and the use of suitable techniques are only justified if they are resulting in more injury-free operations. This must be the personal responsibility of all forest managers.

SOILS AND LAND FORMATION

ACID PEATS AND ASSOCIATED VEGETATION TYPES

by
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Geological Survey

The drift maps of the Geological Survey distinguish peat if its depth is over 24 inches.

Soil Survey

The Field Handbook (1) describes peat as a thick form of surface accumulation of organic matter, (p. 20) without defining 'thick' or 'thin'. Each 'horizon' of the peat is to be described separately. The *Soil Survey Memoirs* define peat over 12 inches deep as an organic soil. If the peat is less than 12 inches deep, the soil is classed as a peaty podsol or peaty gley. Organic soils are those with more than about 40 per cent of organic matter (*Handbook*, p. 12).

Forestry Commission

Bulletin No. 22, p.1, defines organic matter over 6 inches deep as peat, and peat over 24 inches deep is defined as 'deep' from which it follows that peat 6 inches to 24 inches deep is 'shallow peat'.

In order to conform with the *Soil Survey Memoirs*, the following soil classification will be used in future:

(i) If the peat is less than 12 inches deep, class the soil as peaty podsol or peaty gley, as appropriate.

(ii) If the peat is 12 inches to 24 inches deep, class the soil as shallow peat.

(iii) If the peat is more than 24 inches deep, class the soil as deep peat (as hitherto).

The vegetation types linked with these peats are commonly but by no means always after the following patterns (cf. Tansley):—

(i)	(a) Peaty podsol	*Calluna* *Vaccinium*	} Upland heath		
	(b) Peaty gley	*Nardus* *Molinia*	} Acidic grasslands		
(ii)	Shallow peat	*Molinia* *Eriophorum* *Trichophorum*	} Blanket bog Raised bog	} Depending on topography	
(iii)	Deep peat	*Trichophorum* *Eriophorum* *Sphagnum*	} Valley bog		

In using site type classifications which include a description of both soil and vegetation, combinations are suitable, e.g.:—shallow peat blanket bog
or:—peat, basin bog (including both shallow or deep peat, and raised or valley bog).
or:—knoll, peaty podsol (usually).

Alphabetical Glossary

General Terms applied to both Vegetation and Soil

BOG (old usage). "Wet black ground where you may get bogged when on horseback". The source of thatch, and therefore eutrophic peat, in contradistinction to the moss, the source of peat (for burning), which is oligotrophic. (Fraser, 1954, p. 68, from old dictionaries.

BOG (new usage)=MOSS (new usage). The terms are now used synonymously, according to local custom.

MOOR. "a tract of unenclosed waste land". (Tansley, 1939 p. 673) (Oxford Dictionary). Usually applied to high-lying land covered with Ericaceous shrubs or grasslands not primarily pasture (Tansley, op. cit.). The term 'moor' is rejected by Tansley (1939, p. 674).

MOSS (old usage). "a peat moss, particularly of the blanket or raised moss types in which sphagnums are generally abundant" (and see "bog—old usage"). (Fraser, 1954, p. 8, from old dictionaries).

Vegetation Types

BOG (in general) "wet acid peat vegetation". (Tansley, 1939, p. 674).

BOG, BLANKET. The vegetation type "where the rainfall is high and the air so constantly moist that bog is the *climatic* formation, ... covering the land continuously, except on steep slopes and outcrops of rock". (Tansley, 1939, p. 676.)

BOG, RAISED. The vegetation type which "may develop on the top of a valley bog" . . . . . (or) "usually . . . . . on fen". (Tansley, 1939, p. 675).

BOG, VALLEY. The vegetation type "developed where water, draining from relatively acid rocks, stagnates in a flat bottomed valley or depression, so as to keep the soil constantly wet". (Tansley, 1939, p. 675).

FLUSH. (a) "certain plant associations due to the effects of flushing by ground or surface waters. Some form of these *flushes* is of necessity an integral part of every moorland . . . wet or dry flushes, according to the permanence or periodicity of the flushing, and further as acid or calcareous flush, according to the nature of the ground water . . . ". (Crampton, 1911, p. 28). (Flushes=Kolken of Früh and Schröter "Die Moore der Schweiz", 1904 —C.B.C.). Not in Tansley, 1939, except in quotation, p. 522.

(b) Fraser, 1933, p. 79:— "The term "flush" is used to indicate that the soil upon which flush vegetation grows, is irrigated by free-moving water, which passes over or through it from springs, or other local sources of water."

MOOR, HIGH. See BOG, RAISED (Hochmoor). The term 'high moor' is rejected for reasons given by Tansley, (1939, p. 674).

MOOR, LOW. See BOG, VALLEY (Niedermoor). The term "low moor" is rejected for reasons given by Tansley, (1939, p. 674).

Soils Types and Terms

EUTROPHIC (well-feeding)

(a) "rich in nutritive salts" (name introduced by Weber) (Tansley, 1939, p. 673).

(b) with high (salt) requirements. (Pearsall, 1950, p. 66).

OLIGOTROPHIC (few-feeding)
- (a) "poor in nutriment, and particularly in easily assimilable nitrogen". (Warming, 1909, p. 193).
- (b) "poor in nutritive (basic) salts" (name introduced by Weber). (Tansley, 1939, p. 673).
- (c) with low salt requirements. (Pearsall, 1950, p. 66).

OMBROGENOUS
- (a) "due to surface precipitation (high-moors)" (Erdtman, 1929, p. 118, quoting von Post).
- (b) "induced by rainfall". (Fraser, 1943, p. 7).

PEAT
- (a) an organic soil above the mineral substratum, of humus formed under waterlogged conditions and accumulating indefinitely (after Tansley, 1939, p. 84).
- (b) "an accumulation of more or less decomposed plant remains formed on waterlogged sites, swamps, tracts or bogs". (Fraser, 1943, p. 2).

PEAT, ACID syn. oligotrophic, moor, moss or bog peat. Peat formed "where basic ions are in very short supply". Deficient in oxygen. (Tansley, 1939, p. 84).

PEAT, BASIN. see peat, local or azonal.

PEAT, CLIMATIC, or Zonal. "Climatic or Zonal peat is an organic formation which develops zonally on various land forms under the influence of specific climatic conditions, e.g. high rainfall, low temperature and humidity" (Mitchell & Jarvis, 1956, p. 45, *ex* Fraser, 1954).

PEAT, FEN. Syn. eutrophic peat. Peat formed "where the ground water drains from or is in contact with, a limestone or marl, and thus contains abundance of calcium which neutralises the organic acids and may render the reaction distinctly alkaline. Abundant irrigation with water rich in bases always leads to the formation of fen peat". Deficient in oxygen. (Tansley, 1939, p. 84).

PEAT, HILL. A sub-group of climatic or zonal peat q.g. (Mitchell & Jarvis, 1956, p. 45). Supports a blanket bog vegetation type.

PEAT, LOCAL or Azonal (basin peat). "Local or Azonal peat develops initially under the influence of ground water (soligenous) in areas where the relief is decidedly concave, i.e. it originates in lakes or badly drained basins in a free water medium". (Mitchell & Jarvis, 1956, pp. 45–46, *ex* Fraser, 1954). (May support either valley or raised bog vegetation type).

SOLIGENOUS
- (a) "produced either by surface water flowing into the bog area from surrounding country, or by ground water rising up to the surface layers of the soil (von Post)" (Erdtman, 1929, p.118).
- (b) "springing from soil conditions". (Fraser, 1943, p.7).

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THE ORIGIN OF HILL-AND-DALE

by

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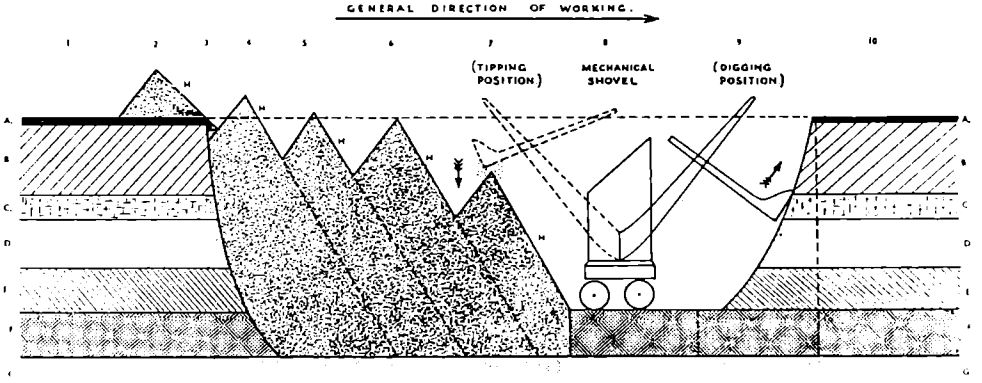
Foresters who have to plant up hill-and-dale formations on old quarries or open-cast workings sometimes wonder how the hills and dales arise. This diagram gives the answer.



DIAGRAMMATIC CROSS-SECTION THROUGH A TYPICAL NORTHAMPTONSHIRE WORKING FOR IRONSTONE. (Not to scale)

Key: 1. Unworked ground.
2. First "hill" deposited on unworked ground.
3. Edge of working.
4. Second "hill" resting on bedrock of Northampton sand.
5 & 6. Third and fourth hills. Note that their general level is below that of topsoil, owing to removal of ironstone bed.

7. Fifth hill in process of formation, through the dumping of overburden by the mechanical shovel.
8. Mechanical shovel, resting on ironstone which it has exposed by earlier working. The jib swivels round from (9) to (7).
9. Jib of mechanical shovel, digging overburden to expose a new strip ironstone.
10. Ground awaiting working.

A. Topsoil (The horizon 'A'—'A' represents original ground level.)
B. Boulder clay (Drift)
C. Lower Lincolnshire Limestone.
D. Lower Estuarine Sand.
E. Lower Estuarine Clay.
F. Ironstone.
G. Northamptonshire sands, below ironstone.
H. Overburden dumped by mechanical shovel, comprising an intimate irregular mixture of layers 'A' to 'E' inclusive.

Note. The succession of strata here shown is a representative one for the Northamptonshire ironstone quarries, but there are considerable differences between one working and another.

The Wet Weather Shelter

Heavy rain clatters down on the galvanised sheeting
A young lad splits logs with a number two hook
The beat steward calls a short Union meeting
And writes up his notes in a Fire Patrol book
A skilled forest worker (skilled also at Pontoon)
Is shuffling cards by a smoky wood fire
The warreners' terrier is steaming and whining near
Its owner who patches a bicycle tyre
Some workers file chain saws and fiddle with spanners
Screwing washers and nuts on yellow machines
A juvenile worker who sits on an oil drum is
Trimming the hair of a youth wearing jeans.

The horseman whose boots leak is drying his socks
And brewing up tea in a black metal can
A wizened man stands in the doorway as look out
Keeping watch for a sign of the foresters' van
No one makes firebrooms, points stakes or peels pitwood
The sawbench is silent, where is Work Study now?
The ganger is racking his brains for a reason
To get the men out from the shelter, but how?
Up go the overheads, down goes production
Whenever a wet wind blows in from the West
Tradition dies hard for the labourer's maxim
He learned from his father is . . . More rain more rest!

R. J. J.

FOREST HISTORY

A SALUTE TO DR. WILLIAM SCHLICH, FORESTRY PIONEER

by

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In the history of tropical forestry the names of Dietrich Brandis, William Schlich and Berthold Ribbentrop have gone down as inspiring pioneers, and the foundations laid by them have paved the way towards the stabilization of systematic and scientific forestry. Dr. Brandis is known as the "Father of Indian Forestry"; but the contributions of Dr. Schlich are equally significant. On the occasion of 125th Birth Anniversary of Dr. Schlich, who was also the first editor of *Indian Forester*, on the 28th February, 1965, an appreciation of his life and work which he spent in all sincerity of purpose and integrity of action towards the establishment and organisation of scientific forestry and forestry education, should be a fitting tribute to this great personality.

Early Life

William Philipp Daniel Schlich was born on 28th February, 1840, in Flonheim, Rheinhessen, Germany, as the sixth child among ten brothers and sisters. In this small town of Flonheim his father, Daniel Schlich, was a Lutheran pastor, later member of Consistory. He also hailed from Hessen, just as Schlich's mother Charlotte, née Frank. Schlich spent eight years of childhood in his home-town. Then in the year 1848 the family moved into Long Göns/Gieben in Oberhessen. After one year of schooling in Flonheim, Schlich came under the tutorship of his strict but good-natured father. At the age of 11 Schlich entered a regular private school in Gross-Gerau. Later, for financial reasons he lived with his relatives in Gross-Gerau, Bonn, Leihgestern and Schotten, taking private tuition for several more years. In 1857 he finished his school studies, after a two-year course in the Technical High School at Darmstadt. However, he continued his studies for a further period of six months in order to gain more knowledge in mathematics and physics. In the summer of 1858 he took a further course in mathematics in Giessen. Hereafter he spent about one year in the Polytechnic Institute at Karlsruhe, where he studied mechanical engineering.

In the autumn of 1859 Schlich decided to return to Giessen and to study forestry at the then Forestry Section of the Faculty of Philosophy, where Professor Gustav Heyer taught all the forestry subjects except road-building and surveying. Whether he was inspired by his uncle Frank, who was then the Senior Forester, in taking up a forestry course or not is not known. After the prescribed minimum period of six semesters (one semester of six months), Schlich passed the final university examination in 1862, and in the same year he got the doctorate with a dissertation on the financial aspects of forestry. Schlich respected Professor Heyer with special esteem and regarded him to be the most inspiring teacher he had ever listened to, just as Heyer, on his part, valued Schlich as the most brilliant among his students and saw in him his probable successor.

After his studies Schlich got an employment in the Forest Service in Viernheim and in 1865 passed the important Civil Service Examination in Hessen. Before his appointment in 1866 as Assistant to the District Forest Officer in Homberg-on-Ohm, he spent some time with Professor Heyer, under whose guidance he conducted a few investigations on forestry problems. He had hardly set his foot in the Forest Service when the seven weeks' war of Prussia with Austria resulted in the occupation of a substantial area of Schlich's home state, Darmstadt, by Prussia, and young Schlich found himself without an

employment, as the little forest land left over did not justify so many forest officers. It was at this critical juncture that an offer was made to him from the India Office to join the Forest Service in India, on recommendation of Professor Heyer to Dr. Brandis. Schlich accepted this offer with pleasure, not having a presentiment of the sharp ascending career that lay ahead of him. Thus India, Burma and Great Britain won the fellow-founder of their forestry, whereas Germany, his mother country and a land of old forestry tradition, lost in Schlich a valuable and promising personality.

Life in Burma and India

Schlich landed in Calcutta on the sixteenth of February, 1867, together with his 23-year-old colleague Berthold Ribbentrop. On his arrival in India Schlich was posted as Assistant Conservator of Forests in Burma, then a part of British India and famous for its valuable teak forests. Soon after reaching Rangoon in March, 1867, Schlich's attention was attracted by the so-called "Taungya System" of forest regeneration, which was advocated for Burma by Dr. Brandis a decade earlier and which was still in its incipient stages. But this system found its best exponent in Schlich, who was already familiar with a more or less similar system, which was in vogue in Hessen (Germany) where he had his practical training. He gained special recognition in the investigation of the little-known forests of "pyinkado" (*Xylia dolabriformis*) in Arakan. His unusual diligence and excellent capacities attracted attention. He was soon promoted to the rank of Deputy Conservator of Forests.

In 1870 Schlich was transferred to the Sind area with a different semi-arid type of climate where he was successful in applying scientific management to the economically important riverain forests of "babul" (*Acacia arabica*) along the Indus river. The timber of this species played a vital role as fuel-wood in the rural economy and was greatly used for the steamboat service on the big river.

His achievements in the field of forestry found their recognition when in 1872 he was posted to a more responsible post of a Conservator of Forests in Bengal, a state which at that time included not only the original Bengal with Bihar, Orissa, and Chota Nagpur, but also embraced the whole of Assam and Chittagong tracts. This expansion of his administrative area alone would suffice to signify the tremendous extent of the responsibilities which fell to the lot of the now 32-year-old forester Schlich. There were many difficulties to be overcome, such as the failure of timber contractors to carry out their contracts and the consequent falling off in forest revenues. He was, however, successful in achieving his objects. He also set to work with great energy to demarcate Forest Reserves and to organize forestry staff.

Soon after his transfer to Bengal Schlich brought to the notice of the Government of India the necessity of suitable forestry training in Indian Forestry as a whole. Till then all persons recruited for the forest service were sent to the Government Engineering College at Roorkee for a one year course. The experience he had gained in various states enabled Schlich to point out that these young men acquired at Roorkee useful knowledge in certain branches of engineering but had little knowledge of forestry as such. To remedy this defect Schlich recommended in 1873 an extension of this course with the addition of forestry subjects. However this recommendation could not take shape at Roorkee owing to certain difficulties. But the Government of India was so much impressed about the soundness of this proposal that in 1875 sanction was accorded to the provision of forestry instruction at Dehra Dun and in 1878 a real start was made. During his tenure of service in Bengal, Schlich was able to implement his plans so efficiently, thanks to the energetic support rendered by the then Governors like Sir G. Campbell and Sir Richard Temple, that he left behind a well organised forest service in Bengal, as he left on his first and only furlough to Europe after

the death of his English wife Mary Margaret whom he had married in 1874. (By this marriage he had a son, who died in his childhood, and a daughter).

Schlich returned to India in 1880 after the expiry of his leave to take charge of the difficult post of a Conservator of Forests in Punjab, a state in which forestry problems were acute. But soon after he was called to officiate as Inspector-General of Forests, as Dr. Brandis, the then Inspector-General, left for Madras on a special commission of reorganising forest service in that state. In 1883 Schlich was confirmed in this post. In 1882 Schlich submitted proposals for centralisation of the control of the preparation and execution of working plans, which finally met the approval of the Government of India. This was one of the most important events in the history of Indian Forestry and the last major contribution in Schlich's Indian career. Schlich continued as Inspector-General of Forests till the 25th February, 1885, when he was called to Great Britain to organise a forest training course for the Indian Forest Service at Cooper's Hill. Thus Schlich, now 45 years old, left India in 1885, never to return again, handing over the charge to his old colleague Berthold Ribbentrop, although he maintained his lien on this post till 31st December, 1888.

Schlich had served for 19 years (1867–1885) in the then India. During this period several epoch-making events took place in the history of Indian Forestry, in which he had directly taken part or had at least acted as counsel. Thus he was responsible for the third revised edition of the Indian Forest Code. Further, he contributed towards the building up of a forestry education system in India. Eventually he was also a member of a small Sub-committee of the Indian Forest Conference held at Allahabad in January, 1874, which played a decisive role in the establishment of the first Indian Forestry Journal *Indian Forester*. The first number of this journal appeared in July, 1875 with a leading prologue and an article "Remarks on the Sunderbuns" by Schlich, who was selected to be the first editor, which post he held till June, 1878. Initially published as a quarterly and then from 1883 onwards as a monthly, the *Indian Forester* enjoys to-day its 91st year of publication, maintaining the traditional standard and living up to its aims and policies laid down by Schlich in his inspiring and stylish prologue in the first issue which runs thus: "Our object is to supply a medium for the intercommunication of ideas and the record of observations and experiments as well as to catch all stray fragments of information, all *facts* and data, and supply the place of "Notes and Queries" to the Forest Service generally. As to our principles they are decidedly liberal and independent. We, and all who communicate with us, are free to express what we think; we shall not repress any criticism on what we honestly believe to be wrong, or say anything that we do not believe to be true, to please *anyone*. We shall endeavour to extenuate nothing, and we shall 'set down "nought in malice"'. But free, full and unfettered discussion of every principle and practice is the very life of forest science and forest art."

The most significant contribution of Schlich in India is perhaps the organisation of the "Imperial Working Plans Branch" in the year 1884, the principal aim of which was the preparation of working plans on approved lines under the direct scrutiny of a central controlling authority. This was later decentralized as a consequence of the expansion of forest administration, although working plans were continued to be prepared on approved lines.

Schlich's Contribution to Forest Education and Training

Prior to 1885 the probationers of the Indian Forest Service had their training in Germany and France. But owing to certain inherent difficulties, this system was discontinued and the Government of India decided to establish a Forestry School in England. Thus in 1885 a forest school was instituted in association with the Royal Indian Engineering College at Cooper's Hill, near Windsor.

Schlich was appointed the first Professor of Forestry in this school. This institution at Cooper's Hill ran for 20 years, turning out 173 probationers, many of whom proved to be eminent foresters. During this period Schlich was active not only as a teacher but also as a writer of his famous work on forestry, "The Manual of Forestry" which enjoyed repeated editions. His contributions to forest science and education found recognition when he was nominated as a Fellow of the Royal Society. He was already a Fellow of the Linnean Society since 1885.

In 1905 the Forestry School at Cooper's Hill had to be closed and Schlich, with his colleague W. R. Fisher, moved to Oxford, which was chosen as the most congenial centre for further training in forestry. The whole equipment from Cooper's Hill was transferred to Oxford, among which were 100,000 saplings intended for the foundation of an experimental garden at Oxford. Although faced with very many difficulties in the initial stages he succeeded in organising and establishing the Forest School at Oxford on a sound basis which now as the Commonwealth Forestry Institute plays a predominant role in forest education and research.

When Schlich finally retired from the Indian Forest Service in 1911 he was appointed Reader in Forestry at Oxford with the personal status of a Professor. From now on his attention was directed to two main objects: first, to make the Chair of Forestry permanent and secondly, to raise the forestry course to a University degree. At the end of the first World War Schlich saw both his ambitions take shape. A professorship of Forestry was granted in 1920 and subsequently attached to St. John's College. Finally on the 1st of January, 1920, Schlich retired from active teaching, his chair being taken up by one of his old pupils R. S. Troup. (He was in turn succeeded in 1939 by another of Schlich's pupils Sir Harry Champion.) Although hard of hearing, Schlich now undertook the revision of the first three volumes of his standard book "The Manual of Forestry", which he had the good fortune to see in print before his death at the age of 85. He expired on 28th September, 1925, at Oxford after an attack of bronchitis. Thus, the science of forestry lost in him a pioneer and champion.

William Schlich as an Individual

Schlich possessed besides an extraordinary strong physical constitution an excellent character and personality, which enabled him to achieve a great work—work which made him an historical and at the same time a legendary figure in the history of tropical forestry. His versatile and thorough knowledge, together with a masterly skill in crystallising and classifying the most important out of a boundless subject, came in useful in the compilation of his Handbook of Forestry. His sweeping enthusiasm, as Forest Administrator and academic teacher, his inexhaustible ardour, his organisational talent and his creative scientific endowments, his unmistakable interest for the practical necessities, his tenacious energy and perseverance with which he set himself to achieve an object and with which he accomplished a job, gave the highest impetus and inspiration to his colleagues and friends.

Schlich's activity as a teacher was devoted in the first place to the subsequent commissions of his students in the Overseas Forest Service. In his lectures and practicals he was above all interested in working out the most important general basic rules for the solution of forestry problems in tropical countries.

He had very close contacts with his colleagues and students just as they on their part had devotion and respect for him. Long after they were gone, in his old age, he could recall individually their aptitudes and their achievements. His students found in him the best guide and sympathetic friend on excursions. With them Schlich shared his love for sport, especially his interest in rugby football, which he actively practised during his stay at Cooper's Hill. Thus he

harboured in him warmth of humanity combined with a tenacious capacity for hard work. This humanity in him was always associated with a distinct adaptability, gallantry and a measured discreet behaviour. Behind his noble and formal demeanour there was hidden an optimistic and a charming humour, always apt at a joke and ready for a first-rate story. He loved social life and was a keen judge of hock and cigars. Schlich enjoyed unlimited confidence and was known for his unconditional reliability and punctuality, although he came to an important decision only after a lapse of time.

His professional judgement had such a great weight with the Government and with private estate owners that he was constantly called in for professional advice, including the drawing up of working plans for large undertakings. He gained practical experience from the numerous excursions in Great Britain. The results of his tours he wrote down in several publications, as well as in several reports and official records. His experimental plantings in Bagley Wood near Oxford, with exotic trees provided a basis for drawing up yield tables of these species in Great Britain.

One of his repeatedly quoted principles of forestry was that no afforestation scheme is of lasting nature that neglects to take into account the fertility of the soil. He was deeply convinced of the soil-improving properties of beech and recommended planting beeches in admixture with light demanders like larches and oaks. This concept had its roots in his working plan ideas that pure beech, although financially with a poor yield, could increase the value per acre of the light demanders like larches and oaks, when planted in admixture. He was of the opinion that all working plan objectives and measures should rest on a healthy basis and propounded the drawing up of yield tables and the compilation of exact site evaluations as indispensable bases and requisites for financial calculations. He never yielded to the criticism of his time that forestry, with long rotation periods, did not need such deliberations. He was an ardent advocate of the large-scale trials of suitable exotic trees.

In recognition of his service to Great Britain Schlich was made a member of the Royal Commission on Coast Erosion and Afforestation. In 1912 he became a member of an Advisory Committee on Forestry, which was set up by the State Agriculture Service. In 1913 and 1914 he also acted as the President of the Royal English Arboricultural Society and led an excursion to the famous Black Forests of Germany in 1913. Schlich was also attached to the Sub-Commission of the Post-War Reconstruction Committee of the Government, which ultimately led to the establishment of the Forestry Commission in Great Britain.

In 1920 Schlich took part in the Imperial Forestry Conference, although he wanted to abstain from it as he was hard of hearing. Even in the year of his death he was physically and mentally so strong and indefatigable that he was selected as a member of the Governing Council of the Empire Forestry Association.

Outside the British Empire also Schlich enjoyed an esteemed reputation, especially in U.S.A.—just as his predecessor, Sir Dietrich Brandis. Schlich's handbook "Manual of Forestry" was the first standard work that paved the way for the dissemination of true ethical values of forestry and forest professions in the New World, just as in Europe. The world-wide expansion of forestry conceptions is quite in accordance with the ideas propounded by Schlich who can, therefore, be looked upon as the pioneer of a new international thinking process in problems of forestry.

The recognition of Schlich's contributions to the American Forestry found expression in his being nominated as Honourable Member of the Society of American Foresters in the year 1924 and, after his death, in the generous contributions made by American foresters and many of his friends towards the establishment of "Sir William Schlich Memorial Fund", in 1927 in Great Britain. From this fund an annual award is granted to a country in the Common-

wealth and U.S.A. The prize for the first time was given to Australia in 1928, then New Zealand in 1930, India in 1931 and U.S.A. in 1932. From the prize given to U.S.A. President Franklin D. Roosevelt was awarded the "Sir William Schlich Memorial Medal" in 1935 in recognition of his efforts towards the development of forestry in that country.

In memory of this great forester and beloved teacher the main lecture hall in the Forestry Department at the University of Oxford was named "Sir William Schlich Lecture Room". A bronze plaque there reminds one of the Founder of this famous forestry education centre, Sir William Schlich. In New Forest, Forest Research Institute, Dehra Dun, a beautiful road has been named after him.

Acknowledgements

In compiling this note liberal use was made of the published literature in various forestry journals which is gratefully acknowledged. Thanks are also due to Shri D. H. Kulkarni for his critical perusal of the manuscript.

A HISTORY OF KENTISH WOODLANDS

by

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Introduction

As far as is known, no previous effort has been made to collect and collate the various references to Kentish Woodlands found in books written about the County. The account which follows is a brief attempt at writing a History of these woodlands. No attempt has been made to list the large number of references used, as the original idea was simply a talk of an hour or so to an Historical Society. Many extracts were made from documents in the Kent Archives Office, and very much more work remains to be done in that office, and elsewhere.

Until about 2000 B.C., evidence suggests that the natural woodlands were unharmed by the presence of mankind, as the inhabitants were nomadic in nature. They favoured margins of rivers and inlets, where the woodland was less dense, and their only tools were very rough flint implements.

Sometime around this date Kent was invaded by a more advanced type of man—Neolithic men—so called because their flint tools were formed and shaped in a better manner. These people cultivated the land, kept herds of cattle, and manufactured pottery—and they had a significant effect upon the woodland. Their aim was to use more ground for agriculture and grazing, and obviously they would clear the greatest area of ground possible with the least amount of effort. It is far easier to clear ground covered with tall trees with little or no growth under them, than to clear ground covered in scrub and brambles.

Trees are found naturally on fertile, well-drained soils, and the best way to clear them is by ring barking or burning them. Resultant death would let light and air in, and cultivation of the ground by hoes could take place.

When the soil fertility diminished, another area would be cleared, and cattle grazing over the abandoned area would prevent regrowth.

These people arrived from the Continent, and the first areas of occupation seem to have been on the North Downs, where shallow chalk soils would have been easy to work—and it is thought that these people evolved the dew or rain

ponds to keep a water supply on these porous soils. For the next 2,000 years or more the better drained soils of the North and South Downs were progressively cleared by farmers and herdsmen, the Neolithic man being succeeded by Iron and Bronze Age immigrants. During the later part of this period, the plough replaced the hoe, and with increasing population and developing social organization the clearance of the land would have been accelerated. The latest arrivals before Caesar's invasion were the Belgae, who were a relatively highly organised people. They introduced the idea of intensive corn growing, and Caesar records that he was very impressed by the large areas of land under corn in North-east Kent.

During this long period of development the Central Weald was almost undisturbed, apart from a few small iron mines, mentioned in Roman reports. The Romans developed a road system across the area during their occupation, mainly to help the export of the corn which was produced by way of a levy upon the inhabitants. Traces of the roads are found today most easily in or near blocks of existing woodland.

The areas of Woodchurch, Bethersden, Smarden and Headcorn at that time were covered in dense oak forest, and low-lying ground was swampy due to absence of drainage.

Nothing much is heard about the area until Saxon times, when the Saxon Chronicle defined the woodland areas. The noteworthy part was the Weald—extending into Sussex—which at that time was 120 miles from east to west and 30 miles from north to south, and was considered to be Crown property. The other main forest area in Kent was the Forest of Blean, north of Canterbury.

It is considered that this would have united with the Weald at one time, but the clearance started by the Belgae was aided by the Romans—especially, no doubt, when Watling Street was constructed, and by A.D. 791 the division was such that they were treated as separate Units.

The Saxon's main interest in the area was concerned with food production, and they estimated the value of a tree in a rather different manner from today. A tree was valued by its circumference and the number of hogs that could lie under its branches. The main use of forest land was to feed the hogs, sheep and oxen which formed a large part of their diet. When this grazing commenced there were no limits upon the area to be used by each man, and it appears that each one had a horn. The animals were able to recognise the note, and should two or more herds become intermingled, the herdsmen stood on different sides and blew, and the animals would separate again.

As time went on and the herds became more numerous, areas of the Weald were claimed and settled upon by herdsmen who owed allegiance to towns and villages outside the area. These settlements have the suffix "den" or "Hurst" and Tenterden was originally *TENETWARADENN*—the pasture belonging to the Men of *THANET*. These settlements were usually linked to the parent town or village by drove roads.

The Blean Wood was reputed to have been the abode of smugglers and outlaws for many centuries, although classified as a Royal Forest. As late as Henry VI's time, wild boars were hunted there. Different kings from the time of the Norman Conquest parcelled it out, until at last almost all of it became the property of the See of Canterbury and its allied religious houses. It thus lost all the privileges of a Royal Forest, its roads became almost impassable, and the smugglers made a settlement called Dunkirk, which still exists.

In a Charter of 993, King Ethelred granted to his mother rights of pannage over parcels of land, which included the following areas: Brabourne, Nackington, Saltwood, Hemsted, Benenden and Biddenden. In Saxon times fisheries were established in the streams and marshes in the area. Eels were often used as rent, and part of Romney Marsh was leased at 1,000 per year at this time.

Fisheries were in existence at Maidstone, East Farleigh, Yalding, Nettlestead, Wateringbury, Mereworth and Hadlow. Vines were also grown quite extensively, although the wine would have been much rougher and sourer than our modern equivalents. Places mentioned were Leeds, Halling, Godinton, Littlebourne and Coningbrook. Saltworks were very numerous around the coast, the refining being carried on by burning wood under pans.

The next source of information was the Domesday Book, and the woods are mentioned according to the number of pigs that they could support, and all the woods belonging to one place were put together. Wye leads the list with 300 pigs, followed by Milton—220, and Boughton Aluph—200. Otley and Yalding woods could each support 150 and Pluckley 140. Derivations of place names are quite interesting here. The prefix "Boughton" means Beech—coming from the Saxon *Boch*, and Pluckley got its name from the grubbing of roots which took place there.

The advent of the Normans caused a temporary heavy increase in wood consumption, as they built timber castles on high artificial mounds called "*Mottes*"—there is a fine example of one of the mounds at Tonbridge, next to the stone castle which was built as a replacement in the 13th century.

Following upon the Conquest and subsequent re-organization of areas, there were no Royal Forests in Kent, but there were two Royal Parks in the course of time. These were at Eltham and Greenwich. Henry III in 1270 spent Christmas at Eltham, and it remained in use until Henry VIII's time, when he decided that Greenwich was more pleasant, Eltham was very heavily wooded until Cromwell's time, when most of the timber was felled realizing £5,000, a great deal of money in those days.

Greenwich was not well endowed with trees, and in 1433 the Park was enclosed and trees planted. Henry VIII began a steady programme of Naval shipbuilding, and established the yards at Deptford and Woolwich, which were both close to the oak from the Weald and his supervisory eye at Greenwich.

Up to 1512, when the Navy Office was initiated, the Naval defence of England was carried out by ships built of Kent timber in Kent yards, manned by men of Kent and Sussex, and the demand on the woods became very heavy. At one time it took three years to get timber from the wood to the yards, as the heavy clay roads could only be used for some three to four months in the year.

It is of some significance that shipbuilding reached its peak during four periods when this country went to war, and the time between each peak approximates to the time required for Oak to reach maturity. The four periods were Henry VIII 1530—1650 Dutch Wars—1800 Napoleonic Wars—1914–18 Great War.

Henry VIII's yards were increased as time went on, and they worked for over 350 years in wood before going over to iron. Even in Henry's time, twenty sailing battleships could be built at one time and by 1784 a painting of a yard at Blackwall shows four 74-gun, two 44-gun frigates and two West Indiamen under construction at the same time. The wood consumption was enormous, although obviously not all from Kent. After the Napoleonic Wars, the Navy could get very little timber from Crown Reserves, and reliance had to be placed upon private growers. In this connection, the Blean Woods—owned by the Church—were still capable of supplying enough timber to build several ships each year for a number of years.

Prior to Henry VIII, the Naval Defence was supplied by the Cinque Ports, whose combined ship service was 57 vessels, each manned by 21 men. Apart from these vessels, they also owned fishing vessels, and all had to be built by themselves from local timber.

The demand for large oak was not merely for ship building, but for house-, barn- and bridge-building as well, and in the 14th and 15th centuries regulatory

Acts had to be passed, whereby at least 12 oak, ash or beech per acre were to be left as standards when wood was being cut. Hop growing spread to Kent from the Continent around 1550, and created a large and steadily increasing demand for poles from then until the late 19th century, when a new system was introduced. The original idea was that hops were planted on slight mounds, each one requiring two or three poles for the plant to climb. These poles were 13/14 ft. long and one needed from 1,750 to 3,000 poles per acre, and the most used kinds were ash, chestnut and larch. The new system used 150 to 200 poles per acre, 18 ft. long, supporting a wire frame from which string is used to hold the hops.

Another industry—short-lived only—that relied upon wood was that of cloth-making, which began about 1337 and died out about 1616. The main centre at first was Cranbrook, no doubt due to the abundance of wood, water—and fuller's earth.

In 1570 Lambarde wrote about Kent and made a reference to the woodland as follows: "This county is flourishing in fertile and fruitful woods and trees, whether you respect the mast of oak, beech and chesten for cattle, or the fruit of apples, pears, cherries and plums for men; for besides great store of oak and beech it hath whole woods that bear chestnut, a mast (if I may so call it, and not rather a fruit, whereof even delicate persons disdain not to feed) not commonly seen in other counties."

Hasted, writing in 1788, said that fruit orchards had been destroyed to make way for hop gardens, and the woods were generally coppice oak, hazel, birch or beech. The timber over this was chiefly oak and beech with elm in the hedges. He mentions the soil as being very good for the growth of oak, which "grew to an amazing size". One tree was felled at Penshurst with 840 cubic feet in it, which is equivalent to 21 tons of timber.

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g) Engineer. (*Acq*) Acquisition Officer.

				REGIONAL HQ's	
	OXON.	BEDS.	HERTS.	DIVISIONAL HQ No. 5 Divn	Year
5	in Div. No. 5	in Div. No. 1	in Div. No. 5	(*Whitehall*)	1920
lo. 5 included Hants., Surrey, Sussex and Kent)					1921
	W. L. Taylor[35]	AMPTHILL	W. L. Taylor[25]	W. L. Taylor *Dv*[34]	1922
		C. F. Bilson *D*[24]			
					1923
		G. B. Rylae *D*[31]			1924
				W. H. Guillebaud *Dv*[37]	1925
					1926
	Div. No. 4	Div. No. 4	Div. No. 4	DIVISION No. 5 (*Santon Downham*)	1927
(all counties S. of Thames excluded)				A. P. Long *Dv*[31]	
		J. P. Whyte *D*[31]			1928
					1929
		D. F. Stileman *D*[46]			1930
		YARDLEY		H. M. Stevens *Dv*[38]	1931
		R. E. Fossey *D*[33]		(*Peterborough*)	1932
)[38]					
				(*Cambridge*)	1933
				E. Wynn-Jones *Dv*[37]	
				F. Cownie *LA*[37]	1934
					1935
					1936
n *D*[38]		W. A. Muir *D*		J. Macdonald *Dv*[39]	1937
				C. G. Morrish *LA*[48]	1938
				EASTERN DIVN	1939
	F. C. Best *D*[40]			C. A. Connell *Dv*[46]	
	D. Grant *D*[42]				1940
					1941
					1942
					1943
					1944
					1945
					1946

	OXON.	BEDS.	HERTS.	CONSERVANCY FOREST STAFF	
			R. Carnell *D*[40]		1946
	WATLINGTON			F. C. Duffton *Eng*[37]	1947
				K. Halton *Acq*[48]	
				J. V. Dent *D(PW)*[34]	1948
				J. W. Anderson *Vln*[49]	
			BRAMFIELD	W. F. Hobbs *Est*[48]	1949
				G. O. Cook *Eng*	1950
	D. Grant *D*[42]	J. Lochrie *PW*[51]	J. Lochrie *PW*[51]		
	H. Searle *A*[42]	D. Grant *D*[48]	D. Grant *D*[48]		1951
PW	J. F. Osmaston *PW*	H. Searle *A*[44]	H. Searle *A*[44]	F. Good *LA*[60]	1952
				T. Pryce *Acq*[45]	
D[44]	R. H. Kendall *D*[48]				1953
(WEN. AND WAL.)		E. S. B. Chapman *D*[41]	E. S. B. Chapman *D*[41]		1954
CT LEVEL)					
°	J. Davidson *D*[41]	BEECHWOOD		M. Harker *D(Vln)*	1955
	WHADDON CHASE				
[48]					
[46]					1956
					1957
D[60]	J. Stoakley *A*[41]			F. D. Barrett *Est*	1958
				K. R. Snook (*LA*)	1959
D	A. C. Christie *D*			A. M. Green *Eng*[41]	
					1960
	A. Joslin *D*[41]	D. Small *D*	D. Small *D*	J. French *Eng*	1961
	J. Laurie Muir *A*[48]				1962
	R. J. Busby *A*				1963
		A. D. Hardie *A*	A. D. Hardie *A*		1964
				K. Halton (*Est*)	1965
F *MANAGEMENT*)					
					1966

Acts had to be passed, whereby at least 12 oak, ash or beech per acre were to be left as standards when wood was being cut. Hop growing spread to Kent from the Continent around 1550, and created a large and steadily increasing demand for poles from then until the late 19th century, when a new system was introduced. The original idea was that hops were planted on slight mounds, each one requiring two or three poles for the plant to climb. These poles were 13/14 ft. long and one needed from 1,750 to 3,000 poles per acre, and the most used kinds were ash, chestnut and larch. The new system used 150 to 200 poles per acre, 18 ft. long, supporting a wire frame from which string is used to hold the hops.

Another industry—short-lived only—that relied upon wood was that of cloth-making, which began about 1337 and died out about 1616. The main centre at first was Cranbrook, no doubt due to the abundance of wood, water—and fuller's earth.

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HISTORY OF FOREST OFFICERS IN EAST ENGLAND

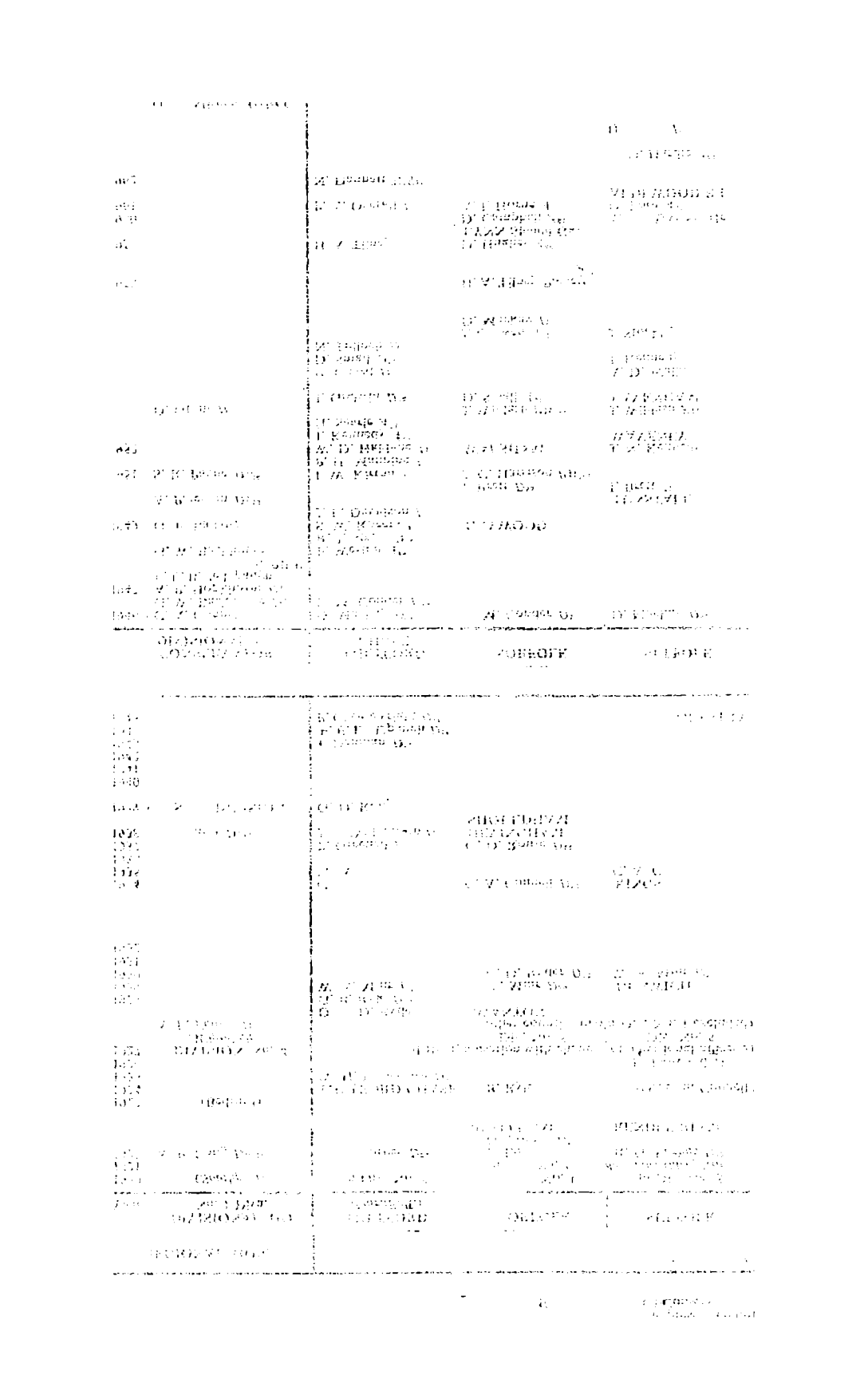
1921 to 1965

by D. Small

District Officer, East England

The present counties in E.(E) Conservancy have been used as the basis for historical tabulation. Other counties are mentioned.
Abbreviations:—(C) Conservator. (*Dv*) Divisional Officer. (*D*) District Officer. (*A*) Assistant D. Officer. (*LA*) Land Agent. (*Eng*) Engineer. (*Acq*) Acquisition Officer.
End of Period of Service is shown by ** (1927). Forests as created are shown in Block Capitals.

	REGIONAL HQ's.	COUNTIES AND FORESTS WITH DISTRICT OFFICERS IN CHARGE												REGIONAL HQ's	
Year	DIVISIONAL HQ No. 1 Divn.	THETFORD (Nor./Suff.)	NORFOLK	SUFFOLK	CAMBS.	NOTTS. (Essex)	LINCS. (Yorks.)	NORTHANTS	BUCKS.	OXON.	BEDS.	HERTS.	DIVISIONAL HQ No. 5 Divn	Year
1920	(*Southport*)	in Div. No. 5	in Div. No. 1 (*Division No. 1 included Yorkshire, Notts., Lancs. and Durham*)	in Div. No. 5	in Div. No. 1	in Div. No. 1/5	in Div. No. 1	in Div. No. 1	in Div. No. 5 (*Division No. 5 included Hants., Surrey, Sussex and Kent*)	in Div. No. 5	in Div. No. 1	in Div. No. 5	(*Whitehall*)	1920
1921														1921
1922	A. P. Long *Dv* [57]	R. G. Forbes *D*[21]	A. P. Long[27] R. G. Forbes *D*[21] SWAFFHAM	R. G. Forbes *D*[21]	A. P. Long[27]	A. P. Long[27]	A. P. Long[27]	HAZELBORO APETHORPE BRACKLEY SALCEY	W. L. Taylor [26]	W. L. Taylor[26]	AMPTHILL C. F. Bilson *D*[24]	W. L. Taylor[25]	W. L. Taylor *Dv*[21]	1922
1923	(Bedford)		RENDLESHAM				ALLERSTON SELBY							1923
1924		THETFORD CHASE	G. B. Ryle *D*[28]	(Order in Council 1924, Transfer of Crown Woods to F.C.)		CLIPSTONE	A. L. Felton *D*	A. L. Felton *D*			G. B. Rylae *D*[24]			1924
1925		W. H. Lovegrove *D*[21]						G. B. Ryle *D*[24]					W. H. Guillebaud *D*[27]	1925
1926				C. E. Fairchild *D*[28]			BOURNE	ROCKINGHAM						1926
1927	DIVISION No. 4 (*Whitehall*)	Divisional Reorganisation with changes of Divisional offices as indicated.											DIVISION No. 5 (*Santon Downham*)	1927
	A. L. Felton *Dv*[28]	Div. No. 5	Div. No. 5 (all other counties in old Div. No. 1 excluded)	Div. No. 5	Div. No. 5	Div. No. 5 D. C. D. Ryder *D*[22]	LAUGHTON Div. No. 5	Div. No. 4	Div. No. 4	Div. No. 4 (all counties S. of Thames excluded)	Div. No. 4	Div. No. 4	A. P. Long *Dv*[21]	
		D. C. D. Ryder *D*[27]	SWANTON				BAWTRY	J. M. Mackay *D*[27]						
1928		G. B. Ryle *D*[28]						J. P. Whyte *D*[21]			J. P. Whyte *D*[21]			1928
1929		W. A. Muir *D*[24]	W. A. Muir *D*[24]	DUNWICH			SHERWOOD							1929
1930			D. C. D. Ryder *D*[22]	W. A. Muir *D*[21]				D. C. D. Ryder *D*[22]	D. F. Stileman *D*[29]		D. F. Stileman *D*[29]			1930
1931									YARDLEY		YARDLEY		H. M. Stevens *D*[28]	1931
1932					C. A. Connell *D*[25]	C. A. Connell *D*[24]	C. A. Connell *D*[25]	R. E. Fossey *D*[25]			R. E. Fossey *D*[25]		(*Peterborough*)	1932
1933							J. Ross *D*[29] BARDNEY	R. Sanzen-Baker[25] G. Lowe *D*[25]	R. G. Forbes *D*[28]				(*Cambridge*)	1933
							C. A. Connell *D*[25]						E. Wynn-Jones *Dv*[27]	
1934		C. A. Connell *D*[25]	C. A. Connell *D*[27]	KINGS									F. Cownie *LA*[27]	1934
1935		W. A. Cadman *D*[25]		C. A. Connell *D*[25]			J. M. Ross *D*[28]							1935
1936							J. B. Stocks *A*[25]							1936
1937		P. Greenell *D*[27]	G. D. Rouse *D*[21]	G. D. Rouse *D*[21]			WIGSLEY J. M. Ross *D*[28]		C. A. Barrington *D*[28]		W. A. Muir *D*		J. Macdonald *Dv*[28]	1937
1938	F. C. Best *Dv*[47]	J. Q. Williamson *D*[28]	HEVINGHAM SHOULDHAM				WILLINGHAM						C. G. Morrish *LA*[28]	1938
1939	S. E. DIVISION	G. D. Rouse *D*[21]				W. V. Jackson *D*[21]	J. B. Stocks *D*[22]		WENDOVER				EASTERN DIVN	1939
1940							W. V. Jackson *D*[28]			F. C. Best *D*[28]			C. A. Connell *Dv*[28]	1940
1941														1941
1942									D. Grant *D*[28]	D. Grant *D*[23]				1942
1943		J. Denman *D*[28]					(*War-time organisation is poorly recorded and is therefore excluded*)							1943
1944		F. E. De Upaugh *D*[28]												1944
1945		F. Cheesewright *D*[28]		(FORESTRY ACT 1945)			R. Carnell *D*[25]	R. Carnell *D*[25]						1945
1946		POST WAR REORGANISATION CREATED EAST ENGLAND CONSERVANCY												1946
	CONSERVATORS & DIVISIONAL STAFF	THETFORD CHASE	NORFOLK	SUFFOLK	CAMBS.	ESSEX	LINCS.	NORTHANTS AND HUNTS.	BUCKS.	OXON.	BEDS.	HERTS.	CONSERVANCY FOREST STAFF	
1946	C. A. Connell *C*[46] G. W. Backhouse *Dv*[46]	D. Mackay *D*[21] E. M. Conder *D*[28]	E. M. Conder *D*[28]	D. Mackay *D*[21]			S. R. Payne *D*[21]					R. Carnell *D*[49]		1946
1947	A. P. Hopkinson *Dv*[48] F. E. B. de Upaugh *Dv PW*[28]					FORESTRY ACT 1947 (Dedication of P. E. Woods)				WATLINGTON			F. C. Dufton *Eng*[27] K. Halton *Acq*[28]	1947
1948	G. W. Backhouse *C*	F. Weston *A*[49]											J. V. Dent *D(PW)*[44]	1948
1949	G. F. Ballance *Dv*[48]	R. J. Street *D*[44] S. W. Rogers *D*[44]	GAYWOOD		S. W. Rogers *D*[44]	J. Lochrie *A*[42]	BURWELL E. S. B. Chapman *A*[48]	E. S. B. Chapman *A*[48]				BRAMFIELD	J. W. Anderson *Vlr*[49] W. F. Hobbs *Est*[48]	1949
1950	A. Paterson *Dv*[48]	J. L. Davidson *D*[48]		TUNSTALL		WALDEN							G. O. Cook *Eng*	1950
1951	S. R. Payne *Dv*[48]	I. W. Kirton *D*[48]	I. Brett *D*[48] J. C. Harrison *PW*[28]	I. Brett *D*[48]	J. Lochrie *PW*[28] J. C. Harrison *PW*[28]	D. Mackay *A*[44] J. N. Kennedy *A*[44]	J. V. Dent *D*[51]	D. Grant *D*[52] H. Searle *A*[52]	D. Grant *D*[48] H. Searle *A*[48]	D. Grant *D*[52] H. Searle *A*[48]	J. Lochrie *PW*[28] D. Grant *D*[48]	J. Lochrie *PW*[28] D. Grant *D*[48]		1951
1952		R. H. Manning *En*[28] W. D. Haldane *D*[28]	WALSHAM	J. N. Kennedy *A*[44]		FORESTRY ACT 1951 (REGULATE FELLINGS)	D. Mackay *D*[28]	R. Crawford *A*[52]	J. F. Osmaston *PW*	J. F. Osmaston *PW*	H. Searle *A*[48]	H. Searle *A*[48]	F. Good *LA*[48]	1952
		J. Kennedy *A*[48] H. Searle *A*[48]		WAVENEY	H. Searle *A*[48]	H. Searle *A*[48] J. Wildash *PW*[48]		R. H. Kendall *D*[48] D. Mackay *PW*[28]	BERNWOOD				T. Pryce *Acq*[48]	
1953	D. Grant *Dv*[48]		J. Wildash *PW*[28]	J. Wildash *PW*[28]	DITTON			PYTCHLEY	R. H. Kendall *D*[48]	R. H. Kendall *D*[48]				1953
1954		J. Godwin *D*[25]	D. Small *A*[48]	LAVENHAM	E. S. B. Chapman *D*[48]	J. Kennedy *D*[48]	D. Mackay *D*[48]		CHILTERNS (WEN. AND WAL.)		E. S. B. Chapman *D*[48]	E. S. B. Chapman *D*[48]		1954
1955		R. Chard *D* D. Small *D*[51]		A. D. Walker *A*[48]		(STATE FOREST AND PRIVATE WOODLANDS INTEGRATED AT DISTRICT LEVEL) HONEYWOOD	H. Searle *D*[48]	T. Kipling *A*[47] J. F. Osmaston *PW*	J. Davidson *D*[48]	J. Davidson *D*[48]	BEECHWOOD		M. Harker *D(Vln)*	1955
		N. Tulloch *D*[28]		J. Kennedy *D*[48]						WHADDON CHASE				
1956			J. Curwen *A*[47] D. Mackay *D*	J. Stoakley *A*[48]	J. Wildash *PW*[47]	J. Wildash *D*[47]			A. D. Walker *A*[48] R. Crawford *A*[48]					1956
1957						E. S. B. Chapman *D*[48]	R. G. Derrick *D*[48]	J. Wildash *D*[48]						1957
1958			H. A. Tilney-Bassett *A*[48]			A. D. Walker *D*[48]			R. M. Semple *D*[48]	J. Stoakley *A*[48]			F. D. Barrett *Est*	1958
1959		H. A. Tilney-Bassett *D*	D. Hughes *A*[48]					J. Laurie Muir *A*[52]					K. R. Snook *(LA)*	1959
1960			D. Campbell *A*[48]	LYNN Should Gay					A. C. Christie *D*	A. C. Christie *D*			A. M. Green *Eng*[48]	1960
1961		P. A. Overall *D*	A. L. Horne *A*	WENSUM Sw Hc D. Foot *A*[48]	D. Small *D*				A. I. Horne *A*[48] D. Foot *A*[48]	A. Joslin *D*[48]	D. Small *D*	D. Small *D*	J. French *Eng*	1961
1962		N. Dannatt *WS*[48]		ALDEWOOD B Is						J. Laurie Muir *A*[48]				1962
1963				A. D. Hardie *A*[48]		D. Small	J. D. Leefe *D*	D. L. Foot *A*	R. J. Busby *A*	R. J. Busby *A*				1963
1964				H. Searle *D*		A. D. Hardie *A*		D. Munro *D* R. D. Toleman *A*			A. D. Hardie *A*	A. D. Hardie *A*		1964
1965	D. A. Mithen *Assist.C*					(*MAJOR REORGANISATION OF FORESTRY COMMISSION AT ALL LEVELS OF MANAGEMENT*)							K. Halton (*Est*)	1965
1966														1966

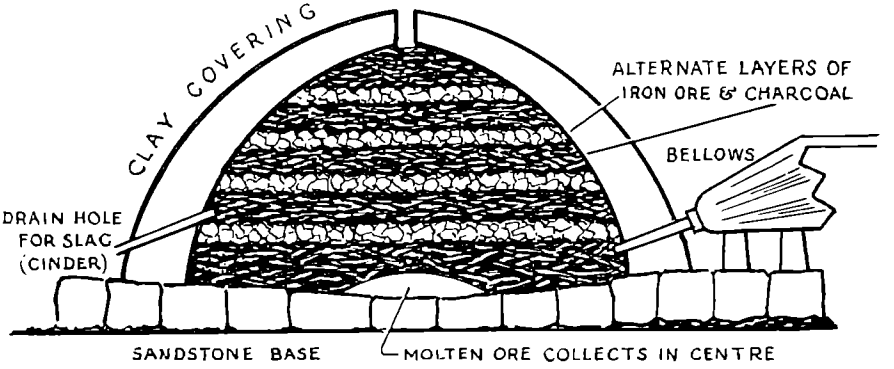


began to interfere with other activities, especially ship building. Elizabeth I passed Acts to protect the timber, and made Orders, one of which was as follows:—

"No person shall convert into coal or other fuel for the making of iron, any timber trees of Oak, Beech or Ash of the breadth of one foot square at the stub within 14 miles from the sea or the rivers Thames, Severn or any other Navigable river."

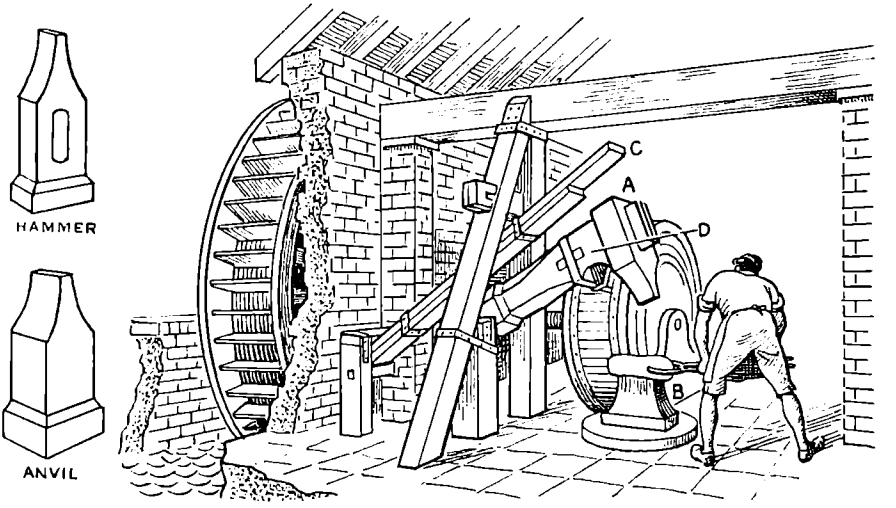
DIAGRAM OF A "BLOOMERY"

ROMAN TIMES



The iron ore was smelted in kilns by mixing alternate layers of charcoal, (coal) and iron ore and set on fire, assisted by a draught. The molten ore emerged at the bottom and had to be reheated and beaten to remove impurities.

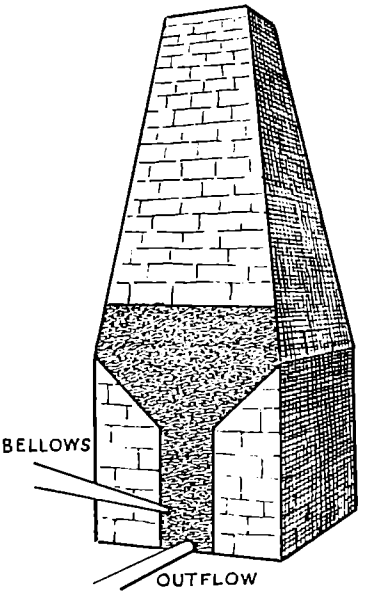
Water power was used to drive the bellows, and also by means of a water wheel and trip, to hammer the iron. A Hammer Beam is referred to in Evelyn's *Silva* and it had to be 22½ feet long and 4 feet square at the barrel.



In 1635 John Browne set up works at Cranbrook and came into conflict with the cloth-makers who were active in the area. These people drew up a

petition showing that their town and neighbouring parishes "which had for many years subsisted by the trade of clothing" were in grave danger of a decline in their trade, owing to the erection of these works. They pointed out that Browne had seized the greater part of the wood felled in the surrounding woods which was a necessity to *their* trade, and they asked that he might be restrained. Browne's reply was that he was only using one furnace, that ordnance and shot could not be made without charcoal, but sea-coal could be used for cloth.

The same owner had another ironworks at Brenchley, which was one of the largest, employing over 200 men. The consumption of timber by such a works would have been enormous, and I have found a figure of 750,000 cubic feet of timber used in one year.



A FURNACE IN 1724

The decline of the industry began around 1660 and by 1740 only four furnaces were still at work, the last notable achievement being the casting of the iron railings for St. Paul's in 1710. These stood until 1874 when they were removed and now surround a monument in High Park, Toronto.

The end of the iron industry came about due to economic reasons, and not because the timber became exhausted. It was found that coal and coke could be used, and higher grade iron ore imported or mined elsewhere in England.

Another industry which has been established in Kent since the time of the first Elizabeth is that of paper making. It began in Kent because of the almost unlimited supply of pure spring water that was available in the early days.

By the end of the 17th century there were several mills in Kent, at Dartford, Canterbury, Aylesford and Boxley, and the paper industry today is Kent's largest single industry. Its importance to the woodlands now is that a large amount of the coniferous early thinnings are taken by Bowater's for paper and hardboard manufacture at Sittingbourne.

Whilst in the Archives Office I found a sale note for underwood, dated 1745, which shows the conditions which had to be followed at that time.

The underwood had to be felled by 10th March, removed before St. Michael's Day, 1746, half the money to be paid by that date, and the rest by Christmas Day.

All oxen used had to be muzzled—or a fine of 10/– for every time they were found unmuzzled—20 standard oak per acre to be left on the ground, and the hedge and ditch around the wood to be made good. In addition, there was a penalty of 3/– for each acre not cut.

I also found an agreement of 1882 which shows the care taken over woodland rights. The owner was "to have power at all reasonable times to enter upon the premises for the purpose of felling, flawing* and converting to use and carrying away any timber or trees, and for planting in woods, shaws, nooks and corners". The tenant for his part was "to protect all woods belonging to the farm and to cut the same at the proper age and growth only, and to plant the same during the succeeding winter, the landlord finding the plants". This was on the Cornwallis estates, and the timber value at that time was £5,751, with the annual income £1,006.

The final facts were obtained from *The Victoria History of Kent* in which one can see the shape of modern woods developing, at least in respect of the estates and parks mentioned, at the beginning of this century.

Knole Park was engaged in filling up blanks in the woods and in creating new plantations. These were of larch, Scots pine, Douglas fir, oak and beech, and were doing well at that time. At Seal Chart, natural regeneration of Scots pine was reported.

Cobham Hall had an ash tree of 140 feet in height, and also magnificent oak, Spanish chestnut, hornbeam and sycamore. They were taking care of their timber, with thinnings being carried out, and fellings replanted.

Waldershare Park maintained their woodlands, filling up gaps with European larch and Scots pine for use in estate fencing.

All these accounts mentioned the decline in the value of their underwood due to the use of wirework instead of poles in the hop gardens.

This concludes this short account, as the great destruction of woodlands in the two World Wars, and the establishment of the Forestry Commission in 1919 to examine and improve the state of the woodlands have been adequately covered elsewhere.

THE OAK TREE IN DEAN FOREST HISTORY

by

E. F. Hale

Executive Officer, Forest of Dean

Part I

There is little doubt that prior to the Roman invasion almost the whole of this island was covered in forest and marshes. Only along the South Coast in a few places was the ground cleared enough for primitive agriculture, elsewhere the settlements consisted of circular areas in the forest where the Ancient Britons had managed to cut down the trees and built a few wooden huts to live in alongside wooden shelters for their cattle.

This vast temperate jungle of trees consisted of oak, ash, wych elm, hornbeam, alder, birch, cherry, lime, field maple, crab apple, sallow, whitebeam, mountain ash, holly, hazel and yew, but the predominant species was oak. It was, however, utterly removed from our present day conception of a forest for

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Notes. *Flawing is the removal of Oak Bark during April/May for use in tannery leather.

A photo of a Scottish furnace appears as Plate 7 on our centre pages.

over the centuries trees had grown and fallen and died in an unbelievable confusion to form an almost impenetrable tangle of vegetation.

In those days the struggle for existence was by man, not by the wild life, for the country belonged to the beasts of the forest and the birds of the air and men had to fight hard to keep a precarious hold of their tiny hard-won scraps of land. The red deer and the hungry wolf, lynx and marten, the brown bear and the wild boar all roamed abroad, the industrious beaver and the otter swam in the rivers while the kite and the eagle soared in the skies. The Romans, who disliked both forests and hunting, came and they mined fairly extensively in the Forest of Dean for iron ore but left its inner fastnesses well alone; centuries passed, the Romans left and the forest was still supreme.

Hunting

With the Saxon invasion a change gradually came over the land, for hunting was their great delight and the pleasures of the chase exceeded all else. The first forest laws were passed in the reign of Canute—1016—and were savage and severe, including death for killing a deer. In the 11th century the Forest of Dean extended over the greater part of the triangle between Chepstow, Ross, Newent and Highnam and it was the Saxons who gave us the word "acorn", from "aik" and "corn", as being a corn or grain produced by the oak.

With the Norman conquest the Forest of Dean became one of William the Conqueror's great hunting grounds and we may read of him staying here in 1069 to hunt the wild boar—and later to chase the hart from the heights of Lea Bailey over the Stenders and Fairplay down to Littledean and Soudley.

It seemed rather odd that although the New Forest has its Rufus stone there is no Milo stone in the Dean to mark a similar event. The New Forest stone commemorates the death of William Rufus, killed by an arrow shot by Sir Walter Tyrrell, which glancing off an oak struck him to the heart. In 1143 Milo Fitz-Walter, Earl of Hereford, overlord of the great Forest of Dean, was hunting in the Flaxley valley when an arrow shot by one of his company glanced likewise off an oak tree and killed him.

It was in this century that great oaks were given to the abbots to build monasteries and to the barons for building their mighty castles, some of which remain today.

Much deforestation took place in the 13th and 14th centuries so that by the end of that period the Forest of Dean had shrunk to roughly the size it is today.

Iron Foundries

In the middle ages the silence of the forest was broken by the noise of iron foundries and the sky glowed red at night with the fires of scores of forges. Armaments through the centuries: crossbows, arrow-heads and guns were made here as well as a great deal of domestic ironware, such as nails, hoops, wire, cart ironware, rods and horseshoes, and all the time the oaks were being felled to provide charcoal for the forges and as the iron-founders used up all the trees in one place so they moved on and the forest became a scene of devastation for little if any replanting was ever done.

Early Shipbuilding

The next major demand on the Forest was for shipbuilding and Britain's "wooden walls" of the 16th to 19th centuries needed an ever increasing volume of open-grown oak to provide the various pieces of ship timber known as "knees", stern posts, crutches, futtocks, catheads, top pieces and floor pieces, as well as vast quantities of other less specialised timber requirements.

Evelyn in his *Sylva* wrote: "I have heard that in the great expedition of 1588 it was expressly adjoined the Spanish Armada that if, when landed, they should not be able to subdue our nation and make good their conquest they should yet be sure not to leave a tree standing in the Forest of Dean." Other reports about this time infer that in Queen Elizabeth's day the Spaniards sent an ambassador to try and accomplish the same mission by destroying the forest by fire.

In the 16th century the banks of the River Severn by the forest were busy scenes of shipbuilding and it is thought that both Raleigh and Drake visited the yards before the action against the Spanish Armada. "Drake's House" at Gatcombe when I saw it last seemed but little changed since those far off days except that the high railway embankment partially blocked the view from ground level and when I stood upstairs on the old sloping oaken floors and looked out of the window, the Severn estuary stretched out in the same wide tidal expanse of water as then, except for the broken railway bridge downstream.

The name of Dean was more closely associated with naval timber than that of any other woodland in England, and it furnished a more constant supply of oak than any of the other Crown forests. Although the Severn yards used a lot of Dean oak much of this naval timber was sent around Land's End to Plymouth Dockyard carried in *hoys*—low sloops with great red sails. This could sometimes be an adventurous journey, for during the reign of Charles I the Turks captured timber cargoes bound from Dean forest to Plymouth whilst the French and Dutch occasionally seized similar shipments.

Part II

The general hazards of drought, flood, wind and weather have, through the ages, had little serious effect on the sturdy oaks of the Dean but for one exceptionally severe storm on 18th February, 1662, which blew down in one night a thousand mature oaks and nearly as many beech.

Throughout a long history of depredations, encroachments, neglect and wanton destruction no instance can compare with the devastation done by Charles I who disafforested and virtually sold 18,000 acres of woodland, on which were growing more than a 100,000 mature trees, to Sir John Winter of Whitecross House, Lydney.

Sir John lost no time in making a fortune for he employed 500 woodcutters and the destruction was so complete that on a survey made in 1667 only 200 oak and beech were found standing.

An agreement between Charles II and Sir John Winter for timber sales was drawn up in June 1662 by Samuel Pepys who gives an account in much detail in his famous diary.

The Enclosure Act

To repair this damage an Act was passed by Charles II, later in his reign, following "Proposals by and on behalf of the Freeholders, Inhabitants and Commoners within the Forest of Dean, for the preservation and improvement of the growth of timber there". Under its provisions 11,000 acres were enclosed, planted and carefully guarded—free for ever from grazing and pannage so that when any part is fit to lay open then an equal amount can be taken in elsewhere so that the whole area enclosed should not exceed, at any one time, 11,000 acres.

This act was hardly enough for by this time almost nothing was left of the oaks of the Dean—the forest was virtually a wasteland of scrub and the situation was so alarming that further drastic measures had to be taken. So the ironworks which consumed such a great volume of oak were closed down and the huge

deer population, responsible for the loss of thousands of young trees, was reduced.

Dr. Cyril Hart in his book *Commoners of Dean Forest* states that had this work not been carried out and if the process of depletion in the Dean had not been arrested then it is possible that the course of British history would have been changed for much of the oak necessary to build the ships for the great naval battles of the 18th and early 19th centuries would not have been forthcoming.

Not everyone realises the huge quantity of oak which was required for shipbuilding in the 18th and early 19th centuries. About 3,000 loads (or roughly 2,000 tons) of oak of 75 to 100 years' growth was required for a 74-gun ship which worked out at a clear felling of about 50 acres. For a ship of 120 guns—a three-decker—about 6,000 loads or 75 acres of oak was needed. We should also remember that our merchant marine annually consumed about three times as much oak as the naval dockyards. For instance in 1790 the Navy used 25,000 loads of timber, in building a few large ships and repairing others but 620 new merchantmen were constructed requiring over 80,000 loads of oak. In addition English oak had been in heavy demand for centuries past for "half timber" buildings, brewers' casks, farm carts, oak charcoal for smelting in iron, lead and glassworks, as well as for building bridges, docks, locks and canal boats.

Lord Nelson

It was probably in 1803 that Lord Nelson paid a visit to the Dean to inspect and report on the Navy timber, and the Rev. R. J. Mansfield in his new book *Forest Story* mentions that Nelson was full of ideas concerning the possible improvement of the "deplorable" state of the forest. Also, the writer has come across an old book which was written shortly after Nelson's visit. This records that he complained of deer barking all young trees, vast droves of hogs eating the acorns, and flocks of sheep biting off the tender shoots.

"Nothing new under the sun" is a common enough saying, but it's surprising how often it's proved right as in the case now related. Readers must be familiar, even if only through the press or television, with those giant machines which can lift a tree—earth and all—and transplant it from one place to another, maybe some miles distant.

This has been heralded as a startling novelty whereby "instant" trees can now be provided for beautifying new housing estates, roads etc. Edward Machen, Deputy Surveyor of the Forest of Dean, writing in his notes of the year 1818, mentions that from the Acorn Patch (the last of the old plantations) a large quantity of young oaks have been transplanted into the open parts of the forest. There was a great amount of holly and other underwood scattered on the parts where the trees are planted which served for shelter and protection and the soil was very good. The trees, though never transplanted before, came up with bunches of fibrous roots and though so large a size, being from 10 to 25 ft. high, scarcely any of them failed.

Profit and Loss

The Commissioners of Woods and Forests in 1803 started to keep careful account of the revenue and expenditure of the chief forests in their care. The period extended over nearly half a century from 1803 to 1846 and showed the Forest of Dean well in the lead with expenditure of £369,260 and receipts of £543,577—a surplus of £174,317 which was £62,000 more than any other forest—including the New Forest. In addition High Meadow Woods purchased in 1817 made a profit of £31,196 from 1818 to 1847.

I think it is true to say that the oak suffers from the attention of more

insects and fungi than any other tree, but after the early years has such remarkable powers of recovery that it seldom succumbs. In the 19th century and prior to 1960 there were several severe attacks by the caterpillar of the Oak leaf-roller moth—the forest oaks being rendered almost leafless whilst the beech and chestnut remained untouched. Within a few weeks of defoliation however, new "lammas" leaves had appeared and all the trees were in full leaf again by late mid-summer.

Part III

In 1814 there appeared a plague of mice which destroyed most of the young trees so that only four or five plants in an acre survived, and we find that cats, poison and traps were used in an effort to stem the havoc but without success. However, a miner named Simmons found a solution for he suggested that pits two feet square and two feet deep should be dug with the sides hollowed out at the bottom. The pits were dug at a spacing of 20 yards over the infested areas and the mice fell in and could not climb out again. Although the mice in the pits were continually preyed upon by owls, hawks, polecats and other creatures Simmons and his helpers were paid for over 100,000 tails they collected.

Rural Rides

1821 saw William Cobbett in the forest on one of his famous rural rides; he complained bitterly about the coal mines and other works spoiling the scene and in his usual forthright manner he demanded—"Here is a domain of 30,000 acres of the finest timber land in the world, and with coal mines endless. Is it worth nothing?"

Water Wheel

The Rev. H. C. Nicholls in his classic *The Forest of Dean* talks about the iron furnaces at Parkend and the ponds and canals which were constructed for the supply of water. He also mentions the giant water wheel which was built at these works in 1827. This wheel, made of oak and a great deal of ironwork, was 51 feet in diameter and six feet wide and was thought to be "nearly the largest in the Kingdom".

About this time too the renowned Duke of Wellington rode on horseback from Cheltenham to Whitemead Park where he spent a couple of nights and then on to Tintern, casting meanwhile an admiring eye on the trees but swearing heartily at the shocking state of the roads.

In the 18th century it seems that the majority of the trees in the Forest were beech with oak taking second place—all the large oaks which remained having been earmarked for the navy.

Great Oaks

Of the widespread oak plantings in the latter half of the reign of Charles II few trees remain, but if you care to look as you travel down the hill from the old New Fancy Colliery heaps to Parkend you will see two or three by the roadside and there are some more in Churchill enclosure; the path to the largest, near Parkend School, is signposted.

This is the famous Charles Oak still alive and going strong and measuring over 21 feet girth at breast height and over 60 feet tall. Other notable oaks worth a visit include the Lord Robinson Oak by the roadside about a mile on the Monmouth side of Staunton. This fine tree, which is probably a mere 150/180 years old, is about 80 feet in height and of extremely good form.

If you travel the road from Christchurch to Lydbrook you will soon notice,

as you start to descend the hill into Lydbrook, a mighty oak away on your right, standing like a giant amidst the young trees of Millway Grove. This tree, still in its prime, could hardly have a better setting for it towers above the young planting all around and is framed by a background of hills. Years ago the vicar of English Bicknor, it is said, paid £5 to save this tree and now it stands in proud isolation and known as the Burden Oak after its benefactor.

The Crad

A quarter of a mile below Sallow Vallets Lodge is the "Crad" Oak reputed to be the oldest oak within the forest boundary—formerly it was over 90 yards round the outside of its branches and was measured by Mr. Machen in 1830. Now unfortunately it is hardly more than a wreck. In Russells enclosure just over a mile from Parkend the Three Brothers Oaks still survive. The three big trees standing so close together are well known and are supposed to have been the first meeting place of Jehovah's Witnesses in the Forest. Unhappily one of the three is now merely a decaying stump.

Although now surrounded by farmland, the great Newland Oak was of course once within the Forest bounds. Now shattered by storm and with but a single branch alive, it remains the oldest living oak for many miles around and in its prime it certainly had the greatest girth of any tree in or about the Dean and was reputed to be the stoutest tree in Britain, being 44 feet round.

Part IV

Sporadic attempts at planting and enclosing were made in the 18th and 19th centuries, interspersed with periods of neglect, and it was not until the beginning of this century that any real working plan for the woodlands was drawn up. In 1916 it was proposed to convert 75 per cent of the Forest of Dean to conifers. Since the passing of the Forestry Act in 1919 large areas of hill country throughout the land have been planted with softwoods and there is no longer the same urgency to grow conifers on hardwood soils. So the policy in the Forest of Dean was revised and hardwoods, mainly oak, were prescribed for as much as possible of the area. The years from 1924 to 1939 were spent in developing this policy.

Dean Oak today

It is true that some of the soils of the forest will not grow oak at all well but one wonders if one does not hear rather too much nowadays about the Forest of Dean being generally unsuitable for growing good oak. It may be pertinent to quote a report in 1680 which said that four areas were covered in very well grown oak and beech of 30–50 years growth—many thousands of them being 40 feet and upwards "without a bough to hurt them".

Much of the poor oak grown in the past may have been so because generally pedunculate oak was planted under the mistaken impression that it was the more valuable species for timber, instead of the better sessile or "Durmast" oak which was probably the principal species in the Forest originally. In addition seed from inferior trees was used, wrong silviculture was practised including growing oak on the poorer soils, and the trees were deliberately mis-shapen to satisfy the special demands of the navy. Nowadays we can have good seed from selected trees to be well grown on suitable soils, making a crop to delight both forester and the public, for on the better soils it has long proved its worth and these parts of the Dean and Highmeadow Woods are amongst the best regions in Britain for the growing of good-sized oak timber.

Unprofitable

Unfortunately, however, the expanding markets in Britain are for softwoods and oak and beech are economically unprofitable—now. But what will public demand be in 50, 80 or 100 years time? It is anyone's guess and good oak, now unprofitable by reason of its long rotation and the market's whim, may in the future be as valuable as burr walnut is today.

Even now the mature oaks which are being felled provide timber for a wide variety of uses. The best trees are needed for furniture, panelling and veneers whilst there is always a demand for good oak for hand carving in church work and public buildings—in the reconstruction of the House of Commons after the last war Dean oak was used. Poorer quality wood goes for mining timber, farm and motorway fencing and the cordwood for making charcoal and wood alcohol; smaller timber from thinnings is sent to Sudbrook Pulp Mill where it is processed to make hardwood pulp for high-grade paper, and between 50 and 100 tons of oak bark is sold every year for tanning leather.

The reader has seen, as the pages of history have unfolded, that Dean oak has been part and parcel of the struggle of our island race, so it is good to know that there are still in the forest today some thousands of acres of young trees to carry on this tradition down beyond the days of our children and our children's children into the 21st century A.D. (See plates 24 and 25, central inset.)

OAK IN THE DEAN FOREST, GLOUCESTERSHIRE: RECORDS OF GROWTH FROM 1784 TO 1884

The date and authorship of this interesting paper are unknown, but it was apparently prepared in the Dean Forest in 1884, *for the Office of Woods.*—Editor.

Recorded Results for a Century

The experiment, of which the results are recorded below, was commenced, and has been pursued, with a view of showing the effect upon the growth of oak trees, of (*a*) transplanting them at a tolerably early age; (*b*) treating them in this way at a more advanced period: and (*c*) leaving them in the original seed bed or nursery.

In or about the year 1784 a small field was sown with acorns. In or about the year 1798–1800 some of the plants were transplanted into the open forest; between the years 1806 to 1812 more of the trees were transplanted, and the remainder were left in the nursery where they were raised. A few of the trees transplanted in 1800 and 1807 respectively, and also a few of those left undisturbed, were carefully marked and measured in the year 1809, and since that time they have been periodically re-measured, and the progress of each carefully noted in a book, of which the subjoined tabular statement is an abstract.

The views which the experiment was designed to test are explained in the following statement contained in the First Report of the Commissioners of Her Majesty's Woods, Forests, and Land Revenues, dated 4th June, 1812. There is little doubt that this statement was written by Lord Glenbervie, the then First Commissioner, who took a deep interest in planting, and to whom the Crown and the public are indebted for a large proportion of the Crown woodlands now in existence.

Statement concerning the Transplanting of Oaks of different Ages, and the Tap-root of Oaks

"One of the reasons which operates with many in support of the opinion that transplanted trees, of whatever age, must be inferior to those which are left in the place where they first sprung from the acorn, is of a *theoretical* nature.

They conceive that the preservation of the main root entire, which in young oak plants generally strikes directly down perpendicularly from the seed, and is called the tap-root, must be of material consequence to the growth of the plant; and, as it must be bruised or broken, and is generally shortened by the knife, on transplanting the tree, it is thought the tree itself can never recover from the effects of that injury.

But if we resort to a much more satisfactory criterion, the very general *observation* and *experience* of much the greater number of the persons who took the trouble to answer the Surveyor General's printed queries are in support of the contrary opinion.

Besides many nurserymen (some of whom have spoken from very extensive practice for more than 30 years), the President of the Royal Society, and many of the most considerable planters and owners of woods in various parts of the United Kingdom, have given their testimony on that side of the question.

Mr. T. A. Knight's sentiments on this subject were communicated to the Surveyor General in the following words: 'The tap-root is of consequence only during the first year's growth of the tree; and I will venture to assert (and I speak from the actual examination of more than 20,000 trees) that not a single instance can be adduced in which anything corresponding with the idea of a tap-root now exists under any one tree of 20 years' growth in England. I think I have shown, in a paper in the Phil. Transns. of 1806 (in which I have pointed out the cause why the radicle or root of germinating seeds descends, and why their germ ascends), that a tap-root must necessarily languish after the first year, and become of no importance. And I speak from very extensive experiments, accurately and attentively made, when I assert, that shortening the tap and lateral roots of young trees tends much to increase their future growth, by increasing the number of their roots.'

Very convincing proof of the total disappearance of any vestige of a tap-root in oaks of a large size fell accidentally under the Surveyor General's particular observation in the year 1809 in the case of three trees of that description at Moccas Court, and four or five in the inclosure called Goldsmith's Hill in New Forest, which had been recently blown down by the violence of a sudden storm, and exhibited the whole compass of their roots in a circle of earth which had been torn up with them, and exposed in a direction nearly vertical. In the tree at Moccas Court there was not the slightest appearance of anything like what could have been an original tap-root. The principal and largest roots had diverged in various ways, mostly horizontal, owing, probably, to the hardness of the substratum, or because the best nourishment was near the surface. The appearance of the four or five windfalls in New Forest was nearly the same, except that the principal roots, though none of them were central like a tap-root, seemed to have descended nearly in a straight direction for three or four feet, but they then spread out all round, in a manner parallel with the general surface of the ground.

Whether a transplanted oak, or one which has never been moved, will *ultimately*, under exactly the same circumstances, attain the greatest perfection in size and quality, is a fact which the observation of no individual can ever be able to ascertain by actual comparison; and it is believed that no regular register has ever been kept through several generations, of such an uninterrupted attention to the point, as could at all tend to a satisfactory decision upon it; but it seems fair to conclude, from the evidence about to be stated, that transplanted oaks will grow as fast (or faster) and continue to thrive as long, as others not transplanted, till they reach a size sufficient for the uses of the Navy; which is the only practical part of the question with which we have any concern.

In the purlieu of Thomas Thistlethwaite, Esquire, in the open part of Bere Forest, there was a large fall of oak timber in the spring of 1810. The Surveyor

General saw many of the trees lying on the ground in the month of August in that year, and was then informed that the plantation had been made about 50 or 60 years before. The trees had been planted in raised circular mounds of earth, a yard or more in diameter, and about two feet from the rest of the ground, which in that place is flat and wet. They must have been of considerable size when planted. The workmen employed in hewing them informed the Surveyor General that one of them which had been then removed had measured a load and a half, and several of the others a load each; though, on the average, their contents were only from 20 to 30 feet.

In the same spring, there was a fall of a considerable number of oaks, planted about 50 or 60 years ago, when of the circumference of seven or eight inches, in an open waste belonging to Sir Henry Mildmay, Baronet, near Hartford Bridge, and not defended from cattle, but by mounds in which they were planted, similar to those in the before-mentioned instance. These oaks, when felled, were found to contain near a load of sound timber, more or less. They have been since replaced by other plants of the same sort, and planted in the same manner. The above information the Surveyor General received from the most unquestionable authority, and he understands that planting in the same mode is very usual in that part of the country.

In September 1809 the Surveyor General saw many oak trees in the park at Moccas Court, and elsewhere in Sir George Cornewall's grounds, where deer, cattle, and sheep were feeding, which had been drawn from plantations of his, of from 20 to 25 years standing, and planted in very large holes well dug, from 12 to 14 years before that time, being at the time of such planting from 12 to 14 feet high. A few years before, those plantations had been carefully thinned, by cutting down the worst plants to grow up afterwards for coppice-wood, and leaving the most thrifty and promising shoots, either for transplanting, or to remain in that ground, being at that time carefully, but not overmuch, pruned. When transplanted, some of the lower branches were taken off, and others shortened, so as to leave none within reach of the deer. Their only protection against the bark being gnawed or rubbed against by those and the other animals, has been the sticking four or five withies, or small wands, in the ground, about six feet high, close to the tree, and tied to it with bands of slender pliable twigs, which are renewed every year for the first few years; and this protection had been found to answer completely. Those trees were then, in general, very thriving, and appear from the best authority to have continued so down to this time.

There is a small field near the Speech House, in Dean Forest, called the Acorn Patch, consisting of several acres, which was sown with acorns about 29 years ago.* Part of this field has been thinned repeatedly since that time. About 15 years ago, Mr. Blunt, then Deputy Surveyor, transplanted from it into the open forest about 40 or 50 trees. All these, except two or three, have continued to grow and thrive from that time, although without any protection from cattle or other injury, except by some loose bushes being laid round them. During the last four or five years, others have also been taken from the same plot of ground, and planted in the same manner, in the neighbouring open parts, to the number of several thousands. On the 14th of September, 1809, three of the trees transplanted by Mr. Blunt, three transplanted in the year 1807, and six which remained in their original place (and where they were not so close together as to be hampered in their growth), were carefully measured under the direction and in the presence of the Surveyor General, by taking their circumference at the height of six feet from the ground. The same trees were again measured on the 24th of August in the following year, when it appeared

* 29 years from 1812, not from 1808.

that those which had been transplanted by Mr. Blunt had increased the most, those transplanted in 1807 the next, and of those which remained in their original place, two had not increased at all, and the other four not so much as any of those transplanted. It is intended to re-measure them all again during the ensuing autumn.

It cannot indeed be advisable, in general practice, to transplant oaks, on a large scale, after they have obtained a considerable height, on account of the great expense which must attend such a mode of planting, if executed in a proper manner; yet as there are cases similar to those in the coppices of Whittlewood, Salcey, and Whichwood Forests, where, unless such plants can be used, all idea of obtaining a succession of timber must be abandoned, it becomes extremely important to know, whether, in such cases, this plan may be resorted to with a reasonable prospect of success."

The subject is referred to in the Second Report of the Commissioners, dated 18th March, 1816, in the following terms:—

"It was mentioned in the Appendix to our First Report that several thousand trees, taken from a small inclosure which had been sown with acorns about 29 years before that time, had been transplanted into the open forest, without any protection from cattle, except by a few loose bushes thrown round them. This plan has been since continued with great success, till all the trees which could be spared from the original plantation, and were likely to be moved with advantage, have been planted out. They have abundantly stocked about 120 acres of the open forest, and though many of them were of the height of from 25 to 30 feet when transplanted, and of corresponding thickness, they are now flourishing as if they had sprung originally from the acorn, or had been planted out from a nursery at from three to five years' growth."

AN ACCOUNT OF THE ADMEASUREMENT OF SEVERAL OAK TREES GROWING NEAR THE SPEECH HOUSE IN DEAN FOREST, SHOWING THEIR INCREASE IN CIRCUMFERENCE AT THE DIFFERENT PERIODS UNDER-MENTIONED

N.B.—The Acorn patch where these Oaks were raised was enclosed and planted with Acorns about 1784. The trees marked A, B, C, were drawn out of it in 1800, and are situated in a row with others on the left-hand side of the road leading from the Speech House to Newnham. D, E, and F were drawn out of Acorn Patch in 1807, and are between the Speech House and Acorn Patch, near the corner of the Speech House fence; and G, H, I, K, L, M, and X are remaining in the Acorn Patch, and have not been transplanted.

(The circumference is taken at 6 feet from the ground, except (I), which is taken at 5 feet 6 inches)

——	A.		B.		C.		D.		E.		F.		G.		H.		I.		K.		L.		M.		N.		X.	
		Increase.		Increase.		Increase.		Increase.		Increase.		Increase.		Increase.		Increase.		Increase.		Increase.		Increase.		Increase.	At the east corner of the Speech House grounds next the road at 5½ feet high. Planted 1807			Increase.
1809, Sept. 14 ..	7⅜	—	8	—	8½	—	7	—	6	—	6	—	14¼	—	13	—	12	—	17½	—	11¾	—	15¾	—	—		—	—
1810, Aug. 26 ..	9½	1½	9¼	1¼	9⅜	⅞	7¼	¼	7⅛	1⅛	6½	½	15	¾	13⅜	⅜	12	—	18¼	¾	12¾	1	15¾	—	—		—	—
1812, Aug. 15 ..	11¾	2⅜	11¼	2	11½	1⅞	8⅜	1⅛	8½	1⅜	8	1½	17½	2½	14¾	1⅜	12½	½	20	1¾	13¾	1	16¼	1	—		—	—
1814, Oct. 5 ..	14¾	3	14	2¾	13⅝	2⅛	11	2⅛	10¼	1¾	9½	1½	19⅛	1⅝	16	1¼	14	1½	21⅝	1⅝	15⅝	1⅞	18½	1¾	13	—	24½	—
1816, Oct. 23 ..	18	3¼	16¾	2¾	16⅝	3	13½	2½	12⅜	2⅛	12	2½	20⅛	1	17	1	14¾	¾	22⅞	1¼	17	1⅜	20½	2	16	3	27⅞	3⅛
1818, Oct. 20 ..	20	2	19	2¼	18⅞	2¼	16⅛	2⅛	14⅜	2	13½	1¼	22	1⅞	18⅛	1⅛	15½	¾	23⅞	1	18½	1½	21⅛	⅛	18½	2½	28⅛	1
1820, Oct. 30 ..	23⅞	3⅞	22¾	3⅛	21⅞	3	19	2⅞	16⅛	1¾	16¼	3	24⅛	2⅛	19¾	1⅜	16⅜	⅞	24⅞	1	19⅞	1⅜	22¼	1⅛	23½	4¾	30⅛	1½
1822, Oct. 2 ..	26⅜	2½	25½	2⅞	25	3⅛	21½	2½	18¼	2⅛	19⅛	2⅞	26⅜	2¼	21⅜	1⅜	17	⅛	25⅞	1	20⅞	1	23⅛	⅞	26⅛	3⅛	31½	1⅛
1824, Oct. 20 ..	29½	3⅛	28¾	3½	28¼	3½	25⅛	3⅞	20⅞	2⅛	22⅛	3	—	—	—	—	17¾	¾	—	—	22½	1⅝	23¾	⅛	30⅛	3½	32⅜	⅞
1826, Nov. 1 ..	32⅛	2⅝	31¼	2½	30⅛	1⅞	27¾	2⅜	22⅜	1½	24⅞	2¾	—	—	—	—	Ditto	—	—	—	23	½	24⅝	⅞	32¾	2⅜	33¾	1⅛
1828, Oct. 16 ..	36½	4⅜	36	4¾	Cut down		31¾	4	25¾	3⅜	29¼	4⅜	—	—	—	—	—	—	—	—	25¾	2¾	26¾	2⅛	37¾	5	36	2¼
1830, Oct. 27 ..	40½	4	40½	4½	—	—	35¾	4	27½	1½	32¾	3½	—	—	—	—	—	—	—	—	26½	¾	29	2¼	40¾	3	37¼	1½
1832, Nov. 2 ..	43½	3	44	3½	—	—	37	1¼	28½	1	35	2¼	—	—	—	—	—	—	—	—	27¼	¾	29¾	¾	44½	3¾	38	¾
1834, Sept. 30 ..	46½	2¾	46¾	2¾	—	—	38½	1½	28⅝	⅛	37	2	—	—	—	—	—	—	—	—	28½	1	30	¼	46¾	2¼	39	1
1836, Sept. 29 ..	48¾	2¼	49½	2¾	—	—	39½	1½	29½	⅝	38½	1½	—	—	—	—	—	—	—	—	30	1½	31	1	48¾	2	41½	2½
1838, Oct. 4 ..	51¾	3	52½	2¾	—	—	41½	1¾	31	1¾	40½	2	—	—	—	—	—	—	—	—	32	2	32	1	51½	2¾	42	½
1840, Oct. 3 ..	53½	1¾	54½	2	—	—	42½	1¼	31½	½	41¾	1¼	—	—	—	—	—	—	—	—	32½	½	32	—	52½	1	42¾	¾
1842, Oct. 13 ..	55¼	2	56	1¾	—	—	43½	1	Dead heads cut down		43½	1¾	—	—	—	—	—	—	—	—	33	½	33	1	54½	2	43	¼

AN ACCOUNT OF THE ADMEASUREMENT OF SEVERAL OAK TREES GROWING NEAR THE SPEECH HOUSE IN DEAN FOREST, SHOWING THEIR INCREASE IN CIRCUMFERENCE AT THE DIFFERENT PERIODS UNDER-MENTIONED—*continued.*

Date	A.		B.		C.		D.		E.		F.		G.		H.		I.		K.		L.		M.		N.		X.	
		Increase.		Increase.				Increase.				Increase.										Increase.		Increase.		Increase.		Increase.
1844, Oct. 1 ..	58½	3¼	58	2	—	—	45	1½	—	—	46	2½	—	—	—	—	—	—	—	—	35	2	34½	1½	57	2½	44½	1½
1846, Sept. 9 ..	60½	2	60½	2½	—	—	47¾	2¾	—	—	49¾	3¾	—	—	—	—	—	—	—	—	36½	1½	36½	2	60½	3½	46¼	1¾
1848, Sept. 18 ..	63½	3	62¾	2¼	—	—	49½	1¾	—	—	52½	2¾	—	—	—	—	—	—	—	—	38	1½	37¾	1¼	63	2½	47¾	1½
1850, Sept. 7 ..	64	½	63½	¾	—	—	50¼	¾	—	—	53¾	1¼	—	—	—	—	—	—	—	—	39	1	38	¼	64	1	48	¼
1852, Sept. 30 ..	64½	½	64	½	—	—	51¼	1	—	—	55¼	1½	—	—	—	—	—	—	—	—	40	1	39¼	1¼	64¾	¾	48½	½
1854, Nov. 2 ..	66½	2	65½	1½	—	—	53	1¾	—	—	57½	2	—	—	—	—	—	—	—	—	41¾	1¾	41¾	2½	67	2½	50¾	2¼
1856, Oct. 20 ..	67¼	¾	66¼	¾	—	—	54	1	—	—	59¾	2¼	—	—	—	—	—	—	—	—	44¼	2½	42	¼	68¼	1¼	51¼	½
1858, Sept. 6 ..	69½	2¼	67¾	1½	—	—	55¾	1¾	—	—	62	2¼	—	—	—	—	—	—	—	—	4¾	½	42½	½	70½	2¼	54	2¾
1860, Oct. 22 ..	71¼	1¾	69¼	1½	—	—	57	1¼	—	—	63¾	1¾	—	—	—	—	—	—	—	—	45	½	43	½	71½	1	54½	½
1862, Nov. 7 ..	72	¾	70	¾	—	—	58	1	—	—	65	1¼	—	—	—	—	—	—	—	—	46	1	43⅜	⅜	72	½	55	½
1864, Sept. 22 ..	73½	1½	71	1	—	—	59½	1½	—	—	67¾	2¾	—	—	—	—	—	—	—	—	46½	½	44	½	73¼	1½	56	1
1866, Sept. 26 ..	75½	2	72¼	1¼	—	—	61½	2	—	—	70½	2¾	—	—	—	—	—	—	—	—	47	½	44¾	¾	74½	1¼	56¾	¾
1868, Oct. 28 ..	76¾	1¼	73½	1¼	—	—	63	1½	—	—	73¼	2¾	—	—	—	—	—	—	—	—	48	1	45⅜	¾	75¾	1¼	57¼	¼
1870, Oct. 11 ..	78⅛	1⅜	74⅜	1⅛	—	—	64½	1½	—	—	76½	3¼	—	—	—	—	—	—	—	—	48½	½	46	½	76¾	1	58	¾
1872, Oct. 12 ..	80⅛	2	75⅜	1	—	—	65¾	1¼	—	—	80⅛	3⅜	—	—	—	—	—	—	—	—	49⅛	⅜	46⅜	⅜	78	1¼	58¼	¼
1874, Oct. 14 ..	81¼	1¼	76⅛	¼	—	—	66¾	1	—	—	83	2⅞	—	—	—	—	—	—	—	—	49½	⅜	47	⅜	78½	½	58⅜	⅜
1876, Oct. 13 ..	82¾	1½	77½	1⅜	—	—	68¼	1½	—	—	85½	2½	—	—	—	—	—	—	—	—	50¾	1¼	47½	½	79⅜	1⅛	59⅜	½
1878, Oct. 14 ..	84¼	1½	78¾	1¼	—	—	69¼	1	—	—	87¾	2¼	—	—	—	—	—	—	—	—	51¼	½	47⅞	⅜	80¼	⅝	59⅞	½
1880, Oct. 14 ..	85½	1¼	79⅜	⅝	—	—	70¾	1½	—	—	89½	1¾	—	—	—	—	—	—	—	—	52	¾	48⅛	⅛	81	¾	60⅛	¾
1882, Oct. 17 ..	87	1½	80¾	1⅜	—	—	71⅞	1⅛	—	—	91¼	1¾	—	—	—	—	—	—	—	—	52⅞	⅞	49	¾	81⅛	⅛	61¼	¼

Notes.—In May 1827, among those on left hand, east from the Speech House, were cut 19 for thinning by John Alford—every other tree; C was one of them.
In May 1823, among those marked for thinning by Mr. Turnbull were G, H, K, and cut down, and I in 1827 being damaged.

BOG BUTTER: ANOTHER EXPLANATION

by
E. Estyn Evans
Belfast

The practice of depositing butter in bogs continued in Ireland at least as late as the end of the 18th century. It seems to me probable that the custom may have lingered on in remote places down to the Great Famine of a century ago, which brought to an end so many practices of prehistoric origin. If it was associated, as I am inclined to think, with the booleying tradition, it is not likely to have survived the break-up of that immemorial way of life. It is interesting that special stone-lined underground constructions for storing butter have been recorded in a description of an old Donegal booley-house quoted by Danagher, but the date is not given and would probably be difficult to ascertain.

Modern or recent parallels to the storage of butter in bogs or moist earth have been cited from India and Morocco, and Wilde has given examples of similar practices from north Europe. It is known from Scotland but not, so far as I am aware, from Wales or the Isle of Man. Wilde states that a substance called mineral tallow was first recovered in Finland in 1763. Sheep-tallow, tasting when old like ripe cheese, was formerly preserved in moist earth by the inhabitants of the Faeroe Islands. Wilde also quotes Classin and Povelson's *Travels in Iceland*, where sour butter, made without salt, was stored up against years of scarcity and sometimes kept for more than twenty years.

This, while it is not the only explanation that has been advanced to account for the Irish deposits, would seem to be the most reasonable view: the butter was deposited in the plenty of summer to be consumed during the lean season the following spring, or later as need arose. Father O'Laverty, discovering "The True Reason why the Irish buried their butter in bog-banks", tells us that they wished to mature it and render it more nutritive. Edward Clibborn thought that the object was to sweeten it until it lost any disagreeable flavour such as garlic. Petty, on the other hand, speaks of "butter made very rancid by keeping in bogs", and Dineley is more precise when he writes of "butter laid up in baskets, mixed with a sort of garlic, and buried for some time in a bog, to make a provision of a high taste for Lent". The alleged preference of the Irish for rancid butter, if it is not a traveller's tale, would be an example of making a virtue of necessity, like the sportsman's high game. Other examples might be quoted of tastes unavoidably developed, being converted through time into luxuries. There is probably no more substance in the view that butter was stored in bogs because, as we know from the analyses, it contained no salt to keep it fresh. Finally there is the belief that most of our butter-deposits were made for reasons of security during the troubled periods of Irish history such as the Cromwellian wars, and that the chances of war, leaving them ownerless, account for the large numbers which are dug up. If this were the case, one would expect more valuable treasures than butter to be exposed by turf-cutters. I cannot think that even the vagaries of war will account for all the unclaimed deposits of butter that have been found or still await discovery.

It is true, however, that most specimens of butter that have been recovered appear to be of no great antiquity. While there are, to my knowledge, no associated finds which would permit of close dating, the depths of these deposits and the character of the containers do not point to very remote periods. There are, for instance, no wooden holders of recognizable Neolithic or Bronze Age character. Unfortunately the wooden or basketry containers are generally so simple in style as to be almost dateless, but the majority has a vague "mediaeval" appearance, and the wood is claimed in some instances to be sycamore, which

is not an indigenous tree. One is tempted to regard the practice as peculiarly Celtic, characterising a culture of specialized pastoralism which seems to have largely replaced, during the Dark Ages, the petty cultivation of Bronze Age survivors and the lingering fishing economies of the older inhabitants.

In a note contributed to Mr. Paterson's article on some bog butter finds in an issue of the *Ulster Journal of Archaeology*, I advanced an explanation of the relative infrequency of present-day discoveries which bears out the general dating now suggested, i.e. to the historic and proto-historic periods, following the sub-Atlantic climatic deterioration. It was, briefly, that in most bogs cutting has now reached a depth below the horizons in which deposits were made. There is no doubt that deposits of butter were much more commonly exposed during the 19th century, especially when new bogs were being opened. There is room here for research in association with pollen studies, but the archaeologist rarely gets the chance of seeing the deposits in situ.

Whether or no we are on safe ground in regarding the custom in Ireland as peculiarly Celtic, it would seem that some explanation other than the utilitarian, even if we accept all the various suggested motives, must be sought to account for the large numbers of unclaimed deposits. I think it highly probable that some deposits, perhaps those placed in the more elaborately worked holders, or possibly those buried without a container, were made for magical purposes. A good deal of mystery and superstition is still attached to butter in the peasant mind: folklore is full of its magic properties. Offerings of butter made to the bogs, particularly the mountain bogs, would have had the practical object of inducing more abundant herbage for the summering cattle. It would be in line with one school of anthropological thought to claim that the utilisation of the preserving qualities of the bogs was a secondary discovery hit upon by the chance recovery of an undecayed ritual offering. But to discuss this here would take us too far into theoretical matters.

It is not difficult to adduce parallels for the use of butter in fertility rites, both in Ireland and elsewhere, e.g. in India. Wood-Martin states that in the west of Ireland lumps of butter were thrown into certain loughs and springs through which the cattle were driven in order to restore them to health. Butter and oatcakes used to be offered to "a magical stone" at Altagore in Co. Antrim. While the motive may have been different in these cases, it is worth recording also that in the Crossmaglen district of Co. Armagh, a native of Sheetrim townland told Mr. T. G. F. Paterson that he remembered butter being left at the grave after a funeral. More frequently we hear of offerings of milk poured into the ground. The well-known Irish custom of spilling "for the fairies" a portion of any drink taken out of doors is no doubt a survival of a ritual offering. Mr. Paterson has recorded the pouring of the first milk (beastings) of a cow at the roots of a fairy thorn, and instances might be multiplied.

But the closest parallel I have come across, if for milk we substitute butter, is from Scotland. In September 1656, according to the Presbytery Records, the minister at Loughcarron was ordered to summon two persons to appear at Dingwall on account of "abominations and heathenish practices" which included "pouring of milk upon hills as oblationes." If milk, why not butter?

RECREATION

PUBLIC RESPONSE TO FOREST RECREATION IN NORTHERN IRELAND

by
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Summary

For one week in July, 1964, 50 per cent of the people visiting Tollymore Forest Park were given a questionnaire to complete. About one third of the forms were returned. This paper is an analysis of the results.

Introduction

Tollymore Park, an area of 1,200 acres near Newcastle, Co. Down, forms the major part of Newcastle State Forest. It was opened as Northern Ireland's first Forest Park on 2nd June, 1955, and has remained the only Forest Park in the province for a period of 10 years.

It is likely that within the next few years several new Forest Parks will be opened and it is, therefore, important to gather as much information as possible about the reaction and response of the public to this new form of recreation and to draw conclusions for future guidance.

That the Tollymore Park venture was a success is immediately evident from the yearly mounting number of visitors to the Park as shown in the table below:—

Table 1. ANNUAL NUMBER OF VISITORS

Year	Number of Cars	Calculated Number of Visitors
1955	7,000	33,600
1956	10,892	45,000
1957	12,529	60,100
1958	15,008	72,000
1959	16,800	80,600
1960	20,272	97,200
1961	23,275	111,700
1962	26,792	128,600
1963	28,324	*135,900
1964 (Estimated)	30,000	144,600

* This figure represents 10 per cent of the entire population of Northern Ireland.

The number of cars is known accurately as a charge per car is made for admission.

The number of visitors has been calculated using the formula No. of cars × 4·8 = No. of Visitors. This formula is based on a 100 per cent count made for a period of one week at the beginning of each month from April, 1964 to September, 1964.

N.B. The average number of persons per car was found to be 3·95, but 17·87 per cent of visitors arrived by other means (mainly bus parties).

The Public Opinion Survey carried out after the public had experienced the Park for ten summers was designed to find out the reasons which prompted so

many people to visit the park, the sections of the public which responded most, their group behaviour in the park and to gather any criticisms or suggestions they had to offer.

The Operation

Procedures

The Survey was carried out in two stages. The first was intended to act as a check on the results obtained from the questionnaires and to give a broader base to the conclusions reached by gathering certain facts from the whole season from Easter to September.

(a) *Monthly sample*

During a period of seven days at the beginning of each month the occupants of all cars entering the park were counted and a record of the number of cars kept.

Similarly all pedestrians, cyclists and bus passengers were counted.

In addition the driver of every tenth car was asked two questions:—

1. Where is your home?
2. How often have you visited the park before?

(b) *Public opinion survey*

From Monday, 20th July till Sunday, 26th July, every second vehicle entering the park was stopped and all the occupants of 12 years of age and upwards were given a questionnaire and an official paid envelope.

This period had been chosen as July is considered to be the main holiday month in Northern Ireland. It was felt that the third week was a typical July period and it avoided the peak "Twelfth Week". Although it included the end of what is becoming the "Twelfth Fortnight".

Each person was asked to complete the form if possible in the Park and to hand it to one of the rangers or post it in one of the letter boxes provided. If this was inconvenient they could take the form away and return it by post. All visitors in the caravan park or on the camping sites on Monday morning, 20th July, were treated similarly, the occupants of every second caravan or tent receiving forms.

Tables, seats and pencils were provided near the car park to facilitate visitors.

The forms were serially numbered which made it easy to keep a record of the number issued each day and to group them by days of issue once collected.

From records from July, 1963, it was estimated that the number of visitors could reach 10,000 and 5,000 forms were printed by Her Majesty's Stationery Office. A sample form is attached as an appendix.

Tabulation of Data

On receipt of the forms in Forestry Division headquarters they were sorted and the answers to the various questions coded, the code numbers being entered in the margin.

The forms were then sent to the Ministry of Finance Central Automatic Data Processing unit where punch cards were prepared for each form. These were machine sorted and responses to each question as far as possible tabulated.

This made it possible to have a series of cross references and to compare the answers to any question from different groups of respondents.

It was not possible for the punch cards to deal with the "off the cuff" criticisms and suggestions or with the replies to the question about visits to other possible Forest Parks, and these had to be sorted and tabulated by hand in Forestry Division headquarters.

Response

The period of seven days had commenced on a Monday so as to give the staff at the Park time to adjust their procedures before the peak period of visitors at the week-end. The weather during the week was dull but mainly mild and dry and was unusually uniform. The operation went smoothly without any hitches and the supply of forms lasted for the period with about 500 copies to spare.

Ninety persons refused to accept forms and in each case the forms were given to the next visitor. A total of 4,474 questionnaires were issued during the period and 1,145 were completed and returned in the Park.

An interval of two weeks was observed to allow time for postal replies to be received but a deadline had to be drawn on 12th August. By that date 420 replies had been received by post.

A further 15 replies have come in subsequently but have had to be ignored as far as the tabulation of results is concerned. (Last of these received 7th September, 1964).

A summary by days of the number of forms issued and the response is given below.

It will be seen that only approximately one-third of the public co-operated and that only about a quarter of the replies were received by post.

The percentage returned each day was at its lowest on the busiest days especially Sunday and improved a little on the relatively slack days of Monday and Friday.

Results of Monthly Sample

Monthly Sample

The three tables below tabulate the results obtained from the count made at the beginning of each month.

Number of Visitors

The number of visitors commences with a peak in April and even the figures for July and August do not reach the same level.

This is because the count began on Good Friday and included Easter Day, Easter Monday and Easter Tuesday.

From past experience the two most congested days in the season are Easter Sunday and Monday. It is possible that for a period of a whole week the number may be as high during the holiday period in July ("Twelfth" Week).

The reason for the peak at Easter is undoubtedly because it marks the beginning of the season of family car outings and that the weather is not warm enough for sitting on the beach.

The figures suggest that August may be a busier month than July but this may only be due to the fact that the first week in August is busier than the first week in July, the very beginning of the main holiday season. Certainly the Public Opinion Survey in the third week in July recorded a visitor count higher than that shown for August.

Mode of Travel

The percentages of visitors arriving by different modes of travel are markedly different from the questionnaire tables.

The explanation is probably that a higher proportion of bus passengers failed to return their questionnaires, indeed one whole bus party refused to accept their forms as they had not intended to visit the park and had been taken by mistake.

It is likely, therefore, that the Monthly Sample figures give a truer picture.

Table 2. PUBLIC RESPONSE TO SURVEY

Date		Number Issued	Number completed and Returned in Park	Number returned by post	Total Each Day	Percentage Returned	Number of Persons who Refused Forms	
Monday	20.7.64	394	134	32	116	42·1	2	
Tuesday	21.7.64	400	106	31	137	34·2	25	(Mainly a bus party which arrived by mistake)
Wednesday	22.7.64	705	202	72	274	38·9	11	
Thursday	23.7.64	564	141	52	193	34·2	11	
Friday	24.7.64	343	119	28	147	42·8	16	
Saturday	25.7.64	647	151	51	202	39·3	14	
Sunday	26.7.64	1,421	292	154	446	31·4	11	
Totals		4,474	1,145	*420	*1,565	35·0	90	
			73·2%	26·8%				

* Plus 15 by post after deadline.

Table 3. MODE OF TRAVEL

Mode of Travel	Monthly Sample	Questionnaires
Car	82·1%	85·75%
Bus	12·8%	8·50%
Other	5·1%	3·39%

Domicile of Car Drivers

Again the figures obtained from the Monthly Sample data are markedly different from the questionnaire tables especially as regards the proportion of persons from outside Northern Ireland. In addition they show an even greater preponderance of County Down visitors.

Table 4. PERCENTAGE OF PERSONS DOMICILED BY COUNTIES AND COUNTRIES

	Monthly Data	Questionnaire
County Down	29·15%	17·19%
Outside Northern Ireland	5·2%	16·35%
Together	34·35%	33·54%

It would appear that the County Down people were the greatest offenders in refusing to return their forms and the persons from outside Northern Ireland were the most co-operative. As the two taken together almost agree as a proportion of the whole it is likely that the results for other counties are more accurate.

Frequency of Visits

The Monthly Sample data records a lower proportion of regular visitors of six and more visits and a much higher proportion of intermediate frequency of from 2 to 5 times.

Table 5. PERCENTAGE OF VISITORS

Frequency	Monthly Sample	Questionnaire
First Visit	22·0	24·92
2–5 Visits	35·7	10·60
6 or More	42·2	59·43

The explanation is probably that the really regular visitors and the "First Time" visitors have co-operated to a much greater extent in replying to the questionnaire and that the 2–5 visit group contained a much higher proportion of persons who failed to return their forms.

Again the Monthly Sample figures are probably more accurate.

Number of Persons per Car

The Monthly Sample showed that the average number of persons per car over the season was 3·95 or approximately four. Yet the questionnaires showed that for every driver there were only 1½ passengers giving an average of only 2½ persons per car (plus children).

The explanation must be that in many cases car parties left the driver to fill in the form while half the other members of the party did not fill in separate forms or were too young to do so.

Table 6. NUMBER OF VISITORS (100% Count) MONTHLY SAMPLE

Month (7 days of each)	Mode of Travel			Total Visitors
	Car	Pedestrians and Cyclists	Bus	
April	9,772	589	365	10,726
May	2,790	161	232	3,183
June	3,431	495	1,156	5,082
July	4,846	152	397	5,395
August	6,102	302	1,721	8,125
September	2,733	140	766	3,639
Total	29,674	1,839	4,637	36,150
Percentage of Total	82·08%	5·09%	12·78%	

Table 7. FREQUENCY OF VISITS MONTHLY 10% SAMPLE

Month (7 days of each)	First Visit No.	2–5 Visits No.	6 or More No.	Total No.
April	43	54	152	249
May	5	9	30	44
June	18	36	36	90
July	30	61	28	119
August	43	70	33	146
September	20	27	25	72
Total	159	257	304	720
	22%	35·7%	42·2%	

Table 8. DOMICILE OF CAR DRIVERS—10% MONTHLY SAMPLE

Month	Antrim	Armagh	Down	Fermanagh	Londonderry	Tyrone	Belfast	England and Wales	Scotland	Irish Republic	Abroad	Total
April	16	14	57	—	—	4	149	3	2	2	—	247
May	4	3	15	1	—	2	17	—	—	—	2	44
June	8	4	46	—	2	—	28	—	—	1	1	90
July	13	5	30	—	1	2	57	2	2	6	—	118
August	14	10	37	—	1	5	67	8	1	3	—	146
September	6	4	24	—	—	—	34	2	—	2	—	72
Total	61	40	209	1	4	13	352	15	5	14	3	717
Percentage	8·5%	5·58%	29·15%	1%	·5%	1·8%	49·1%	5·2%				

Results of Public Opinion Survey
The People Themselves

Sex

The respondents were fairly easily divided between the sexes with a slightly higher number of females. This is as would be expected as there are slightly more females in the whole population.

Marital Status

Married persons made up a considerably higher proportion of respondents than single persons, especially among the males, there being considerably more single females than single males.

Table 9. SEX

Males	Females	No Response
726 46·39%	875 50·16%	29 1·85%

Table 10. MARITAL STATUS

Married	Single	No Response
878 56·10%	524 33·48%	138 8·82%

Table 11. CORRELATION OF SEX AND MARITAL STATUS

Sex	Married		Single		No Response		Total
	No.	%	No.	%	No.	%	
Male	418	47·6	220	42·0	88	63·8	726
Female	432	49·2	303	57·8	50	36·2	785
No Response	28	3·2	1	·2	—	—	29
Total	878	100	524	100	138	100	1,540

Age

Unfortunately no details are available for the number of children under the age of 12 years as forms were only issued to persons of 12 years and upwards. It is fair to assume, however, that children of the younger age classes are brought to the park at least as much as those in the bracket 12 to 15 years. If, therefore, the number of children in that group is multiplied by five we obtain a fair idea of the number of all children under the age of 15.

The table following shows that the three main groups are the young adult 20 to 39 years, the middle-aged adult 40–65 years and the children under 15 years.

Teenagers and the over-65s are not large groups among the visitors.

All age groups with the exception of the over-65s visit the park roughly in the proportion that each forms of the whole population.

Table 12. AGE GROUPS

Age in Years	No. of Respondents	Per cent of Respondents	Per cent of N.I. Population (1961)
12–14	104	6·64	5·6
15–19	199	12·72	8·45
20–39	590	37·7	25·0
40–64	543	34·7	27·5
65 Plus	86	5·49	10·1
No Response	43	2·75	—

Table 13. ESTIMATE FOR AGE GROUP 0–14

0–14	520	31·9	28·9

Relationship between Age and Marital Status

It is clear from the tables that the middle-aged single person is not attracted to the Park in anything like the number of similarly aged married persons.

This is because Forest Recreation appears to be essentially a family or group activity.

Table 14. AGE AND MARITAL STATUS

Age Group Years	Married		Single	
	No.	%	No.	%
Under 15	—	—	90	17·2
15–19	1	·1	177	33·8
20–39	359	40·9	191	36·5
40–64	440	50·1	49	9·3
65 Plus	59	6·7	12	2·3
No response	18	2·1	5	·9

Groupings in which Visitors Arrived

That Forest Recreation is a family or group activity is even more clearly demonstrated by the table showing the groups in which people arrived.

Those arriving alone form a minute proportion and with both family and friends the largest. It is clear that people prefer to arrive in parties, either with families or friends and preferably with both.

Table 15. GROUPINGS IN WHICH VISITORS ARRIVED

Group	Number of Persons	Percentage of Persons
Alone	14	·89
With friends	382	24·41
With family	556	35·53
With family and friends	563	35·97
Total	1,565	100%

Occupational Grouping of Visitors

Occupation

The various occupations quoted by visitors in response to the question "What is your occupation?" were broken down into 11 groups to meet the full capacity of the punch card sorting machine.

The grouping was based on the population census so that comparisons could be made with proportions in the general population of Northern Ireland and were as follows:—

1. *Professional People* including doctors, accountants, dentists, etc. and semi-professional people such as nurses, teachers, etc.
2. *Sales and Commercial Occupations*, shopkeepers, commercial travellers and managers of wholesale and retail businesses, salesmen and van salesmen. Also persons employed in Finance and Insurance, and banking.
3. *Skilled and Semi-skilled Workers* in the gas, glass, furnace, electrical, engineering, woodworking, leather, textile, clothing, food, paper and construction works.
4. *Unskilled Workers* mainly in the building industry, warehouse men, etc.
5. *Administrators*, directors, managers, i.e., Civil Servants, building and contracting, secretaries of companies, office managers.
6. *Transport and Communications*, drivers of lorries, buses, railwaymen, sailors (merchant), aircrew, postmen, etc.
7. *Farmers*, agricultural, forestry and horticultural workers, fishermen and workers in quarries.
8. *Clerical Occupations*, clerks, typists, and persons employed in personal services, sports and entertainment,
9. *Housewives*, this is not a group as such in the census return yet is one of the major occupation groups in the population.
10. *Students and School Children.*
11. *Other Occupations* including armed forces, police, persons of private means, retired, etc.

The groupings are arranged as far as possible in accordance with the last published census return (that for 1951). The numbers, however, for the 1961 census returns were obtained from the census office and adjustments were made where necessary in the groupings.

The following table shows the place of each of the above groups in the population of Northern Ireland according to the 1961 census figures.

Table 16. NORTHERN IRELAND CENSUS 1961—OCCUPATIONS ACCORDING TO PUBLIC OPINION SURVEY GROUPINGS

Occupation Group	No. of Population Northern Ireland	Percentage in Northern Ireland including children over 12 and Housewives
1. Professional and Semi-Professional	41,519	3·8
2. Sales and Commerce	57,347	5·3
3. Skilled and Semi-skilled workers	180,464	16·5
4. Unskilled	68,809	6·0
5. Administrative	8,053	·7
6. Transport and Communications	41,557	3·9
7. Farmers, etc.	80,538	7·4
8. Clerical, etc.	105,940	9·7
9. Housewives (Women not gainfully occupied)	309,413	28·3
10. Students and School Children over 12 years of age	113,915	10·4
11. Other occupations including Armed Forces, Security Forces, Retired, etc.	79,769	7·3
No response to census	5,833	·5
Total	1,093,157	100

These figures exclude children under 12 years.

Table 17. OCCUPATIONS OF VISITORS (RESPONDENTS)

Occupational Group (See previous table)	Number of Visitors	Percentage of Visitors (Respondents)	Percentage of Northern Ireland Population for Comparison
Housewives	362	23·13	28·3
Skilled	235	15·01	16·5
Students	196	12·52	10·4
Professional	179	11·44	3·8
Clerical	140	8·95	9·7
Sales	124	7·92	5·3
Administrative	94	6·01	·7
Transport	45	2·88	3·9
Unskilled	18	1·15	6·0
Farmers	12	·77	7·4
Other	78	4·98	7·3
No Response to Question	82	5·24 (Questionnaire)	·5 (Census)
Total	1,565	100	100

Some of these groups overlap and it is useful to join some of the occupations into what may be termed "White Collar" and "Blue Collar" workers.

Table 18. WHITE COLLAR WORKERS

Occupation	Percentage of Visitors	Percentage in Northern Ireland Population (For Comparison)
Sales	7·9	5·3
Administrative	6·0	·7
Clerical	9·0	9·7
Total	22·9	15·7

Table 19. BLUE COLLAR WORKERS

Occupation	Percentage of Visitors	Percentage in Northern Ireland Population
Skilled and Semi-skilled	15·0	16·5
Transport, etc.	2·9	3·9
Unskilled	1·2	6·0
Total	19·1	26·4

From the above figures it will be seen that the main occupational groups visiting the Park are in descending order. Housewives, students and school children (if under 12 years are included) skilled workers, professional people and clerical workers.

It may be surprising to find that skilled manual workers make so high a proportion of the visitors but it must be remembered that the motor car is no longer the monopoly of the upper and middle classes of society.

It must be remembered also that if related groups are merged as above that "White Collar" workers make up a higher proportion than "Blue Collar" workers and their percentage of visitors exceeds their percentage of the whole population.

The almost complete absence of two major components of the population calls for comment.

(a) *Unskilled workers*

Their small numbers may be due to lack of interest or lack of transport, or it may be that few people wish to describe themselves as labourers, or it may be that this group contained a high proportion of people who would or could not co-operate by filling in the form.

(b) *Farmers*

It is an interesting fact that in a rural community such as mid-Down, a well-known Forest Park during the main holiday period can only draw 12 farmers, foresters and fishermen. It is perhaps understandable that farmers, etc. get enough of the open air and would obtain more recreation from visiting the city. They are also known for their dislike of forms.

Comparison between Proportion of Respondents and their Proportion of Whole Population

In the above comparison the Administrative Group shows up best, followed by the Professional Group.

Clerical, sales and students also show a higher percentage among visitors than their percentage of the population.

Housewives show a smaller percentage than their percentage of the population but this may be due entirely to the manner in which the census reports are compiled and include all women "economically inactive" in one category.

Skilled workers and transport workers as groups fall slightly short of their percentage of the population while unskilled workers and most of all farmers make up a tiny fraction of their population percentage.

Mode and Distance Travelled
Domicile of Visitors

Mode of Travel

The table below shows the numbers and percentages of respondents who arrived by different methods of travel.

Table 20. MODE OF TRAVEL

Mode of Travel	Number of Respondents	Percentage of Total	Percentage Grouped Cars/Others	Group Percentage as found in Monthly Sample for Comparison
Car Drivers	562	35·91	85·75	82·1
Car Passengers	780	49·84		
By Bus	133	8·50	11·89	17·9
On Foot	31	1·98		
On Motor Cycle	20	1·28		
On Pedal Cycle	2	·13		
No Response	37	2·36	2·36	—
Total	1,565	100		

Reference has already been made to the fact that the Monthly Sample shows a higher proportion of both bus and other modes of transport compared with cars. It seems likely that local visitors arriving on foot did not fully co-operate and that their number should be greater.

The monthly count also showed a most consistent average of 3·95 persons per car varying monthly from 3·75 to 4·25 and may for practical purposes be taken as four persons per car. This means that car drivers should make up 25 per cent of total persons arriving by car instead of 42 per cent as above and suggests that car drivers co-operated much more fully in returning forms than did car passengers.

Domicile of Respondents

The table overleaf shows the domicile of respondents by Counties for North Irish Residents and by Countries for those elsewhere in the British Isles. The remainder are bracketed as abroad and are mostly from the Dominions.

Table 21. DOMICILE

Country or County of Domicile	No. of Respondents	Percentage of Respondents	Grouped Northern Ireland and Other
Co. Antrim	196	12·52	81·67
Co. Armagh	17	4·86	
Co. Down	269	17·19	
Co. Fermanagh	6	·38	
Co. Londonderry (including City)	17	1·09	
Co. Tyrone	53	3·39	
Belfast	661	42·24	
England & Wales	110	7·03	16·55
Scotland	52	3·32	
Irish Republic	63	4·02	
Abroad	31	1·98	
No Response	31	1·98	1·98
Total	1,565	100	100

Reference has already been made to the inconsistency between the above figures and those obtained from the Monthly Count, when even in July and August the visitors from outside Northern Ireland only amounted to 8 per cent. None the less it is still noteworthy that in one case more visitors are shown to arrive from outside our border than from Counties Londonderry, Tyrone and Fermanagh taken together, and in the other case more respondents are domiciled outside Northern Ireland than in Counties Armagh, Londonderry, Tyrone and Fermanagh.

Distance Travelled

The table below shows the number of respondents who travelled from areas ranged in a series of arcs each of 10 miles width centred on Tollymore Park.

As the 21–30 mile area is dominated by Belfast the people travelling from that circle have been divided into Belfast and other.

It will be seen that the effective range for the great bulk of respondents is 40 miles. Only 6·69 per cent travel from beyond the 40-mile radius and half of these, three per cent, are from Dublin many of whom are brought in special coach parties.

If the theory is accepted that many of the non-respondents were of local or County Down origin then the percentage of people from beyond the 40-mile radius would be even further reduced.

Comparisons will be made later between the reasons for coming and the activities of persons travelling from different distances.

Table 22. DISTANCE TRAVELLED

Radius from Tollymore Park in Miles	No. of Respondents who travelled from each arc	Percentage of total Respondents	Grouped 0–40 41–Plus
0–10	232	14·82	
11–20	117	7·48	
21–30			86·07
Belfast	592	37·83	
Other	221	14·12	
31–40	185	11·82	
41–50	42	2·68	
51–60	2	·13	
61–70	6	·38	
71–80	47	3·00	6·77
81–90	—	—	
91+	9	·58	
No Response	112	7·16	7·16
Total	1,565	100	100

It is noticeable that the people in the 11–20 mile bracket make up a smaller proportion of the total than those in the 31–40 mile range. This would appear to be because they are neither sufficiently near to be very convenient nor sufficiently far away for a visit to be a real "outing" yet this slack area includes Downpatrick, Hillsborough, Ballynahinch, Dromore, Banbridge, Newry, Warrenpoint and Kilkeel. Many of these are, of course, more convenient to Rostrevor Forest, Mourne Park and Hillsborough Forests.

It has been suggested that people from Kilkeel, etc., only visited Tollymore Park once and did not return as it "was overrun by Belfast folk".

The 21–30 mile bracket includes Dundalk from where a sizeable number travelled.

The Dublin people were incorrectly coded as being in the 71–80 range whereas they should have been in the 61–70 arc.

Duration and Frequency of Visits

Frequency of Visits

Visitors were asked whether this was their first, second to fifth visit or sixth and subsequent visit. The replies are tabulated below:—

Table 23. FREQUENCY OF VISITS

Frequency of Visits	No. of Respondents	Percentage of total Respondents
First Visit	390	24·92
2–5 Visit	166	10·60
6 or more	930	59·43
No Response	79	5·05
Total	1,565	100

Reference has already been made to the discrepancy between these figures and those obtained from the Monthly Sample, and how the first visit figures agree but that the other two vary widely.

It is clear from both, however, that a very large section of visitors, probably about half, are regular visitors who return time and time again and that about one quarter of the visitors are first time visitors.

Duration of Visits

Length of stay was divided into three periods—1–2 hours, 2–4 hours and 5 or more hours. The intermediate bracket proved the most popular but a fair number of people stay for 5 hours and longer.

Table 24. DURATION OF VISITS

Length of Stay	No. of Respondents	Percentage of total Respondents
1–2 hours	207	17·25
2–4 hours	859	54·89
5 or More hours	233	14·89
No Response	203	12·97
Total	1,565	100

Relationship between Duration and Frequency of Visits

It is interesting to compare and co-relate the replies to the above two tables relating to duration and frequency of visits. It shows that the more often people return the longer they tend to stay, while first visitors tend to stay for shorter periods.

Table 25.

Length of Stay	Percentage of Total Respondents		
	First Visit	2–5 Visits	6 or More Visits
1–2 hours	24·3	22·3	13·1
2–4 hours	49·0	50·6	60·2
5 hours plus	8·5	12·7	18·0

Duration of Stay related to Age Groups

The figures shows a tendency for the older people, 65 years and over, to stay a shorter time and that teenagers stay for shorter periods than the under-15-year-olds.

Duration of Stay related to Distance Travelled

The duration of stay tends to increase with distance (except for the slack area of 11–20 miles) up to a range of 40 miles and thereafter to decrease.

This is illustrated best by percentages staying for five hours and more.

Table 26.

Duration of Stay	Distance Travelled—Radii Miles				
	0–11	11–20	21–30	31–40	40–50
5 hours and more	9·5%	7·7%	13·6%	20·0%	7·2%

Duration of Stay related to Occupations

Farmers tend to stay for a shorter time than other occupational groups and only 8·3 per cent of farmers stayed for the five-hour period.

Skilled workers and transport workers had the highest percentage of longer stays, 20 per cent staying for the five-hour period or longer.

Enjoyment of Visits

The vast majority of visitors stated they enjoyed their visit "Very Much".

Only eight of all the respondents said "Not At All". Two of these were children, two teenagers, two were over 65 years of age and the age of the other two is unknown.

Table 27. ENJOYMENT OF VISITS

Enjoyment Rating	No. of Respondents	Percentage of Total Respondents
Very Much	1,371	87·61
Fairly Well	144	9·20
Not very Much	8	·51
Not At All	8	·51
No Response	34	2·17
Total	1,565	100

Enjoyment Related to Duration of Visits

The persons who stayed longest enjoyed their stay the most.

Table 28.

Enjoyment Rating	1 to 2 hours	2 to 4 hours	5 hours+
Very Much	83·3%	90·3%	94·5%

This may be partly due to the fact that bus parties stay for short periods and have not time to appreciate the Park fully.

Enjoyment Related to Groups in which Visitors Arrive

The larger the group the greater appears to be the enjoyment.

Table 29.

Enjoyment Rating	Alone	With Families	With Friends	With Family and Friends
Very Much	73·3%	91·5%	81·1%	92·7%

Family groups obtain the greatest enjoyment. It is also noticed that married people show more appreciation than single persons. 91·3 per cent of married people enjoyed their visit very much against 81·9 per cent of single people.

Enjoyment Related to Age Groups

Teenagers showed the least appreciation and the middle-aged adults the highest appreciation, followed by children and young adults. Many teenagers added comments about the lack of suitable company of the opposite sex while some of those who had the right company found the place a paradise.

Table 30.

Enjoyment Rating	Age Groups				
	12–14	15–19	20–39	40–64	65 Plus
Very Much	88·5	77·4	86·6	93·7	84·9
Fairly Well	6·7	18·1	11·5	4·2	9·3

Seventy-two per cent of the "Fairly Wells" were in the 15–39 age bracket and were probably mostly around the late teens and early twenties.

Enjoyment Related to Occupations

The most appreciative groups were housewives 93·6 per cent followed by professional 93·3 per cent and the least appreciative were farmers 75 per cent followed by sales and commercial 80 per cent.

Farmers also had the highest percentage of those who only enjoyed themselves "Fairly Well' 25 per cent followed by sales and commercial 16·1 per cent.

Enjoyment Related to Distance Travelled

The 11–20 mile range visitors were less appreciative than either those closer 0–10 or those farther away. The Belfast people showed the highest appreciation followed by the rest of the 21–30 mile group.

Table 31.

Enjoyment Rating	Distance Travelled—Miles/Radius				
	0–10	11–20	21–30	31–40	41–50
Very Much	88·8%	82·0%	*90·4%	88·6%	88·1%
Fairly Well	10·4%	16·2%	8·1%	9·2%	11·9%

* Belfast 91·6 per cent.

Enjoyment Related to Frequency of Visits

The regular visitors showed the highest percentage who enjoyed their visits "Very Much"—90·1 per cent as against 84·9 per cent for less frequent visitors. This may only mean that those who enjoy their visit most are most likely to come back.

Reasons For Visiting Park

Generally the answers given by ticking the appropriate box in reply to Question 1. "What are your most important reasons for coming?" were vague.

They seem to portray a general urge to get out and away rather than any particular interest.

The attraction of the Mourne Mountains and the proximity of the seaside while being important considerations do not appear to be vital to the success of the Park.

Table 32. REASONS FOR VISITING PARK

Reasons for Visit	Number	Percentage of Total Answers
Scenery or Sightseeing	973	31·57
General Enjoyment	756	24·51
Attraction of Mourne Area	554	17·97
Interest in Trees and Nature	345	11·19
Part of Visit to Seaside	227	7·37
Too Cold on Beach	58	1·88
Other Reasons	154	5·0
No Response	16	·52
Total	*3,083	100

* An average two reasons per respondent—(1,565).

The reason "Too cold on the beach" would be a more important consideration earlier in the season especially at Easter and during spells of bad weather. The week of the survey was mostly mild and dry.

Reason for Coming related to Mode of Travel

The bus parties showed more interest in the Mourne Area as a reason for coming and less interest in trees and nature. This is probably because the visit was often part of a general trip round the Mournes with only a short stop at the Park.

Motor cyclists showed least interest in trees and nature and the Mournes and more in general enjoyment while those arriving on foot showed the highest interest in trees and scenery and least in general enjoyment.

Reason for Coming Related to Groupings in which Visitors Arrived

Persons arriving alone who only numbered 28 showed as a group the greatest interest in trees and nature and the greatest awareness of its being too cold on the beach.

Otherwise little information could be gained from this heading.

Reasons for Coming related to Age

Among the age groups the most interested in trees and nature were the over 40s and over 65s followed by the children. The teenagers were the least interested in trees and nature.

Reasons for Coming related to Distance Travelled.

A surprising number of visitors in the 41–50 mile bracket gave as a reason for coming "Part of a visit to the seaside", 23·4 per cent against a general run of from five per cent to nine per cent for other distances.

It may be that these are furthest from either coast. Towns in this range are: Aughnacloy, Cookstown, Ballygawley, Pomeroy and Monaghan.

The 71–80 mile group gave as a reason an interest in the Mourne Area but most of the bus parties from Dublin fall into this group.

Reason for Coming Related to Occupation

An interest in trees and nature was given by a higher percentage of Farmers (28 per cent) than any other group followed by Professional 16·8 per cent.

Students as a group gave as reasons the highest percentage "General Enjoyment" but otherwise little was learnt by this heading.

Other Reasons

More was learnt from the "Off the Cuff" answers under "Other Reasons" than in the coded section. A selection are given below. They speak for themselves.

"Peace and Quiet".
"Peace and Tranquility".
"Atmosphere of Forest restful and refreshing to weary spirits".
"Peace and to get away from the City".
"Seclusion".

"Pure Fresh Air and admire God's handiwork".
"Natural Beauty".
"Ideal for Children".
"The Park itself".
"Something about the Park which compels me to revisit it".

"Always something new on the Walks".
"Fault of C.I.E. (Corais Iompair Eireian—Transportation Company of Ireland). We should have gone to Armagh".
"Exercise large dog. Dogs' paradise".
"Wish to be alone with my boyfriend".
"Heard so much about it, had to see it. 100 per cent smashing".

"Ideal for honeymooners".
"Relaxing".
"Having heard of its beauty I was not disappointed".
"Quietness".
"Heard a lot of talk in Cookstown about Tollymore".

"Dogs enjoy walks plus us".
"Wonderful soft air".
"The family insisted".
"Getting away from it all".
"No room for parking in Newcastle".

"To give dogs a run and a swim".
"While paper explains the eye cannot lie".
"Can picnic away from crowds".
"To show off the Park to Visitors".
"Relaxing peace of the glens".

"Grand for Children".
"Friends had told me not to miss the view".
"Parents". (A teenager).
"Beautiful fresh, woodland and sea air".

"Peace, quiet, away from the bustle of everyday life".
"To get away from the noise of traffic for a few hours".
"To get away from the crowds in the town".
"Interested, as a visitor from another state, in how a forest can be developed for public enjoyment". (Civil Servant, Dublin).
"Freedom from milling crowds".

"Good for courting".
"Get away from everyone".
"To find somewhere not crowded with people".
"Quiet and peaceful walks".
"Beauty unspoilt".

"Picnic meal without being encrusted with sand".
"Pleasant walks untroubled by cars".
"Complete change from seaside".
"County Down, pleasant and changeable".
"Mountain air".

"A young family and a dog".
"Children enjoy it, so does the dog".
"We find Newcastle too busy and Tyrella too dangerous (so many people learning to drive on beach)".
"Ornithology".
" 'Bird' Watching".

"Peace, solitude, serenity, natural beauty and rusticity".
"To get away from Belfast".

Participation in Recreational Activities

Question 2 on the form asked the question "While you were here what did you do?" and listed 15 possible activities which could ticked and also gave scope for additional items in the person's own words. The replies can be given either as a percentage of the respondents (1,565) or as a percentage of the answers (6,812). On the average each person ticked four items.

The answers as a percentage of the respondents are given overleaf:—

Table 33.

Activities	No. of Respondents who Participated	Percentage of Total Respondents
Walk by river	844	53·93
Picnicking	825	52·72
Walk by Lake	787	50·29
Visit Museum	636	40·64
Visit Café	611	39·04
Sitting and Watching	494	31·57
*Woodland Walk on own	353	22·56
Visit Arboretum	280	17·89
Visit Forest Plots	250	15·97
Camping	86	5·5
Caravaning	31	1·98
1 Mile Planned Walk	629	40·19
2 Mile Planned Walk	423	27·03
3 Mile Planned Walk	238	15·21
4 Mile Planned Walk	218	13·93
Other Activity	93	5·94
No Response	14	·89
Total	1,565	100

* This was intended to be an "unplanned" walk, but some people may have thought that it was a walk unaccompanied.

Activities Related to Duration of Visit

Persons staying for 1–2 hours had a higher percentage who did the one-mile walk, visited the Museum, café, arboretum and forest plots and sat and watched.

Persons staying for long periods of five hours and more had a higher percentage who did the two-, three- and four-mile walks.

The 2–4 hour visitors had the highest percentage of picnickers, persons walking by the river and lake.

Activities Related to Mode of Travel

Bus parties tend to spend more time sitting and watching, camping (possibly youth organisations), visiting the Museum, forest plots and café, but this is related to the above paragraph.

Motor cyclists had a high percentage doing the two-, three- and four-mile walks, although the pedestrians had the highest percentage on the four-mile walk.

Activities Related to Groupings in which people arrived

Persons arriving alone had a higher percentage doing the three- and four-mile walks. This could be related to the above paragraph where these walks were done to the greatest extent by pedestrians and motor cyclists. It must be remembered that all these groups are extremely small and are greatly outnumbered by car passengers and persons arriving in parties.

Activities Related to Sex and Marital Status

Men, especially single men, have a higher percentage camping and doing

the longer walks. Women have a higher figure for sitting and watching. Otherwise there is little to be learned under this heading.

Activities Related to Age Groups

The under 15-year-olds have the highest percentage visiting the Museum and café and doing the three- and four-mile walks.

The teenagers have the highest percentage walking by the river and the lake (possibly holding hands).

The young adults have the highest percentage picnicking and doing the two-mile walk.

The Middle-aged adults have the highest percentage visiting the arboretum and doing the one-mile walk.

The 65-year-olds-plus have the highest proportion sitting and watching and visiting the forest plots.

Activities Related to Distance Travelled

1. *Camping*

This section produced some interesting results.

The 51–60 mile bracket had the highest percentage camping (14·3 per cent) followed by 91 plus (5·1 per cent) and 71–80 miles (4·8 per cent) and 41–50 miles (2·4 per cent).

These figures could be due to troops of Scouts or Guide companies but show that campers are usually from beyond the 40-mile radius. One troop was from Dublin.

2. *Caravaning*

Similarly the greatest percentage for caravaning was in the 91-mile-plus range (5·1 per cent).

3. *Picnicking*

The percentage of persons picnicking rises in a regular curve all the way and flattens out at 21–30 miles, reaches a peak at 31–40 miles and thereafter falls regularly all the way.

It would appear that picnicking, an essential feature of Forest Recreation, has an effective range of 40 miles with a 20-mile minimum.

4. *Longer Walks* 3 *and* 4 *Miles*

In each case the percentage of persons doing the longer walks falls from the 0–10 mile range to a low level for the 10–20 mile bracket and then rises again.

The 3-mile walk percentage rises with distance, out to 40 miles, and then understandably falls.

The 4-mile walk percentage, however, continues to rise with distance out to 70 miles before falling. This may be due to the fact that many of the 60–70 mile range visitors are going to camp or caravan or stay nearby in a hotel for the night and do not have to travel home again that evening.

Activities Related to Frequency of Visits

During their first visit visitors tend to sit and watch, visit the cafe and do the one-mile walk.

The 2 to 5 frequency visitors have a higher percentage for camping, visiting the arboretum, forest plots and the museum and the 4-mile walk.

The regular visitors have a higher proportion of visitors who do the 2- and 3-mile walks and who caravan.

It is possible that people only do the 4-mile walks once and may find them too long. Some have complained that one of them is just a hard slog.

It is likely that the 2- and 3-mile walks are repeated more often for pleasure and, therefore, rate higher among the persons making their sixth or subsequent visit.

Activities Related to Occupations

The sales and commercial group have a high proportion among the caravaners, six out of 31, and the students have a high proportion among the campers. Housewives have a high percentage sitting and watching (9·0 per cent) only beaten by "Other" which includes retired people (9·7 per cent). Housewives also have the highest percentage picnicking (14·7 per cent) followed by skilled workers (12·5 per cent).

Farmers had the highest percentage caravaning but their numbers were so small that this proportion (1·7 per cent) was made up by one man and so this can be ignored. They also had the highest percentage walking by the river made up by nine out of a total of 12 farmers, and visiting the arboretum, four out of 12.

Students and schoolchildren had the highest percentage visiting the museum.

Strange to say the transport and communications workers had the greatest percentage doing the 3-mile walk and tied with the clerical group on the 4-mile walk.

By virtue of their large numbers the housewives, of course, made the largest single group of participants in several activities including visiting the arboretum 60 people professional being next in actual number (40 people).

Similarly housewives made up the greatest number of any one group visiting the museum and café.

Skilled workers made up the greatest actual number of people doing the 3- and 4-mile walks, 74 people followed by students and children, 64 people. Only children 12 and over are included in these figures.

Other Activities

As was the case with reasons for coming each person could give details in his own words of the activities not listed. Some of those added are noted below:—

"Painting and sketching".
"Photography".
"Scout activities".
"Could not get out of car because of rain (as usual)".
"Climbing". Possibly outside the Park.

"Swimming in river". (A camper).
"Football".
"Watching fish in river".
"Just relaxed".
"Young children romped around".

"Filling in forms".
"Visited toilet, excellent facilities".
"Amused children who always love following arrows in woods".
"Details confidential".
"Fishing".

"Watched salmon coming up river".
"Paddled in Spinkwee River".
"Talked at great length to one of the rangers and found him very helpful about the history of the area and appreciated talking to him very much".

Charges for Camping, Caravaning, Parking and the Forest Park Booklet

Charges

Questions were asked about the level of charges for car parking, for caravans and for camping. The replies are complicated by the fact that many people replied who were not actual campers or caravaners and who were probably not aware of the actual charges.

It was possible to check on this aspect by sorting out the actual caravaners and actual campers.

The campers, however, fall into two categories (a) youth organisations, (b) general campers. Different charges are made for these two distinct forms of camping but their replies are merged.

Table 34. CHARGES

Facility	Visitors' Opinion of Level of Charge Percentage of Total Opinions									
	Surprising Low		Reasonable		Too High		No Response		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Car Parking	162	10·35	1,106	70·67	163	10·42	134	8·56	1,565	100
Caravans (All replies)	18	6·52	144	52·18	27	9·78	87	31·52	276	100
Caravans (Persons who actually caravaned)	1	3·6	23	82·1	3	10·17	1	3·6	28	100
Camping (All Replies)	27	9·78	147	53·26	38	13·77	64	23·19	276	100
Camping (Actual Campers)	12	17·1	41	58·6	13	18·6	4	5·7	70	100

As would be expected car parking obtains the highest percentage of surprisingly low opinions although many people stated that the charge was reasonable for admission but too high for parking only. It would appear that the public would be more satisfied if it was known as an admission fee for entrance.

The caravaners appear to be well satisfied, 82·1 per cent of actual caravaners stated that the charge is reasonable. The campers, however, are the least satisfied.

It seems likely that the 17·1 per cent who stated that the charges were "surprisingly low" were mostly Scouts and Guides and that the 18·6 per cent who stated that the charges were "too high" were mostly general campers. This 18·6 per cent is the highest percentage of "too high" opinions for any of the charges.

The 58·6 per cent who considered the camping charges reasonable are probably a mixture of both types.

Forest Park Guide Booklet

The replies to the two questions about this booklet were to some extent compromised by the fact that the term "Forest Park Guide" was used and many people stated that they did not meet him or her, or that they did not know that guides were available.

However, it is possible to sort out the replies to some extent by separating the answers of those who had actually read the booklet from those who had not.

Table 35. PROPORTION OF RESPONDENTS WHO HAD READ THE BOOKLET

	No. of Respondents	Percentage of Respondents	Grouped Number	Grouped Percentage of Total
Have read the Booklet	464	29·65	622	39·74
Have Glanced at a Copy	158	10·09		
Have not read the Booklet	817	52·21	943	60·26
No Response	126	8·05		
Total	1,565	100	1,565	100

It is interesting to know that approximately 30 per cent have read the booklet thoroughly and 40 per cent to some extent but it must always be remembered that this is 40 per cent of respondents and not of visitors.

It is likely that the two-thirds who threw their forms away contain a very high percentage of persons who have not read the booklet.

At the worst there are 622 people out of 4,474 visitors who have read the booklet so that the lowest percentage and probably closest to reality is 13·9 per cent of readers.

Appreciation of Booklet

The following table summarises the opinions expressed about the booklet by those who had actually read it and ignores the opinions of those who had not read it or who had only glanced at a copy.

Table 36.

Comment	Number of Readers	Percentage of Readers	Number	Percentage
Very Interesting	229	49·35	432	93·10
Interesting	203	43·75		
Dull	7	1·15	32	6·90
Too Detailed	3	·65		
Too Technical	7	1·51		
No Response	15	3·23		
Total	464	100	464	100

It would appear that most readers are satisfied.

Criticisms and Suggestions

The answers to three questions have been divided into criticisms and suggestions no matter where the reply was given.

The three questions were:—

(a) Are the facilities adequate? (If not give details).

(b) Is there anything you found lacking or disliked? (Give details).

(c) Have you any suggestions to offer for the improvement of this Forest Park or the development of others?

Four hundred and eighty-six people found something lacking or the facilities inadequate and in the main these have been classed as criticisms.

Four hundred and eighty-four people replied to the last of the three questions with suggestions for improvement.

The respondents were fairly evenly spread over all ages, sexes and other groups.

The two main categories were each divided into 10 sub-sections which are summarised and listed in detail below:—

Table 37. CRITICISMS AND SUGGESTIONS

Subject	No. of Criticisms	No. of Suggestions	Total Number	Percentage of Total
Walks and Picnic sites	136	192	328	24·55
Car Park, Road and Access	134	81	215	16·09
Toilets and Ablutions	106	95	201	15·04
Sporting, Entertainment, Noise	19	142	161	12·05
Café and Catering	52	79	131	9·81
Camp Sites	28	35	63	4·72
Animals, Birds, Fish, Insects	29	30	59	4·42
Trees, Shrubs, Exhibition	24	29	53	3·97
Human and Staff	21	10	31	2·32
Caravan Sites	12	5	17	1·27
Miscellaneous	19	58	77	5·76
Total Number of Remarks	580	756	1,336	100

Walks and Picnic Sites

It will be seen that one quarter of all remarks concerned the walks and picnic sites and that the most numerous complaint was that the labelling and signposting was misleading and inadequate. The most numerous suggestion under this heading was for more tables and seats for picnic parties.

Car Park and Roads

Next in descending order were remarks about the car park and roads. In fact the highest number under any sub-heading was 68 complaints about the car park surface.

Toilets and Ablution

Comment about the toilets was extremely varied and seemed to depend on the time of arrival. Persons arriving at slack periods probably in the morning were very complimentary but those at peak periods found much ground for complaint. In fact 28 people stated that the toilet was out of action and that

the water supply had failed. Twenty-five of these were Sunday visitors, the peak day. Many also complained of the lack of soap and towels. The most usual suggestion about the ablutions was for the provision of hot water.

Sporting and Entertainment

Comments were of two types, on the one hand 39 wanted a children's playground and others wanted putting, boating and 39 wanted bathing facilities. On the other hand some complained that there were too many noisy games and 15 wished to have transistor radios banned from the Park.

Café

Many people found the catering facilities inadequate and thought that the café should be open more often and provide meals,

The people who found the café closed were evenly spread throughout the week and may have been morning visitors.

The caravan and camping visitors especially wanted a shop to sell food stuffs.

Camp Sites

The Scouts were, in some cases dissatisfied with their site and the wet firewood sold to them by the Ministry.

The general campers required additional sites and felt that youth organisations got too much preferential treatment.

Animal Life

No less than 26 people complained about insects, midges and wasps. A similar number suggested more wild animals and birds.

Trees and Shrubs

Many people would like more information and better labelling of trees and some require more floral displays.

Staff, etc.

Only one person out of 1,565 respondents complained about the staff being uncivil whereas very many were delighted with the attitude and helpfulness of the rangers.

Caravan Sites

A few complaints were made about the sites being too far from the toilets and ablutions and that there should be more sites.

Miscellaneous

Seventeen people pleaded that nothing be done to commercialise or develop the park in an unnatural way and some complained that the booklet was not available.

Criticisms

Café	*Number of Complaints*
Not open when required	15
Variety poor. This includes one complaint that there was no Wall's ice cream	15
Prices too high (Café only)	2
Not big enough. This was only used where it was clear that the accommodation was not sufficient for the patrons	2
Ice cream too dear	2
"Service poor" was interpreted as slow service	7
Charges not displayed	1
	52

Car Park and Roads	
Car Park surface bad or dusty	68
Car Park either overcrowded or too small	22
Parking disorganised. (Includes park road signs and directions)	8
Roads and paths bad surface (including "crazy path")	10
One-way system	1
Car Park surrounds untidy	1
Car Park bad—General Complaint	7
No demarcation of car spaces	4
No notice at Newcastle end exit	2
Walk-up to car park is too steep	6
Entry signs not distinct enough	1
Parked cars	2
Parking in a field	1
First arrivals should be allowed to pick best parking spots	1
	134

Walks and Picnic Sites	
Inadequate labelling of planned walks	42
Signposts misleading due to vandalism	10
More signposts required (includes pointers back to car park)	16
Better signs required	7
Views and paths overgrown by scrub or trees	14
Too much litter about	12
Path surface	26
Existence of deck chairs for hire not advertised	1
Some walks not interesting enough	8
	136

Toilets and Ablutions	
Not sufficient accommodation at peak periods	4
Not clean enough	8
Used towels not collected frequently enough	1
No towels*	16
No soap*	15
No mirror*	5
Toilets not well enough signposted	3
No coat hooks	2
Washing facilities—General Complaint*	8
Latches on toilet doors	1
Toilets out of action (includes water supply failure)	28
No toilet paper, etc.	4
Inadequate—General Complaint	11
	106

* These complaints also made by campers and caravanners. These are included in the totals.

Camp Sites	*Number of Complaints*
Could be improved—General Complaint	3
Firewood supplied too damp or otherwise unsatisfactory	8
Location of sites unsuitable	6
Water supply	1
Ground surface of site	3
No hinges on camp toilet doors	1
Too many visitors to site	1
Organisations get preferential treatment	1
Cars at Camp site	1
No camping facilities for families	1
Camp toilets misused by visitors	1
Grass too long	1
	28

Caravan Sites	
Sites not suitable	1
Toilets too distant	3
Roads bad at site	1
Information on caravan and tent charges unavailable	2
Facilities for short-stay visitors inadequate	1
Surface bad	2
Booking of site for Caravan Club Rallies	2
	12

Noise	
Too many transistors	15
Too many noisy games	2
No music	1
Movement of cars within park	1
	19

Insects and Animals	
Too many insects	26
Dogs	2
Sheep	1
	29

Trees, Shrubs and Exhibition	
Not enough labels generally (i.e. on trees on walks) Labels contain no information on age of trees	12
Not enough information	2
Trees in aboretum needed dead wood removing	1
Breaking of trees and shrubs	1
Trees need more attention	1
Exhibition signs and picture mounts need replacement	1
Exhibition closed too early	1
Azaleas not pruned	1
No fire extinguisher or "no smoking" signs in museum or bungalows	1
Layout of exhibits in museum or contents of museum	1
Labels not clear enough	2
	24

Human	*Number of Complaints*
Not enough suitable company of the opposite sex	7
Staff uncivil	1
Too many people	5
Immodest behaviour of courting couples	1
Tents and campers (Too many)	2
Caravanners and caravans (Too many)	1
Staff not uniformed (e.g. car park attendants)	3
Digging up of plants (Wild Flowers)	1
	21

Miscellaneous	
Everything too congested	2
No Union Jack Flying	2
Too much regimentation	1
Stones on lawn	1
Literature unavailable	5
No free literature	1
Improvement of "Danger of Smoking" notices	1
Some guard rails too wide for children	1
Forestry symbol at Park is unsatisfactory	2
Existence of (Human) Guide not advertised	1
Not enough literature	2
	19

Suggestions

Catering	*Number of Suggestions*
Should supply meals. (At reasonable prices)	24
Should have a bar	12
Better Catering facilities—General Suggestion	15
Goods Shop (Foodstuff, Forest Produce and Equipment)	14
Café appearance	1
Mountain Top Café	1
Sale of Flasks of Tea for Picnicking	1
Juke boxes	4
Other shops, cafés, refreshment stalls throughout park	6
Beer Garden, German style	1
	79

Access to Park	
More car parks elsewhere (including lay-bys)	14
More roads open to cars	9
Provide motorised transport (especially for older people) (Includes suggestions for miniature railway)	19
Animal Transport (including pony treking, horse riding)	13
Better U.T.A. (Ulster Transport Authority) service	3
Maps and Information throughout Park	8
Arrow on entrance signpost to show direction	1
Information about car park prices at entrance	1
Refund of car park fee if only driving round park	1
A mountain road	3
Sale of Maps only	1
More paths and longer walks	4
Organised bus trips to Park	2
More open space	2
	81

Facilities on Walks and Picnic Sites		*Number of Suggestions*
Better facilities for picnickers	118	1
More seats		27
More tables and seats		53
More shelters throughout park		30
Fire places and barbecue sites		7
More litter receptacles (includes walks)		31
Water Points (including car park)		16
Safety rails (at river particularly)		14
More picnic sites		2
More bridges		4
Signpost to highest point of Park		1
Platforms over river		2
Lighting of walks at night, use of coloured lights and lighting of lake		3
Folding tables for hire		1
		192

Toilets and Ablutions		
Additional Toilets (especially on long walks)		32
Hot water	Includes requests from campers and caravanners	27
Shaving points		4
Electric lights		21
Attendants in toilets		2
Wash hand basins		7
More privacy		2
		95

Camp Sites		
Additional sites for general campers		18
General suggestion for overall improvement of facilities		1
More bins or more frequent emptying of present bins (This applies to Caravan Site also)		5
Hot showers (shilling meter suggested)		5
Tents for hire		1
Drains for the disposal of dishwater, etc.		1
Lighting of site		2
Locking of camp site/caravan site toilets and provision of keys on deposit		1
Sites to be demarcated		1
		35

Caravan Sites		
More sites		2
Screening of individual caravans by bushes		1
Lighting required		2
		5

Sporting and Entertainment Facilities		
Roller skating		1
Putting and golf		13
Boating		15
Tennis		7
Bathing (includes "paddling pool for kiddies")		34
Fishing		11
Children's Playground (includes children's amusement centre and recreation room for children)		39
Dance hall and Cinema		3
Evening facilities for entertainment (e.g. square dances and camp songs)		2
Bad weather entertainment (e.g. amusement arcade)		4
Table tennis		1

Sporting and Entertainment Facilities—*continued*	*Number of Suggestions*
Hiring of fishing rods	1
More facilities generally	3
Band (i.e. Royal Ulster Constabulary Band)	3
Rough shooting	1
Club for teenagers	1
Playing of records	1
Playing fields	2
	142

Animal, Bird and Fish Life	
More wild birds	10
More wild animals	7
More fish	2
Ornamental water fowl on lake	5
Aviary	1
Boards illustrating common birds, plants, etc.	1
Nature reserve or zoo	3
Aquarium	1
	30

Flowers, Trees and Colourful Shrubs	
More flowers and colourful shrubs generally	6
More expert planning of garden	2
Rose garden or rose beds	4
More species of trees and shrubs	6
Flowering shrubs along walks	2
Keep grass short on lawn near car park	1
Flowers at the wooden bridges	1
Flowers at the entrance and car park	2
Flowers at the lake	1
More wild flowers	1
Landscape gardens (also lawns with flowers)	2
Sale of trees and shrubs	1
	29

Staff	
Provide guides	7
Provide attendant in museum	1
Supervision of camping	1
Modern uniform	1
	10

Miscellaneous	
Chair lift	2
No commercialisation or development or use of unnatural materials	17
Litter warnings	2
More advertisement of Park(s)	7
Chalets (e.g. for honeymooners)	2
Provide more facilities generally	1
Fairy Glen layout	1
Dogs' drinking trough	1
Fountain (includes Lion's Head water flow)	2
Charge an entrance fee	4
Clean out streams and lake	1
Locate new parks beside seaside resorts	1
Development of other parks on present lines	2
Telephones	2
Respacing of Forestry Division fence 25 yards from Glen River (above Newcastle) to allow for walks along river bank	1

Suggestions—*continued*

Miscellaneous—*continued*	*Number of Suggestions*
Telescope with money slot at car park	2
Children's Hostel	1
Visit by official to Canadian and U.S.A. Parks to report on amenities	1
Provision of insect sprays and large plastic tents to keep off flies	1
Treatment of car park surface with waste oil	1
Post Office	1
Left luggage facilities for bus travellers	1
Coloured glass "Glenariffe" type houses	1
Sand buckets for disposal of cigarette butts	1
First-aid post	2
	58

Other Forest Parks

Visitors were asked to tick those forests listed to which they would make regular visits if developed as Forest Parks.

A list of 13 forests, some in each of the six counties, was given.

The answers were sorted into replies from persons domiciled in each county and Belfast.

The highest number of votes were given to forests in the following order: Rostrevor, Ballycastle, Ballypatrick, Downhill, Gosford Castle, Slievegullion, Ely Lodge, Castle Archdale, Castlecaldwell, Binevenagh and Lough Navar.

Belfast, Down, Eire, Scotland and England and Wales all favoured Rostrevor before any of the others. Antrim, however, favoured Ballycastle. Armagh gave first preference to Gosford Castle. Derry gave first preference to Downhill and Tyrone to Drumcairne, while Fermanagh favoured Ely Lodge and Castle Archdale equally—six votes each. (Only six visitors from Fermanagh filled in the forms).

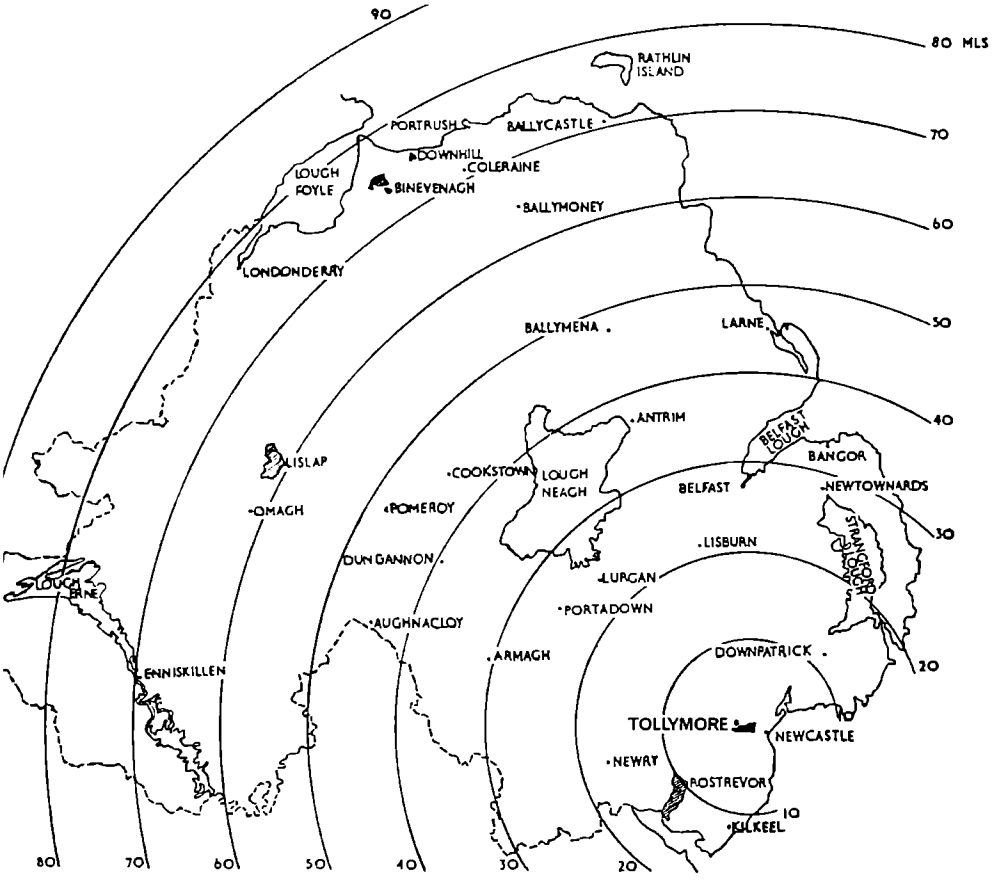
Table 38. OTHER POSSIBLE FOREST PARKS
NUMBER OF RESPONDENTS WHO WOULD MAKE REGULAR VISITS

Forest	Belfast	Antrim	Down	Armagh	Londonderry	Fermanagh	Tyrone	Irish Republic	Scotland	England and Wales	Abroad	Total
Rostrevor	280	71	154	50	3	—	9	14	4	8	1	594
Ballycastle	258	86	76	7	5	—	8	5	3	5	2	455
Ballypatrick	184	70	55	5	4	—	4	5	2	2	2	333
Downhill	110	40	28	4	12	1	9	4	3	2	—	213
Gosford Castle	62	21	31	53	—	—	13	8	1	3	—	192
Slievegullion	59	20	38	30	—	—	13	8	1	4	—	173
Ely Lodge	56	17	21	9	2	6	8	2	—	2	—	123
Castle Archdale	59	13	15	7	3	6	2	1	—	1	—	107
Castlecaldwell	41	14	11	11	—	4	3	3	2	2	—	91
Drumcairne	22	1	8	6	6	—	36	2	1	2	—	84
Lislap	19	12	13	3	5	1	19	4	—	3	—	79
Binevenagh	35	15	5	3	10	—	2	4	—	2	—	76
Lough Navar	36	6	6	2	—	3	—	1	1	1	—	56

Seventy-four persons ticked all the 13 forests listed and as this merely indicated a general willingness to visit any forest park anywhere these have not been included in the figures above.

In addition to the 13 forests listed the following forests were written in by the number of visitors mentioned in brackets: Hillsborough (11), Mourne Park (8), Tardee (5), Belvoir Park (4), North Carn and Woodburn (4), Carndaisy (4), Randalstown (3), Belmore (3), Castlewellan (2), Castleward (2) and one each Baronscourt, Glenarm, Donard Demesne, Springwell, Glenshane, Favour Royal, Portglenone, Cam, Lough Bradan and Parkmore.

Several visitors also mentioned the following areas and private estates as suitable: Dungannon Park (5), Belfast Castle Estate, Sperrin Area, Dufferin Estate, Portaferry area, Scrabo Hill, Killynether, Dree Park, Mullyroden Estate, Millisle area, Glens of Antrim and Stricklands Glen.



Map to show distances from Tollymore Forest Park, Northern Ireland.

Conclusions

Much has been learnt with a fair degree of certainty which formerly could only have been guessed.

Forest recreation is seen to be an activity mainly for family parties with all ages participating fully except the over-65s. Its greatest appeal is for the urban, industrialised or office worker and its least appeal for the rural dweller and farmer.

Teenagers and the over-65s enjoy their visits less than other age classes though, of course, for different reasons.

People do not travel uniformly the numbers gradually diminishing with distance. Rather they travel more thickly from certain zones, (a) the very near inside a radius of 10 miles and (b) the 20–40 mile zone about one hour's travel (average) distance from the Park. In between these two zones there is a shadow area 10–20 miles from which people travel in smaller numbers, stay for a shorter time and show less appreciation.

A higher number of visitors from outside the Province are attracted than might have been imagined and make up a sizeable proportion of the visitors.

People tend to return very frequently and the more often they return the longer they tend to stay and the more they enjoy themselves.

Visitors have no very clear reason for coming but "getting away from it all" seems to be the dominant one among adults while children find adventure in following paths and exploring.

The participation pattern is obscure largely because scope is limited and the park small. In an American Forest Park with climbing, canoeing, hunting, treking, etc., this would not be the case. Even so some conclusions can be drawn. Picnicking is related to distance travelled and as a typical Forest Park activity this factor is an important indicator. This would suggest that Forest Parks have a really effective range of 40 miles. Only about $6\frac{1}{2}$ per cent arrive from beyond the 40 mile range.

The present level of charges seem to be acceptable but those for the general camper least so. The current Forest Park Booklet seems to meet what the public require though it is not read by a very high percentage. There may be a case for a simpler and cheaper forest map.

Many worthwhile criticisms and suggestions have been made which will be considered in detail. A determined effort must be made to improve the labelling of the planned walks and to provide American picnic tables and seats.

Arrangements are already in hand to improve the toilet facilities and the car park.

It must always be remembered that if the Park is to keep its appeal as a sanctuary for the urban dweller it must be kept natural and free from noisy games and sports.

Other Forest Parks

It is quite clear that other Forest Parks are urgently needed both to relieve the pressure of visitors travelling from Belfast to Tollymore Park and also to provide Forest Parks for those areas which lie beyond the 40-mile radius from Tollymore.

For the first of these objects Rostrevor would seem to be an ideal and obvious choice.

Derry City is at the extreme opposite corner of the province and as our second largest city should be given facilities for Forest Recreation. Binevenagh (with Downhill) and Lislap and possibly Banagher would seem to be well situtated and within the 40-mile limit from Derry.

Visitors from Coleraine could also enjoy Binevenagh while Omagh and Enniskillen are within range of Lislap.

It is suggested that at least two other Forest Parks should be considered, one at Ballycastle in the North East and the other at Lough Erne in the South West. Ely Lodge, Castlecaldwell and Castle Archdale have all a high amenity and recreational potential.

Acknowledgements

The writer desires to express his high appreciation for the help he obtained in preparing this report from a great number of individuals.

Mr. Bell and the Forest Park Staff who with Mr. Sherwood the District Forest Officer carried the operation through from April to September and did efficiently and well all that was asked of them.

Mr. Blackmore and Mr. Gadd at Forestry Division headquarters who were given the job very late in the season of arranging the coding and analysis of the questionnaires. Mr. Blackmore speeded the whole process up when time was fast running out.

Mr. Everett and Mr. Clotworthy who did most of the coding which the machine was unable to do.

Mr. Bishop of Her Majesty's Stationery Office who arranged for the printing of 5,000 forms just before the 12th July holidays.

Mr. Street of the Ministry of Finance whose help in the General Automatic Data Processing Unit was invaluable and without which most of the results and conclusions would have been impossible.

TOLLYMORE FOREST PARK

PUBLIC OPINION SURVEY

Your co-operation will be greatly appreciated in giving frank answers to this questionnaire. The information will be of great assistance in planning and developing Forest Parks in the Province.

Please return the completed form to the Ranger at the exit gate or place it in the letter box provided. If this is inconvenient please return it by post using the official paid envelope provided.

TICK THE ANSWER MOST APPROPRIATE THUS √ OR
ADD THE REPLY IN YOUR OWN WORDS

For Official Use

1. What were your most important reasons for coming—
   (*a*) ☐ Scenery or sight seeing. (*d*) ☐ Too cold on the beach.
   (*b*) ☐ Interest in trees and nature. (*e*) ☐ Part of visit to seaside.
   (*c*) ☐ Attraction of Mourne Area. (*f*) ☐ General enjoyment.
   ☐ Other reason, give details below.

.....

2. While you were here what did you do—
   (*a*) ☐ Camping. (*i*) ☐ Visit Museum/Exhibition.
   (*b*) ☐ Caravanning. (*j*) ☐ Visit Café.
   (*c*) ☐ Sitting and watching. (*k*) ☐ One Mile Planned Walk.
   (*d*) ☐ Picnicking. (*l*) ☐ Two Mile Planned Walk.
   (*e*) ☐ Walk by river. (*m*) ☐ Three Mile Planned Walk.
   (*f*) ☐ Walk by lake. (*n*) ☐ Four Mile Planned Walk.
   (*g*) ☐ Visit Arboretum. (*o*) ☐ Woodland walk on own.
   (*h*) ☐ Visit Forest Plots. (*p*) ☐ Other activity, give details.

.....

3. How much time do you usually spend here (day visitors only)—
   (*a*) ☐ 1–2 hours. (*b*) ☐ 2–4 hours. (*c*) ☐ 5 or more hours.

4. How did you travel to the area—
   (*a*) ☐ Car driver. (*d*) ☐ Motor Cycle.
   (*b*) ☐ Car passenger. (*e*) ☐ Pedal Cycle.
   (*c*) ☐ Bus. (*f*) ☐ On foot.

5. Did you visit the Forest Park—
   (*a*) ☐ Alone. (*c*) ☐ With friends.
   (*b*) ☐ With family. (*d*) ☐ With family and friends.

6. How much did you enjoy your visit here—
   (*a*) ☐ Very much. (*c*) ☐ Not very much.
   (*b*) ☐ Fairly well. (*d*) ☐ Not at all.

7. Are the charges for car parking—
   (*a*) ☐ Surprisingly low. (*b*) ☐ Reasonable. (*c*) ☐ Too high.

8. Are the charges for caravans/tents—
   CARAVANS:
   (*a*) ☐ Surprisingly low.
   (*b*) ☐ Reasonable.
   (*c*) ☐ Too high.
   TENTS:
   (*d*) ☐ Surprisingly low.
   (*e*) ☐ Reasonable.
   (*f*) ☐ Too high.

9. Are the facilities adequate (if not give details)—

For Official Use

10. Is there anything you found lacking or disliked (give details)—

11. Have you any suggestions to offer for the improvement of this Forest Park or the development of others—

12. Would you make regular visits to the Forests mentioned should they be opened as Forest Parks—

(*a*) ☐ Rostrevor, Co. Down.
(*b*) ☐ Ballycastle, Co. Antrim.
(*c*) ☐ Ballypatrick, Cushendun, Co. Antrim.
(*d*) ☐ Slievegullion, Forkhill, Co. Armagh.
(*e*) ☐ Gosford Castle, Markethill, Co. Armagh.
(*f*) ☐ Downhill, Castlerock, Co. Londonderry.
(*g*) ☐ Binevenagh, Limavady, Co. Londonderry.
(*h*) ☐ Drumcairne, Stewartstown, Co. Tyrone.
(*i*) ☐ Lislap, Omagh, Co. Tyrone.
(*j*) ☐ Castle Archdale, Kesh, Co. Fermanagh.
(*k*) ☐ Ely Lodge, Enniskillen, Co. Fermanagh.
(*l*) ☐ Lough Navar, Derrygonnelly, Co. Fermanagh.
(*m*) ☐ Castlecaldwell, Belleek, Co. Fermanagh.

13. What Forests in addition to those above would you consider suitable for development as Forest Parks—

14. Are you—

(*a*) ☐ Male.
(*b*) ☐ Female.
(*c*) ☐ Married.
(*d*) ☐ Single.

15. Which age group are you in—

(*a*) ☐ Under 15 years.
(*b*) ☐ 15–19.
(*c*) ☐ 20–39.
(*d*) ☐ 40–64.
(*e*) ☐ 65 plus.

16. What is your occupation.....

17. Where do you live—

Nearest Town..... County.....

18. From where have you travelled today—

Nearest Town..... County.....

19. Have you read the Forest Park Guide—

(*a*) ☐ Yes. (*b*) ☐ No. (*c*) ☐ Glanced at a copy.

20. Did you find the Guide—

(*a*) ☐ Very interesting.
(*b*) ☐ Interesting.
(*c*) ☐ Dull.
(*d*) ☐ Too detailed.
(*e*) ☐ Too technical.

21. How often have you visited the Park before.....

Issued by
MINISTRY OF AGRICULTURE FOR NORTHERN IRELAND
Forestry Division - Dundonald House - Belfast

ABBOT'S WOOD POND

by

D. Fulcher

Forester, South-east England

Long ago, in the twelfth century, the Abbot of Battle Abbey had control over what is now known as Abbot's Wood, Wilmington, a portion of the Wilmington Beat of Friston Forest, East Sussex. The monks had in the wood a stew pond, supplying fish to the Abbey.

The earth bank and overflow channel must have been designed by a Brother with a most exact eye for levels, and a great deal of labour went into the formation of the dam in those Drott-less days.

As the years passed, the Abbey lost its power and its lands, and the neglected dam crumbled, no doubt weakened by rabbits and voles: the stream resumed its old course.

Later, one of the Dukes of Devonshire, who then owned the land, repaired the old dam. Stout wooden sluice gates were put in, and once more the Abbot's pond was the home of fish and of wildfowl. By the time the land was acquired by the Forestry Commission in 1954, however, the sluice gates had decayed, and again the stream ran through the old bank.

The old lake site was planted-up in 1961 using Norway spruce and Western hemlock, but frost damage was severe and growth was painfully slow. Weed growth was terrific, much of the area bearing dense meadowsweet up to five feet tall. It was in view of the difficulties of the site from a silvicultural angle that discussion between the Divisional Officer, the then District Officer and the Forester led to the idea of re-forming the pond as a permanent source of water for fire-fighting, and as a wild-life sanctuary.

In the autumn of 1963, the dam was re-formed, using a bulldozer engaged on road construction in the block. Fortune, however, did not smile on this venture, and a period of heavy rain filled the three-acre pond almost overnight. In order to prevent the collapse of the bank, we regretfully cut a gap to pass the flood safely until a really adequate concrete spillway could be constructed.

During the spring and summer of 1964, the lake bed presented a depressing sight, and proved an ideal breeding area for mosquitoes. Work began in August on a spillway of rather more generous dimensions than those calculated as necessary for the $1\frac{1}{2}$ sq. mile catchment, and we were blessed with a spell of settled dry weather. The spillway is a ten feet wide stairway of six-inch concrete, within concrete walls. The steps are lightly re-inforced, each is about ten feet in length and there is a two feet drop between steps. A good bed of hardcore to take the outflow from the bottom step should prevent undermining by scour.

Shuttering was made up and concreting done by the Forest Workers, who took a great interest and pride in the job. Work was completed in September 1964 and at the same time the earth bank was strengthened with the help of a Drott. Two small islands were thrown up as prospective safe nesting sites for waterfowl.

Rain was now awaited with impatience, but this was a typical fairly dry Sussex autumn and not until October was the spillway christened. The freshly filled pond, again extending to about three acres, and with extensive shallow margins calculated to attract a variety of wild fowl, appeared rather stark and we wondered how long it would be before the water would be colonized by plant-life. This first spring, however, water plantain, water crowfoot, pondweeds (*Potamogeten* spp.), burr-reed and yellow flag have appeared in some profusion. The Scientific Adviser to the Wildfowlers' Association, introduced by the Wildlife Officer, kindly paid us a visit, and supplied not only valuable advice

on the management of the water but also native food and cover plants for wildfowl.

Birds have not been slow to find the pond. Both Common and Green Sandpipers were seen during the autumn migration, our record being four Green Sandpipers feeding together on the muddy margin. Although Teal were the first duck seen on the water—a party of fourteen—Mallard are the most common. Parties of up to twenty have been seen throughout the winter. Widgeon and Shoveller have also visited the pond and at the time of writing (June 1965) we have a semi-resident pair of Tufted Duck which I hope may nest this year. At least three Mallard have nested near the pond, but only one has succeeded in bringing off young, the other two nests having fallen victim to either vermin or small boys. Coot and Moorhen have nested successfully this spring. Two pairs of Coot have reared 14 young and at least three pairs of Moorhen have bred. One pair of Little Grebe has produced two young and so we now have a nucleus of a resident population.

The public visiting Wilmington have shown great interest in the pond and several gifts of ornamental water plants have been received. The local Natural History Society is making an intensive study of the build-up of plant and insect life, and the pond is also the subject of an educational film being made by Dr. Philips, of Eastbourne, who has had nature films shown on B.B.C. Television.

We have thus created not just a static water supply, but a living lake, with its own growing populations, and, not least, a great deal of public goodwill. (See plates 20 to 23, central inset).

Leaves

Interesting things are leaves,
Hear them whispering in the breeze,
Elongated, flattened, round,
Simple, pinnate, lobed, compound,
Succulent and large in size,
Parking place for dragon flies.
Hirsute, variegated, shiny,
Prickly, evergreen, quite tiny.
Tied up neatly in a bunch,
Sauce with lamb for Sunday's lunch.
Umbilical—depressed with dimples,
Scabrous—rough with warts and pimples,
Polished—glaucous underneath,
Woven for a victor's wreath.
Marked with ribs and veins so feint
Artists take these home to paint.
Orange, yellow, red and brown,
In October fluttering down
To the ground, and in the water,
Whirling round in every quarter.
Adam thought when he saw Eve's
"Interesting things are leaves!"

R. J. J.

BOOK REVIEWS

THE FORESTS OF IRELAND.

Edited by **H. M. Fitzpatrick.**

Published by the Society of Irish Foresters 1966. *Copies obtainable* 32/- *post free from H. M. Fitzpatrick, Nun's Cross, Ashford, Co. Wicklow, Eire*

Reviewed by **S. H. Sharpley,** *Executive Officer, Publications, London*

The object of the Society of Irish Foresters, which was formed in 1942, is to advance and spread in Ireland the knowledge of forestry in all its aspects; and its book is well timed to achieve this purpose. The land of Ireland which was swept almost bare of its great forests by the iron-smelters of the 17th century, and suffered from wholesale felling during the two world wars, is now again producing timber in quantity; and the people can see the young forests which have been planted during the last decades growing towards maturity. The Editor has compiled, and made extremely readable, a mass of information on every aspect of Irish forestry, which should both satisfy the thirst for knowledge and stimulate the forestry tradition in Ireland.

The study covers the whole of the country, both Northern Ireland and the Republic, and is an authoritative account of past and present forestry there. The information has been taken from official reports and records of all kinds, and the papers of scientific journals.

A history of the Irish forests and a general physical description of the country is followed by details of land use and the species of trees and their silviculture. Then comes a summary of the State forest policies, and statistics of land acquired for afforestation. Each forest area is described. Over 95% of the trees planted are conifers, Sitka spruce and Lodgepole pine predominating. This planting policy is due not only to the economic demand for softwoods, but also to the wet climate and the peaty nature of the soil of many of the areas acquired.

Private woodlands extend to about 90,000 acres, compared with nearly 450,000 acres of State Forest. They yield chiefly hardwoods, and the old estates are the sole source of large oak, beech, and Spanish chestnut. But the acreage of these estates has been dwindling and, owing partly to the scarcity of professional foresters, maintenance has in many cases been below standard. State aid is available to private owners.

For forest research, Northern Ireland relies to a great extent on the British Forestry Commission, but also carries out research itself in subjects of special importance to the conditions, such as the field experiments on peat at the research forests at Beaghs and Ballintempo Forest. In the Republic, the overall responsibility for forest research lies with the Agricultural Institute, in co-operation with the Forestry Division of the Department of Lands. Much useful work has been done at the Avondale Forest garden, where forest plots have been established to demonstrate the growth of the more important species under silvicultural conditions. In 1957 a Research Section was set up in the Forestry Division, and a Census of Woodlands carried out for the two years 1958 and 1959. Some of the other work of the Section is described in brief.

Finally, the book contains detailed information on timber marketing, recreation in the forests, forestry legislation, State assistance for private forestry, and taxation of woodlands. A soil map and a map of the forests are supplied in an end-pocket.

There are 20 full-page plates, of a very high standard, showing forest views and maintenance operations, and two excellent colour photographs.

The book is bound in stout cloth board.

SHELL NATURE LOVERS' ATLAS OF ENGLAND, SCOTLAND AND WALES

Edited by **James Fisher**

Ebury Press and Michael Joseph, 1966. 7*s.* 6*d.*

Reviewed by **S. H. Sharpley**

The need has now been filled for a handy-sized road atlas showing all manner of nature reserves and parks and zoos, which motorists and others might be near to but not otherwise know about.

About one-tenth of the country is now dedicated to nature conservation in one form or another: Forest Parks, National Parks, areas of outstanding beauty, nature reserves, bird sanctuaries, wildfowl refuges, archaeological and geological sites, as well as zoos, aquaria, and botanic gardens. The author is a well-known ornithologist who is also interested in all branches of natural history, and has himself visited most of the special areas referred to in the atlas. Many people will be relieved to know that nature reserves whose treasures are best protected by secrecy have not been included.

Nearly seven hundred areas and places likely to be of interest to nature lovers are marked with distinctive signs on each map page, and on the page opposite are descriptions and information about visiting them. These descriptions are commendably full and interesting, with details almost rivalling a guide book in some cases. Four-figure national grid references are used. There is an index, and lists of addresses of national nature organizations and county naturalists' trusts.

The atlas measures $8\frac{1}{2}$ by $5\frac{1}{2}$ inches. It is handy in every way and, to coin a phrase, no nature lover should be without it.

FORESTRY COMMISSION STAFF

At 1st March, 1966

Notes: (1) Owing to regrading and re-organisation, some inconsistencies in arrangement, etc., have proved unavoidable this year.

(2) The stations of individual officers are shown only where they are different from that of their main office. The list should *not* be read as a seniority list; it has been compiled from returns submitted by the various offices to the Establishment Section. It was compiled *before* the departure of certain Headquarters Sections to Basingstoke and *before* Forester regrading was completed.

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Chappell, R. E. (T) (Superannuation)
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ASSISTANT SENIOR OFFICER FOR SCOTLAND: M. Nicolson

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CLERK OF WORKS:	Collin, H. J. (T.W.G.III) (Kielder)
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Pannett, H. (Allerston)
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ASSISTANT CONSERVATOR: Stocks, J. B.

DISTRICT OFFICER I: Blatchford, O. N. (Godalming); Burton, E. S. V. (Chichester) Dickenson, M. E. S. (Chichester); Savage, G. F. d'A. (Reading); Simmonds, S. A. (Estate); Thallon, K. P. (Reading)

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SENIOR EXECUTIVE OFFICER: Gulliver, H. W.

CONSERVANCY MECHANICAL ENGINEER: West, R. W. (T.W.G.I)

CLERK OF WORKS (ESTATE): Humm, E. F. (T.W.G.III)

CIVIL ENGINEERING ASSISTANT: White-Cooper, R. R. T.

DRAUGHTSMAN (CART.): Taylor, Mrs. G. M.; Bichard, Miss J.

HEAD FORESTER: Brook, J. W. (Slindon); Cross, L. G. F., M.B.E. (Bramshill); Davies, D. J. (Hemsted); King, B. H. (Hursley)

FORESTER

Arnott, W. (Andover)
Awbery, P. P. (Queen Elizabeth)
Barden, J. T. (St. Leonards)
Barling, F. C. (Vinehall)
Bashall, J. F. C. (Friston)
Batt, C. J. (Gravetye)
Bayston, P. W. R. (Bedgebury)
Bignell, R. A. (Rogate)
Brinsley, D. A. (Alice Holt)
Budgen, E. (Micheldever)
Cale, G. F. (Queen Elizabeth)
Catchpole, R. A. (Orlestone)
Cooper, J. (Slindon)
Cooper, J. H. (Bedgebury)
Cordery, E. B. (Badbury)
Davies, W. J. (Challock)
Davy, J. H. (Rogate)
Devine, R. (Maresfield)
Dineen, P. J. (Hursley)
Drake, F. H. (Alton)
England, W. J. H. (Bedgebury)
Francis, R. E. (Chiddingfold)
Freeth, A. J. (St. Leonards)
Fulcher, D. E. (Friston)
Griggs, B. (Hursley)
Harvey, D. R. (Rogate)
Henderson, J. R. (Brightling)
Howell, W. R. (Challock)
Hyslop, R. M. (Uckfield)
Langford, D. M. E. (Abinger)
McNamara, N. A. G. (Bramshill)
Marples, D. (Slindon)
Meek, W. T. (Challock)
Middleton, W. F. C. (Arundel)
Moseley, J. (Bedgebury)
Newland, R. L. (Bramshill)
Parnall, D. L. (Orlestone)
Percy, D. M. (Hursley)
Rickards, S. W. (Slindon)
Robinson, D. A. (Hursley)
Smith, H. J. (Shipbourne)
Spiller, G. D. (Challock)
Sutton, B. E. (Chiddingfold)
Trodd, K. H. C. (Micheldever)
Usher, F. (Havant)
Vickery, F. J. (Mildmay)
Wainwright, K. (Vinehall)
Walker, I. (Bramshill)
Watkinson, R. F. V. (Bucklebury)
Watts, F. C. (Bere)
Wood, I. E. (Chiddingfold)

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Choules, C. (Andover)
Cooper, P. L. (Bucklebury)
Davis, D. E. (Alton)
Davys, J. P. (Chiddingfold)
Green, G. G. (Alice Holt)
Hinds, C. H. (Shipbourne)
Hoblyn, R. A. (Alice Holt)
Hunt, P. B. (Brightling)
Kennard, J. T. (Arundel)
Lawes, R. F. (Bere)
Leemans, B. R. (Bramshill)
Mobbs, P. J. (Maresfield)
Monk, R. F. (St. Leonards)
Pearce, P. H. (Micheldever)
Perkins, R. M. (Mildmay)
Ralph, P. W. (Mildmay)
Seddon, T. R. T. (Abinger)
Tyers, J. D. A. (Brightling)
Vines, R. C. B. (Challock)

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Bishop, Miss L. A.
Carter, J. E.
Cobbett, F. J.
Crowe, G. W.
Dawson, R. O.
Deal, Miss L.
Draper, F. A.
Gardner, Miss C. M.
Gathercole, M. J.
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Harris, Miss P.
Jennings, Miss J. F.
Johnson, Miss E. J.
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Norton, Miss G. R.
Osman, F. F. J.
Root, M. J.
Smith, Miss H. J.

ENGLAND, SOUTH-WEST CONSERVANCY

Flowers Hill.
Brislington,
Bristol, 4.
Telephone: Bristol 78041-4.

CONSERVATOR: C. A. Connell, O.B.E.

ASSISTANT CONSERVATOR: Dixon, E. E. (Harvesting and Marketing); Penistan, M. J. (Forest Management)

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CONSERVANCY MECHANICAL ENGINEER:	Inglis, E. J. (T.W.G.I.)
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SUPERINTENDENT OF WORKS:	Lang, A. S. (T.W.G.III) (Halwill)
CLERK OF WORKS (ESTATE):	Boundy, L. D. (T.W.G.III) (Exeter)
CIVIL ENGINEERING ASSISTANT:	Payne, K. W.; Williams, J. C.
DRAUGHTSMAN (CART.):	Moore, R.; Powell, R. W.

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Beasley, G. F. (Halwill)
Bruce, J. M. (Exeter)
Cameron, A. H. (Bodmin)
Gunter, A. T. G. (Hereford)
Lewis, C. J. (Savernake)
Linder, R.
Parsons, F. F. G. (Wareham)

FORESTER
(*Old Style*)

Barber, E. G. (Charmouth)
Barton, E. N. (Quantock)
Beard, A. C. (Dymock)
Bowdler, T. C. (Exeter)
Bowman, P. (Bodmin)
Braine, R. G. (Dartmoor)
Bultitude, R., B.E.M., (Molton Woods)
Clarke, H. F. (Pershore)
Coles, L. H. (Saveranke)
Cox, D. J. (Cranborne Chase)
Deal, W. (Hartland)
Everitt, E. C. W. (Cotswold)
Fife, R. G. (Okehampton)
Fox, F. G. (Wyre)
Fulford, A. G. (Bodmin)
Gould, J. (Wyre)
Green, W. J. (Blandford)
Hendrie, J. A. (Wareham)
Hibberd, E. C. (Neroche)
Hockaday, C. (Land's End)
Humphrey, A. W. (Exeter)
Humphries, W. J. (Salisbury)
James, M. E. H. (Hereford)
Jenkinson, G. A. (Quantock)
Judge, J. N. (Bristol)
King, R. J. (Savernake)
Lewis, W. P. (Poorstock)
McIntyre, N. E. (Salisbury)
Mills, E. W. (Savernake)
Parker, J. (Exeter)
Parsons, P. H. (Wilsey Down)
Scott, M. J. (Eggesford)
Sherrell, D. A. (Mendip)
Skinner, F. C. (Hereford)
Snellgrove, D. S. (Bodmin)
Stone, P. L. (Halwill)
Stott, W. S. (Honiton)
Strawbridge, F. (Brendon)
Tackney, A. J. (Wareham)
Thompson, L. T. J. (Mendip)
Waller, A. J. (Halwill)
Walsh, J. E. (Halwill)
Walton, R. (Wareham)
Whale, R. S. (Plym)
Williams, L. H. (Bovey)
Wills, K. G. (Bradon)
Wilson, M. J. (Dorchester)
Young, R. E. (Wyre)

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(*New Style*)

Anderson, J. E. (Dymock)
Ayres, D. (Savernake)
Bibby, W. B. (Hereford)
Budden, R. C. (Poorstock)
Carter, D. E. (Exeter)
Chalmers, J. G. (Dartmoor)
Cliffe, P. E. (Dartmoor)
Devine, T. D. (Halwill)
Edwards, B. F. (Neroche)
Fruen, C. R. (Bruton)
Grenfell, R. G. P. (Molton Woods)
Hall, M. P. (Bradon)
Hambly, J. R. (Bodmin)
Hodge, R. J. (Wyre)
Houghton, M. A. (Hartland)
Millman, M. R. (Honiton)
Mitchell, G. G. (Cotswold)
Morrish, F. G. (Blandford)
Murphy, B. (Bristol)
Peach, J. (Mendip)
Pedler, D. C. (Plym)
Powell, R. B. (Wareham)
Rayner, G. L. (Savernake)
Stark, M. H. (Brendon)
Sturgess, W. F. (Savernake)
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Tilley, J. W. (Bradon)
Tisdall, J. C. (Halwill)
Trotter, W. (Dartmoor)
Wade, J. (Kielder)
Webb, P. J. (Hartland)
Yearsley, D. E. (Brendon)

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CLERICAL OFFICER

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Chainey, D. V.
Collett, J. A.
Durn, Miss W. M.
Edmondson, Miss D. M.
Foote, C. E.
Gibbs, Miss S. M. E.
Hale, E. W.
Hobbs, A. G. C.
Hoyles, W.
Hudson, D.
Kimber, Miss L. P.
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Lloyd, L. H.
Owen, Miss J. A.
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Richings, Miss M.
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Roberts, S. A.
Stone, G.
Watts, L. G.
Young, G. B.

ENGLAND, NEW FOREST

The Queen's House,
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Hants.
Telephone: Lyndhurst 2801

DEPUTY SURVEYOR: W. A. Cadman

DISTRICT OFFICER I: Chard, R.

DISTRICT OFFICER II: Wildash, J. T.; Gradwell, J. W. (E); Yorke, D. M. B.

HEAD FORESTER: Liddell, J.; McNulty, M. E.

FORESTER

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Campbell, I. R.
Christmas, S. E. V.
Conduit, J. S.
Cuff, E. W.
Dunning, A. R.
Fletcher, R.
Fox, K. W.
Goodson, P. B.
Green, F. J.
Hall, I. G.
Hindley, N. H.
Hodgson, R. S.
Holloway, A. T.
James, A. L.
James, H. B.
Meech, R.
Perkins, D. E. S.
Reece, A. V.
Roe, W. T.
Sainsbury, B. H.
Stirrat, J. B.
Thomas, T. J. H.
Wood, J. F. B.
Yerbury, E. S.

TRAINEE FORESTER

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Barfield, G. F.
Colley, M. A.
Evans, R.
Evans, W. C.
Howard, D. J.
Pulford, B.
Willingham, M.

HEAD KEEPER: Breakspear, A. F.; Humby, J.; Smith, B. B.

AREA CIVIL ENGINEER: Hughes, R. E. (T.W.G.B.)

SUPERINTENDENT OF WORKS: Bradbeer, E. G. (T.W.G.II)

CLERK OF WORKS (ESTATE): Gilbert, R. L. (T.W.G.III)

CIVIL ENGINEERING ASSISTANT: Fulcher, R.

DRAUGHTSMAN (CART.): Kennedy, W. J.

HIGHER EXECUTIVE OFFICER: Watson, W. G.

EXECUTIVE OFFICER: Foard, W. H.; Kennedy, D. A.; Wilkinson, M.; Pettitt, A. G.; Tester, R. W.

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Lawrence, Miss J.
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Hemsley, A. R.
Slayton, Miss S. E.
Stilwell, Miss N.
Taylor, N.
Judd, Miss M. E.
Witt, V.
Gray, D.

ENGLAND, FOREST OF DEAN

Whitemead Park,
Parkend,
Lydney, Glos.
Telephone: Whitecroft 305

DEPUTY SURVEYOR:	R. G. Sanzen-Baker
DEPUTY GAVELLER:	Tallis, J. R. (Coleford)
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DISTRICT OFFICER II:	Jardine, J. (Estate); Sidaway, R. M.
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DRAUGHTSMAN (CART.):	Elley, B. G.
PLANT MANAGER:	Muddle, W. J. (Mile End Depot)
WORKSHOP MANAGER:	Gawn, S. (Mile End Depot)
SUPERINTENDENT OF WORKS:	Labram, W. J. (Cinderford)
EXECUTIVE OFFICER:	Hale, E. F.; Rose, A. C.

CLERICAL OFFICER

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Bevan, Miss J. M.	Howell, A. E. (Coleford)	Williams, Miss M. M. (Mile End Depot)
Brain, C. R. A.	Hyett, D. F. (Mile End Depot)	
Carpenter, Miss B. J.	Rose, T. A.	
Cox, D. J.		

HEAD FORESTER: Jennings, R. J. (Dean); Lingwood, N. J. (Dean)

FORESTER

Brain, J. S. (Dean)	Lee, J. J. (Parkend)	Roberts, G. E. J. (Dean)
Davis, S. (Dean)	McCreath, N. F. (Dean)	Russell, C. F. (Dean)
Dunn, M. J. (Dean)	North, S. J. (Dean)	Sharp, H. O. (Parkend)
Falconer, I. A. (Dean)	Parry, H. M. (Dean)	Taylor, G. E. (Dean)
Fraser, A. M. (Dean)	Pugh, T. C. (Parkend)	Venner, B. G. (Dean)
Freeman, J. E. D. (Dean)	Richards, J. B. (Dean)	Wallis, K. E. (Dean)
Jones, H. (Tidenham Chase)	Ricketts, G. A. (Dean)	Westacott, W. D. (Dean)

TRAINEE FORESTER

Bell-Scott, M. H. (Dean)	Richards, M. (Dean)	Wearing, M. F. (Dean)

SCOTLAND, NORTH CONSERVANCY

60 Church Street,
Inverness.
Telephone: Inverness 32811

CONSERVATOR:	H. A. Maxwell
ASSISTANT CONSERVATORS:	Chrystall, J.; Innes, R. A.
CONSERVANCY LAND AGENT:	Bennett, A. P. (Estates)
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DISTRICT OFFICER II:	Michie, E. J. S. (Fort Augustus); Ray, A. (Fort Augustus); Marnie, R. J. R. (Fort William); Hamilton, G. J. (Dingwall)
SENIOR EXECUTIVE OFFICER:	MacBeath, T. S. B.
CONSERVANCY CIVIL ENGINEER:	Malcolmson, P. (Senior Grade)

ASSISTANT ENGINEER (CIVIL): Davidson, K. T. (T.W.G.I.) (Fort Augustus); McKillop, E. R. (T.W.G.I.) (Inverness); MacKenzie, N. A. (Main Grade) (Fort William)

ASSISTANT ENGINEER (MECHANICAL): Fox, E. P. M. (T.W.G.I.)

SUPERINTENDENT OF WORKS: Baxter, W. (T.W.G.II) (Inverness); Carmichael, J. H. (T.W.G.II) (Inverinate); Dargie, J. H. (T.W.G.III) (Fort Augustus); McConnachie, J. (T.W.G.III) (Dingwall); Murray, D. F. M. (T.W.G.III) (Fort William); Noble, A. (T.W.G.III) (Fort Augustus); Ward, A. A. (T.W.G.III) (Inshriach)

CLERK OF WORKS (ESTATE): Fraser, G. (T.W.G.III); Stables, J. M. (T.W.G.III)

LEADING CIVIL ENGINEERING ASSISTANT: Johnson, M. R. (Fort Augustus)

CIVIL ENGINEERING ASSISTANT: Allingham, J. (Fort Augustus); Cartlidge, R. G. (Dingwall); MacIntosh, D. J. (Fort William); Newton, B. E. (Inverness); Robertson, G. D. (Fort William); Vickers, A. W. (Fort Augustus)

DRAUGHTSMAN (CART.) Atherton, A. P.; Riddell, Miss I. H.

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CHIEF FORESTER: MacLeod, D. M. (Mull)

HEAD FORESTER: Frater, J. R. A. (Inchnacardoch); MacDonald, C. (Skye); Mackay, A. (Affric); Mackay, J. A. (Glenurquhart); MacLeman, A. (Ardross); MacRae, D. J. (Balblair); Ross, D. (Black Isle); Thom, A. B. (Torrachilty)

FORESTER

Auld, J. B. (Lael)
Baird, T. L. (Ardross)
Beaton, D. A. (Mull)
Beattie, W. R. (Rumster)
Boustead, J. (Glenurquhart)
Brown, R. S. (Aigas)
Calder, A. M. (Skye)
Cameron, F. (South Laggan)
Cameron, W. J. (Oykel)
Campbell, J. (Rassay)
Campbell, J. (Ratagan)
Campbell, R. W. (Leanachan)
Carmichael, D. (Fiunary)
Chree, J. W. (Inchnacardoch)
Clark, J. (Ferness)
Crawford, A. (Black Isle)
Denholm, J. (South Strome)
Dyce, W. J. P. (Ratagan)
Evans, R. (Glengarry)
Fell, J. B. (Affric)
Fleming, C. E. S. (Mull)
Forsyth, A. (Dornoch)
Fraser, L. A. (Black Isle)
Fraser, T. (Creagnaneun)
Galt, T. J. (Clunes)
Gibson, A. (Torrachilty)
Gordon, J. (Ferness)
Gordon, J. (Black Isle)
Grant, D. (Queen's)
Grant, W. M. (Morangie)
Green, A. A. (Ceannacroc)
Henderson, A. A. (Shin)
Howard, R. L. (Culloden)
Hunter, W. (Borgie)
Laird, D. M. (Achnashellach)
Lockhart, W. A. (Shin)
McAllan, F. M. (South Strome)
Macdonald, J. (Torrachilty)
Macdonald, P. A. R. (Glengarry)
Macdougall, D. A. (Strathmashie)
MacInnes, A. (Queens)
MacInnes, D. F. (Black Isle)
MacKintosh, D. C. (Port Clair)
MacKay, H. (Farigaig)
Mackintosh, L. W. (Glenrigh)
MacIntyre, J. A. (Achnashellach)
MacKay, J. (Port Clair)
MacKay, J. W. (Affric)
Mackinnon, J. (Culloden)
MacLean, A. R. (Inverinate)
MacLean, K. A. (Naver)
MacLennan, D. (Affric)
MacLeod, A. D. J. (Mull)
MacLeod, J. (Sunart)
Macpherson, W. D. (Slattadale)
MacRae, H. (Lael)
McCreadie, F. (Inshriach)
Millar, J. (Fiunary)
Morris, H. D. (Glenrigh)
Morison, A. W. (Black Isle)
Morrison, I. C. (Balblair)
Munro, A. (Black Isle)
Murdoch, R. K. (Mull)
Murray, R. (South Laggan)
Nicol, A. (Leanachan)
Officer, A. W. (Culloden)
Ogilvie, J. A. (North Strome)
Patience, J. J. (Skye)
Patience, W. M. (Helmsdale)
Phipps, N. (Strathnairn)
Reid, G. W. M. (Skye)
Reid, H. R. (Farigaig)
Riddell, J. M. (Dornoch)
Robertson, D. D. C. (Glengarry)
Saunders, E. (Glenloy)
Scott, J. (Inshriach)
Scott, M. P. (Strathconon)
Small, G. (Morangie)

FORESTER—*continued*

Smith, D. R. (Ratagan)
Stobie, F. D. (Boblainy)
Sutherland, D. R. (Strathdearn)
Sutherland, F. W. (Glenhurich)
Taylor, C. A. (Nevis)
Taylor, J. W. (Eilanreach)
Thom, H. (Culloden)
Thomson, R. (Glenurquhart)
Toulmin-Rothe, I. P. (Mull)
Watson, J. C. (Ceannacroc)
Watt, G. D. (Inchnacardoch)
Wray, S. R. P. (Glenhurich)

ASSISTANT FORESTER

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Brown, A. R. (Strathdearn)
Davidson, J. (Leanachan)
Dunbar, G. R. (Torrachilty)
Fisher, J. H. (Ardross)
Herd, A. (Black Isle)
Macrae, L. D. (Inchnacardoch)
Ogilvie, R. S. (Torrachilty)
Sandilands, A. (Naver)
Smith, M. J. A. (Shin)

SCOTLAND, EAST CONSERVANCY

6 Queen's Gate,
Aberdeen.
Telephone: Aberdeen 33361

CONSERVATOR: G. I. Mackenzie

ASSISTANT CONSERVATOR: Horne, R. J. G.; Petrie, S. M.

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DISTRICT OFFICER II: Everard, J. E. (Fochabers); French, W. F. (Perth); Jackson, R. D'O. P. (Kingswells); Platt, R. A. (Estate, Perth)

SENIOR EXECUTIVE OFFICER: Steele, J.

CONSERVANCY ENGINEER: Gaskin, A. J. (W.G.M.G.)

CONSERVANCY MECHANICAL ENGINEER: Swinyard, H. W. J. (T.W.G.I.)

AREA CIVIL ENGINEER: Auld, J. M. (T.W.G.I.) (Perth); Clarkson, W. H. (T.W.G.I.) (Huntly)

SUPERINTENDENT OF WORKS: Clark, J. D. (T.W.G.III) (Burghead); Forbes, C. (T.W.G.III) (Huntly); Logan, G. M. (T.W.G.III) (Perth); Ross, P. F. (T.W.G.III) (Drumtochty)

DRAUGHTSMAN (CART.): Williamson, G.

HEAD FORESTER

Allison, R. A. (Speymouth)
Anderson, D. (Clashindarroch)
Fraser, E. D. (Craigvinean)
Garrow, P. J. (Rannoch)
Gilbert, G. (Durris)
McDonald, W. (Drumtochty)
Milne, W. G. (Culbin)
Murray, G. J. A. M. (Glenlivet)
Nicolson, W. J. (Newton and Roseisle)
Rose, A. (Ledmore)
Urquhart, D. J. (Bin)

FORESTER

Adam, R. (Hallyburton)
Aitken, R. G. (Rosarie)
Allan, J. (Edensmuir)
Anderson, D. F. (Glenerrochty)
Anderson, M. (Teindland)
Anderson, W. B. (Newton)
Bain, J. (Tentsmuir)
Biggar, A. W. (Elchies)
Bowie, A. G. (Bin)
Christie, J. H. (Aultmore)
Cotton, D. (Clashindarroch)
Davidson, A. L. (Kirkhill)
Douglas, W. S. (Whitehaugh)
Ewen, B. A. (Bennachie)
Ellen, R. M. (Blairadam)
Elliott, D. M. (Speymouth)
Findlay, J. C. (Durris)
Foggo, B. L. (Speymouth)
Fraser, D. (Rannoch)
Fraser, J. R. (Newtyle)
Gale, A. W. (Forest of Deer)
Gordon, A. N. (Glenisla)
Gordon, W. J. (Culbin)
Grigor, E. (Glenisla)
Guild, J. (Montreathmont)
Harwood, A. E. (Edensmuir)
Hepburn, N. R. (Hburtonally)
Innes, G. C. (Midmar)
Johnstone, W. (Glendoll)
Jolly, J. McC. (Glenerrochty)
Kemp, W. Y. (Cushnie)

Kingham, H. A. (Monaughty)
Lindsay, J. D. (Rannoch)
McConnachie, K. (Glenlivet)
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Priestley, P. (Blackcraig)
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Reid, J. G. M. (Private Woodlands, Fochabers)
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Salmean, C. (Glendevon)
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Stewart, W. B. (Pitfichie)
Stuart, P. (Pitfichie)
Thirde, J. S. (Fetteresso)
Thomson, R. B. (Tentsmuir)
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Thow, G. B. (Inglismaldie)
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Watt, W. J. (Allean)
Webster, J. O. (Blackhall)
Weir, A. H. (Blairadam)
White, P. A. (Clashindarroch)

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FOREMAN: Anderson, S. C. (Keillour); Grant, A. M. (Elchies) McCann, W. (Drummond Hill); Soppit, J. (Montreatmon);

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SCOTLAND, SOUTH CONSERVANCY

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SENIOR EXECUTIVE OFFICER: Cowan, A. A.

CONSERVANCY ENGINEER: Walker, P. H. F. (W.G.S.G.)

AREA CIVIL ENGINEER: Brown, R. R. (W.G.M.G.); Green, A. M. (T.W.G.I)

CONSERVANCY MECHANICAL ENGINEER: Hart, A. E. (T.W.G.I)

SUPERINTENDENT OF WORKS: Cowperthwaite, F. T. (T.W.G.II); Crossan, G. W (T.W.G.III); Smith, W. B. (T.W.G.II); Gibson, J (T.W.G.III)

SENIOR CLERK OF WORKS (ESTATE): Johnston, F. J. (T.W.G.II)

CIVIL ENGINEERING ASSISTANT: Irvine, J.; McMillan, J. G.; Thomson, A.

DRAUGHTSMAN (CART.): Sutherland, J. W.

HIGHER EXECUTIVE OFFICER: Burnett, A. G.; Hendry, D. L.

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FORESTER

Amer, D. J. (Glentrool)
Bagnall, J. A. (Forest of Ae)
Bagot, W. (Changue)
Broll, J. L. (Yair Hill)
Brookes, C. (Cairn Edward)
Campbell, D. (Penninghame)
Carruthers, J. (Fleet)
Carruthers, M. F. (Elibank & Traquair)
Chisholm, M. R. (Carrick)
Cochrane, A. S. (Dalmacallan)
Cooper, B. (Forest of Ae)
Davidson, J. R. (Duns)
Drysdale, N. (Carrick)
Duncan, D. (Kirroughtree)
Edward, R. M. (Brownmoor)
Edwards, O. N. (Glengap)
Gallacher, J. M. (Upper Nithsdale)
Gallacher, P. (Cairn Edward)
Goodlet, G. A. (Stenton)
Graham, P. (Carrick)
Gutch, J. H. M. (Newcastleton)
Harkness, J. R. (Castle O'er)
Harland, J. (Wauchope)
Harvey, T. S. (Eddleston Water)
Hogg, J. L. (Kirroughtree)
Hope, T. C. (Fleet)
Kirk, D. M. (Mabie)
Liddell, A. T. (Cardrona)
Lloyd, S. (Laurieston)
McArthur, A. (Dalbeattie)
McClelland, P. W. (Glentrool)
McGeorge, R. (Selm Muir)
McGivern, W. M. (Edgarhope)
McLaren, A. R. (Glentress)
MacMillan, A. M. (Saltoun)
McNaught, D. J. (Craik)
Mowat, P. (Tool Instructor, (Glentrool)
Murray, D. M. (Bareagle)
Murray, W. (Arecleoch)
Nelson, T. (Dalbeattie)
O'Mara, J. P. (Moffat Water)
Park, H. C. B. (Glentrool)
Parker, J. (Glentrool)
Parkinson, J. W. (Castle O'er)
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Waugh, G. (Auchenroddan)
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Pickthall, H. M. (Cairn Edward)
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Walsham, J. A. (Bareagle)
Waters, D. C. W. (Castle O'er)
Whyatt, J. G. (Upper Nithsdale)

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Brown, W. (Forest of Ae)
MacInnes, R. S. (Kirroughtree)
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Robson, D. I. (Glentrool)
Povall, J. G. (Fleet)
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Robinson, W. I. (Greskine)
Schneider, H. (Newcastleton)

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McSorley, J. F.
Martindale, T.
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Todd, Miss M. A. G. I.
Vanbeck, G. T. I.

SCOTLAND, WEST CONSERVANCY

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CONSERVANCY MECHANICAL ENGINEER:	Atkins, F. C. (T.W.G.I)
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CLERK OF WORKS (ESTATE):	McClory, J. (T.W.G.III) (Kilmun); MacDougall, H. (T.W.G.III) (Barcaldine)
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CIVIL ENGINEERING ASSISTANT:	Banks, A. (Cairnbaan); Denham, J. M. (Aberfoyle); Reed, B. (Aberfoyle); Turnbull, I. McL. W. (Cairnbaan); Watson, R. (Barcaldine)
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Beaton, K. A. (Torrie)
Black, D. F. D. (Garadhban)
Cameron, A. (Strathyre)
Campbell, J. A. (Loch Ard)
Francey, G. S. (Loch Goil)
Fraser, T. S. (Rowardennan)
Gillies, A. (Strathlachlan)
Jackson, J. (Benmore)
Johnston, C. R. (Eredine)
Keiller, W. C. (Garshelloch)
Lawson, D. W. (Tulliallan)
McCallum, D. (Achaglachgach)
Mackay, A. (Barcaldine)
McKenzie, I. H. M. (Inverliever)
MacLean, A. (Kilmichael (S))
McMillan, J. (Minard)
MacNicol, I. (Fearnoch)
MacPhee, C. J. (Glencoe)
McRorie, J. P. (Balquhidder)
Mitchell, R. F. (Leapmoor)
Morrison, N. (Glenrickard)
Munro, D. (Carradale)
Murray, R. G. (Glenfinart)
Polwart, A. (Glendaruel)
Robertson, D. A. (Achray)
MacCaskill, D. A. (Inverinan)
McDonald, M. K. (Devilla)
McGeachy, R. H. (Glenbranter)
MacGregor, D. R. (Garelochhead)
Mackay, D. J. (Asknish)
McLarty, H. C. (St. Fillans)
Rodger, J. H. (Loch Etive)
Ross, D. H. (Carron Valley)
Ross, I. (Kilmichael (N))
Sinclair, L. (Glenduror)
Stout, H. C. (Knapdale)
Young, A. (South Kintyre)

FORESTER

Armstrong, P. (Glenbranter)
Barker, G. J. (Loch Ard)
Beaton, J. M. (Achray)
Blake, G. W. (Ardgarten)
Caird, D. G. (Glenrickard)
Campbell, D. (Achray)
Campbell, D. McL. (Knapdale)
Campbell, M. M. (Barcaldine)
Campbell, W. W. (Loch Ard)
Cowie, F. R. (Achray)
Craig, J. M. (Ardgartan)
Crawford, W. (Achaglachgach)
Cruikshank, A. (Eredine)
Cunningham, A. J. (Corlarach)
Dye, W. E. (Asknish)
Fergusson, P. D. (Saddell)
Fraser, J. M. (Devilla)
Garrioch, I. M. (Barcaldine)
Graham, H. (Kilmichael (N))
Hamilton, J. (Lennox)
Hart, C. W. (Glenduror)
Harvey, R. (Carron Valley)
Livingston, J. (Glenrickard)
Lyon, J. H. M. (Barcaldine)
Lyons, D. J. (South Kintyre)
McCallum, D. F. (Whitelee)
McDonald, W. (Inverinan)
MacDuff, R. J. A. (Cairnbaan)
MacFadyen, D. (Inverliever)
McGavin, J. M. (Ardfin)
Macintosh, A. (Rowardennan)
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Murray, J. T. H. (Knapdale)
Murray, R. A. (Glencoe)
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Reid, I. L. (St. Fillans)
Robertson, J. B. (Loch Ard)
Robertson, K. (Loch Eck)
Robertson, N. (Tighnabruaich)
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Simpson, A. A. C. (Carradale)
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Smellie, A. (Cumbernauld)
Smith, A. K. (Strathyre)
Solway, D. F. (Glenfinart)
Stuart, A. M. (Loch Eck)
Turner, A. S. (Glenbranter)

TRAINEE FORESTER

Delap, P. (Ardgartan)
Douglas, D. A. T. (Garadhban)
Fox, A. B. (Loch Ard)
Freeman, W. McB. (Glenrickard)
Heddon, G. S. (Ballachulish)
Littlewood, A. T. (Inverinan)
Muhl, R. G. (Knapdale)
Rae, G. W. (Glenbranter)
Ratcliffe, P. R. (Inverinan)

FOREMAN: McEachern, J. (Kilennan); Rose, W. (Strathyre)

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Power, Miss T.
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WALES, NORTH CONSERVANCY

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CONSERVATOR: J. H. James

ASSISTANT CONSERVATOR: Drummond, R. O. (Silviculture); Holmes, G. D. (Harvesting and Marketing)

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CONSERVANCY ENGINEER:	Swanson, R. P. (W.G.S.G.)
CONSERVANCY MECHANICAL ENGINEER:	Low, W. L. (T.W.G.I)
AREA CIVIL ENGINEER:	Baylis, D. O. (T.W.G.I) (Aberystwyth); Bromley, A. R. (T.W.M.G.) (Llanrwst); Egerton, F. C. (T.W.G.I) (Llanrwst); Jameson, V. O. (T.W.M.G.) (Shrewsbury)
SUPERINTENDENT OF WORKS:	Dummett, E. J. (T.W.G.II) (Llanrwst); Eley, E. J. (T.W.G.III) (Ruthin); Gwynne, G., M.B.E., (T.W.G.III) (Dolgellau); Redford, H. (T.W.G.II) (Kerry); Whiteford, G. (T.W.G.III) (Aberystwyth)
CLERK OF WORKS (ESTATE):	Bush, E. J. (T.W.G.III) (Aberystwyth); Griffiths, W. E. (T.W.G.III) (Llanrwst); Wood, D. (T.W.G.III) (Machynlleth)
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CIVIL ENGINEERING ASSISTANT:	Bryant, B. J. (Aberystwyth); John, E. E. (Llanrwst); Lewis, M. W. (Newtown); Maxwell, B. F. (Llanrwst)
DRAUGHTSMAN (HIGHER GRADE):	Bryan, F.
DRAUGHTSMAN (CART.):	Little, M. H.

HEAD FORESTER

Davies, A. I. (Clocaenog)
Dick, C. R. (Hafren)
Evans, A. C. W. (Kerry)
Evans, J. E. (Taliesin)
Griffiths, I. L. (Gwydyr)
Heavener, C. H. (Coed-y-Brenin)
Hughes, J. W. (Dovey Corris)
Jenkins, T. L. (Ystwyth)
Waters, R. W. (Dovey Valley)
Yapp, P. W. C. (Radnor)

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Ambler, C. R. (Cynwyd)
Brown, R. H. (Coed Sarnau)
Brown, R. I. (Mathrafal)
Burns, A. A. (Hafren)
Butterworth, P. (Radnor)
Carter, T. A. (Gwydyr)
Daniel, C. E. (Ystwyth)
Davenport, J. B. (Coed-y-Brenin)
Davies, C. C. (Radnor)
Davies, D. D. G. (Dovey Valley)
Davies, P. G. (Elwy)
Edwards, R. (Coed-y-Brenin)
Evans, J. F. (Lleyn)
Evans, P. (Clocaenog)
Farrelly, F. (Clwyd)
Fletcher, K. W. (Bechan)
Gardner, E. C. C. (Clocaenog)
Goodbody, D. (Dovey Twymyn)
Griffiths, C. (Coed Sarnau)
Griffiths, E. (Beddgelert)
Griffiths, O. G. (Coed-y-Brenin)
Griffiths, R. W. (Mon Newborough)
Hamilton, J. P. (Dyfnant)
Harker, G. (Clocaenog)
Harrison, P. G. (Penllyn)
Hindle, P. H. J. (Hafren)
Hughes, A. (Dyfnant)
Hughes, L. E. (Gwydyr)
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Jones, D. J. (Gwydyr)
Jones, E. (Dovey Valley)
Jones, E. W. (Coed-y-Brenin)
Jones, G. W. (Aeron)
Jones, H. G. (Mon Pentraeth)
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Jones, L. (Aeron)
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