

The Forests of Ireland

THE FORESTS OF IRELAND

SOCIETY OF IRISH FORESTERS

THE
FORESTS OF
IRELAND

*An Account of
The Forests of Ireland
from Early Times
Until the Present Day*

EDITED BY H. M. FITZPATRICK.

Published for the Society of Irish Foresters.

THE FORESTS OF IRELAND

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FOLEY'S BRIDGE IN TOLLYMORE FOREST PARK, COUNTY DOWN.



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YOUNG SCOTS PINE AND EUROPEAN LARCH IN ELY LODGE FOREST IN COUNTY FERMANAGH.

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MAPS

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He wishes to thank Mrs. M. Thornbury for her help in typing and assembling a very difficult manuscript.

H. M. FITZPATRICK.

April, 1965.
Ashford, Co. Wicklow.

FOREWORD

The Society of Irish Foresters as it approaches the silver jubilee of its formation, has the honour of publishing this book in the service both of the practising forester and of the general public.

Although many articles on all aspects of forestry in Ireland have appeared in the Society journal, "Irish Forestry" and elsewhere, and although our ancient forests have been referred to by many authors, this is the first time that a full and comprehensive work has been published on the Forests of Ireland.

There may be some truth in the often repeated statement that we lack a forestry tradition and that in Ireland forestry is something which is left to the Government rather than the individual. If so, the appearance of this book is a good omen for the future as it is the work of a great number of individuals, all members of the Society of Irish Foresters and it brings together the scattered elements of our forest heritage and assembles them into a balanced account. As the story unfolds it will be seen that the tide of clearance, destruction, neglect and decay has been turned and that a new awareness of the part that forests can play in our environment and economy is growing fast. The loss of our once great forests has been so complete that the Irishman accepts the need for re-forestation almost without question. This acceptance is now being replaced by interest and pride as more young forests grow towards maturity. A tradition does not grow in a year or a decade but it is developing before our eyes.

The idea which sparked off this enterprise rose from a proposal made in March 1961 at the nineteenth annual general meeting of the Society by Mr. N. O'Carroll that the funds of the Society should be utilised for such a purpose in furtherance of the object of the Society as expressed in its constitution "to advance and spread in Ireland the knowledge of forestry in all its aspects."

The sub-committee formed to consider the matter was convened by Mr. H. M. FitzPatrick and reported the following year. Their report was accepted and Mr. H. M. FitzPatrick was appointed editor of the proposed book.

He has had the very difficult and onerous task of producing a readable and coherent text from a mass of overlapping detail supplied by the many contributors whose work is acknowledged elsewhere. The Society, and indeed all those interested in forestry, are very much in his debt.

The Society of Irish Foresters is an All-Ireland society and takes much pleasure in publishing this book at a time when our divisions show signs of healing. Throughout the book every effort has been made to treat the island as a whole and to give facts and figures for both parts of our country.

It is hoped that this book will mark the greatest stride which the Society has yet taken towards the achievement of its objects.

C. S. KILPATRICK,

President.

7. 1. '66.

THE FORESTS OF IRELAND FROM EARLY TIMES UNTIL THE PRESENT DAY

Prehistoric Period

GEOLOGISTS recognise four main glaciations in the British Isles, the last being centred in the west, chiefly in Ireland. Authorities agree that during the last glaciation and for a long time afterwards there were no forests in these islands; the recession of the ice which started about 18,000 B.C. was followed by the immigration from the continent of such plants as dwarf birch and willows. Towards the end of the period of recession, about 8,000-7,500 B.C., trees and shrubs spread over the land. Birch and pine were there in quantity with some hazel and oak and traces of alder and elm, indicating greater warmth. As the climate improved the birches probably advanced freely and rapidly; pine was only a minor species at first but there is evidence of a sharp rise in hazel towards the end of the period.

In the period which followed, from 7,500 down to 5,500 B.C., the climate grew warmer until a mean summer temperature possibly 2° C higher than at present was reached. It was marked by the spread of hazel which appears to have formed masses of pioneer scrub on the margin of the pine forest as well as undergrowth in the forest in the mountains but not in the Central Plain. By the middle of the period pine had replaced birch in the centre of the country but not in the north; oak and elm had increased considerably and pine had invaded the dry edges of the bogs. For the first time dense forest existed.

From 5,500 to 2,500 B.C. the climate continued warm but became damper. Elm and oak spread to the north and up the hills, alder increased rapidly and holly became prominent, especially in the south-west. The end of the period left us with deciduous trees dominant, mainly oak and elm, with elm particularly abundant. Hazel scrub had developed on exposed land in the west and the wet climate encouraged the growth of sphagnum which invaded peat areas and destroyed some forests.

Up to this time the human inhabitants of our country had little effect on the vegetation. The first settlements were on the beaches and the next along the rivers—Stone Age implements have been found in the vicinity of the rivers Bann, Barrow, Corrib, Erne, Shannon, etc.

In the next period, from 2,500 to 550 B.C., the climate became drier and the population spread widely over the hill-sides and esker ridges where they formed civil communities and started pasturage and tillage. This was the Bronze Age and marked the beginning of forest clearance in Ireland for agricultural purposes. The effect, however, was slight,

and we are told that at the end of the Bronze Age Ireland was "still forest-clad right to the western coasts and high up on the mountains." The main species were oak, pine, birch and alder; yew, bird cherry and much hazel were amongst its constituents.

After 550 B.C., our climate became wetter and decidedly cooler. Peat bog spread, destroying pine and birch forests, the remnants of which are found in the new peat. The disappearance of forest from a large part of the west dates from this period and blanket bog began to be an important climax type. Pine forest may have completely disappeared or survived only as a relict. Man aided the destruction—Iron Age Celts began the large-scale clearances of trees from the plains which went on for hundreds of years. No great climatic change has taken place since, although some improvement may have occurred about 300 A.D. and again about 1,000 A.D.

It is curious to note that beech, hornbeam and lime which are so plentiful in England never reached Ireland.

Early Historic Times

From the Bronze Age, when only the edges of the forest can have been nibbled at, to 1600 A.D. when very substantial areas were "plain land," there must have been constant clearance for agricultural purposes which is almost entirely unrecorded. Casual references in manuscripts, the evidence of place names and of the Brehon Laws, the remarks of early Norman invaders such as Giraldus provide the only clues.

The Brehon Laws deal with woodland ownership, rights and preservation. They resemble those in other European countries in periods when timber was plentiful enough to be freely available and when forests were unappropriated or held in common by the tribe. At the same time these laws suggest that clearances around settlements were extensive; proximity to a wood was held to enhance the value of a farm. This was due as much to the fashion of running swine in nearby forests as to the convenience of local timber and fuel in days when transport was primitive. These domestic woods were often privately owned and were sometimes enclosed. Man's natural right to certain essential commodities was recognised by law, even in these appropriated woods; for instance, rights to obtain wild garlic, firing, nuts, the framework of a vehicle, timber for a bier or spancel, a yoke, a plough, a shaft for a spear, a sapling or horse rod, a barrel hoop or a churn staff were all allowed.

In the list of trees given in the Laws are included pine and arbutus. There is some doubt about the translation of the name "ochtach" as it may mean "pine" or a "roof tree" used in house construction. The inclusion of "roof tree" in a list of trees would appear peculiar.

Place-names are useful in determining the location and type of woodlands. The majority of our old townland names date from the seventh and eighth centuries and of 62,205 which have survived, 1,310 contain the word "derry." Elm and Yew, now rare species in the wild state,

were, on the evidence of place-names, widespread species. Similarly, arbutus, at present confined to a small area in the south-west and to the shores of Lough Gill in Co. Sligo, once grew in all the western counties from Cork and Kerry to Mayo. The Irish name for pine, gius, is seldom found as part of local names and where it does occur may mean "bog deal," the remains of pine trees long buried under peat.

The farming of the ancient Irish was predominantly pastoral, and grazing was probably the principal agent in the destruction of the primeval woods. Fire is often mentioned as an additional agent, but is unlikely to have had much effect, as deciduous woods, especially in a wet climate, are fire resistant. Ground fires will sweep through them in dry seasons, destroying saplings and undergrowth but doing little harm to large, thick-barked stems.

To the End of the Middle Ages

Giraldus Cambrensis, a monk who came with King John in 1183, found the country "well-wooded" but with "in some places very beautiful plains though of limited extent in comparison with the woods." He mentions the abundance of yew trees and the "vast herds of boars and wild pigs" which he saw. Accounts of the campaigns of Richard II in 1394-5 tell of large woods adjacent to the River Barrow at Levaraugh, Garbh-coill and the Rower near New Ross. A map of this district shows that many years later, in 1570, great woods still existed on both sides of the Leinster Chain in counties Carlow and Wexford.

Hogan in 1598 describes part of counties Down, Antrim, Armagh, Fermanagh, Wexford and Leix as "full of wood and bog," "very fine woodland," but says nothing about other counties. Dymok, writing about the same time, gives a list of "strengths and fastnesses of wood and bog as are in every province of Ireland." No areas are given but he states that there was "great plenty of wood except in Leinster" — yet more than one-third of the fastnesses listed are in that province which comprised the area of the Pale, all of which was well known to the English. Fynes Moryson in 1603, in his account of his campaigning with Lord Mountjoy, states that "Ulster and the western parts of Munster yield vast woods, but I confess myself to have been deceived in the common fame that all Ireland is woody, having found in my long journey from Armagh to Kinsale few or no woods by the way excepting the great woods of Offaly and some low scrubby places which they call glens." This is the first statement which suggests any general scarcity of forests here. Their plentifulness in Ulster may be explained by its being the last stronghold of the old Gaelic Ireland which held out against the invader until the Flight of the Earls at this time. Eileen McCracken in her *Woodlands of Ireland About 1600* tells us that one of the biggest areas of woodland and possibly the densest was the oak forest of Killetra, Glenconkeyne and Monterwelin which lay to the north-west of Lough Neagh and stretched northwards to within a few miles of Coleraine. This was described by Sir John Davy in 1607 as "well-nigh as large as the

New Forest in Hampshire and stored with the best timber in Ireland." On the Antrim coast the glens of Carnlough, Glenariff, Cushendun and Glenarm carried oak in the wet valley bottoms and on the lower slopes, with hazel, holly and ash on the higher, drier ground. Hazel was widespread on the southern part of the Antrim coast, with some ash, birch and alder and heavy oak forest in the valley of the Glynn river. Perrott attributed the prolonged resistance of the Earl of Tyrone to the troubles encountered by the English soldiers fighting in woods "especially short and scrubby woods and thickets" and after his defeat O'Neill consented that "all and singular the thickets, groves and woods lying between his country and the bordering Englishry should be cut down and made plain land." Several maps exist showing the forests of those times but they are more picturesque than informative.

The clearance of the primeval forest was an essential part of the operation of colonization, both to provide agricultural land for the settlers from Britain and to remove the cover which the trees afforded to the Irish. As grants of land were made at the will of the reigning sovereign, there had been little security of tenure since the Tudors began their reconquest. The Stuart Plantations, the Cromwellian Settlement, the Restoration of 1660 and the Revolution of 1689 all came in a short space of time and the owners of estates naturally tended to make the most of their assets while they could. The woodlands were capable of highly profitable exploitation and for a century and more extensive clearances took place.

In earlier times pannage, underwood and bark were valued along with the timber; later the timber became of prime importance for ship building, house construction, pipe staves and charcoal. About 1610 the first furnaces were built and iron ore was imported for smelting with locally produced charcoal. These iron works were set up wherever there was a supply of wood and they did not leave a district until it had been swept completely bare of trees. Gerard Boate, writing in the days of Cromwell, remarks that the woods were fast disappearing, in Ulster particularly large districts were "almost everywhere bare even in places which were encumbered with great and thick forests in the war with Tyrone."

By 1700 the forests had been reduced to a negligible area. The age of exploitation of the woods was nearing its end and the first attempts were being made to undo, by planting and preserving, the ravages of the preceding century.

Estate Planting Begins

Tree planting began in the eighteenth century on the great estates when their owners felt sufficiently secure to indulge on a grand scale in farming and estate improvement. There was a rapid and extensive development of landscape planting and afforestation along the lines already well established in England and in this country in counties Dublin, Kildare and Wicklow. This development coincided with the era



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Glendav, Macroom Forest, Co. Cork.



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Cloghmore Glen, Rostrevor Forest, Co. Down.



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SITKA SPRUCE IN BALLYKELLY FOREST, CO. DERRY.

This plot in Compartment 6 was planted in 1916 and at 41 years when the photograph was taken it had 165 stems on an acre, height to 3" diameter 91 feet, volume on an acre 7,500 cubic feet, average stem 45 cubic. Estimated value of an acre of timber standing was £1,400 in 1958.



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Norway Spruce in the Park at Camolin Forest, Co. Wexford.

of Capability Brown (1716-1783) whose school of planters changed the face of England and whose influence was to give the emerging demesnes here a pattern which has survived almost until the present day. Thousands of trees were planted in groups and belts and extensive park lands were enclosed and planted, mainly with hardwoods — oak, beech, sycamore, ash and elm, singly or in clumps, merging into the broad undulating belts on the periphery of the demesne.

Planting became fashionable and was a mark of the improving landlord. In addition many advocates of forestry, following in the footsteps of John Evelyn, wrote on its profit aspects. Arthur Young, in the account of his tour in Ireland, says: "I have made many minute calculations of the expense, growth and value of plantations and am convinced from them that there is no application of the best land in that kingdom will equal the profit of planting the worst of it." Samuel Hayes, one-time owner of Avondale, wrote a "Practical Treatise" on forestry in 1794 which contains many references to the economic returns from timber and particularly to the coppice oak woods of county Wicklow. Good prices were obtained at that time and he records that "an acre of coppice from twenty to twenty-five years' growth, in which there are no reserves from a past fall, may be worth £30" and he estimates that by leaving reserves and managing the coppice according to his system an acre may be worth £330 in fifty years.

Whether activated by pride or by the fashion of the time or by the profit motive, the landowners pressed on with planting. By the end of the century there were in county Wicklow notable woods in Shillelagh, Ballycurry, Avondale, Grange Con, Kilruddery, Powerscourt, Glenart and Charleville. The survey of Co. Tyrone in 1802 explains in much detail the planting methods adopted on the estate of Lord Mountjoy, including ploughing, turf planting, contour draining and the sowing of broom in patches. The Earl of Clanbrassil at Tollymore Park in County Down planted from 30,000 to 60,000 trees a year. Much larch was used and a traveller in 1808 remarks on its excellent growth and says "the uninterrupted winds from the Channel do not seem to have been inimical to the plantations which are about 40 years growth with some of the larch 7 feet in circumference at 4½ feet from the ground no more than 36 years of age." Another visitor at about the same time was not so effusive in his praise and wrote "the plantations are very extensive but want the judicious application of the axe, particularly to the fir tribe, which rather preponderate too much."

Other estates where planting was done in those early days were Shane's Castle, Clandeboye, Caledon, Baronscourt, Kinnitty, Curraghmore, Ennis, Durrow, Abbeyleix, Rockingham, Dundrum, Loughcrew, Killarney, Tullamore, Ballygar and dozens of others still notable for their trees.

Many of these estates had their arboreta and pleasure grounds in which were planted rare exotic trees. Although intended purely for interest, these places gave valuable object lessons in the chances of survival of foreign species and present-day commercial species became known through them. Interesting arboreta still exist at Castlewellan,

Powerscourt, Kilmacurragh, Curraghmore, Fota, Muckcross, and many other demesnes.

Planting continued for 150 years and produced a striking change in the appearance of the country. A. C. Forbes, writing in 1903, says:— "Woods, shelter belts and park timber may be met with all over Ireland which vary in age from a few years to considerably over one hundred and, although each individual estate varies, the general result has been a slow and steady development of estate forestry. This may be dated from the end of the seventeenth century down to the last twenty years. This abundance of park, hedgerow timber and small clumps entitles the east and south of the country to be termed well-wooded." The total area of woods and plantations was given as 340,000 acres in 1841 but these figures are not reliable. From 1851 onwards systematic returns were made and these show a steady increase from 305,000 acres then to 340,000 in 1880.

Only a small proportion of these privately owned woodlands could be termed commercial and, although they are usually lumped together as "private forestry," few were managed with the object of obtaining a regular return from the sale of timber. Planted originally for ornament, shelter or game cover, woods on most Irish estates were retained generation after generation for reasons of sentiment or prestige and the "selling of the trees" usually presaged the decline of the family. Occasional trees were cut down to supply timber for estate purposes or "to oblige" a local sawmiller who was forced to depend mainly on windfalls, but all too often woods stood long past maturity and, worse still, plantations were left unthinned because of lack of knowledge, of a proper plan of operations or because of an extraordinary reluctance to fell a single tree. The rare estates which employed a trained forester and managed the woods in a rational manner found that forestry was a profitable business and many of them have survived until the present day, still following a simple system of thinning, clearing and replanting which keeps their capital intact and provides a steady income.

Decline of Estate Woods

In the main, however, the landlords were unable to weather the economic storms which beset them after 1880 and the private woodlands suffered in the decline of the great estates. The eighties saw a succession of ruinous harvests which gravely reduced income from land whether farmed directly or let to tenants. The "Land War" organised by Parnell had resulted in the first of the Land Acts, passed in 1881, which shook the confidence of the landlords as they recognised in it a forewarning of the change in the ownership of Irish land which was to follow in the next half century. Whatever the cause, the axe and the saw moved into the stately woods which had been so reverently preserved and the "travelling mills" came over in force from England and Scotland and commenced the wholesale felling of demesne timber. The owners welcomed the money from these sales; they needed it to balance their

losses in other directions. Most of the trees were ripe for felling and there could be no valid objection to their realisation if the ground had been replanted. But few of the sellers cared to spend anything on the replacement of trees cut. Nearly all of the land was left derelict, to develop into profitless rabbit-infested scrub. Other areas from which all the commercial trees had been picked, retained the appearance of woodlands but were, in reality, understocked to an uneconomic degree. Middle-aged woods and pole plantations, in fact everything which could produce a board or a pit-prop, went at the same time, and the mills travelled around the country leaving a trail of destruction behind them. As a small local sawmiller told the Departmental Committee on Irish Forestry in 1907: "They sold the woods in bulk, mature and immature, for a lump sum and the land is lying desolate to this day. No use is being made of it."

With the disappearance of the woods, the sawmill in many a locality vanished too. With it went the custom of using home-grown timber and the lore connected with it. It was replaced by the imported article which received preferential rates on the railways and appeared, ready sawn for use, in every village in the land.

The closing years of the nineteenth century witnessed the end of the tree planting vogue of the eighteenth and the start of the clearance which still continues. The area of woodlands declined from the peak of 340,000 acres in 1880 to 300,000 acres in 1906 and to about 130,000 acres in the twenties, of which 90,000 acres was in the Irish Free State and 40,000 acres in Northern Ireland. During the Second World War requirements of timber were met by the wholesale felling of woodlands, hedgerow and park trees and the results of this felling are everywhere in evidence today. The acreage remaining nominally under trees in private ownership is probably less than 100,000 acres for the whole country and much of it is so sparsely stocked with useful trees as to hardly deserve the name of woodland.

The better areas still belong to estates which have escaped breaking up into agricultural holdings. One or two of the largest have woodlands running to 1,500 acres but in general the acreage is from 300 to 600 acres. Some wooded estates have survived in the ownership of colleges, monasteries and hospitals.

State Forestry Begins

The year 1903 left its mark on Irish forestry by the great storm which blew down an immense number of trees but it was significant for far more than this; it marked, however imperceptibly, the first definite turning of the tide of deforestation. In that year the inauguration of a State forestry programme took place with the setting up of a Forestry Branch of the Department of Agriculture and Technical Instruction and the acquisition of Avondale in Co. Wicklow as the first forestry centre and school for the training of young Irishmen as practical foresters. A. C. Forbes, a well-known English expert and the author of several

books on forestry, was appointed in charge and in 1904 the first batch of six students was enrolled. Accommodation and tuition were provided in the mansion house and practical work was done on 550 acres of open park-land and derelict woods. Here for ten years a succession of three year courses was held; the land was planted as a "Forest Garden" with more than 100 experimental plots to test little known species under sylvicultural conditions. The young men trained were subsequently appointed to the slowly expanding service and they formed an important part of its staff for many years.

At the time Avondale was bought, 300 acres of woods at Ballyfad, Co. Wexford, were taken over by the State and run from Avondale. Later came Dundrum, Co. Tipperary, 1,200 acres; Camolin, Co. Wexford, 600 acres; Bailieboro, Co. Cavan, and Ballygar, Co. Galway, all woodlands left in the hands of government when estates were divided amongst farmers by the Land Commission.

In 1907 a Departmental Committee was appointed to enquire into and to make recommendations on "the financial and other provisions necessary for a comprehensive scheme of afforestation." This committee held fifteen meetings, examined forty-eight witnesses, compiled an enormous amount of statistics, and with commendable expedition, the following year published a blue book of nearly 500 pages which is still a mine of useful information about all matters appertaining to forestry in this country. The report advocated the purchase by the State within ten years of 300,000 acres of mountain land, of which two-thirds would be plantable. Forty years were allowed for the planting of this 200,000 acres and the sum of £3,000,000 was set down as the cost of the work.

The first result of the committee's report was a vote of £6,000 from Parliament for the purpose of acquiring estate woodlands from the Land Commission and their maintenance. This led to the purchase of Ballykelly, Co. Derry, 254 acres; Knockmany, Co. Tyrone, 467 acres; Castle Caldwell, Co. Fermanagh, 303 acres; Kilrush, Co. Clare and Woodford, Co. Galway. A modest forest service was established at this time and a year or two later further finances were obtained from the Development Commission which permitted the purchase of mountain land at Baunreigh, Co. Leix, Glendalough, Co. Wicklow, and Ballyhoura, Co. Cork. Then came 1914 and the First World War put a stop to progress.

First World War

During the war years woods in Ireland and Great Britain were felled to make up for reduced imports of timber and a large area was devastated. A Parliamentary "Reconstruction" committee in 1918 considered what should be done to restore the woods and also examined the broader issue of State afforestation. Their report recommended the acquisition of 1,750,000 acres in the then United Kingdom and its planting over 40 years. Ireland's share of this area was to be 150,000 to 200,000 acres.

In 1919 control of forestry in Ireland passed to the Forestry Commission following the United Kingdom Forestry Act of that year. The

Commission operated the existing forests, acquired new areas and enlarged the nurseries in accordance with their over-all policy, but in 1922, with the political settlement, forestry once more became an Irish concern. At that time the staff consisted of an Assistant Commissioner, A. C. Forbes, two Divisional Officers, J. Crozier and A. G. Kilmartin, four District Officers, D. McCaw, M. O'Beirne, W. E. Ager and A. McRae, and seven Foresters, P. Barry, M. Swords, F. Murphy, P. McGreevy, J. O'Keeffe, J. O'Leary and M. B. Ryan. All these officers remained with the southern government in the then Free State. In Ulster there was one District Officer, D. Stewart, and he and the two foresters in his district, M. Byrne and J. P. Rodgers, remained to work with the government of Northern Ireland. From then on forestry north and south of the Border went their separate ways.

The Free State, later to become the Republic of Ireland

In 1923 about 1,000 acres was planted in the Free State. The rate of planting was increased in the following years and reached about 3,500 acres per annum in 1929 and this rate was kept up for several years, gradually rising to 7,600 acres in 1939. In that year the Second World War started and afforestation dropped yearly to 4,230 acres by 1945. Post-war conditions permitted a quickening of the pace again and the annual programmes reached 8,000 acres in 1950, nearly 10,000 acres in 1953, 15,000 acres in 1956, 23,000 acres in 1959 and 26,000 acres in 1961. This massive increase followed the adoption of an economic plan by the Government in 1948, the "long-term Programme of Recovery," and a subsequent survey done by the Forestry Division which indicated that 1,200,000 acres in the Republic could be planted with profit. The Programme laid down a policy for the afforestation of one million acres at the rate of 25,000 acres a year, and this policy received the endorsement of the Food and Agriculture Organisation of the United Nations. Mr. Roy Cameron, a distinguished Canadian forester who was adviser to the organisation, came to Ireland in 1950 and investigated the whole subject of State afforestation. His report suggested that the programme should be divided into two parts, a commercial programmes designed to meet minimum requirements for sawn softwood in times of emergency and a social forestry programme for soil conservation, stabilisation of employment in congested areas and reclamation of idle lands, each programme to aim at an ultimate target of half a million acres of plantation. Ten years later the First Programme for Economic Expansion stated: "Present plans provide for the planting of 22,500 acres in 1958-59 and 25,000 acres in 1959-60 and subsequent years. The programme envisages the growing of saw-log timber on a 50 year rotation. Small dimension timber for pulp, etc., as far as not obtainable from the thinning of plantations grown on a saw-log rotation, would be produced from plantations grown on a rotation of, say, 30 years."

After five years, in July 1964, the Second Programme of Economic Expansion appeared. It recorded that "the annual planting programme

of 25,000 acres of new forests has been in full operation since 1959-60. This rate of planting will be maintained during the second period, i.e. until 1970, subject to the availability of suitable land." (Policy is treated in Chapter V).

Northern Ireland

In the part of the country later to become Northern Ireland the first State forest was at Ballykelly, near the city of Derry, where an old oak wood, probably a survival of primeval forest, still remained. Here 254 acres were bought in 1910. Later, in 1911, came 468 acres at Knockmany in the Clogher Valley in Co. Tyrone, and in 1913 303 acres were acquired at Castle Caldwell in Co. Fermanagh. No further areas were added until after the First World War when, during the regime of the Forestry Commission, 2,820 acres were leased from the Duke of Abercorn at Baronscourt in Co. Tyrone. The year 1922 brought a change of government and the four forests passed under the charge of the Ministry of Agriculture in Belfast.

In 1923 and '24 a committee known as the Charlemont Committee examined the natural and industrial resources of Northern Ireland and made recommendations for their development. In dealing with forestry they recorded that only 40,000 acres or 1.2 per cent of the land surface carried trees and that this area yielded 25,000 to 30,000 tons of sawn timber annually and that 200,000 tons was imported from foreign countries. They recommended that 10 per cent of the 550,000 acres of rough hill pasture in the six counties should be taken over gradually during the next 50-60 years, to be afforested by the state at the rate of 1,000 acres annually. The Committee further recommended that non-state forestry should be encouraged by the payment of planting grants of £4 10 0 per acre to corporate bodies and £3 per acre to private owners with, in addition, scrub clearing grants of £2 to £4 per acre. plants at cost price and free advice on all forestry matters. These latter recommendations were adopted in part by a grant scheme of £2 and acre for planting and £1 an acre for scrub clearing. Plants were supplied at a flat rate of 30s. per thousand in the early days and in all more than 13 million young trees were sent out up to 1962.

The rate of planting in the State Forests was stepped up to 1,000 acres in the early 1930s. Newcastle Forest was acquired in 1923 and Hillsborough in 1926, both areas of demesne land on fertile soil. With the agricultural depression after 1930 much hill land came on the market and a rapid advance took place in the north Derry hills between the Bann Valley and the River Roe, where grazing land was acquired to form the forests of Cam, Springwell and Gortnamoyagh. By 1939 25,000 acres had been acquired and 14,000 acres had been planted.

During the Second World War, in spite of shortages of labour, seed and equipment, the annual programme of 1,000 acres was maintained. Heavy felling for war purposes took place in the State forests, and during the five years of hostilities 50,500 tons of pitwood and 483,000 cubic

feet of commercial timber was supplied. At the same time the Forestry Division of the Ministry acted as agent for the Timber control section of the British Ministry of Supply. A Census of Woodlands was undertaken and timber was purchased from private owners on a large scale. The census gave a figure of 60,000 acres under trees, of which 40,000 acres was in woods of over 5 acres. Price Control was introduced and sales totalling $8\frac{1}{2}$ million cubic feet of softwood and $5\frac{1}{4}$ million cubic feet of hardwood were handled, entailing the clear felling of 5,470 acres and the thinning of many more.

A committee under Lord Babington enquired into forestry development in 1943 and recommended the doubling of the planting rate by the State to 2,000 acres after the war, with an ultimate target of 100,000 acres. It was suggested that the price paid for land should go from £4 to £8 an acre and that the Planting Grant should be increased. It was later raised to £7 10 0 an acre.

Since the war a major forest region has been established in East Fermanagh and South Tyrone. By 1951 4,000 acres of marginal farmland with a heavy clay soil had been purchased piecemeal as and when offered and from these acquisitions the forests of Mullaghfad, Bunnougher, Doon, Fardross and Tully were formed. In North Antrim large areas of deep blanket bog were bought after 1950 and form the forests of Ballypatrick, Breen, Ballybraddin and Beaghs. Further blanket bog lands in West Fermanagh were acquired and have been developed as the forests of Lough Navar, Blackslee, Belmore and Ballintempo.

The largest single block was built up in West Tyrone by 1960 where there is 7,500 acres west and south of Killeter and a further 2,500 acres comprising the forest of Lough Bradan. Some of this land is in water catchment areas and is held on lease from public authorities.

The highest acreages are in counties Tyrone and Fermanagh, each with 28,000 acres; counties Antrim and Derry have each about 18,000 acres, with Co. Down and Co. Armagh far behind with 9,000 acres and 6,000 acres respectively. Expressed as a percentage of the total area this may be shown as Fermanagh 6 p.c., Tyrone 3.5 p.c., Derry 3.5 p.c., Antrim 2.5 p.c., Armagh 1.75 p.c. and Down 1.5 p.c.

(Policy is treated in Chapter V)

CHAPTER II

GENERAL PHYSICAL DESCRIPTION OF THE COUNTRY

Topography, Geology, Soil, Climate, Roads, Railways, Ports, Towns and Population

Twenty-six of the thirty-two counties of Ireland are in the Republic, the remaining six are in Northern Ireland. Three entire provinces, Leinster, Munster and Connacht, and three counties out of nine in Ulster are situated in the "south," although part of one of them, Donegal, is in fact the most northerly land in the country.

THE REPUBLIC OF IRELAND

THE total surface area of the Republic is 17 million acres. The best of this land is used for arable crops which occupy $3\frac{1}{2}$ million acres. Of the remainder, 8 million acres is permanent grassland employed either for meadowing or as pasture, $\frac{1}{2}$ million acres is woods and forests and the rest, 5 million acres, is under towns and cities, consists of lakes and rivers, or is bog, heath, or grass-covered moorland, or bare, rocky waste land.

The topography of Ireland is remarkable. The most pronounced feature is the extensive central plain which takes up more than half the area, and the location of highlands in an almost unbroken chain around the island, except for a stretch of about 50 miles on the east coast. On the west a high mountainous region extends from Malin Head in Donegal southwards to Cape Clear on the south coast of County Cork. From these the high hills sweep eastwards across Counties Cork and Waterford, never far from the sea, until the confluence of the rivers Suir, Nore and Barrow is reached at Waterford Harbour. In County Wexford the mountains start once more and continue right up to the suburbs of the city of Dublin. Here the first wide break in the coastal barrier occurs and for 50 miles, as far as the Carlingford Mountains, the central plain borders the sea. North of Carlingford are the Mourne and other mountains in Northern Ireland dealt with in the following section

The nature of the terrain has a profound effect on the location and growth of our Irish forests. For economic reasons they tend to be established on land unsuited to farming, which is the wetter area of the plain and the lower slopes of the hills and mountains, situated above the land enclosed for intensive agriculture. Exposure to wind, especially our persistent wind from the south-west, has a retarding effect on tree growth, and the presence or absence of shelter in the form of high ground on the south-western side is an important factor in selecting forest sites.

Most of the state forests of Ireland are in the mountain regions and for this reason a short sketch of our highlands is given here.

THE LEINSTER CHAIN

The Dublin and Wicklow Mountains stretch as a continuous tract of high and barren moorland from the gates of the capital to the southerly borders of County Wicklow. The main mass is from 10 to 15 miles across and lies at about 1,500 feet above sea level with many rounded summits rising to heights of 2,000 feet and over. Granite forms the core of the ridge and this is overlain on the lower slopes and in the valleys by sedimentary rocks, mica schists, slates and shales.

Prominent peaks are Kippure, 2,475', Sugar Loaf, 1,654', (a quartzite cone on the north eastern side of the range), Djouce, 2,385', Mullaghcleevaun, 2,788', Tonelagee, 2,686', Table Mountain, 2,302', Croagh-ammoira, 2,181', and Lugnaquilla, 3,039', the highest mountain in Leinster.

This is an important forest region and there are over 50,000 acres of state plantations in the glens and on the mountain slopes. Many of the glens are richly wooded as a result of earlier planting by private owners, notably Powerscourt, the Glen of the Downs, Dunran, the Devil's Glen, Glenealy, Clara, Avoca and Shillelagh.

South-west of Arklow the Leinster Chain continues, with Croghan Kinshelagh rising to 1,993 feet, and the highlands run towards the Slaney at Bunclody in a series of minor peaks, Annagh Hill, 1,499', Slieveboy, 1,387', and Gibbet Hill, 1,033'. Across the river the ground rises steeply to the Blackstairs-Mount Leinster range where it reaches 2,610' feet and carries the granite chain down to its southern extremity on the River Barrow near New Ross and the striking outpost of Brandon Hill, 1,694' across the river near Graiguenamanagh. This region from Arklow southwards contains about 17,000 acres of state plantations.

THE MUNSTER BARRIER

A few miles from the extremity of the Leinster Chain the mountains start anew. They consist for the most part of Devonian Old Red Sandstone outcrops which have resisted weathering and form the higher ground, while the more easily eroded limestone and shales are found in the valleys. The bleak sandstone moorland of the Derrysaggart Mountains and the ridge of Shehy divide the highlands into two contrasting parts. To the west sandstones dominate in long, high mountains reaching into the peninsulas: to the east, the ridges are lower and rich limestone and shale land is found in the valleys of the rivers Bandon, lower Lee and the Blackwater. On the hills the exposure of the barren and slow-weathering sandstone is extreme; the bare rock comes to the surface in wide continuous tracts and drift soils rarely go beyond 500 feet elevation on the slopes.

The principal ranges of the Munster Barrier are, from north-west to

south-east, the Mullaghareirk Mountains rising to over 1,300 feet from the lowlands of North Kerry, the Glanna Ruddy and Stack Mountains, 1,170', which continue the high ground to the outskirts of Tralee and beyond this town, in the Dingle peninsula, Slieve Mish, 2,796', and Brandon, 3,127'. The Macgillicuddy Reeks extend from the Lakes of Killarney to Valentia, with summits Mangerton, 2,796', Carrantuohill, 3,414' (the highest mountain in Ireland), Mullaghnafrin, 2,539', Coomacarra, 2,541', and many others about 2,000' over sea level. In between, high, bare or bog encumbered country intervenes.

East of Killarney are the Derrysaggart Mountains which on their western side form the Caha, 2,000', and Slieve Miskish with Hungry Hill, 2,251', extending south-westwards into the Bere peninsula between the Kenmare River and Bantry Bay. The principal peaks of the Derrysaggart are the Paps, 2,275', Caherbarnagh, 2,238', Mullaghanish, 2,133', Gullaba and Carran, 1,980'. Between Inchigeelagh and Bantry Bay are the Shehy Mountains, 1,797', Owen Hill, 1,762', and Mullaghmeesha, 1,600'.

On the eastern side of the Millstreet-Macroom road lie the Boggeragh Mountains which rise abruptly from the banks of the Blackwater and reach to the road joining Mallow and Blarney. Heights are: Musheramore, 2,118', Seefin, 1,619', Bweeng, 1,372', and Mount Hilary, 1,288'. With hardly a break the high ground continues to form Nagle's Mountains reaching to Fermoy to join the low hills running to Midleton and Youghal. Principal summits are Knocknaskagh, 1,406', Corran and Seefin, 1,392'.

Mitchelstown stands in the pass which carries the road linking the lowlands of Tipperary and the valley of the Blackwater. North of the town rise the Ballyhoura Hills, 1,700', and the lofty Galtees with Galteemore over 3,000'. Southwards are the Kilworth Mountains, low hills up to 1,000' which merge into the Knockmealdown range with Knockshannahullion, 2,153', and Knockmealdown, 2,609'. Beyond the Clonmel-Dungarvan road are the Monavullagh and the Comeragh Mountains which follow the course of the River Suir almost to the city of Waterford. Here outstanding peaks are Knockanaffrin, 2,478', Coumfea, 2,340', and Seefin, 2,387'.

Outposts of the coastal range are the Slievefelim and Silvermine Mountains between Thurles and Nenagh with Cullann, 1,524', Mauher-slieve, 1,783', and Keeper, 2,279'. These hills join up with the Devil's Bit Mountain, 1,577', situated between Templemore and Roscrea in Co. Tipperary. Near Clonmel is the prominent summit of Slievenamon, 2,368', at the western end of a narrow ridge rising abruptly from the plain outside Fethard and stretching in a line of low hills to meet the River Nore from whose other bank the country slopes upwards to the summit of Brandon Hill beside the Leinster chain.

The long low hills of Slieveardagh, at no point higher than 1,000', stretch from Cashel to Freshford where a narrow valley separates them from the "Castlecomer Plateau", a coal-bearing elevation of 500' to 1,000'

reaching from Kilkenny to Carlow and as far north as Stradbally.

The mountain ranges grouped together as "The Munster Barrier" and described above, contain many of the most extensive State forests in the country. Their foothills and slopes and their wide valleys provide some excellent land for afforestation and State plantations in the counties of Limerick, Kerry, Cork, Tipperary and Waterford, amount to over 120,000 acres.

THE WESTERN HIGHLANDS

This region extends from northern Sligo down to Lough Derg at Killaloe, a few miles from Limerick city. In the north lie the great mass of the Dartrey Mountains flanked on the seaward side by Ben Bulbin and joining the flat-topped ranges which run to near Swanlinbar in Co. Cavan. Ben Bulbin, 1,730', is limestone and Slieveanierin, 1,927', Cuilcagh, 2,188', and Gubnaveagh, 1,708', are formed of shales, grits and sandstones and have large areas of peat moorlands. This is the country of great lakes hemmed in by hills. Near the Donegal border is Lough Melvin, in the midst of the mountains is Lough Allen and to the south Lough Key and Lough Arrow. Between these last two lakes and the narrow tongue of lowland which links the Central Plain to the sea at Sligo Bay are the Curlew and Bricklieve Hills reaching slightly over 1,000'. West of this lowland rise the Ox Mountains which, starting at the narrow pass of Collooney through which flows the confluence of several rivers, run in an unbroken ridge for 30 miles exceeding 1,773' and never dropping below 800' until they reach Lough Conn and Killala Bay. The core of the Ox Mountains is of granite overlaid in parts with schist, and it is almost desolate of vegetation throughout; peat covers a large tract between the summit and Killala Bay.

The chain of lakes which stretches from Galway city to the sea at Ballina almost completely cuts off the main mountain group of West Mayo and West Galway from the lowland to the east as well as from the Ox Mountains. Lough Corrib flanks the highland of Connemara for a distance of 26 miles and 4 miles beyond its northern shore Lough Mask and Lough Carra carry the divide of lowland and highland to near Castlebar. To the north of this town are the last two links, Lough Cuilin and Lough Conn, and northwards a low plain partly covered with bog extends for four miles to the tidal limit of Killala Bay.

North-western Mayo from Ballycastle to Newport and Castlebar is a district of rugged mountains, with bare quartzite rock predominating. There are several summits which rise to over 2,000'—Nepin, 2,646', the highest peak in Connacht, Birreencorragh, 2,295', and Nepin Beg, 2,065'. To the north-west a high moorland rising to 1,200' occupies a wide tract and meets the sea abruptly beyond the summit of Maumakeogh near Killala Bay. To the west the highlands are continued into the Corraun peninsula and into Achill Island with quartzite heights, Slievemore, 2,204',

and Croaghaun, 2,192', rising sheer out of the Atlantic.

Granite is the dominant rock of Iar-Connacht and Connemara and the covering of peat is very extensive. To the north of this mountainous country are the quartzite summits of the Twelve Bens, all over 2,000', Maumturk, 2,307', and Croagh Patrick, 2,510', this last height rising abruptly out of the waters of Clew Bay. Others of these south Mayo mountains are Partry, 1,462', Maumtrasna, 2,239', Mweelrea, 2,610', and the Shreeffry Hills, 2,429'. In Iar-Connacht, south of the road from Oughterard to Clifden, the highlands suddenly taper off to a low-lying wilderness of bare rock and low hills which reaches to Galway Bay.

Between Galway and the Shannon are the broad desolate hills of the Slieve Aughty with rounded summits of over 1,200' which bring the Connacht Highlands to the Shannon at its outlet from Lough Derg, the start of the rich limestone plain which extends to Mullaghereirk, at the beginning of the Munster Barrier.

The mountain ranges of Connacht have been the scene in the past 15 years of an all-out afforestation drive and already over 40,000 acres of plantations have been formed, most of them on wastes of peat-encumbered lands which have been drained by monster ploughs hauled by powerful crawler tractors.

THE NORTH-WESTERN HIGHLANDS

The mountains of the north-west occupy a wide area in the three adjoining counties of Donegal, Derry and Tyrone, but here we are concerned only with the first of these counties. Quartzite, mica-schist and granite occupy a wide area of Donegal and form the ranges which extend from the north coast down to Lower Lough Erne. A prominent peak is Muckish, 2,197' which stands to the north of Errigal, 2,466', and the Derryveagh Mountains with Slieve Snacht, 2,240'. To the south, between Lough Finn on the road from Ballybofey to Glenties and the town of Donegal, rise the Blue Stack mountains with Gaugin, 1,863', Binmore, 1,835', and Blue Stack, 2,219'. Across Barnesmore Gap the hills continue to Pettigo, reaching elevations of 1,323' at Clogher Hill and 1,071' to the west of Lough Derg.

West of Ardara the high ground extends with summits of 1,550' and 1,650' to meet the sea where the lofty cliffs of Slieve League, 1,972', overhang Donegal Bay.

In the Inishowen peninsula, between Lough Swilly and Lough Foyle are extensive hills with Slieve Snaght, 2,019', and Scalp Mountain, 1,589'.

In Co. Donegal a total of over 20,000 acres of mountain land has been afforested, nearly all within the last 15 years.

There remain three mountain ranges of importance for tree planting.

In the south midlands the Slieve Bloom range lies athwart the boundary of Leix and Offaly and forms a long low ridge stretching from Ballyfin to the vicinity of Roscrea and rising towards its western end to

the height of Arderin, 1,733'. The core of these mountains is of sandstone with a covering of shale which has been eroded from the summits but persists on the slopes and in the valleys. The rounded hill tops are peat-covered but heavy clay soils and gravel deposits are found at lower levels.

The slopes and valleys of the Slieve Bloom furnish considerable forest areas and a total of 11,500 acres has been planted.

Near Wexford town the Forth Mountains form a low, undulating terrace of craggy quartzite with a maximum elevation of 700'. Here there is an area of 2,180 acres planted.

The Carlingford Mountains in Co. Louth are the continuation seawards of Slieve Gullion, 1,894', in Co. Armagh. They provide good slopes and valleys which have been planted to the extent of 1,800 acres.

NORTHERN IRELAND

NORTHERN IRELAND consists of the counties of Antrim, Armagh, Derry, Down, Fermanagh and Tyrone and contains the two cities of Derry and Belfast.

The total area of land is 3,353,600 acres, 5,240 square miles, approximately one-sixth of the whole island.

In 1960 80,000 acres were under forest, about 1,000,000 acres were used for arable farming, the same area for permanent grazing and 740,000 acres were classified as rough grazing.

THE ULSTER BASIN

The outstanding physical feature of this region is a wide central depression, partly lake-filled, enclosed within a ring of separate mountain groups. Lough Neagh lies in the middle, and its waters wash the shores of five of the six counties which constitute Northern Ireland.

The greater part of Antrim is a high plateau composed of basaltic rocks. Areas of lava form beds of great thickness rising to 1,800 feet above sea level. A large part of eastern Antrim is high moorland between the Bann River and the sea and from the coast, where the massive cliffs of basalt overlying chalk form a magnificent wall, several glens, renowned for their beauty, penetrate the plateau as steep-sided valleys for distances of three to four miles.

The Mountains of Mourne in Co. Down are an isolated highland with granite peaks rising to over 2,000 feet which forms a solid barrier running northwards from Rostrevor to beyond Newcastle where the peak of Slieve Donard rises to 2,796 feet beside the shores of Dundrum Bay.

The Sperrin Mountains with several rounded summits above 2,000 feet, lie to the north-west of Lough Neagh in counties Derry and Tyrone to the east of the Foyle basin. Schists and gneiss, rising gaunt and bare, are very common in this range but are overlaid in portions of their lower levels by fertile drift soils. In northern Tyrone the eastern

division of the plateau attains its maximum width and elevation and does not descend below 600 feet until the banks of the Foyle tributaries are reached, but to the south its continuity is much broken by several large gaps in the vicinity of Fintona and Five-mile-town. Farther south the descent to the lowlands is abrupt and the lake basin of the Erne in Co. Fermanagh borders the south western rim of this range for a distance of 50 miles. The north-eastern rampart of the Sperrins which extends as far as Magilligan sand-flat belongs geologically to the Basaltic formation of Antrim.

SOILS*

The soil pattern is complex as a result of the inter-action of the major factors of soil formation and its relationship to the local geology is complicated by the fact that most Irish soils are derived, not from the underlying rock formations, but from the transported glacial drift which mantles them. As Ireland was subjected to two main glaciations and since each of these involved a number of advance and retreat stages of the Ice sheet, it can be expected that the resultant drift deposits are of mixed origin and of complex geological and physical constitution with consequent differences in our soils.

These soil differences have been affected in their development by other factors, notably the rainfall and the evaporation of water from the surface of the ground. As most of the rain water soaks away before it has time to evaporate, our soils tend to be leached or podzolised, and we have also large areas of gleyed soils where drainage is impeded, giving surface water gleys or ground water gleys where there is a high water-table. Surface water gleys may occur in "Drumlin" soils and ground water gleys may be found in depressed sites in association with leached and podzolised groups on higher ground.

The majority of Irish soils were formed initially under a forest cover, later to be superseded by a gramminaceous vegetation. They are relatively young but have been greatly modified by man since the clearance of the virgin forests.

In terms of a world scale our soils fall into the broad division of Pedalfers, or, more specifically, into the zone of the light-coloured podzolised soils of the cool-temperate, humid regions, with extensive areas of intra-zonal soils. Zonal soils are those with clear profiles that show the dominating effect of climate and vegetation in their formation, while intra-zonal groups, for the most part, reflect the influence of some local factor, such as topography or parent material. Our mineral soils fall into two broad groups — the zonal podzolised and the intra-zonal gleyed, these latter resulting from impeded drainage due to impermeability or to a high water-table. We have also organic soils, peats, and alluvial soils.

* Note: An article on *The Soils of Ireland* by Pierce Ryan, B.Agr.Sc., M.Sc., Head of National Soil Survey of the Agricultural Institute, appears in *Irish Forestry*, Autumn 1963.

The main changes taking place at the present time are due to water, mostly rain-water, carrying material downwards in the soil. Where there is free drainage there are usually A/B/C profiles, with the constituents leached from the surface A horizons deposited in the B horizons, both overlying C which is the parent soil material.

The Great Soil Groups which we have in Ireland are briefly described below. There are others which have a more limited range and there are a number of related sub-groups within the main groups.

ALLUVIAL SOILS

This is a scattered group found in river and estuarine basins and the soils which comprise it differ widely in texture and drainage. They are immature with indistinct profiles and are potentially productive if not subject to periodic flooding.

BROWN EARTHS

These are known as "brown forest soils" to distinguish their comparatively uniform, brownish profile from the podzolised soils of coniferous forests and heaths. Recent evidence suggests that they may be the natural soil climax under deciduous forest with podzols forming where the forest was removed and where reversion to heath took place. There are two sub-groups, acid brown earths and brown earths of medium-high base content. The former occur usually on the more acid parent materials such as non-calcareous shales, sandstones, granites, mica-schists and glacial drift of these materials, but may also be found on glacial drift that has been decalcified and base-depleted through weathering and leaching. The second sub-group is associated with limestone or other base-rich rock or glacial drift that has undergone less leaching.

The brown earths are extensively cultivated for agriculture. They are top class forest soils in their natural state, excellent for hardwoods, Douglas Fir and a wide range of conifers.

RENDZINA-LIKE SOILS

These are important agricultural soils and consist of a rather shallow surface soil resting on the parent material, mostly carboniferous limestone or limestone glacial drift. The surface layer is dark brown to black in colour and its organic matter content is high as mineral soils go, with humus of a mull type. Often it has been decalcified by rain to an extent that there are no longer any free carbonates present and where excessive base depletion has occurred soils with A/B/C profiles are found.

Hazel scrub grows naturally on these soils, especially in counties

Clare and Galway, and they are excellent for Silver Fir, Ash, Beech, Sycamore and *Pinus radiata*.

GREY-BROWN PODZOLICS

In Ireland the most common soil on limestone drift is deep and arable and is usually grey-brown in colour. The lighter textured of this group are good all-purpose agricultural soils when well manured and managed but the heavier ones are best suited for grazing use. They are excellent for forestry.

MODIFIED GREY-BROWN PODZOLICS

These soils are found in the eskers of the Midlands. They are a mixed group and many retain a high base status and reaction is about neutral to slightly alkaline. As drainage is good, conditions for tillage are first-rate if slopes are not too steep for easy cultivation. Grazing is good in normal summers, but drought can be severe in dry seasons.

BROWN PODZOLICS

These are the dominant soils of medium elevations on acid parent materials such as sandstones, granites, mica-schists and non-calcareous shales as well as glacial drifts from such sources. When well-drained they are good tillage and all-purpose farm soils, provided they are limed and manured properly. In counties Wicklow, Wexford and Waterford in primeval times they were under oak forest; now they produce good crops when planted with Douglas Fir, Larch and other conifers.

PODZOLS

These are poor soils, deficient in lime and plant foods generally, which commonly occupy hills and mountains of acid rock—shales, sandstones, quartzites, granites, mica-schists—situations where high rainfall and low evapotranspiration combined with acidity allow a considerable downward leaching of bases which include iron and aluminium oxides and humus. The surface layer tends to become acid and micro-organisms engaged in decomposition are discouraged, with the result that raw humus forms on which a heath vegetation grows. There are distinct A/B/C profiles and in extreme cases the B horizon develops a thin iron pan.

These soils can be improved by deep ploughing and manuring and when the surface is level enough they have been reclaimed for farming. Usually, however, they are of little or no agricultural value and large areas have been purchased by the State for afforestation. They will grow pines, especially *Pinus contorta*, and, with deep ploughing to break up the iron pan and manuring with phosphate, may suit Sitka Spruce.



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GIRTHING SITKA SPRUCE AT BREAST HEIGHT IN KNOCKMANY FOREST, CO. TYRONE. When it was 39 years old in 1958 this plot in Compartment 16 carried 6,400 H.ft. on an acre. The tree being measured by Hugh Shiels is $15\frac{1}{2}$ " B.H.Q.G. and 106' high and the one behind John McSorley is $19\frac{1}{4}$ " B.H.Q.G. and 119' high. Since 1958 storm damage has been severe.

SKELETAL SOILS

Thin soils are sometimes found in upland regions interspersed through areas of outcropping rocks. This group, known as Skeletal, comprises ranger, which is a moder-mor humus layer over broken rock of an acid nature, and lithosol which, as its name implies, is composed of coarse gravel and sand. Although not easily improved, surface treatment can raise their value for rough grazing.

GLEYS

These are soils where drainage is bad, with persistent or intermittent waterlogging and poor soil texture. They afford a restricted rooting medium for plants, aeration is unsatisfactory, decomposition of organic matter is slow, encouraging a surface accumulation of raw humus, and when tilled they are found to be sticky and hard to work into a friable state. Under grazing they poach badly. These soils are common in counties Fermanagh, Sligo, Leitrim, Cavan and Monaghan and are highly productive for forestry, especially for Oak and Norway Spruce.

PEATS

Basin peats are formed by the accumulation of plant remains in post-glacial lakes—the deeper layers consisting of swamp species and the upper ones mostly of Sphagnum species.*

Climatic or Blanket peats occur on mountains where they form a continuous cover following the contours of the hills. Their formation results from a cool, humid climate and an acid underlying rock. The layer is usually shallow but some deep peats do occur in the dips in the hills. The lower layers in such cases are usually black and non-fibrous but the more recently formed blanket peats are mostly brown and fibrous. They were derived mainly from Eriophorum, Scirpus and Sphagnum.

Peat is a difficult subject for reclamation due to its high organic content, poverty of plant nutrients, bad aeration and capacity to hold water in large amounts. Efficient drainage combined with mounding have rendered large areas plantable where site conditions such as shelter were favourable and large mountain tracts in the North, North-west, West and South-west have been closely drained and strip mounded by outsize ploughs drawn by crawler tractors. Tree growth on peat benefits from applications of phosphate and dressings of about 1½ oz. per plant are now customary.

* Most of the basin peats are strongly acid but in parts of Armagh and Fermanagh fen peats are found where there is limestone in the drainage water. In some places, such as Loughall, Co. Antrim, deposits of calcereous marl are found under the peat and over grey mottled alluvial sand.

CLIMATE

RAIN

The maritime nature of the Irish climate, with mild damp winters, cool cloudy summers and the strong westerly winds which sweep across the country, has a profound effect on its forests. The heaviest rainfall occurs in the coastal ranges of Kerry, Connacht and Donegal; in the neighbourhood of Mangerton near Killarney 100 inches is not unusual; in Mayo measurements of 70 inches are normal but in Donegal it falls to 60 inches. These figures contrast with 40 inches along the western side of the Central Plain and as little as 27 inches in the "dry" coastal belt near Dublin.

More important than the total amount of precipitation is the large number of days in the year on which rain falls. Rarely has the country less than 200 "wet" days annually, that is, days on which there is 0.1 inches or more of rain. In the West, where the moisture-loaded airstream from the ocean rises over the seaward-facing slopes of the mountains, 250 rainy days are to be expected each year, because heavy condensation of moisture follows the rapid cooling of the air as it ascends to cross the highland barrier. In some years bright sunny weather occurs in spring and early summer, from March to June, leading to droughts which cause losses in newly planted trees, damage in nurseries and fire hazard in the forest.

WIND

The persistent wind from the west and south-west governs the location of forests. Trees, some species more than others, are retarded or totally arrested in growth by constant wind, and the forests need protection against exposure to it if they are to be a success. For this reason our greatest forests are found on the eastern and north-eastern slopes of the hills or in sheltered valleys. Reliance also has come to be placed in two species, Sitka Spruce and *Pinus contorta*, because they are both good wind resisters.

Ireland lies in the highway of the storms which cross the Atlantic to Western Europe at all seasons of the year. Strong gusts of 70 to 80 miles an hour are not unusual, and occasionally storms of up to 100 miles an hour occur. Happily storms of such violence are rare, but even though they may come only once in 10 years they can do severe damage in Irish forests by breaking stems and blowing down trees.

TEMPERATURE

The average temperature in winter ranges between 41° F. and 45° F. (5° C. and 8° C.) and the summer temperature varies from 57° F. in

the north to 61° F. (14° C. to 16° C.) in the south-east. Rarely is there extreme cold for a long period but air frost, especially late spring frosts, can be a problem for the tree grower. These occur less often in coastal regions than in low lying inland plains and they are so infrequent and slight in the extreme south and south-west that sub-tropical plants flourish in parts of Cork and Kerry. Snow is infrequent and falls are usually light and do not lie for more than a few days except on mountains, especially those in the north-west.

ROADS

The total public road mileage in the Republic consists of about 10,000 miles of main roads and 40,000 miles of county roads. The main road system comprises the national trunk roads which amount to 1,550 miles, and the 8,450 miles of link roads joining large towns. Most of the main roads have a waterproof surface, that is, an impervious covering of tar, bitumen, asphalt or similar material, but the surface condition of county roads, the roads serving the areas lying between the main roads, is less consistently good. In some counties, notably Meath, Dublin and Kildare, nearly 100 per cent are tarred, but the proportion falls off in Louth, 79 per cent, Tipperary, 72 per cent, Kilkenny, 71 per cent, Carlow, 65 per cent, Wicklow, 64 per cent, down to 50 per cent in Cork and Kerry, and 19 per cent in Roscommon and Leitrim. For the whole country about 20,000 miles of county roads, representing 50 per cent of the whole, are tarred.

The national trunk road system is based on Dublin and broad thoroughfares branch out from the capital north, south and west in the direction of all the principal towns. Future development aims at improving this network so that by 1975 dual 24' carriageways will stretch from the city to Balbriggan, Clonee, Lucan, Naas and Bray, covering 75 miles in all. Beyond these towns 33' wide three-lane carriageways will reach Dundalk, Navan, Kinnegad, Portlaoighise and Wicklow, a total distance of 150 miles. The remainder of the national trunk roads, 1,325 miles, connecting all the larger towns, will be two-lane 24' carriageways, in accordance with present planning. ("Administration," Summer 1962).

In Northern Ireland there are 13,859 miles of public roads. Of these, a stretch 8 miles in length south of Belfast, has been constructed as a modern motorway, the M1, 374 miles are trunk roads, 956 miles, 1,733 miles and 2,865 miles are class I, II and III roads respectively. The remainder, 7,923 miles, or rather more than half the total mileage, are unclassified roads of varying quality.

RAILWAYS

The rail network of the Republic, like the roads, radiates from Dublin. Main lines connect the capital with the towns of the north, west, south and east coasts. The northern line follows the coast to Dundalk

and then turns inland on its way to Belfast and Derry. The line to the west divides at Mullingar into two branches, to Sligo and to Athlone, where it divides again into the Mayo and the Galway branches. The main southern line runs to Cork with branches at Portarlinton for Athlone and Waterford, Ballybrophy for Limerick, Limerick Junction for Limerick and Waterford, and Mallow for Waterford and Killarney. The east coast line joins Dublin and Wexford where it links at Rosslare with the Waterford and Mallow branch. Many of the smaller cross-country lines which were part of the system have been closed in the last few years. In Northern Ireland railways have been drastically pruned and in 1965 there remained only 237 miles in operation of which the chief stretch is the line linking Dundalk, Belfast and Derry.

INLAND WATERWAYS

The canal system joins Dublin with Waterford via the River Barrow and with Limerick via Lough Derg and the River Shannon. In recent times it has been little used for commercial transport. The Northern Ireland canals are in a state of desuetude.

SEAPORTS

The main ports for ocean-going ships are Dublin, Wexford, Waterford, Cork, Limerick, Galway and Sligo in the Republic; and Belfast, Larne and Derry in Northern Ireland. Most of the coastal towns have small harbours used for bringing in coal, grain and fertilizers and, to a limited degree, for the export of pitwood and other timber. They include Drogheda, Coleraine, Portrush, Newry, Greenore, Balbriggan, Arklow, Wicklow, Dungarvan, Youghal, Kinsale, Bantry, Dingle, Tralee, Kilrush, Westport and Ballina. In addition, harbours at fishing villages such as Howth, Skerries, Dunmore East and Killybegs have accommodation for small trawlers and similar craft. In recent years facilities for container and drive-on, drive-off traffic have been provided at many ports.

POPULATION TRENDS

The population of the Republic in 1961 was 2,818,341 persons. Of these, 1,332,149 lived in Leinster, 849,203 in Munster, 419,465 in Connacht and 217,524 in the three counties of Ulster. Dublin city is by far the most populous area in the state with 537,448 persons, having increased by over 300,000 since 1881; a further 57,840 are in the suburbs. Of the other three county boroughs, Cork has 78,000 in the city and 37,709 in the suburbs and Waterford 28,000, about the same as 80 years ago, and Limerick has grown from 38,000 to slightly over 50,000 persons.

Northern Ireland had a population of 1,425,462 persons in 1961, the highest since 1851 and showing a continuation of the upward trend which

began in this century. Belfast had a population of 416,000 in the city proper, and a further 114,000 persons in the surrounding built-up area.

During the past 35 years the number of persons engaged in agriculture in the Republic has been steadily falling from 644,000 to 452,000, a drop in terms of the national working population from 53 per cent to 37 per cent. In the last quarter of a century the farm population has gone down by one-fifth, the heaviest reduction, over one-third, being experienced on holdings under 30 acres, that is, on about half the farms in the country. A similar change has taken place in Northern Ireland. There, numbers of workers in agriculture, including owners and their families, have dropped from 184,404 in 1945 to 114,700 in 1961, a decrease of 38 per cent in 16 years.

CHAPTER III

THE NATIONAL ECONOMY AND LAND USE

Returns from Agriculture and Forestry

LAND USE

THERE are 20,373,700 acres in the whole of Ireland and the 1961 census returns show its utilization as follows:

	Northern Ireland	Republic
Grain & Pulse Crops	299,000 acres	1,074,000 acres
Root & Green crops	88,000 "	500,900 "
Fruit, flax, etc.	9,000 "	12,600 "
Hay in rotation	290,000 "	305,600*
Other Hay	209,000 "	1,547,500 "
Pasture in rotation	196,000 "	— "
Permanent Pasture	844,000 "	7,963,600 "
Rough Grazing	750,000 "	— "
Woods & Forests	84,000 "	393,300 "
Roads & Buildings	185,000 "	— "
Other land	401,000 "	5,226,200 "
TOTALS	3,350,000 "	17,023,700 "

The predominant use of the land is for the production of grass. In the North just under 1,000,000 acres was being cropped and one-third of this was intended to go back to permanent pasture and one-third for hay. Down South, mostly in the north and east of the country, there was 1,500,000 acres under tillage. Cereal crops in the North include wheat, barley and oats; wheat is confined to small areas in south Down and North Derry but barley is now fairly widely grown in Northern Ireland. In the Republic the important wheat growing districts are in the south-eastern counties of Leinster and in counties Cork, Tipperary and Waterford; barley has become the most important grain crop and

*Includes rye grass for seed and first crop hay only. In the Republic pasture in rotation is bulked with permanent pasture; most of it is permanent. "Other land" in the Republic includes grazed and barren mountain, turf bogs, marsh, water, towns, roads, etc. In Northern Ireland it covers parkland, bog, etc.

is mainly used for feeding purposes in Munster and for malting in Leinster. Only a small amount of oats is grown. Potatoes are by far the most important Irish root crop and occupy nearly half the ground under root and green crops. They are grown on virtually every farm but the areas of commercial production are in Donegal, East Galway and the regions close to the consuming centres of Cork, Dublin and Belfast. The other important cash root crop is sugar beet, grown principally around the four processing factories of Thurles, Mallow, Carlow and Tuam. Commercial fruit is mainly grown south of Lough Neagh, North Derry, Wexford and Waterford.

The production of cattle is the paramount single product of Irish agriculture. In the North there are 1,000,000 head and in the Republic 4,800,000, which includes 1,300,000 cows. Cattle have been the principal source of foreign earnings for many years, exported as stores to Britain, as fat cattle or as carcass meat to there and other countries. The traditional pattern of the trade is that the calves begin their lives on the dairy farms of the deep south, are reared to store stage in Counties Roscommon, Sligo, Galway and Mayo, and are "finished" in counties Kildare, Meath and Westmeath which are famous for their fattening pastures. In most parts the old-time fairs are being replaced by marts and this is leading to a more streamlined system in the cattle trade generally.

Sheep number about 3,500,000 in the Republic and 1,100,000 in Northern Ireland. Galway is the main sheep rearing county but sheep are of considerable importance in all mountain areas. They are concentrated in or near the hill masses of Wicklow, Waterford, Cork, Kerry, the Mourne, the Antrim uplands and the Sperrins. There are 1,000,000 pigs on each side of the Border and the numbers are increasing. Pig production is very much a part of the dairying economy of the southern counties of Munster, but they are kept everywhere and are important on the small farms in the North, in Cavan and Monaghan and in the feed grain areas of the south and east.

FORESTRY AND LAND USE

Nearly all land for forestry lies in the Hill Pasture zone, land which before planting is used for grazing sheep and store cattle. A survey carried out in the Republic in 1949-50 indicated that there was a total area of 1,200,000 acres suitable for afforestation "if its devotion to that purpose would be in the national interest."

CAMERON REPORT

The F.A.O. forestry expert, Mr. Roy Cameron, in his *Report on Forestry Mission* in 1951 went into the question of probable yield of timber and its value. He assumed that 69 H. feet per acre per annum

would be a realistic assessment of the average yield of Irish plantations, many of which will be on poor soil, and that 325 H. feet would go to produce a Petrograd standard of lumber, 165 cubic feet true measure, at that time costing £45 f.o.b. and £53 to £55 laid down in Ireland. With a growth rate of 69 H. feet per acre, Mr. Cameron pointed out, 4.7 acres of trees would produce in one year the roundwood needed for a standard, or a gross return of about £10 per acre per annum.

"A realistic assessment of the situation," Mr. Cameron stated, "demands recognition of the fact that the lands required for the production of timber on an economic basis are to a large extent lands of value for hill grazing, although their carrying capacity for stock may often be quite low," and he shows his understanding of Irish farming by adding, "The problem is complicated by the fact that in many instances the hill grazing is necessary as a complement to valley agricultural lands. Its withdrawal from that use will destroy the economic soundness of many existing farm units."

The conclusion drawn by this expert was that in the light of all the facts ascertainable by him a "commercial" forest of 470,000 acres should be the national target.

No figures of the agricultural return from hill grazings were given by Mr. Cameron. The Acland Committee in Great Britain accepted a figure of 10 lb. of mutton as the yearly production of an acre of land of the type used for afforestation. This was in 1917. A revised figure in 1943 was 6.66 lbs. of mutton, dead weight, and 1.75 lbs. of wool. In terms of a plantable acre, that is excluding unplantable land with some grazing value, the corresponding yields are 12.38 lbs. of mutton and 3.25 lbs. of wool. "Put in another way" the 1943 British Report on Post-war Forest Policy says, "on the average the afforestation of 100 plantable acres of hill land displaces 110 sheep, of which 75 are ewes."

RETURNS COMPARED

In 1957 a report on *Forestry, Agriculture and Marginal Land* in Britain gave the findings of a Working Party which examined the economic aspects of the transfer of land from agriculture to forestry by comparing the costs and yields of actual examples of forestry and agricultural enterprises which were being carried out side by side. They chose areas in the New Forest and the Sherwood Forest as examples of poor light land and areas in Northumberland and Montgomery as examples of marginal farm hill lands. The studies showed that if farm buildings had to be provided there was little to choose in the New Forest between investment in forestry or in agriculture (5.9 per cent and 5.42 per cent respectively). Improvement of farmland by fencing, draining, manuring and re-seeding, but with no outlay on buildings, yielded 19 per cent from agriculture. In the Sherwood Forest the comparison showed that the return from agriculture, 6.5 per cent, was about as

good as that from forestry, 6.7 per cent. On the marginal uplands forestry tended to have a slight advantage with a return of 6 to 8 per cent on the invested capital against 6 to 7 per cent for agriculture.

The conclusion from these studies was stated: "Capital investment in agriculture achieves its maximum rate of return within two or three years, whereas in forestry it does so only in, say, fifty or sixty years. But even after making allowances for such considerations, we have formed the view that in the long term, afforestation of marginal land would yield greater import savings than would agricultural development. The balance in favour of forestry might be substantial, and we think it probable that future generations would reap larger direct returns if much of our marginal hill land was afforested than if it were all retained in agriculture."

FIRST PROGRAMME FOR EXPANSION

These conclusions are valid for this country as conditions are generally similar. No comparable study has been made here and calculations of returns from investment in forestry tend to be academic. In Northern Ireland it has been shown that an interest rate of 3—4 per cent may be expected, which is the same as the figure arrived at by the Forestry Commission for their plantations in Great Britain. The study of the Republic's economic development which preceded the Government's first Programme for Expansion adopted in 1958 speaks of the "discouraging conclusion . . . that moneys invested in the forestry programme would produce a return of no more than 2½ per cent per annum." This conclusion resulted from an analysis of costs and returns which was made in 1956 assuming a 50 year rotation and a continuance of expenditure and returns at 1956 money values. A later examination which took into account economies in labour costs, resulting from work study and an incentive bonus scheme, and assumed an increase to general import levels in the prices of forest products sold from the State plantations showed a net financial yield of 5¼ per cent per annum on the total outlay. "This means," it is stated in the study, "that if the cost assumptions are realised and there is, in fact, a market at the expected prices for the timber available, a 50 year sawlog rotation could be secured without loss if the compound interest rate did not exceed 5¼ per cent on all outgoings." For these calculations volume production in thinnings and final crop was derived from the British Forestry Commission Yield Tables, which were available for all species except *Pinus contorta*: for this species estimates of volume based on measurements of immature Irish plantations had to be employed.

SECOND PROGRAMME FOR EXPANSION

The Second Programme for Economic Expansion which appeared in 1964 sounds a warning. "The rise since 1958 in wages and other costs

. . . may affect the ultimate financial return." It is pointed out that this ultimate return, leading to the 5¼ per cent profit anticipated five years before, will depend on factors at present conjectural such as thinning yields and length of rotation, as well as future prices of pulp wood and timber, "any one of which can materially affect the profitability of the investment."

EMPLOYMENT

Not the least of the "profits" from forestry investment is the work provided for adult male labour. In recommending a "social" forestry programme, Cameron speaks of the West where "tens of thousands of acres" are so poor that the local population must either emigrate or live on doles and says: "Forestry seems to provide an answer to this unfortunate situation . . . as modern mechanical planting techniques give promise of forests on lands on which formerly trees could not be made to grow . . . Regular employment would be provided during that part of the year when rural employment is scarce." The 1958 study endorses this view: "Because of the substantial employment it provides . . . the present planting programme would be justified, notwithstanding the heavy financial burden, if there was a reasonable expectation that the financial outcome envisaged would be realised." The 1964 Programme reiterates this point: "Because of the remunerative employment afforded, forestry can stimulate the economic life of many rural areas." In Northern Ireland the provision of employment is again an important investment criterion. It is hoped there that with the expansion of forestry a thriving body of workers and their families can be built up, both directly in forestry and indirectly through the establishment of new industries.

In 1963 there was an average of 1,300 workers employed by the Forestry Division in Northern Ireland or 2 men per 100 acres of plantation. The total number directly employed in State forestry in the Republic in 1964 was about 5,600; no figures are available for indirect employment which arises in the felling, extraction and utilisation of forest produce. Employment will rise with the annual increase in forest area and the development of plantations and the total number directly employed is expected to reach 6,400 in 1970; indirect employment will naturally go up also.

TOURISM

An ancillary benefit of forestry is in the realm of tourism. As many forests are situated in areas of scenic beauty they can become an asset to the tourist industry. This aspect of their value is being exploited by the improvement of forest routes, car parks and game shooting, and National Forest Parks have been opened at Tollymore and are planned for Killarney, Gouganebarra, Rockingham and Glendalough. Work has started on the John F. Kennedy Memorial Forest Park at Slieve Coillte, New Ross.

CHAPTER IV

SPECIES OF TREES IN IRISH PLANTATIONS AND THEIR SILVICULTURE

IN Ireland we have a bare dozen indigenous species and of these only three or four are of any forestry importance. Oak was the predominant tree at one time and most of the primeval forests in the lowlands were either pure Oak, or of Oak growing in association with Ash, the second most important species. The other species which occurred in large areas of ancient Ireland was Birch, alone or in mixture with Ash, Oak or Alder. The remaining "natives" are Wych Elm, Cherry, Whitebeam, Rowan, Willow, Hawthorn and the Poplars, the Grey Poplar and the Aspen, never more than scattered individuals or small groups. Even less significant are the other members of our native woody flora—Holly, Crab Apple, Juniper and Yew. Scots Pine, at one time plentiful in Ireland, is considered to have disappeared at an early stage in our forest history.

EXOTIC TREES

Little is known about the first introductions of exotic species. According to Loudon, the oldest foreign tree in his time was an English Elm planted at Howth Castle about 1585. The next introduced trees are said to be a Sycamore planted on the terrace of the Old Palace at Kilmore, Co. Cavan, by Bishop Bedell in 1632 (and still there in 1964) and an Evergreen Oak planted at Courtown, Co. Wexford before 1648. Tighe, in the Survey of Kilkenny, states that at Rosannarrow in that county there was in 1801 a fine avenue of Elm, put down in commemoration of King William's entertainment there with his army on his way to Carrick on the 20th July, 1690. At Moira, Co. Down, a number of exotics were planted at about this time by Sir Arthur Rawdon. At Kilruddery, Bray, the Spanish Chestnut in the Deerpark dates from 1690, and Loudon records large trees of this species growing at Malone near Belfast, and says that they were there before 1700.

In the early eighteenth century trees imported from abroad were widely planted. Rev. J. K'Eogh, chaplain to Lord Kingston at Mitchelstown, Co. Cork, published in 1735 his *Botanologia Universalis Hibernica* containing the names of all the introduced species known to him. He lists Bay, Box, Cypress, Fig, Medlar, Myrtle and Tamarisk grown in gardens and Pine, Chestnut, Savin Juniper and Walnut in parks and

fields. Ornamental planting was done at Castleward, Co. Down, between 1710 and 1759 and Tulip Tree, Flowering Ash, Maritime Pine and Silver Fir were planted. Robinson founded a nursery in Kilkenny in 1765 and introduced the Turkish Hazel, Ailanthus, Judas Tree and other species grown in the London nurseries at that time. In 1770 the Earl of Clanbrassil in Co. Down and John Foster at Oriel Temple in Co. Louth started planting exotics. Foster, one of the instigators of the Glasnevin Botanic Gardens, Dublin, founded in 1798, had at Oriel Temple a greater number of foreign species than were to be found anywhere else in the country. He appears to have been the introducer of Red Maple, American Horse-chestnut, Sophora, Portugal Laurel, Canadian Poplar, *Quercus palustris*, Lucombe Oak, *Quercus aegilops*, *Thuja occidentalis*, *Pinus cembra*, *Betula lutea*, *Tsuga canadensis* and American Larch. The same species were planted by the Earl of Clanbrassil at Dundalk and at Tollymore Park, Co. Down, and trees sent by him to his mother at Cypress Grove, Templeogue, Co. Dublin include Robinia, Hornbeam and Virginian Juniper. John Templeton had brought American species to his grounds at Malone, Belfast, about 1770 and these included Bank's Pine, *Pinus mugo*, Canadian Maple and Liquidamber. Lord Ferrard, a son of John Foster, introduced *Cupressus lusitanica* in 1809 and *Cunninghamia lanceolata* to Oriel Temple in 1823. At Charleville in Offaly Norway Maple and many other species were planted in 1785. Tighe, in the Survey of Kilkenny, refers to a Cork Oak which in 1801 was 5' 1" in girth at ground level and to large Lime, Horse-Chestnut, Beech and Plane. Dubourdieu, in the Survey of Antrim, mentions Sycamore and Spruce which were apparently common trees in 1812. Weymouth Pine at Adare and Balsam Poplar at Ballybeg, Co. Kildare, are recorded by Wakefield in his *Survey of Ireland* in 1812.

After 1840 conifers became the fashion. Their popularity was increased by the discovery of the western North American species which thrive so remarkably in our climate. Broad-leaved trees were less and less cared for and this tendency has continued to the present day. Hard economic realities support this preference—conifers are the only trees which will grow profitably in the poor land available for afforestation and their timber, softwood, is much more in demand than the hardwood produced by broad-leaved species.

AVONDALE EXPERIMENTAL PLOTS

At the commencement of this century the development of forestry was one of the cares of the newly formed Department of Agriculture and in 1903 steps were taken to establish a school in which young men could be trained in general forestry work in a practical way. Avondale estate, near Rathdrum, Co. Wicklow, was bought by the government for the purpose. This was the old home of Charles Stewart Parnell and formerly the property of Samuel Hayes, an enthusiastic tree planter and the

author of a book entitled *Planting* published in 1794. It contained a mansion house and outbuildings, about 200 acres of grassland and over 300 acres of woodland.

In addition to the training of foresters, it was felt that experiments were needed to test the suitability of many species for commercial planting. Recently introduced trees had never before been planted on sylvicultural lines and their economic value was unknown. It was decided that Avondale should be used to show, as far as this could be done in one place, the cost of production, yield in timber and comparative market value of the species planted.

Over 100 acres was laid out in the open park as plots and a number of clumps of the rarer species were planted in corners and spaces between the plots. An arboretum was formed near the mansion house and the two acre garden was turned into a tree nursery. From 1905 to 1912 120 acres of sample plots were planted. The open park was bisected by a broad glade three chains in width, having on each side of it a single row of trees, each tree being of the species in the adjacent plot. Right and left of the glade one acre plots 10 chains in length and 1 chain in width were planted, the narrow end of each plot adjoining the edge of the glade. There were ten main sections, the four at the north end consisting of broad-leaved species, the six at the south end of conifers. Further sections were formed on the slopes and low ground near the river, making nineteen sections in all comprising the following genera:

Acer, *Ulmus*, *Fagus*, *Castanea*, *Carpinus*, *Quercus*, *Fraxinus*, *Carya*, *Juglans*, *Platanus*, *Liriodendron*, *Prunus* and *Populus* amongst the broad-leaves, and *Abies*, *Picea*, *Pinus*, *Larix*, *Cedrus*, *Pseudotsuga*, *Tsuga*, *Cupressus*, *Juniperus*, *Thuja*, *Sequoia* and *Cryptomeria* of the conifers.

Many of the species were failures and their places were taken in the plots by the auxiliary species intended as nurses. Others proved their worth and all the following which were tried out at Avondale are now important species in Irish afforestation:

Abies procera, *Abies grandis*, Sitka Spruce, Norway Spruce, Corsican Pine, Scots Pine, *Pinus Radiata*, European and Japanese Larch, Douglas Fir, *Tsuga heterophylla*, Lawson Cypress, *Cupressus macrocarpa*, *Thuja plicata*, *Populus serotina* as well as Oak, Beech, Ash, etc. *Pinus contorta* was unknown at the time. A fuller account of the Avondale experimental plots is given in Chapter VIII.

A picture of the general composition of Irish State Forests may be gained from the statistics published by the two Forestry Services. In Northern Ireland the percentages of each species planted over the ten years from 1924 to 1934 was:

STATE PLANTATIONS

	1923/4	1924/25	1925/26	1926/27	1933/34
Douglas Fir	34.4%	11.1%	24.2%	19.6%	2.9%
Norway & Sitka Spruce	33.3%	59.6%	57.3%	51.4%	63.4%
Scots & Corsican Pine	.	17.3%	7.7%	17.6%	12.8%
European & Jap. Larch	32.3%		8.0%	7.4%	17.1%
Others		12 %	2.8%	4.0%	3.8%

Over the years since 1934 the exact proportion of species varied from year to year in accordance with the nature of the ground planted but the general framework is:

CONIFERS

Sitka Spruce	55%
Norway Spruce ...	10%
Larches	7%
Pines	16%
Other conifers ...	6%
	<hr/>
	94%

HARDWOODS

Beech	2%
Oak	2%
Ash	1%
Other hardwoods ...	1%
	<hr/>
	6%

In the Republic the composition of State Forest plantations is as follows:—

	1938/39	1939/40	1940/41	1941/42	1942/43
Norway Spruce	12½%	18 %	20¾%	20¾%	17¼%
Sitka Spruce	13 %	13½%	18¼%	16 %	14¾%
Eur. Larch	7¼%	8¼%	6½%	5 %	4½%
Jap. Larch	6¾%	6¾%	3½%	1¼%	4¼%
Scots Pine	27½%	13 %	19 %	28 %	26½%
Corsican Pine	2¼%	2 %	1¼%	1¼%	1¾%
Other Pines	18½%	26¼%	18¼%	14 %	16 %
Other Conifers	1 %	¾%	1 %	1½%	1½%
Oak	3¼%	3 %	3½%	3 %	2¼%
Ash	1½%	2¼%	1½%	2 %	1¾%
Beech	4¾%	4¾%	4¾%	6 %	6¼%
Other Hardwoods	1¼%	1½%	1¼%	1¼%	2¼%

In recent years there has been a remarkable rise in the proportions of Sitka Spruce and *Pinus contorta* used annually:

CONIFERS

	1959/60	1960/61	1961/62
Sitka Spruce ...	44.9%	44.1%	41.7%
<i>Pinus contorta</i> ...	28.6%	30.9%	30.4%
Norway Spruce ...	9.4%	10.1%	10.0%
Scots Pine ...	3.9%	3.3%	3.7%
Jap. Larch ...	1.4%	1.6%	1.2%
Corsican Pine ...	0.2%	0.2%	0.7%
European Larch ...	0.4%	0.1%	0.2%
<i>Abies procera</i> ...	3.0%	3.7%	4.9%
<i>Abies grandis</i> ...	1.8%	0.4%	0.5%
Other conifers ...	2.9%	2.4%	3.0%

HARDWOODS

	1959/60	1960/61	1961/62
Beech ...	1.3%	1.1%	1.1%
Oak ...	0.6%	1.0%	0.8%
Ash ...	0.1%	0.1%	0.1%
Birch ...	0.8%	0.4%	1.0%
Sycamore ...	0.2%	0.4%	0.5%
Other Hardwoods ...	0.5%	0.2%	0.2%

TOTAL

Conifers ...	96.5%	96.8%	96.3%
Hardwoods ...	3.5%	3.2%	3.7%

Notes on Species

INDIGENOUS TREES

The first trees to be cultivated in Ireland were, naturally, those native to the country, but the extent of planting was very limited. A. C. Forbes comments: "So long as native trees abounded there was little or no incentive to add to their number by planting" and he dates the first planting to the twelfth century, when yews were grown in monastery grounds and castle gardens.

YEW. *Taxus baccata*, Linnaeus.

This slow growing tree is no longer considered worth planting for the value of its timber. The *Topographia Hiberniae* of the fourteenth century states that "yew is commonly planted in cemeteries" and the theory has been advanced that these places provided the only enclosed grounds where the tree, essential for archers' bows but deadly poisonous to horses and cattle, could be safely grown out of the reach of these animals. In later days its hard red timber was valued for furniture, panelling and veneers.

The Irish Yew is a fastigate sport of the Common Yew which originated at Florencecourt near Enniskillen in 1780.

There are large Common Yews at Maynooth College, said to have been planted by Maurice Fitzgerald in the twelfth century, at Crom Castle, Co. Fermanagh, Muckross Abbey, Killarney, 58' x 9' 9", Kilmacurragh, 42' x 9' 4", Tollymore, 50' x 10' 7", Shelton Abbey, 16' girth at ground, and many other places. It is a proverbially long-lived tree.

The above measurements were made at the time of the Conifer Conference in 1931.

OAK. *Quercus robur*, Linnaeus (*Q. pedunculata*, Ehrhart) and *Q. sessiliflora*, Salisbury.

This was the chief tree in the forests of ancient Ireland and for many centuries supplied the timber for houses, boats, furniture, vehicles, bridge building and purposes for which large sizes, durability and great strength were essential; oak bark was used for tanning and its branches for firewood. The most famous of the old oak woods, remnants of which still exist, were at Shillelagh, from which was obtained the roofing of Westminster Hall; Abbeyleix, where many trees were reserved for the Royal Navy during the Napoleonic War but are still there as they were not needed following Nelson's victories; Dartrey near Cootehill; Shane's Castle; Glengariff; Doneraile; Glaslough; Ballykelly which supplied the timber to build Derry; and Oak Park, Carlow.

Most of the old woods were self-sown or resulted from coppices, but when artificial means were employed the usual method of growing was by dibbling the acorns when freshly fallen from the trees in autumn directly into their final situation. A. C. Forbes quotes from an account book of 1730 for Acton's estate at Kilmacurragh an item of £200 "for dibbing trees." This method continued to be practised in the estates and is still employed in the very limited growing of oak by the State services. A common way is to dig square or diamond shaped beds about four feet across 20 feet apart on the planting ground and to sow a dozen or more acorns in each bed. The intervening space is filled with Norway Spruce. Subsequent care must be meticulous and it consists of thinning the groups of oak to a single tree which usually needs pruning, and removing spruce to prevent smothering. Examples are in the State forests at Kilcooley, near Urlingford, Newcastle, at Ballymahon, and at



Pinus contorta in Compartment 8, Kilworth Forest, Co. Cork,
about 25 years old.



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High pruning Sitka Spruce to 16 feet in Ross Forest, Co. Galway.

Inistioge, all about 25 years old. When propagated in nurseries oak is usually two or three years of age when planted out, having been transplanted once or twice.

Oak thrives only in deep, rich, fertile loams or brown earth soils, or deep clays where it will grow fairly rapidly. It really requires ground of agricultural fertility which rarely comes into the hands of the State foresters. On less fertile sites the Sessile Oak is better than the Durmast Oak.

Oak needs a long rotation, at least 120 years.

ASH. *Fraxinus excelsior*, Linnaeus.

Next to Oak in ancient Ireland Ash was highly valued and was used for shafts for weapons, tool handles, wheel making, hurleys and as fuel wood. It rarely occupied extensive areas and was at its best on fertile, deep, well drained loams over limestone rock; poorer trees occurred on heavy clays or on gravel soils and it was never found on poor soils, sands or peat. An Ordinance of 1534 laid down: "It is enjoyned that every husbnde having a plough within the Englishe pale shall sette by the year 12 ashes in the ditches and closes of his farme upon payne of 2d. to be forfyte to the Deputy."

Nowadays Ash timber is much in demand for sports goods and handles and is also used for vehicle building. It is planted by the forest services wherever soil is found suitable to its exacting needs.

Ash coppices freely and it is seen most often in that form, often with standards which have developed from seedlings. The best trees are those which are fast-grown, because slow-grown ash has a high percentage of porous wood and is soft, weak and brittle. In counties Meath and Westmeath ash thrives remarkably and is a common hedgerow tree.

It is grown from seed either directly after collecting in autumn, or stored layered in sand and sown in the second spring. It is fit for planting in two or three years and grows rapidly from the start. It is best felled before 60 years and rotations never exceed 70 years.

BIRCH. *Betula verrucosa*, Ehrhart, and *B. pubescens*, Ehrhart.

Birch was a plentiful tree in the primeval forests of Ireland but was of small importance for timber and usually existed as scrub on the margin of bogs and on the lower slopes of the hills. It is still plentiful on waste ground today as it is a pioneer species quick to invade and colonise bare land and succeeds on varied soils and situations. Most abundantly does it grow on newly felled woodland where once it has gained a foothold it grows rapidly and in a few years forms a dense thicket.

Birch is seldom planted in the Republic although it is a useful shade tree to protect frost tender species. In places natural thickets

are opened for underplanting with more valuable shade-bearing species, the over-storey of birch being gradually removed before the whipping of its wiry twigs damages its nurslings. In the North large numbers are planted as soil improvers in a mixture with Sitka Spruce on infertile peat soils.

Birch is easily grown from the tiny seed scattered lightly and barely covered in the nursery. It is planted at two or three years of age and rarely left to stand for more than 30 years when it produces good close-grained wood suitable for small round articles such as cotton reels and tool handles. In Scandinavia it is highly valued for plywood making and charcoal burning.

ALDER. *Alnus glutinosa*, Gaertner.

This is a tree of moist mineral soils by lake and riverside and is never found at any distance from water. It was always a scarce species and is now only grown for planting wet land liable to periodic flooding or for forming a fire screen along the margins of inflammable conifer plantations. It is easily grown from seed or propagated by coppicing on a short rotation. The timber is light and is used for clog soles, toys, small handles and broom heads.

In Pynnar's Survey of 1618 there is this reference: "The Earl of Abercorn built near the town of Strabane some large timber houses, the groundsells of oaken timber and the rest of alder and birch which is well thatched with heath and finished."

ELM. *Ulmus*.

The wood of the Elm is tough and resilient and has a high resistance to splitting. Its common use was for the hubs of cartwheels to hold the close-set spokes and for the heads of larger mallets. Water pipes were made of elm—the elms of the Grand Canal in Dublin were planted in 1766 for this purpose—as were water pumps and structural work like dock timbering as this wood when kept constantly wet did not perish for many years.

In spite of the demand for its timber—it is popular for coffins, too—Elm has never been much planted. It needs a fertile soil and flourishes on the alluvial deposits on the banks of rivers. The great Elm of St. Wolstan's beside the Liffey at Celbridge was 38' in girth at the time it was blown down in 1776 and was regarded by Samuel Hayes as the largest of its kind in the world. There is a plot at Avondale and occasional patches in the Department's plantations, but it mainly exists as avenue and hedgerow trees.

The Wych Elm, *Ulmus glabra*, is one of our three indigenous species, the others being *U. major*, known as the Irish Elm, and *U. nitens*, Moench, the so-called Cornish Elm which is probably wild in the south of Ireland. The Wych and Cornish Elms are raised from seed picked off the tree as soon as ripe in late June and sown immediately; the Irish

Elm can be propagated only from root suckers which spring up plentifully around mature trees.

PINE. *Pinus sylvestris*, Linnaeus.

The Common or Scots Pine has a wide distribution over Northern Europe and Asia and is an indigenous species with us, but it is probable that the native race became extinct and has been replaced by trees of foreign origin.

This pine spread widely in Ireland during a cycle of warm and relatively dry weather in about 2,000 B.C. A later deterioration in the climate with an increase in rainfall led to the formation of peat which killed the pine trees growing on the bogs and covered and preserved those blown over in the gales of that period of oceanic weather. The great stumps and spars of "bog deal" buried deep under peat in all parts of the country provide evidence of this occurrence. The Book of Leinster tells that the House of Cruachan, seat of Queen Maedbh of Connacht, was built of pine (ochtach) reclaimed from the bog, covered with wattles of oak and lined with polished yew timber. This practice of using "bog deal" for building as well as for fuel persisted until recent times, as did, too, the use of strips torn from straight grained logs and plaited to make ropes and as tapers for lighting in country cabins.

There is evidence suggesting that there were pines in our forests as late as the sixteenth century. Harvey, who accompanied Essex in Ireland, tells of a "great fir tree" which he came on in Kilkenny when he got lost during a wolf hunt and in a later reference he mentions "an ancient wood of fir trees" near Garrett Fleming's castle at Ballaclinte on the Lagan.

The cultivation of Scots Pine in modern times is dealt with in the following section.

WILLOW. *Salix alba*, Linnaeus.

An inhabitant of river banks and wet places, the native Willow is not a common tree. The timber is used for making chip baskets, and "osiers," grown on coppiced stems, were at one time in demand for baskets and furniture making. The tree is easily propagated by cuttings.

POPLAR. *Populus canescens*, Smith.

The Grey Poplar is the only one of the genus which is an undoubted native. It is rare and is found most plentifully in the fertile lowlands of the south.

CHERRY. *Prunus avium*, Linnaeus and *P. padus*, Linnaeus.

The Gean is widespread and, although commonest on the limestone, is found growing in oak woods along valley sides in Co. Wicklow and in the south. It is seldom planted even though it can grow into a sizeable tree and produce a beautiful timber prized for turnery and carving.

P. padus, the Bird Cherry, is rare and never attains any size.

MOUNTAIN ASH and WHITEBEAM. *Pyrus aucuparia*, Gaertner and *P. aria*, Ehrhar.

The Mountain Ash or Rowan is found wild all over the country and is met in the valleys of the Slieve Bloom and other mountain ranges. The wood is fine grained and has been used in turnery. The Whitebeam prefers a dry limestone soil and is seldom seen.

ARBUTUS UNEDO, Linnaeus.

This small-growing evergreen is found only in Co. Kerry, south-west Cork and at scattered points as far north as Lough Gill in Co. Sligo.

JUNIPER. *Juniperus communis*, Linnaeus.

The Common Juniper grows wild in limestone areas of the West as a small, often prostrate, shrub.

Introduced Species from Great Britain and the European Continent

This section includes only species valuable for their timber which are used in commercial forests and omits the many imported trees which are planted for ornament or interest.

As soon as the country became sufficiently pacified to permit of tree planting by people who had obtained grants of land in Ireland, small numbers of foreign species were imported from England and Scotland by the settlers. This probably started in a small way in the seventeenth century, there are references to Beech at Eyrecourt, Hornbeam at Kilmore, Co. Cavan, Scots Pine at Galway Bay and English Elm, Spanish Chestnut, Lime, Walnut, Sycamore and Evergreen Oak at other places. The continental species, Walnut, Sycamore, Spanish Chestnut and Evergreen Oak were familiar trees in England, having, it is said, been introduced by the Romans, and our first plantings probably came from there. The spurt in planting which accompanied the laying down of demesnes in the eighteenth century led to the establishment of many

nurseries and from that time it is likely that the seed of Norway Spruce, Silver Fir, European Larch, Austrian, Corsican and Maritime Pine, Maple, as well as of those species already introduced, was obtained direct from their native countries.

SCOTS PINE. *Pinus sylvestris*, Linnaeus.

The first genuine "Scots" pine in Ireland may possibly have been one planted by a Cromwellian soldier named Porter at Killeen on Galway Bay about 1652, and mentioned in Dutton's Survey of Co. Galway. Pocock in the account of his 1725 tour tells of seeing "20,000 firres on the south of Coolnamucky (Carrick-on-Suir) which thrive much." Loveday, who was at Thomastown, Co. Tipperary, the family home of Father Mathew, in 1732, saw "large plantations of Fir." A "colony of Scotchmen" was planted at the base of Torc Mountain, Killarney, according to Sir Richard Hoare who was there in 1807. Planting of this and other species had been actively pursued throughout the preceding century, encouraged by grants paid by the Royal Dublin Society from 1741 to 1809, the seed of Scots Pine being, as far as we can tell, imported from Scotland. It played a great part in the wave of estate planting throughout most of the nineteenth century, and when State Foresry started in 1904 Scots Pine was a prominent species in the first years of afforestation, especially as a nurse with other trees, and a 1½ acre plot was put down at Avondale. As the percentage figures quoted earlier show, it retained its popularity for many years and as recently as 1945/46 it stood at 38½ per cent of all trees planted. Later it suffered a setback, due to the poor performance of many plantations, resulting possibly from seed of unsuitable provenance. Any successful plantations were in the drier climate of eastern Ireland and with the shift of afforestation to the rainy zone west of the Shannon the use of Scots Pine fell rapidly until today it is no more than 4 per cent of the annual planting programmes.

In the Republic in 1962 there was an acreage of 39,000 or 11 per cent of the whole, and in the 1958 census of crops 10 years and upwards 25,000 acres or 21 per cent of the total for the country was either pure Scots Pine or mixtures of which it was the principal species. Growth measurements made at that time showed that it had an average volume of 617 H ft. per acre. A later survey indicated that over half the Scots pine plantations rated as Quality Class II and over and it is reckoned that they will produce an average gross yield of 4,000-5,000 H. ft. per acre in a rotation of 50 years.

The experience with the species in Northern Ireland was much the same. There, they find it is at its best in the eastern half of the country, particularly on sheltered sites near the sea. Further west it succeeds best on fen peats and other low-lying and fertile areas. Supplies of seed are now being obtained from Western Scotland instead of from

Eastern Scotland or Germany and Scandinavia as was formerly the practice.

In the country generally Scots Pine is still regarded as an important species. It will make a fair start on nearly any site, although it may never form timber on unsuitable ones such as highly limy soils or shallow soils over limestone, compact Old Red Sandstone soils, or ill-drained acid peat. On many poor soils—dry sands or gravel moraines it will do well and it is quite happy among the heather on dry peat sites. It will not stand exposure, especially from the sea, and is useless as a shelter tree in the West of Ireland. It is easy to raise from seed and may be planted as two-year or three-year-old transplants. It takes root readily, is completely frost hardy and puts up a good show in new plantations. Although "light demanding" it is best kept close, 4½' or 5' apart at most, and should receive only the lightest thinnings in the first twenty years. A study of its growth rate has shown that only 8 per cent of the volume of timber produced in 50 years grows in these first two decades, compared with nearly 30 per cent for other common conifers, and that any reduction in the number of stems lessens the rate of growth as well as encouraging grass and weeds to come up under the light canopy of the pine.

Large Scots Pine are common all over the country. At the time of the 1931 Conifer Conference notable trees were at Curraghmore, 103' x 14' 4", Kilronan, 88' x 7' 10", Birr, 92' x 6' 10", Castlemartyr, 105' x 9' 6", Muckcross, 90' x 7' 8", and Headfort, Kells, 117' x 7'. There are good plantations at Mount Anglesby, Clogheen, about 45 years old and of Quality Class I, and slightly younger Quality Class I stands at Croneybyrne, Rathdrum Forest.

The wood, which is of medium hardness with a red coloured heartwood, has a great many everyday uses—as building timber for joists and joinery, transmission poles, pit props, railway sleepers, chip and wall-board and paper pulp—and it absorbs creosote and other preservatives readily.

The timber is imported under several trade names—Red Deal, Baltic Redwood, Archangel Fir, Riga Fir and so on and is probably the timber in most common use in Europe today.

Maladies of the Scots Pine include Honey Fungus, *Armillaria mellea*, Butt Rot fungus, *Fomes annosus* and Pine Needle Cast fungus, *Lophodermium pinastri*. Attacks by Pine Weevil, *Hylobius abietis*, can be severe; Pine Bark beetles, *Myelophilus piniperda* and Pine Sawfly, *Diprion pini* and *Neodiprion sertifer* occasionally do spectacular damage.

CORSIKAN PINE. *Pinus nigra*, var. *calabrica*, Schneider.

This pine, from Corsica and the shores of the Mediterranean, is a bad transplanter and hard to establish, but once it has taken root it grows rapidly and far exceeds the Scots Pine in height and in timber

production. It likes a light sandy or gravelly soil and, as it tolerates wind, it is useful for sand dune afforestation and for gravel ridges. It has been mixed with *Pinus contorta* on the poor soil of Forth Mountain in Co. Wexford and at Nephin Beg Forest in Co. Mayo. Three one acre plots were planted in Avondale between 1905 and 1909. There are old stands on private land at Ballyhad in the Vale of Clara and at Ballinahinch, Ashford, in Co. Wicklow. This last, on half an acre, carries a remarkably high volume of timber. The wood is a good general purpose softwood, inferior to Scots Pine.

AUSTRIAN PINE. *Pinus nigra*, var. *austriaca*, Arnold.

The Austrian Pine tends to be heavily branched and it produces a coarse soft timber of poor quality. It is useful for shelter on the exposed margins of plantations and will do on a dry limestone gravel. There is a one acre plot at Avondale but it has not been used in State afforestation.

MARITIME PINE. *Pinus pinaster*, Aiton.

Extensive tracts of sand dunes in south western France were reclaimed in the last century by this pine which is a native of the lands bordering on the Mediterranean. It has been used by the forestry service to afforest sand dunes at Curracloe, Co. Wexford, and Ards, Co. Donegal, sowing the seed directly in the sand. Large trees were reported at the time of the Conifer Conference in 1931 growing at Curraghmore, 98' x 10' 9", Shelton 72' x 9' 8", Glenstal, 92', Muckcross, Killarney 116' x 6' 7", Tollymore 82' x 11' 2" and a few other places. There are extensive woods at Mullaghmore, Co. Sligo, grown from 1850 onwards by direct seeding in the sand dunes and peat bogs near Cliffoney.

EUROPEAN LARCH. *Larix decidua*, Miller.

This is a tree of the high mountains, the Swiss and Austrian Alps, Eastern Poland and the Tatra Mountains in the Carpathians. It was probably first brought to Ireland around 1740,—A. C. Forbes writes of one at Greenmount, Co. Antrim cut down in 1910 which showed 165 annual rings on the stump which would give 1745 as the year of planting. He mentions, too, a tree at Carton planted after 1750 and other old trees at Doneraile, Abbeyleix and Headfort. In a statute of George III in 1776 for the protection of trees and woods in Ireland "larix" is listed as a timber tree, suggesting that it had already taken its place in the "afforestation drive" on private estates, its appeal being its capacity to produce strong and durable timber at an early age.

At the time Avondale was laid out European Larch ranked high in favour and was planted as a principal species and as a nurse. In the early state plantations it formed from 7% to 10% of the species used and when the conditions were to its liking, with a deep, moderately

fertile and well-watered loam or gravel, and shelter from wind, it did well. Later, when afforestation spread to poor mountain and peat lands, it was less and less planted and today accounts for no more than 0.2% of the trees used annually. There is an area of 8,300 acres with larch as the principal species in the State forests of the South, representing 2% of the whole. In Northern Ireland it has proved disappointing and the only satisfactory plantations are on the coast of Co. Down. At Tollymore there is a stand of Quality Class I planted in 1936.

It is either pure grown or mixed with Scots Pine or Beech. Pure crops are found to suffer badly from Larch Canker fungus, *Dasyscypha willkommii*, especially on border-line soils, and the second species helps to keep them healthy. It provides an alternative crop too, should the larch fail, and, in any case, the larch thinnings give an early return as they are keenly sought for fencing, garden rustic work and pit props.

In the Republic nearly three quarters of the larch plantations are Quality Class III and over and are expected to yield a gross volume of 2,500 to 3,000 H. ft. per acre at 50 years, of which between a quarter and one-third will have been produced in the first 20 years. This indicates the virtue of heavy and early thinning and the aim should be to maintain two-thirds of the bole under a crown of live branches.

The timber is exceptionally strong and durable and is used for transmission poles, vehicle and boat building and gate making. Due to its tendency to warp it is not suitable for house building but is sometimes used for wall plates.

HYBRID LARCH. *L. eurolepis*, Henry.

This is a cross which arose accidentally about 1905 on the Athol estate in Perthshire through the pollination of the female flowers of a Japanese Larch by European Larch growing nearby. It has proved itself a valuable species on poor soils in the Highlands of Scotland but is reported to be "generally disappointing" in Northern Ireland, largely owing to unsatisfactory seed. It is hoped that supplies of good seed will be obtained from the seed orchards at Tollymore and Pubble within a few years. Down south it has not, so far, been much planted.

NORWAY SPRUCE. *Picea abies*, Karst.

The first planting in Ireland of this species from central and northern Europe was at the beginning of the eighteenth century or even earlier. It was never popular as an ornamental tree in demesnes, its sombre appearance was against it, but was considered profitable for commercial forestry, especially on land too wet for other species. Its percentage ranking in State forestry fluctuated over the years, but the downward trend which took place was due not so much to any sylvicultural shortcomings as the reduced intake of suitable land. In the South it was 34% of all planting before 1934 and fell to 10% in the period 1954-61; this

holds true also for Northern Ireland. The 1958 Census in the Republic showed Norway Spruce as occupying 16% of the area planted at that time, and 16% of the crops with measurable volume.

Norway spruce is a tree of wet soils and has been widely used on moist grassland and cutaway woodlands and is thoroughly at home amidst grass and rushes such as are found in counties Cavan, Monaghan and Leitrim. Its comparative frost hardiness causes it to be selected in preference to Sitka Spruce on inland sites such as raised *Molinia* bogs but generally it is kept off peats, particularly blanket bog in the west and off the Old Red Sandstone mountain podsols of the south. It dislikes exposure, especially to sea winds but, even though shallow rooting, is not unduly subject to storm throw.

The 1958 census of woodlands in the Republic recorded 12,162 acres of pure Norway Spruce with a total volume of 13,974,500 H. ft.

A remarkable plot of Norway Spruce was grown on an alluvial flat beside the River Avonmore at Avondale. When measured in 1961 at 55 years of age it had 184 stems per acre with a total volume of 6,782 H. ft. The top height was 94', Mean Quarter girth 11½", Mean Height 92', and Mean Tree Volume 36.86 H. ft.

In the North there was at Drum Manor, near Cookstown, a stand of Quality Class I planted in 1928, virtually unthinned and standing at 7,500 H. ft. per acre in 1961, with a top height of 75 ft.

Norway Spruce is planted pure or as a nurse species with oak, beech, ash or elm groups. Planting on the level, or with raised mounds or ploughed ribbons is employed, depending on surface conditions.

Crops are fit for thinning at about 20 years when heights of 25' to 30' have been reached. The tendency is towards bolder thinnings with artificial pruning of 150 to 200 stem per acre.

It is a healthy tree and suffers little from insects or fungi. *Fomes annosus* occurs but is not a serious menace. Crown die-back has been noticed in a few places.

Most of our seed comes from northern Europe, principally Denmark and Germany, and the results have been uniform. There are noticeable early flushing and late flushing strains which are of importance in resistance to spring frosts, but this has not been considered a point for special study of provenance as the leading bud is usually late in bursting and escapes damage.

The wood of spruce is soft, white and easily worked; it is used for joinery, construction, box-making, plywood, fibre board and paper-making. It kiln-dries well and is easily worked. Large quantities are imported from Scandinavia for house building and sold as "White Deal."

A profitable return is obtained from the sale of Norway Spruce for Christmas Trees, either entire plants grown especially for the purpose, or the tops of normal thinnings.

COMMON SILVER FIR. *Abies alba*, Miller.

Of all the early importations, this species from the mountains of central Europe gave most promise of becoming an important forest tree. Every tree-minded land-owner planted it at one time and many of the original Silver Firs, now 200 years old, are still standing, overtopping all other trees and forming conspicuous features in old estate woods. Specimens were recorded in 1931 at Avondale, 132' x 18' 3" at 5' the largest of a group planted in the time of Samuel Hayes, Woodstock 105' x 15' 4", Castlewellan 106' x 13' 2", Powerscourt 116' x 14' 7", Headfort 121' x 15' 3". Curraghmore 121' 6" x 12' 10" planted 1770, Tollymore 104' x 16' and many other places. A pure plot of 1½ acres was laid down in the Silver Fir section at Avondale in 1905 and it was used as a nurse for other Silver Firs. All the Common Silver Fir suffered severely from late frosts for many years; the pure plantation was a failure and in the other plots the nurses were outgrown by the species they were intended to protect. Small numbers continued to be planted by the Forestry Division until about 1925 when attacks by an aphid, *Adelges nüsslini*, became so serious that young trees succumbed all over the country and the species ceased to be planted.

The timber is soft, white, rather coarse, non-resinous and inferior to Spruce.

GREEK SILVER FIR. *Abies cephalonica*, Loudon.

This tree was brought from the mountains of Greece in 1824 and found a place in conifer collections where it grew well. Specimens were reported at the 1931 Conifer Conference in Powerscourt, 61' 6" x 12', Hamwood, Co. Meath, 86' x 12' 7", Clondeboye, 70', Tollymore, 70', and Woodstock, Co. Kilkenny, 86' x 14'. A plot at Avondale made excellent growth but the species was never taken up in Irish forestry.

SPANISH CHESTNUT. *Castanea sativa*, Miller.

A native of Southern Europe, where it is valued for its edible fruit as much as its timber, the Spanish Chestnut was probably brought to England by the Romans but does not appear to have been planted in Ireland until nearly 1700. There are many large trees, that at Rossanagh, Ashford, Co. Wicklow, 80' x 30', being probably the largest in the country. There is a 7 acre plot at Avondale, in the valley, which suffered severely from frost in its early days, and small numbers have been planted in a few forests on good soil. The timber is inclined to have "ring shake" which appears as deep cracks in sawn timber. It rarely ripens its seed in our temperate climate; it grows easily from imported "nuts" and is treated like oak in the nursery.

BEECH. *Fagus sylvatica*, Linnaeus.

According to Samuel Hayes, Beech was introduced from England during the seventeenth century and was first planted in Ireland at Shelton Abbey in Co. Wicklow, and he says that all the trees known to him were grown from the seed of the trees there. A. C. Forbes quotes a letter from Boates' *Natural History of Ireland* describing swarms of cockchafers infesting Connacht and saying "at Eyre Court they did great damage to a well-improved English plantation and stripped the hedges, gardens and groves of Beech in 1697."

It is now a common tree and regenerates itself naturally in all parts of the country. Limestone rock soils suit it best but there are good beech trees on all deep and well-drained loam soils, mainly in groves and hedgerows. Large Beech are at Powerscourt, Dunloe, Birr, Bangor, Doneraile, Tollymore, Shelton Abbey to name only a few of the places where this tree is close on 100' in height. There are plots at Avondale and it has been planted in fair numbers in state forests, often in mixture with larch and for underplanting, especially on dry limestone soils not suitable for other species. It represents about 5% of total State planting in the Republic.

Beech timber is strong with a smooth grain and is highly valued for turnery, furniture and veneer making. The furniture factories in counties Meath and Louth use large quantities and draw on the old trees of the private estates in their neighbourhood for their supplies.

SYCAMORE. *Acer pseudoplatanus*, Linnaeus.

A native of Europe, the Sycamore is found in the Pyrenees, Alps and Carpathians. It is thought to have been introduced to England by the Romans but did not reach Ireland until the seventeenth century. It is now a common tree in all parts of the country. Fertile limy soils suit it best and, given suitable soil, it is quick to colonise open spaces in woods of other species; it is difficult, however, to establish on new ground. It tolerates exposure to wind and is a useful species for shelter belts near the sea coast.

Small numbers of Sycamore are planted in the state forests. In the North seed is collected from a group of excellent trees at Drumilly, Armagh. There is a plot at Avondale.

The timber is of high value for turnery, furniture and flooring. It is hard and dense, with an even grain and a clear white colour; it wears slowly and smoothly and is sought after for the floors of dance halls. Veneer sycamore with a wavy grain is exceptionally valuable.

NORWAY MAPLE. *Acer platinoides*, Linnaeus.

Widely spread in Northern Europe, the maple needs a good fertile soil and, although it grows well in Ireland, it is seldom planted by the

State or private owners. Large numbers are growing in the woods on the Digby estate at Tullamore and there is a plot at Avondale.

HORNBEAM. *Carpinus betulus*, Linnaeus.

The Hornbeam is indigenous in England, in the south-eastern part of the country, but is not a native of Ireland. It resembles beech, both in general appearance and in its use for underplanting, but it is frost-hardy and does well on heavy clay soil. There is a plot at Avondale but it has not been planted in any other State Forest. The wood is exceptionally hard, dense and heavy and has been used for cog wheels in mills and as rollers for saw benches as it resists wear.

WALNUT. *Juglans regia*, Linnaeus.

A native of Greece and regions further eastward, the Walnut was introduced to England by the Romans and came to Ireland probably in the seventeenth century. It is exacting as to soil and climate and is more a tree for parks and gardens than for woods. There is a plot at Avondale and single trees to be seen at Kilkea Castle, Ballykilcavan, Birr, Shelton, Rossanagh and many other places. The timber is very valuable for veneer making.

POPLAR.

None of the pure species of poplars are of forestry value and the small amount of planting which is done is mainly with the following hybrids, propagated by cuttings.

BLACK ITALIAN POPLAR. *Populus serotina*, Hartig.

Probably the commonest poplar in Ireland. Large trees of over 100' are at Birr and Adare and there is a plot at Avondale planted in 1909.

Populus robusta, Schneider.

This hybrid originated at Metz in 1895 and was first planted at Glasnevin in 1900. There are plantations at Dundrum and Delgany Forests.

Populus eugenii, *P. gelrica*, *P. deltoides* and other hybrids are at Shelton Abbey in a plot planted in 1956, with the object of providing cuttings of canker-free strains.

Poplars require a fresh, non-acid soil of more than usual fertility, damp but well drained, and they respond to after-care such as screefing around the stems and the application of phosphate fertiliser.

The timber is white, light and tough, and is used for match-making, veneers for chip baskets, waggon bottoms and other purposes where its resistance to splitting and wear is of value.

Trees From Western North America

Giving evidence to the Committee on Irish Forestry in 1907, Dr. Augustine Henry said:

“Prejudice should not exclude foreign trees; the question is whether they will grow well as forest trees. After I had gathered my facts as to exotic trees in Ireland, I formed my theory and my theory is this, that owing to the insular position, extreme mildness and rainy nature of the winter, the Gulf Stream and the excessive rainfall, the climate of Ireland differs in every respect from the climate of continental Europe or of the greater part of France. Where we have an analagous climate the same species of tree do very well. In British Columbia, Washington and Oregon there are a Gulf Stream, a rainy winter and a rainfall nearly parallel to the west half of Ireland. If you look at the rainfall maps you will see that the west half of Ireland is very rainy, and most of the waste land is in this rainy belt. In British Columbia, Washington, Oregon and California the forests are the greatest forests in the world and all the trees without exception that grow on the Pacific Coast have done extremely well in Ireland . . .”

Dr. Henry's conclusions were based on the Douglas Fir, Sitka Spruce, Thuja, *Abies grandis*, *Pinus radiata*, which he had seen all over Ireland when he was collecting material for the work *Trees of Great Britain and Ireland*, published between 1907 and 1912. These importations had come in the latter half of the nineteenth century and up to the time of Avondale were regarded mainly as ornamental trees for parks and gardens. Now, as a result of the advocacy of Dr. Henry and the example of A. C. Forbes and J. D. Crozier who planted the early state forests, Pacific Coast species have usurped the forests of Ireland and account for 80% of the trees planted annually and are destined to continue as very important trees in our future forests.

SITKA SPRUCE. *Picea sitchensis*, Carrière.

This tree is a native of the coastal belt of western North America and was first planted as single specimens on private estates in Ireland about 1834. The oldest known tree, said to date from this time, is at Curraghmore, Co. Waterford. It was from 110' x 10' girth in 1891 and by 1962 had increased to 154' in height. Shelton Abbey in Co. Wicklow has one 156' x 17' 9" and at Ballinahinch, Co. Galway, there is a specimen 106' x 7' 5" in 1962 known to have been planted in 1907.

Sitka Spruce is an outstanding tree in Irish forestry; the 1958 Census of Woodlands showed that 31% of the measurable volume of

timber in the plantations consisted of this species, occupying about 29.5% of the area planted.

Sitka Spruce is reasonably successful on a wide range of sites but is most at home on moisture-retaining mineral soils in regions of high rainfall and humidity. On the blanket bogs of the West it is extensively planted, keeping it to the *Molinia caerulea*/rush types and avoiding the *Calluna vulgaris* and *Erica tetralix* types. On intermediate vegetation types it is usual to intermix *Pinus contorta* with Sitka Spruce. This practice, however, has been discontinued in the North. Ameliorative measures on bog soils are deep ploughing and the application of ground mineral phosphate.

On good sites a crop usually closes at 15 years and is shortly afterwards ready for thinning. Markings used to be conservative, anything beyond a light low thinning was considered rash, but heavier marking has lately become the practice in order to get diameter increment. Nowadays in the Republic it is customary to do heavy low thinnings from the beginning, carrying out pruning of selected stems at the same time. This is done before they exceed 6½" in diameter and is usually carried to about 19' eventually on 150 to 200 stems on an acre. In the Northern Ireland plantations which give promise of saw timber thinning is usually done by the Scottish Eclectic method, favouring about 50 trees on an acre, these being high pruned.

The 1958 Census showed that areas of Sitka Spruce with measurable volume in the Republic totalled 17,824 acres and carried 31,128,000 H. ft., that is an average of 1,740 H. ft. per acre. The plantations ranked in accordance with the British Quality Classes as follows:

Quality Class	I	II	III	IV	V	below V
Percentage Area	1%	12%	25%	23%	24%	15%

The average Quality Class level was in IV.

The Volume Sampling Survey gave the following data for Quality Classes II and IV at 23 years of age:

	Mean Ht.	Vol. per acre	Current Annual Increment
II	47'	2,400 H.ft.	319 H.ft.
IV	32'	1,500 H.ft.	213 H.ft.

In the North, Quality Class I plantations forty years old are at Castlecaldwell, Co. Fermanagh, Knockmany, Co. Tyrone and Ballykelly, Co. Derry.

It was mentioned earlier that Sitka Spruce thrives on high rainfall and humid conditions. This is certainly borne out by the plantations in the damp mountainous regions of the Slieve Bloom and Co. Wicklow where the rainfall averages over 60 inches. Late frosts are injurious:

that of the end of May 1961, which was as low as 18° F. (—7° C.) caused severe damage in young plantations. In the North they find that Washington Provenance is more frost tender than Queen Charlotte Island seed but that it has extra vigour. Gales overthrow or break Sitka Spruce seriously, especially pure crops in the pole stage at 50' and upwards in height, as was proved in the bad storms of 1957 and 1961.

The Spruce Aphis, *Neomyzaphis abietina* causes defoliation and checks growth. It is found to be worse on dry sites. Butt rot due to the fungus *Fomes annosus* is prevalent. An attempt to check it is being made by applying creosote to cut-over stumps. Group dying resulting from *Rhizina undulata* is common and a few serious outbreaks have occurred.

The Republic imports its seed mainly from the Queen Charlotte Islands in British Columbia. In the North some comes from the State of Washington.

Sitka Spruce produces readily saleable timber and is in demand for pit props, fibre board and paper manufacture, box boards, joinery and house building. Kiln drying young timber may cause cell structure collapse resulting in a "scrubbing board" or "wash board" effect.

DOUGLAS FIR. *Pseudotsuga menziesii*, Franco.

This tree was introduced from western North America shortly after 1850 when a few were planted in demesnes. Outstanding specimens are at Powerscourt, 112' x 9' 4", planted in 1865, Carton, 102' x 9' 4", Clonbrock, Co. Galway, 81' x 5' 10" planted in 1879, Headfort, 94' x 12' 11", Tollymore Park 87', Shelton Abbey, 116' x 9' 6" as recorded for the Conifer Conference in 1931. Never much used in southern Irish forestry, even in its heyday in the 1920's, it rarely topped 3% of the species planted, its popularity declined during the next decade and by 1940 it was hardly represented in the current planting and the crops already in existence were regarded as having no future, due to their stagnant and debilitated appearance. Subsequently, following heavy thinning, a dramatic improvement took place in these stands and Douglas Fir is now once more regarded as a valuable species. The most notable plantations which were saved by this vigorous opening up are to be found in the Suir Valley between Carrick and Clonmel, and on Slievenamon as well as in the glens of Co. Wicklow.

To do well, Douglas Fir needs comparatively good ground, deep and moist but well drained and above all, well-sheltered. On exposed sites its tops soon become bent over and ragged and there is the added danger of windthrow. It has no place on peat, and dislikes limy soils, so that in practice it is confined to the lower slopes of the mountains in counties Wicklow, Wexford, Waterford, Tipperary and Louth. It has given good results as an under-storey with light-topped broad-leaved species and is at its best when planted in old woodland soils. Pure crops

are considered best and thinnings usually start at 15 years or even earlier and are heavy. Pruning of selected stems, 150 or so to the acre, is usual to a height of 20' when they are no more than 6½" in diameter. The expected rotations in State forests are from 40 to 60 years.

The 1958 Census recorded 3,395 acres of pure crops with a volume of 7,602,400 H.ft., giving an average of 2,239 H.ft. per acre, the highest for any species.

Young trees suffer from an aphid, *Adelges cooleyi* and a needle-cast disease, *Phaeocryptopus gäumannii*. The species is moderately resistant to butt-rot caused by *Fomes annosus*.

Losses in home-grown seed are caused by the grub of a fly, *Megastigmus spermotrophus*. Much of the seed sown is imported, however, and it is found that the green Douglas Fir from the coastal district of Washington gives satisfactory results. The grey and blue varieties are not favoured.

When well grown, sawn and dried, the timber is of great strength and is suitable for all structural purposes. It has a good colour and attractive grain and possesses many of the qualities of imported "Oregon Pine," its usual trade name. So far insufficient saw logs have come on the market to test it properly. Its value is found mainly in transmission poles which fetch exceptionally high prices. It is excellent for pit props and is used for fibre board manufacture.

GIANT FIR, *Abies grandis*, Lindley.

This fast growing species comes from the Pacific Coast region where it extends from mid-California to north of Vancouver and spreads inland to Idaho and Montana. Discovered in 1827, it was first introduced in quantity in 1851 and there are many large specimen trees in demesnes dating from later in the century. At Baronscourt, Co. Tyrone, a tree planted about 1866 was 115' x 8' 9" at the time of the Conifer Conference in 1931. Other tall trees at that time were at Carton, Kilonan, Clonbrock, Curraghmore and many other places.

This was one of the first species to be planted at Avondale and a one-acre plot there when 41 years old in 1946 had a mean height of 90'. This plot was severely damaged by a gale in 1954 which over-turned or snapped off the tall weak stems and it has been cleared and re-planted. Younger stands are at Roddenagh, Aughrim Forest, at Rathdrum Forest and at Lislip Forest, Omagh, there is a Quality Class I plot dating from 1946.

Abies grandis needs a sheltered site with a fertile soil: it has not been widely employed in State forestry either North or South and never exceeded 3% of the annual planting. A limited use for it is in under-planting. It was found to be the most frost hardy of all the Silver Firs planted side by side at Avondale and it appears resistant to *Fomes annosus*.

The amounts of timber marketed have been small and were not well



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Road Grader in Chevy Chase, Gort Forest, Co. Galway.



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Forest workers' cottages in Knockmany Forest, Co. Tyrone.

received by the trade. British tests class it close to Sitka Spruce except in toughness and it seems suitable for many purposes for which spruce is normally used.

NOBLE FIR. *Abies procera*, Rehder.

This tree was discovered by David Douglas on the southern side of the Columbia River in 1825 and was later found in the mountains of Washington, Oregon and California. Under its earlier name of *Abies nobilis* it was planted in many pineta and at the time of the Conifer Conference in 1931 there were specimens in Powerscourt 88' x 9' 9", Castlewellan 64' x 8' 9", Carton 94' x 9' 4", Curraghchase, Co. Limerick, 63' x 6' 10", Rostrevor 70' x 7' 3" and many other places.

The Avondale plot, put down in 1905, suffered severely from frost and replacements were made repeatedly until 1910. Later, it did well and, although a bit uneven, it encouraged further planting which succeeded remarkably, especially on high ground. There are small areas at Aughrim and Mountrath Forests dating from the early 1920 period, a 30 year old stand at Tardree in Co. Antrim, and in recent years it has been widely planted on small areas of exposed sites especially in the West, where it is useful for shelter. It will do well on dry mountain land of the *Nardus-Molinia* type and with heather in the vegetation. In the North it is regarded as a tree with a good future and has proved an ideal species for dry exposed situations at any elevation. There, even though difficult to establish owing to its slow early growth and its attraction for rabbits, once established it grows very vigorously, almost as quickly as *Abies grandis*. Seed is home collected as far as available. The timber is soft and often suffers from drought crack. Very little has come on the market so far.

SHORE or LODGEPOLE PINE. *Pinus contorta*, Loudon.

The range of this species in western North America is extensive, reaching from British Columbia to the western parts of Alberta and up to the timber line in Alaska and as far south as California. Seed was first sent to Britain in 1854. In Ireland the earliest planting was at Ashford Castle, Cong, Co. Mayo, in 1884, the tallest of these trees being 97' x 10' 8" in 1961. Two rows were put down at Avondale in 1920, one of the Coastal and one of the Inland varieties. The superior performance of the Coastal variety, sometimes dubbed Shore Pine, led to its being chosen for planting and from 1923 seed was obtained from Long Beach in the State of Washington. In 1928 an inland variety, then generally referred to as *Pinus contorta* var. *murrayana*, was tried out but the results did not encourage a change from the coastal type which continued to be favoured until after the Second World War. At that time seed came in from Lulu Island, British Columbia, to the South as well as to Northern Ireland.

The variation in performance between different seed provenance has been the subject of considerable study. On the poor soils to which this species is normally restricted, strains from Washington coast region and the Olympic peninsula have done much better than any other and that area is now the main source of supply for the Forestry Service in the Republic.

The ability of *Pinus contorta* to grow on windswept moors with the poorest peat soils soon gained it recognition in the Republic as a valuable tree for mountain afforestation. Before 1934 about 10% of the total planted was of this species: in the next ten years it rose to 14.2%; the following decade saw it at 29%, after which it never fell below 30% and in one year, 1952, it was 40% of total planting. The Census of 1958 gave a total area of 11,727 acres 10 years and over with a volume of 4,852,800 H.ft. and by 1962 there was an area of 84,000 acres under this one species.

In Northern Ireland the picture was much the same until a few years ago when in 1961 the decision was made to discontinue its use on deep peat as it had been found unsatisfactory. The earlier practice of mixing it with Sitka Spruce in alternate lines was dropped, too, as it was found that much pruning and other attention was necessary. Both Lulu Island provenance and the inland types were planted and also some intermediate types. Excellent results were obtained from the last, particularly at Baronscourt. Seed is now being obtained from coastal Washington sources.

At first *Pinus contorta* was regarded solely as a pioneer species on the poorest sites with the object of improving conditions for more valuable species by providing shelter and ground cover. Its outstanding growth, however, soon had it accepted as a commercial species in its own right and early plantations have produced a high yield of quite good quality timber on infertile land. Examples of this are on Old Red Sandstone podsols of the Knockmealdown, Comeragh, Tallow and Drum Hills of Co. Waterford and the Ballyhoura and Kilworth Mountains in Co. Cork. Younger plantations are on climatic peats in counties Kerry, Galway, Mayo and Donegal as well as on the Raised Basin Bogs of the Midlands. *P. contorta* suits *Calluna* heath where conditions are too dry for Sitka spruce and on peats where *Calluna vulgaris* and *Erica cinerea* predominate over *Molinia caerulea* and other grasses and rushes. It is easily raised in the nursery and is usually planted out as two-year and three-year old transplants. Ploughed ribbons are normal practice, with slit and notch planting at 5' spacing and the application of 1½ oz. of Ground Mineral Phosphate to each plant. Thinning may start at 15 years when top heights are 25' to 30'. Some years ago, before experience was gained with this species, thinnings were delayed and were too light when they were eventually made, resulting in very restricted crown development and tendency to wind-blow. Pruning of 150 to 200 stems per acre of 6½" diameter and less to a height of 19' or 20' is normal practice. Where

growth is promising, stands will probably be given a rotation of 40-50 years and then clear-felled. On deep peat areas a shorter pulp-wood rotation is likely.

Provisional Yield Tables have been prepared in the Republic and here are examples of growth on sites which would be regarded as exceedingly poor for any other species:

Quality Class	Age	100 largest trees per acre		Main Crop		Total crop yield incl. thinnings	Mean Annual Increment
		Mean Top Height	Mean Girth	Stems per Ac.	Vol. per Ac.		
	Yrs.				H.ft.	H.ft.	H.ft.
I	26	47'	27"	640	2,330	3,450	133
II	27	38½'	23"	890	1,780	2,430	90
III	25	25	16"	1600	850	970	39

Pinus contorta is attacked by Pine Shoot Moth, *Evetria buoliana*, Schiff, Pine Sawfly, *Diprion pini* and *Neodiprion sertifer*, Pine Weevil, *Hylobius abietis* and Pine Shoot Beetle, *Myelophilus piniperda*. It seems to suffer from Butt Rot more than any other conifers and there have been cases of Group Dying caused by *Rhizina undulata*, and poles left lying on the ground for even a short time pick up staining and rotting fungi.

The results of studies on samples of 28 year old logs sent to the British Forest Products Research Laboratory were promising as regards kiln drying, sawing and machine tool working. The light thinnings so far marketed have been accepted by chip and hardboard manufacturers and it is confidently expected that useful commercial timber will be produced by this species.

WESTERN RED CEDAR. *Thuja plicata*, D. Don.

The Thuja is a native of the coast region from Alaska to California, growing in association with Sitka Spruce, *Pinus contorta* and Nootka Cypress in the northern and with Douglas Fir and Tsuga in the southern part of its range. It was introduced in 1853 by William Lobb at the time when other species from the region were attracting attention and it was planted on many estates as a specimen tree and occasionally in plantations. Large trees are at Adare, Derreen, Castlewellan, Powerscourt, Clonbrock, Muckross and many other places and there are plantations at Ballykilcavan, Stradbally, Lackendarragh, Enniskerry and at Avondale. Little planting has been done in State plantations because of a fungus,

Keithia thujina, which causes leaf blight in the nursery. If this problem can be surmounted thuja is a useful tree on limestone gravel and for under-planting. The timber is light, strong and durable and can be used untreated for cladding walls or cleft into sheets for roofing shingles.

LAWSON CYPRESS. *Chamaecyparis lawsoniana*, Parlatore.

This cypress is a native of Oregon and California and was introduced by Murray in 1855. It has become a common species and is planted in all parts of the country in gardens and shelter belts. There are large trees at Kilmacurragh, Adare, Castlewellan, Derreen and Killarney and plantations at Avondale, planted in 1907, at Derrydonnell, Athenry Forest, planted in 1936 on limestone "pavement," and in Abbeyleix estate. It grows well on all mineral soils and tolerates exposure but has a liability to fork near the ground. The timber is fine grained, strong and durable.

MONTEREY CYPRESS. *Cupressus macrocarpa*. Hartweg.

The home of this cypress is on the Californian coast in a narrow belt two miles long near Monterey and on the adjacent island of Guadalupe whence seed was sent in the middle of the last century. It is difficult to establish as it is a poor transplanter but once it takes root it grows remarkably fast and makes a fine shelter tree, especially near the sea. Large specimens are at Ards, Co. Donegal, Killarney, Adare, Castlewellan, Derreen, Headfort, Birr and Muckcross (where it has self-sown seedlings). A one-acre plot was planted at Avondale in 1906, direct seeding was done at Camolin about 1933, and there is a good plantation of clean stemmed trees at Ballintombay, Rathdrum, dating from 1929.

WESTERN HEMLOCK. *Tsuga heterophylla*, Sargent.

This species is found from Alaska southward along the coast of British Columbia, Washington, Oregon and California where it seldom occurs in pure stands but is usually mixed with Douglas Fir, Sitka Spruce and Thuja. It was introduced in 1851 and there are large trees at Castlewellan, Kilronan, Co. Roscommon, Woburn, Kilmacurragh and other places. There is a 2½ acre plot at Avondale and small plantations at Glenealy, Baunreigh, Killarney, Castlecaldwell and Rostrevor; it is used mainly for underplanting light crowned trees such as larch and oak and for filling in gaps in woods. It is a vigorous grower and so far has been disease free.

MONTEREY PINE. *Pinus radiata*, D. Don.

The Monterey Pine has its home near the coast of Monterey in California, often in greatly exposed situations. It was introduced in 1851 and is especially suited for seaside planting and will get up in the teeth of the strongest winds. There are many large trees, even in inland

places such as Birr, Clonbrock and Blandfort and plantations at Avondale. It is used principally for shelter belts on the exposed margins of plantations and is to be found in Delgany and Glenealy, Glenshelane near Dungarvan, Slievenamon, Curracloe and Gort forests. The Avondale plot in 1949, when it was about 40 years old, had an estimated volume of 9,626 H.ft. of pine and 1,763 H.ft. of European larch to the acre. It is a poor transplanter and is tender and may suffer in severe winter frosts. It produces a large volume of timber which is coarse and knotty unless the trees are artificially pruned. In New Zealand large areas of this pine are grown for paper pulp and it may have a value for this purpose here if sufficient quantities of the timber are ever available.

BALSAM POPLARS.

Several species of Balsam Poplars are native to North America but only one, *P. trichocarpa*, Torrey and Grey, is of interest to us in Ireland as the parent of two vigorous hybrids, *P. generosa*, A. Henry, a cross between it and *P. angulata*, and a further cross between it and *P. tacamahaca*. The latter has been planted in Northern Ireland.

Trees From The Far East

Many species, mainly conifers including pines, cypress, spruce and firs, were introduced from China and Japan during the last century, but only one, Japanese Larch, made its mark in commercial forestry.

JAPANESE LARCH. *Larix leptolepis*. Gordon.

This species was brought in by John Gould Veitch in 1861 at about the time when the European Larch, on account of disease, was falling into disfavour with planters. The remarkable vigour of the new tree at once attracted attention and it was widely planted. No large specimen trees are known and it apparently does not reach the stature of European Larch.

In the Republic it is the principal species in 12,000 acres of plantations, about 60% of them being Quality III or over and expected to yield 4,000 c. ft. gross volume in 50 years. Growth is rapid in its early years and thinning starts at about 15 years of age and is heavy. Much culling of crooked and wolf trees must be done if a satisfactory crop is to be produced. Its popularity in Northern Ireland is on the wane due, mainly, to the small demand for its timber. It grows in soils too poor for European Larch and stands exposure well. The timber resembles the European species, and mature, slow-grown wood is probably as strong. It is used for transmission poles.

Trees From India

As in the case of China and Japan, the influx of trees from India was very great but only one, the Deodar Cedar, is used in plantations and that only in a very limited way.

DEODAR. *Cedrus deodara*, Loudon.

The Deodar is an important forest tree in the western Himalayas where it grows best in the inner valleys with heavy winter rainfall, usually in mixture with Spruce, Pine and Oak. It was introduced in 1831, and reaches a large size in this country. The Conifer Conference records in 1931 show trees at Fota 85' x 8', Hamwood 85' x 9' 3" (planted 1844), Castlewellan 55' x 4' 8", Tollymore 60' x 9' 10" and Doneraile 75' x 6'. There is a plot at Avondale and an interesting plantation at Glengarra, Co. Tipperary on Old Red Sandstone drift soil of good depth. This plantation is 1½ acres in extent and when it was about 70 years old in 1951 it was estimated to have 160 stems to the acre with a total volume of 4,763 H.ft. Ten years later the volume was 6,500 H.ft. an acre, and individual tree lengths were over 100'.

Trees From The Southern Hemisphere

Nothofagus, Podocarps and Monkey Puzzles from South America all grow well in Ireland but do not rank as forest species. The only southern species which has a future in our forests is the Australian Eucalyptus. About ten species have been tried, mainly from Tasmania, Victoria and New South Wales, and are found to grow rapidly in mild parts of the country.

EUCALYPTUS. *Eucalyptus globulus*, Labillardière.

The Blue Gum was introduced in 1852 from Tasmania where it occurs in the south-eastern part of the island near the coast. It is the species most commonly planted here and single trees and small groups are to be seen in gardens in mild localities near the sea. There are specimens on Dinas Island, Killyarney, Derreen, Bangor Castle, Rostrevor, Tollymore and Killiney.

Eucalyptus johnstoni, *E. urnigera*, *E. ovata*, *E. obliqua*, *E. viminalis*, *E. gigantea*, *E. amygdalina*, *E. radiata* and *E. dalrympleana*.

Small groups containing some of these species are to be found at Mount Usher, Ashford, Co. Wicklow, Avondale, where *E. viminalis* planted in 1909 was 124' in 1962, Delgany and Glenealy. A plot of *E. johnstoni* at Glenealy had an estimated volume of 9,000 H.ft. per acre at 26 years.

STATE FOREST POLICY

Progress towards the target with some particulars of the new forests

THE Annual Reports of the Minister for Lands at one time set out briefly State forest policy in the Republic. For instance, the report for the period to 31st March, 1943, states:

“The forest policy remains as laid down in previous reports, namely, to create a home supply of raw timber sufficient to meet home requirements, so far as it is possible to grow in this country the types of timber required. It has been estimated that the total national objective of both State and private woodlands should be 700,000 acres of afforested land, including 100,000 acres of protection forest and 600,000 acres of fully productive forest.”

In a White Paper dated 20th December, 1948, the ultimate target was raised to 1,000,000 acres. The State planting rate went up to 12,500 acres in 1952-53, 20,000 acres in 1957-58, 22,800 in the following year and 25,100 acres in 1959-60. This record was beaten in 1960-61 when 26,000 acres was planted; 25,300 acres was done in 1961-62 and 24,700 acres in the year to the 31st March, 1963.

The study of our “Economic Development” (the Whitaker Report) published in 1958 and the resulting White Paper entitled “Programme for Economic Expansion” examined forestry expenditure and concluded: “There is a good prospect that, in the long-term, the forest undertaking will be able to yield a return of about 5%, if not on the total investment, at least on that portion of the expenditure classified as capital for budgetary purposes.” The White Paper sums up our planting policy thus: “The long-term planting rate is subject, inter alia, to the rate at which land can be acquired and to the extent to which marginal peat soils can be successfully utilised. An annual planting rate of 7,000 acres would suffice for present domestic requirements of sawnwood and pulpwood, but if consumption were to increase to the much higher Danish levels the produce of an annual planting programme of 17,500 acres would be absorbed in the home market. The programme envisages the growing of sawlog timber on a 50 year rotation. Small dimension timber for pulp, etc., as far as not obtainable from the thinnings of plantations grown on a sawlog rotation, would be produced from plantations grown on a rotation of, say, 30 years.”

The Second Programme for Economic Expansion appeared in July

1964. It reported that by 31st March of that year the area of State Forests had reached 405,000 acres and stated that "the continued planting of about 25,000 acres each year will increase the area under State Forests to about 550,000 acres by 1970, i.e., 80% over the 1960 figure." The report mentions that: "A feature of the planting programme in recent years has been the high proportion in the eight western counties (Donegal, Sligo, Leitrim, Mayo, Galway, Roscommon, Clare and Kerry). The annual acreage planted in these counties rose from 8,700 in 1958-59 to 11,000 acres in 1963-64. The extent to which this emphasis on State forestry in the western regions will be maintained or expanded will depend on the outcome of the research that the Department of Lands is carrying out on problems of soil fertility and exposure encountered on western planning sites."

In Northern Ireland the Ministry of Agriculture is the State Forestry Authority. The main object of forest policy is the conversion of areas of low agricultural production to forests which will eventually provide a sustained yield of timber produce. The emphasis is on economic production which will give a regular supply and attract new wood industries to the country with a promise of expansion. A secondary consideration is the need to provide productive work in areas of serious unemployment which, by causing a drift to the towns and overseas, accentuates the social problems of the whole country. A further consideration is the importance of providing land and facilities for recreation and amenity. (See Chapter IX).

AGE CLASS DISTRIBUTION OF STATE FORESTS

The State forests of Ireland are predominantly young. In 1933 the total area of plantations in the Republic was 38,200 acres. In Northern Ireland there were 7,607 acres at that time. The totals crept up slowly until 1950 when there was a sharp increase in the planting rate on both sides of the border as the following data indicates:

Recent tables of age classes:

Republic at end of March 1963.

Age	Area	% of total
1—10 years	203,000 acres	53%
11—20 "	73,000 "	19%
21—30 "	60,000 "	16%
31—40 "	29,000 "	8%
Over 40 years	15,000 "	4%
TOTAL	380,000 "	

Northern Ireland. 30th September, 1963.

Age	Area	% of total
0— 5 years	24,249 acres	35%
6—10 "	13,830 "	20%
11—15 "	10,979 "	16%
16—20 "	5,568 "	8%
21—25 "	4,572 "	7%
26—30 "	4,099 "	7%
31—35 "	3,347 "	5%
36—40 "	1,065 "	1%
41 years & over	976 "	1%
TOTAL	<hr/>	
	68,685 acres	

COMPOSITION OF FORESTS ACCORDING TO SPECIES

Economic considerations, both as to the sort of timber required and the type of land available for forestry purposes, dictate that over 95% of the trees planted should belong to softwood species, while the predominantly wet climate and the peaty soil of many of the acquired areas make Sitka Spruce and *Pinus contorta* by far the dominant species used. Wherever suitable soil is found, however, usually in former demesne lands, hardwoods are planted. While the exact proportions of species vary from year to year the general framework takes the following shape:

Republic		Northern Ireland	
Sitka Spruce	42%	Sitka Spruce	54%
<i>Pinus contorta</i>	30%	Larches	14%
Norway Spruce	10%	Pines	13%
Scots Pine	3%	Norway Spruce	7%
Japanese Larch	2%	Douglas Fir	6%
Corsican Pine	1%	Other Conifers	2%
European Larch		Oak	3%
Silver Firs	5%	Ash	
Other Conifers	3%	Beech	
Beech	1%	Other Hardwoods	1%
Oak	1%		
Birch	1%		
Other Hardwoods	1%		

See Chapter IV for a more detailed exposition on the subject of species.

ACQUISITION OF LAND

ACQUISITION OF LAND

The national forests have been built up during the past half century by purchasing land for cash (except a few areas held on long lease) either directly from the owner or through the Land Commission. The complexity of acquisition can be gauged from a table in the Cameron Report (1950) which shows that the total area at that time, 210,000 acres, was the result of 970 separate transactions of which 326 were for areas of less than 50 acres, 195 for less than 100 and 172 for less than 200 acres. Only 5 deals brought in blocks of over 3,000 acres. In recent years the average number of acquisitions has exceeded 500 annually and on 31st March, 1965 the total area acquired was 570,000 acres which had involved 6,028 separate transactions. As they are taken over, these areas are grouped into units for the purpose of planting and management, and in March 1963 there were 175 "Forests" in the Republic ranging in area from 400 acres to over 6,000 acres of productive land. Every one of the twenty-six counties is represented in the following table with the exception of Meath:

ULSTER

	No. of forests	Productive area
Cavan	4	5,973 $\frac{1}{4}$ acres
Donegal	15	32,995 "
Monaghan	3	6,045 "

MUNSTER

Cork	18	68,987 $\frac{1}{2}$ "
Clare	8	16,025 $\frac{3}{4}$ "
Kerry	7	15,703 $\frac{1}{2}$ "
Limerick	4	8,496 $\frac{3}{4}$ "
Tipperary	14	38,214 $\frac{1}{2}$ "
Waterford	8	27,658 $\frac{3}{4}$ "

LEINSTER

Carlow	3	5,886 $\frac{1}{2}$ "
Dublin	2	3,705 $\frac{1}{2}$ "
Kildare	3	6,639 $\frac{3}{4}$ "
Kilkenny	6	11,214 $\frac{1}{4}$ "
Laois	7	20,069 $\frac{1}{2}$ "
Longford	2	3,000 "
Louth	1	2,009 $\frac{1}{2}$ "
Offaly	2	5,441 $\frac{3}{4}$ "
Westmeath	4	5,554 $\frac{1}{2}$ "
Wexford	7	15,835 $\frac{1}{2}$ "
Wicklow	20	54,257 $\frac{3}{4}$ "

CONNACHT

Galway	16	43,388½	„
Leitrim	4	12,568½	„
Mayo	10	18,947½	„
Roscommon	3	7,235¼	„
Sligo	4	9,363	„
TOTALS	175	445,317	acres

Plantations cover 380,229¾ acres and 65,087¼ acres forms a plantable reserve, of which 13,000 acres is in Cork, 5,500 acres in Donegal, 6,400 acres in Galway, 4,600 acres in Kerry and 6,000 acres in Mayo, nearly 54% of the whole in only five counties.

In Northern Ireland the pattern is very much the same. There were (on 31st March 1963), 70 forests, from 200 ac. to 7,500 ac. in area with representation in each of the six counties:

ULSTER

	No. of forests	Productive area
Antrim	16	14,746 acres
Armagh	5	5,262 „
Derry	11	18,330 „
Down	7	7,573 „
Fermanagh	15	24,583 „
Tyrone	16	27,018 „
TOTALS	70	97,512 acres

Plantations covered 67,380 acres and the planting reserve at that time was 29,809 acres with 6,898 acres in Fermanagh, 11,338 acres in Tyrone and 4,986 acres in Antrim.

The Forest Regions

STATE FORESTS OF THE REPUBLIC OF IRELAND

THE LEINSTER CHAIN

This important forest area extends from the plains of Dublin southwards to the valley of the lower Barrow and eastwards to the Wicklow and Wexford coasts and contains one of the loftiest and most continuous highlands in Ireland. On its slopes and foothills and in its valleys are situated the following forest areas:

LEINSTER CHAIN

CARLOW
 Borris 415 ac.
 Bunclody 3058 $\frac{1}{4}$
 Rossmore 2676

DUBLIN
 Killakee
 2367 $\frac{1}{4}$ ac.
 Saggart 1830

WEXFORD
 Bree 1977 $\frac{3}{4}$ ac.
 Camolin 2567 $\frac{1}{4}$
 Coolgreaney
 2528 $\frac{1}{4}$
 Forth 2226 $\frac{1}{4}$
 Gorey 2045 $\frac{1}{4}$
 Killanne 4015 $\frac{1}{2}$
 New Ross 1636 $\frac{1}{4}$

WICKLOW

Aughrim	Clonegal 3242 $\frac{1}{4}$	Glen-Imaal	Rathdrum
4293 $\frac{1}{4}$ ac.	Delgany 1475 $\frac{1}{4}$	2593	3926 $\frac{3}{4}$
Avoca 2028 $\frac{3}{4}$	Enniskerry	Glenmalure	Rathnew 2538 $\frac{1}{2}$
Avondale 683 $\frac{1}{2}$	1221	7168 $\frac{3}{4}$	Roundwood
Ballinglen	Glencree 1874 $\frac{1}{4}$	Hollywood	2487 $\frac{3}{4}$
2924 $\frac{3}{4}$	Glendalough	5538 $\frac{3}{4}$	Shelton 3347 $\frac{3}{4}$
Blessington	5602 $\frac{3}{4}$	Rathdangan	Tinahely 2245 $\frac{1}{2}$
2486 $\frac{3}{4}$	Glenealy 2713 $\frac{1}{2}$	2487 $\frac{3}{4}$	

County Wicklow includes the lion's share of the Leinster Chain and its rounded granite core, which forms an elevated moorland, is flanked with silurian and mica-schist rocks dissected on the east and west by deep gorge-like valleys. It is in these valleys that the forests of the region are mainly situated.

Free draining acid brown earths composed of local shales and mixed glacial drift cover the lower slopes up to about 1,000 feet. These are excellent for conifers. Above this level the podsols and climatic peats are suitable only for less exacting species, chiefly Sitka Spruce and Contorta Pine. The rainfall is heavy in the mountains, being as much as 80 inches on the summits and 60 inches on most of the high ground, but on either flank the precipitation diminishes—to 35 inches on the eastern coast and in the valley of the Barrow—and is evenly distributed throughout the year.

The afforestation of the glens began after 1920 with the planting of Crone and Ballyreagh in Glencree, Lugduff in Glendalough, Ballyboy and Clohernagh in Glenmalure and the Aughrim-Aughavannagh valley, all on the east, and Stranahely, Glen of Imaal, on the west side of the range. From a few hundred acres in extent these forests have been built up by successive acquisitions of bare land abandoned for agriculture and the largest, Glenmalure, now exceeds 7,000 acres, most of it under productive plantations.

Influenced by the Avondale experimental plots, Western American conifers were the chief species in this afforestation. Douglas Fir was planted on the well drained sheltered slopes below 1,000 feet and Sitka

Spruce on wet ground and on the exposed grassy areas of former sheep grazing running up to 1,800 feet. Norway Spruce was confined to pockets and valley bottoms subject to late spring frosts. In the early days Scots Pine was used indiscriminately on the dry Calluna covered hills, but it was almost a complete failure and has been replaced by Contorta Pine and, in some cases, by Sitka Spruce after ploughing. On lower ground and on sheltered high ground, however, Scots Pine has done well and there are excellent stands in Glendalough and Glenree. The first State plantation of Contorta Pine is at Ballintombay, Rathdrum, in a belt along the upper planting limit where, unfortunately, it has suffered severely from storm damage.

Since 1950 heavy ploughs powered by crawler tractors have been used to drain and mound mountain land previously regarded as unplatable. Extensive areas have been ploughed and planted with Sitka Spruce and Contorta Pine in the King's River valley in Hollywood as well as in most of the other Wicklow forests and the tendency is to push the planting limit still further upwards; it has passed the 2,000 feet level in some places. Small quantities of ground mineral phosphate are used to stimulate growth on these poor sites.

A subsoiling plough capable of breaking an iron pan at a depth of 18 inches was used at Rathdangan before planting Sitka Spruce.

There are remnants of primeval oak forests at Derrybawn and Lugduff, Glendalough, at Croneybyrne, Rathdrum and at Glen O'Downs, Delgany.

Aughrim and Ballinglen Forests lie at the southern end of the main Wicklow Mountains in the valleys of the Ow River and the Derry Water. Roddenagh Wood, 179 acres, was described by Nesbitt in 1904 as a fine coppice wood of oak with regular age classes of standards. These standards were cut in the Great War and when the wood was bought by the Department in 1922 nothing remained but coppice oak scrub. It was cleared and re-planted with mixtures of Douglas Fir/Japanese Larch, Silver Fir/Japanese Larch, Sitka Spruce on the wet ground and one block of pure Japanese Larch. Three Silver Firs, *A. grandis*, *A. procera* and *A. alba* were used. *A. grandis* kept ahead of the larch but the other two species suffered from suppression as did also the Douglas Fir due to first thinnings being delayed until 1945, 1946 and 1947.

This wood, 40 years old, has recently been exploited for transmission poles, mainly from the Japanese Larch.

On the adjoining properties of Roddenagh and Killaduff 300 acres of Douglas Fir was planted in 1921-22 and succeeding years on former sheep grazing rising from 600' to 900' and facing north, north-east and east. The plantations on the lower, more sheltered slopes did well where the soil was damp but above 650'-700', especially on dry ridges, the Douglas Fir failed and was replaced in 1942 by Japanese Larch. The better Douglas Fir areas suffered check firstly from neglect of furze cleaning and secondly by postponement of thinning until they were 20 years old. The removal

of coarse stems in 1942-43, about 360 hoppus feet per acre, resulted in a remarkable spurt in growth, a doubling in tree volume was recorded five years later (the average dominant increased from 3.62 H.ft. to 6.07 H.ft. and the average co-dominant from 1.6 H.ft. to 2.9 H.ft. between 1943 and 1948 in one area examined). In 1963 Compartment 62, Killaduff, planted in 1926, had 220 stems on one acre with an average height of 75' and an estimated acreage volume of 2,400 H.ft.

Ballygobban, at the head of the Ow River valley near Aughavannagh, was planted in 1932, '33 and '34 with Sitka Spruce on the better ground towards the valley floor, Sitka Spruce/*Pinus contorta* on the poorer peaty areas, *Pinus contorta* pure on the exposed and drier peaty ground and Japanese Larch on rock-strewn ridges with grass and bracken.

In recent years these plantations have produced pulp-wood, box-wood and pit-props. Sitka Spruce, in Compartment 52, planted in 1934, had in 1963 360 stems on an acre, average height 59', acreage volume 3,700 H.ft. It had been thinned three times.

Rathdrum Forest properties are mainly in the valleys of the Avonmore and Avonbeg and on the slopes of the intervening hills. Ballintombay was planted in 1926 with pines, Scots, Corsican and Contorta on the high ground. There is a plot of *Cupressus macrocarpa* said to be the best in the country.

Glendalough Forest is on the hills surrounding the two lakes and in the watershed of the Avonmore and Annamoe River. Lugduff property is to the south side of the lakes, rising from 440' at the lake side to 2179' at the summit of Mullacor one and a half miles to the south, and was planted from 1922 onwards. There is a plot of Douglas Fir on land previously part of a mountain farm (average height 46', Q.G.B.H. 5½" and vol. 2,000 H.ft. per acre at 28 years). Other successful species are Sitka Spruce, Japanese Larch and, at 1,100' elevation, Scots Pine.

Glenmalure Forest is on the sides of a narrow, steep-sided valley of glacial origin. Planting started in 1922 at Ballyboy with Sitka Spruce, Douglas Fir, European and Japanese Larch, Scots Pine and *Pinus contorta*. In Compartment 52 planted in 1924 there is a 16 acre stand of Sitka Spruce said to be growing at the highest elevation, about 1800', for this species in Ireland.

In 1961 a sample plot contained 860 stems per acre with an average volume of 7.14 H.ft. per tree and a total volume of 6,140 H. feet. The average volume per acre for the whole stand at that time was estimated at 4,500 H.ft. (at 37 years).

Roundwood Forest is situated on the hills surrounding the high plateau of Calary. Ballinastoe property is on the eastern slopes of Djouce mountain between 995' and 1800'. Scots Pine planted in 1937 at 1135' on an areas of *Ulex galli*, *Calluna* and *Molinia* made slow growth. Scots Pine in Compartment 1, planted 1936, in 1963 had 1240 trees per acre, average height 33' and volume per acre 2100 H.ft. It had received one thinning at that time. Sitka Spruce dating from the same year did well at a slightly

higher elevation, 1255' *Pinus contorta* has been used on all exposed ground and is satisfactory.

In 1958 mountain areas from 1200' to 1500', previously considered unplantable on account of poverty of soil, were ploughed with a Cuthbertson plough and planted with Sitka Spruce 75% and *Pinus contorta* 25% and given small dressings of ground rock phosphate.

Glen Imaal Forest on the west side of the mountains is in a wide valley, where the River Slaney rises and the initial acquisition, Stranahely, was formerly an artillery range. Planting started in the late twenties and was principally Norway and Sitka Spruce, Douglas Fir, European and Japanese Larch and Scots Pine.

In 1963 these figures were furnished for Compt. 21 planted with pure Sitka Spruce in 1929:

No. of stems per acre, 260, with a mean Q.G. 9", mean Tree Height, 74', mean Tree Volume 19.4 H. ft., Top Height 76.5', Total volume on an acre 5,044 H. ft. Total B.A. 146 sq. ft. Quality Class II. Schneider Increment 4.8%. C.A.I. 308 H. ft. (Note: "Top Height" is the mean height of the 100 largest trees and is used to decide "Quality Class.").

A nearby Compartment No. 20 was planted in the same year with Douglas Fir and this data was furnished in 1963:

350 stems per acre, Mean Q.G. 6 $\frac{3}{4}$ ", Mean Tree Ht. 53', Mean Tree Vol. 7 H. ft., Vol. per acre, 2,457 H. ft., Top Ht., 62', Quality Class IV, Total B.A. 112 sq. ft. Schneider Increment 7%. C.A.I. 197 H. ft.

Some Japanese Larch was planted in this plot in 1932, three years after the original planting and some of them were 67' in 1963, i.e., overtopping Douglas Fir.

Blessington Forest is on the north-western side of the Wicklow Mountains and consists partly of former sheep farms and gravel ridges in the valley of the King's River. One such area, Ballyward Property, was planted in 1932 and '33 with Sitka Spruce, Scots Pine, Douglas Fir, Norway Spruce and small numbers of *P. contorta* and European Larch. The 1958 Census gave an overall volume of 810,000 H.ft. equal to an average volume per acres of 1,557 H.f. *P. contorta* was windblown at that time and was removed. The best plot of Sitka Spruce had in 1962 a volume of 3,200 H.ft. on an acre.

Delgany Forest is in east Wicklow, and in the Glen o' the Downs, Bellevue Property, about two miles from the sea, there is a group of *Eucalyptus muelleri* in Compt. 5, altitude 350' planted in 1934. In 1959 Top Ht. was 94', average height 87', max. girth 50", form factor .45, average tree volume 43.55 h.ft., stems per acre 120 and volume per acre 5,226 H.ft.

Glenealy Forest is in an open valley which extends from Rathnew towards Rathdrum, flanked on its north-western side by Carrick Mountain. On its southern slope in Ballymanus Property, the site of an old oak forest, there are plots of *Eucalyptus* planted in 1934 and 1935, raised from seed donated by the Director-General of Forestry, Canberra. The 1934 planting was assessed in 1957 and the following data collected:

Species	S.P.A.	Mean Ht.	Mean B.H.Q.G.	V.P.A. H.ft.	Actual no. of trees
<i>E. muelleri</i>	505	69'	7½"	6,124	62
<i>E. radiata</i>	786	42'	5¼"	2,822	28
<i>E. dalrympleana</i>	501	57'	7"	4,371	29
<i>E. urnigera</i>	704	70'	6½"	6,207	80

A second planting was done in 1935 in C.11 not far from the last plots. An assessment was made in 1957:

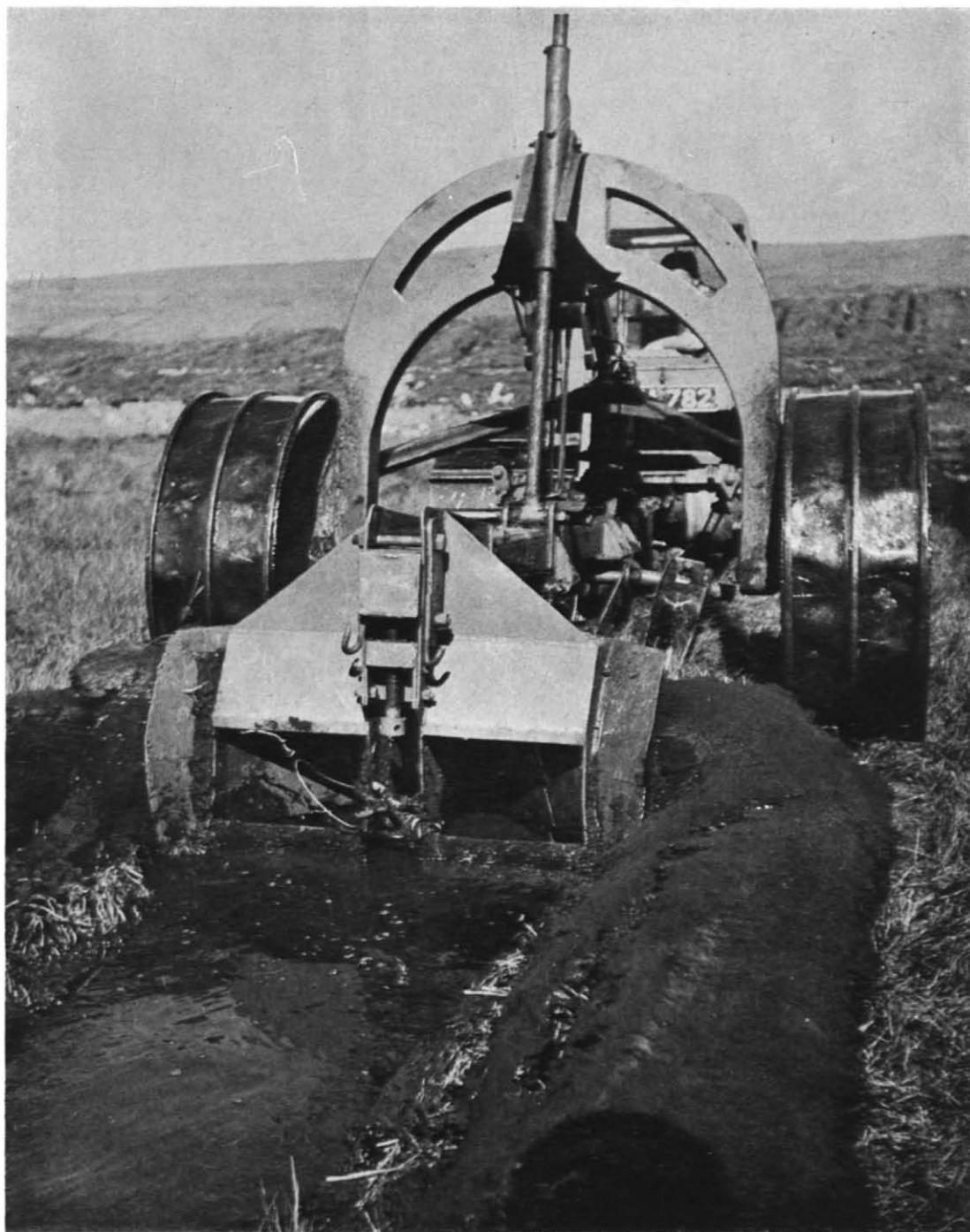
Species	S.P.A.	Mean Ht.	Mean B.H.Q.G.	V.P.A. H.ft.	Actual no. of trees planted in plot
<i>E. urnigera</i>	744	57½'	4¾"	2,805	120
<i>E. muelleri</i>	899	70½'	5¼"	5,441	300
<i>E. johnstoni</i>	961	61½'	6¾"	7,851	35
<i>E. amygdalina</i>	5 trees left				50
<i>E. gigantea</i>	775	51'	6"	4,448	25
<i>E. viminalis</i> (mountain type)	500	50'	4"	1,250	3,768
<i>E. viminalis</i> (coastal type)	Few trees left				1,985

E. amygdalina and *E. viminalis*, Coastal type, were an almost complete failure, due to frost.

A further plot laid down in 1937 gave the following data in 1957:

Species	S.P.A.	Mean Ht.	Mean B.H.Q.G.	V.P.A. H.ft.	Actual no. of trees planted in plot
<i>E. muelleri</i>	1,040	61'	6¼"	7,737	1,225
<i>E. urnigera</i>	634	59'	5¼"	3,005	530
<i>E. viminalis</i>	—	—	—	—	2,120

The two Co. Dublin forests are situated on the northern slopes and foothills of the Dublin mountains within 10 miles of the city centre. At Killakee there are groups of hardwoods planted about 1938.



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REPRODUCED BY PERMISSION OF THE MINISTER.

Cuthbertson double mould-board plough at Castledaly Forest,
Co. Galway.



BRITISH CROWN COPYRIGHT.

REPRODUCED BY PERMISSION H.M.S.O.

Peat ploughing with single mould-board plough in Ballypatrick Forest, Co. Antrim.

CO. WEXFORD

Camolin Park, 640 acres in extent, in the lowlands to the east of Slieveboy, the oldest part of Camolin Forest, was acquired in 1907. A mixed crop of hardwoods and conifers occupied 450 acres at that time, the remainder being open parkland, lowlying and subject to frost. The first planting was of Norway and Sitka Spruce in mixture, Douglas Fir, *Abies grandis*, European and Japanese Larch, Weymouth Pine, Spanish Chestnut and Beech. Measurements in these stands in 1949 gave the following data:

Norway Spruce 38 years. Total Ht. 55', Timber Ht. 43', 480 stems and vol. per acre 4646 H.ft. U.B.

Sitka Spruce 38 yrs. Total Ht. 80½', Timber Ht. 63', 280 stems and 5,401 H.ft. per ac. U.B.

A. grandis 30 yrs. 500 stems per acre. Average dominant ht. 55'.

Douglas Fir 39 yrs. Total ht. 65', Timber ht. 50', Stems 270 and volume 2,550 H.ft. per acre. (This plantation had suffered severely from *Adelges*). Measurements made in 1958 showed that Norway Spruce had reached 79' and the Sitka Spruce 82' total height. The Douglas Fir was by then 75' high and had 140 trees per acre with a volume of 3,066 H.ft.

Pinus radiata planted in 1927 by 1958 was 86' in ht., with 190 trees and a volume of 5,073 H.ft. per acre.

A mixed crop of *Pinus radiata* and *Cupressus macrocarpa* planted in 1930 by 1958 had 270 trees to the acre with a mean total ht. of 56' and a volume of 3,100 H.ft.

Cupressus macrocarpa planted in 1927 with European Larch as a nurse was measured in 1957. The mean heights were then 65' for the Cypress, 63' for the Larch and volume per acre 3,480 H.ft. for the Cypress and 470 H.ft. for the Larch.

Curracloe Forest lies on the coast to the north of Wexford Harbour. This stretch of sand dunes, two miles long and half a mile broad at its widest point, and extending to 530 acres, was bought in 1931 and afforested during the following two years. The principal species were Scots and Corsican Pine on the bracken covered ground, Sitka Spruce on the swampy inland strip, and Maritime Pine, direct sown, on the grassy portion. Small areas were planted with *Pinus contorta*, Mountain and Austrian Pine, *Pinus radiata* and Alder. By the autumn of 1945 there were a few good blocks of Maritime and Corsican Pine, 20' high with a mean B.H.Q.G. of 4" but containing many leaning, curved and heavily branched Maritime Pine. At that time most hope lay in these two species and in *Pinus radiata*, Austrian and Contorta pine.

The picture in 1958 was of clean, healthy looking stands of Corsican Pine, 31' mean ht., 1,200 stems and 1,440 H.ft. to the acre. *P. radiata*, had 300 stems with a top height of 46' and a volume of 2,295 H.ft. to the acre. Scots Pine contained 920 stems, 25' top ht. amounting to 828 H.ft. on an acre.

The older part of Clonegal Forest is on the western side of Gibbet Hill, the summit (1053') of a low rib linking the southern Wicklow Hills near Shillelagh with the Blackstairs Mountains at Bunclody. The first plantations, in Coolmelagh, date from 1928. Thirty years later the data for Sitka Spruce in Compt. 5 was: 270 stems and 3,000 H.ft. per acre with an average total height of 62'.

There are stands of Douglas Fir, Scots Pine, *Pinus contorta*, and other conifers in this forest.

Forth Forest is on an isolated range of low hills nowhere exceeding 800' in height and lying south-west of the town of Wexford, where four blocks of bare mountain land were taken over in 1933. Planting was done by breaking up the surface of the ground with hand picks to form planting "spots" on which was placed a thin mound in order to add to the small amount of humus in the soil which consisted of broken quartzite and quartz rock. *Pinus contorta* was planted on about 700 acres prepared in this way. Measurements made in Compt. 4 in 1958 showed that there were 950 stems with a mean height of 30 feet and a volume of 1,340 H.ft. to the acre. The seed origin is believed to be "sea coast of Washington." Another sample acre had 900 stems, mean tree height 31' and 1,692 H.ft. in 1957 when it was 24 years old. In Compt. 5 there are "Diamond beds" created by the complete digging with picks of small plots with 7' sides, 18' apart. Each bed was planted in 1933 with Sitka Spruce, Japanese Larch and Scots Pine surrounded on the rim of the bed by *Pinus contorta*. The spaces between the beds were left bare. Each bed received a dressing of $\frac{1}{2}$ lb. ground rock phosphate, except every tenth one which was left unmanured as a control. The manured beds were distinctly better in the first years but the effect wore off and by 1958 there was no apparent difference between them and the control.

Only the *Pinus contorta* remained in that year and had the following measurements: 493 stems, mean Ht. 42' and volume per acre 1,848 H.ft.

Borris and Bunclody Forests occupy extensive areas of sheep grazing on the Blackstairs range and consist of conifers planted from about 1935 onwards.

FORESTS OF THE MIDLAND PLAINS AND THE SLIEVE BLOOM RANGE

This region is taken as the lowlands south of Cavan, reaching westwards to the Shannon and southwards as far as the base of Slievenamon in Co. Tipperary. The forests of the plains are for the most part based on eighteenth century estate woodlands with additions consisting of land marginal to farming such as lowland bogs and swamps, limestone crags and gravel ridges. The Slieve Bloom forests are on poor farm land and mountain grazing in the valleys and on the slopes of the range.

Areas on 31st March, 1963

Kildare	Kilkenny	Laois	Longford
Donadea 2329 ac.	Callan 1546 $\frac{3}{4}$ ac.	Clonaslee 5290 $\frac{1}{4}$ ac.	Ballymahon 1338 $\frac{1}{2}$ ac.
Edenderry 1592 $\frac{1}{2}$	Graiguena- managh 2247	Durrow 2325	Granard 1764 $\frac{1}{4}$
Monasterevan 3208 $\frac{3}{4}$	Knocktopher 923 $\frac{3}{4}$	Emo 4487 $\frac{1}{4}$	
	Mullinavat 2369 $\frac{1}{2}$	Mountrath 4402 $\frac{1}{2}$	
	Piltown 1587 $\frac{1}{2}$	Ossory 4003	
	Thomastown 2624	Portlaoise 1719 $\frac{3}{4}$	
		Stradbally 1794 $\frac{3}{4}$	
Totals: 7,130 $\frac{1}{4}$	11,298 $\frac{1}{2}$	24,122 $\frac{1}{2}$	3102 $\frac{3}{4}$

Offaly	Tipperary (part of)	Westmeath
Kinnitty 5226 $\frac{1}{2}$	Roscrea 2678 $\frac{1}{4}$	Athlone 497 $\frac{1}{2}$
Tullamore 1727 $\frac{1}{4}$	Urlingford 3255 $\frac{1}{4}$	Castlepollard 2516 $\frac{3}{4}$
		Lough Ennel 988 $\frac{1}{4}$
		Lough Owel 1662 $\frac{3}{4}$
Totals: 6953 $\frac{3}{4}$	5933 $\frac{1}{2}$	5665 $\frac{1}{4}$

The original estate woods, the greater proportion of which were hardwoods with, at most, a small mixture of conifers, have been progressively cleared and replanted. In replanting, Norway Spruce was widely used where soil and other conditions favoured its rapid growth.

Emo Park, at one time the estate of the Earl of Portarlington, forms the central block of Emo Forest. In 1929 910 $\frac{1}{2}$ acres of old oak woods and open parkland passed into State ownership and by 1947 750 acres had been planted. Species used included Scots Pine, European Larch, Douglas Fir, the former in 50% mixture and the latter planted pure. The Douglas Fir is described in 1947 as being up to 25' and well closed in but with the bulk of the stems retaining coarse branches from ground level. By 1956 it had been thinned to about 400 stems to the acre and pruned and looked promising.

In Compt. 8 there is an area of Beech natural regeneration dating

from about 1943 when it was opened up gradually to encourage seeding. In 1956 it was closely stocked and up to 15' high. Sitka Spruce has not succeeded in this frosty region but there are good areas of Norway Spruce with groups of Oak and Beech through them. A feature of this demesne is the avenue of large Wellingtonias planted by the late owner.

Cush Bog, on Garryhinch property, also part of Emo Forest, was bought in 1935. It is a flat area running down to the River Barrow, with a sticky marl sub-soil overlain with about 12" of a black, amorphous, alkaline peat and was planted in 1936 with Scots Pine.

The original property of Durrow Forest was the Castledurrow estate of 752 acres acquired in 1931. Formerly an area of Oak, Beech and Ash woods, it has been cleared and replanted with Scots Pine and Norway Spruce principally and with some Sitka Spruce. A light cover of Ash, Hazel and Birch had been retained as protection against frost but in spite of this cover severe damage was done in May 1945 and the Sitka Spruce was nearly all killed. The area is developing into a Scots Pine, Norway Spruce stand with much natural Ash and Birch in groups and individual standards.

In nearby Dunmore Property where 324 acres of old woods were acquired in 1936, there is in Compt. 34 a naturally regenerated area of Beech, Scots Pine, European Larch and Norway Spruce dating from about 1946.

Moore Abbey, Monasterevan Forest, was bought in 1953 when it consisted of recently cut-over woodland and a few stands of 50 year old Norway Spruce, Douglas Fir and Ash. Planting done in the late fifties consists of Norway Spruce and Oak in alternate bands of three lines each, Beech and European Silver Fir in mixture, and Douglas Fir, Norway Spruce and Scots Pine. There is much natural Ash.

Kilcooley Abbey property of Urlingford Forest was acquired in the mid-thirties from Mr. T. B. Ponsonby, a keen forester who had for many years managed his woods skilfully and who had practised the Selection and other systems of natural regeneration. The Forestry Division planted areas of open parkland with Norway Spruce, Scots Pine and European Larch through which there were small groups of Oak at about 20' spacing. Dense stands of light 20' high Ash, Birch and Alder were opened by a heavy thinning and inter-planted with Norway Spruce, Scots Pine and Beech. Dating from the days of the previous owner there are middle-aged plantations of Douglas Fir, Japanese Larch and Silver Fir and old woods of Beech, Oak and Ash which are being managed on the Selection System.

Lough Owel Forest, near Mullingar, consists of the remnants of estates divided by the Land Commission and formerly old woodland and wet grassland. Planting was with Norway Spruce interspersed with groups of Oak. In Baronstown there is a promising stand of these species, planted in 1937, the Oak of Dutch origin.

The first acquisition in Castlepollard Forest was Mullaghmeen, a dry,

grassy, limestone ridge along the Meath border near Oldcastle which was planted in the mid-thirties with Beech, Corsican and Scots Pine.

The range of the Slieve Bloom, which is unbroken for its whole length from near Mountmellick to Roscrea, a distance of 18 miles, is intersected by many valleys which cut into, but nowhere penetrate, through the mountain mass. These are the sites of extensive plantations of Sitka Spruce, Japanese Larch and *Pinus contorta*, and together with areas on the foothills, amount to 14,550 acres in the forests of Mountrath, Ossory, Kinnitty, Roscrea and Clonaslee.

Baunreigh, the oldest part of Mountrath Forest, was acquired in 1911. The original block amounts to 1,926 acres and lies in a deep-cut valley about two miles long, the source of the Delour river, and is sheltered from all winds except those from the south-east. Planting started in 1913 and continued until 1926. Here Sitka Spruce proved itself an ideal tree. In 1948 a 32 year-old stand gave this data: Mean total ht., 72', Mean timber ht. 53', stems 650 and volume per acre 5,980 H.ft. *Abies grandis*, *A. procera* and *Tsuga heterophylla* did remarkably well but plantings of Scots Pine and European Larch were a failure.

Glendine Property, Ossory Forest, a few miles to the west of Baunreigh, is another deep, narrow valley. Here again, Sitka Spruce has proved itself as is shown by this data collected in a stand due for final felling in 1963:

Planted in 1919, top ht. 73', mean ht. 63', stems 380 and vol. 4,520 H.ft. per acre with current annual increment 217 H.ft.

Another stand, 35 years old at that time, had this data:

Mean ht. 75', stems 240 and vol. 4,570 H.ft. per acre. C.A.I. 460 H.ft.

On the north side of the range is Kinnitty Forest where the afforestation of the glens started in 1935 with Sitka Spruce as the predominant species. Other species were Japanese Larch and *Pinus contorta*.

An unusual forestry plantation is on Clonsast Bog, Clonbullogue, the property of Bord na Mona. It is known as Trench 14 and consists of a strip of cut-away bog a mile long, 30 yards wide and about 9½ acres in area which was the scene of experimental planting by the Forestry Division in 1955. There are 17 species in half acre plots. These comprise Lawson Cypress, Sitka Spruce, Norway Spruce, Serbian Spruce, Monterey Pine, Scots Pine, *Pinus contorta*, Douglas Fir, *Populus gelrica*, *Populus serotina*, *Populus robusta*, Hybrid Larch, Japanese Larch, Japanese Larch/Sitka Spruce, Japanese Larch/Norway Spruce, *Thuja plicata*, *Tsuga*, *Abies grandis* and *Abies procera*. Half of each plot was treated with 3 oz. per plant of Ground Mineral Phosphate, except *P. contorta* which got only 2 oz. Seven years later the indications were that, if the depth of peat left after cutting permitted mixing with the underlying mineral soil, it should be possible to grow trees satisfactorily on these midland bogs.

THE SUIR VALLEY AND THE REGION OF THE COMERAGHS

In this region are included the Co. Tipperary Forests on Slievenamon and all the Co. Waterford forests except Cappoquin and Ballyduff.

Areas of State Forests in 1963:

WATERFORD		TIPPERARY	
Clonmel	3,818½ acs.	Anner	1,932½ acs.
Comeragh	3,856¾	Carrick-on-Suir	1,932
Curraghmore	3,478	Slievenamon	1,554½
Dungarvan	3,094½		
Kilsheelan	4,945¼		
Ring	2,294		
Totals	21,487		5,419

The Suir Valley has long been a centre of commercial forestry with extensive plantations of Scots Pine, European Larch and Spruce at Coolnamuck, Churchtown, Landscape and Gurteen-le-Poer grown specifically for pit props which were exported through the port of Waterford to the coal mines of South Wales. At the beginning of this century there were 1,200 acres of these conifers which were managed on a rotation of about 35 years with thinning at 15, 20 and 27 years and with a total yield of 115 tons per acre.

The existing plantations and large areas of bare ground were bought or leased by the State from 1920 onwards and now form parts of the forests of Carrick-on-Suir and Kilsheelan. They lie on the south bank of the Suir in a narrow belt along a foothill ridge of the Comeragh Mountains, and occupy a steep slope with ideal conditions for the growth of conifers. The acquired plantations of Scots Pine and Larch which were laid down from 1890 to 1910 have produced a handsome return from the sale of transmission poles and timber. The Department's planting consists of Douglas Fir, Scots Pine, European and Japanese Larch, Sitka and Norway Spruce.

In 1953 a 64 year European Larch stand had 120 stems with a mean total height of 76' and a volume of 2,300 H.ft. to an acre. A nearby Scots Pine wood of the same age had 240 stems, mean total height 54' and a volume of 2,000 H.ft. to an acre. In Compartment 104 Kilsheelan Forest Douglas Fir 35 years old had 250 stems, mean total height 60' and volume 2,660 H.ft. on an acre. A 50 acre plantation of European Larch, 36 years old, had 260 stems and a volume of 2,600 H.ft. on an acre. At 1,000' altitude on peaty ground with *Molinia*, *Pinus contorta* gave over 1,600 H.ft. per acre at 20 years of age when measured in 1960.

The main mass of Clonmel Forest overlies Old Red Sandstone, impoverished on the higher slopes but providing good conifer soils on the middle and lower levels. Russellstown, acquired in 1922, is an example

of a difficult subject due to exposure and soil impoverishment. The first plantations, which consisted of Scots Pine and Larch, made poor growth. They were destroyed by fire in 1937 and the area was replanted in 1938 with Mountain and Contorta Pine, Japanese Larch and Sitka Spruce.

Other forests in the Comeragh district are Curraghmore, where 2,680 acres of cutaway conifers woods were taken over from the Marquess of Waterford in 1932, Dungarvan, consisting of existing plantations in the valley of the Colligan River and large blocks of sheep grazing, and Comeragh, where the area is mostly composed of rough mountain land. Ring Forest is on poor farm lands on the Drum Hills extending to near the sea at Mine Head. All these forests are under conifers, Sitka Spruce, Japanese Larch, Scots Pine, Contorta and Monterey Pine from 25 years of age downwards.

Boherboy, Anner Forest, is on the slopes of Slievenamon. In Compartment 12 a 1930 plantation measured in 1963 had 300 stems, mean top height 70', and 2,982 H.ft. on an acre. In the neighbouring forest of Slievenamon in Ballyknockane property, Compartment 30, Sitka Spruce planted in 1935 by 1963 had 490 stems, mean top height 56', and 3,077 H.ft. on an acre.

THE REGION OF THE KNOCKMEALDOWN AND KILWORTH MOUNTAINS

This is an area of "difficult" forestry land with unproductive soils derived from Old Red Sandstone consisting mainly of quartz and containing few bases and little weatherable material. There is especially a great deficiency of lime. Peat, derived from surface vegetation equally deficient in bases, forms a thin layer over the mountains and, aided by the humid climate, has led to extreme podzolisation and the formation of hardpan which is impermeable to water.

Treatment for afforestation consists in the breaking of the pan and the mixing of the upper and lower layers of the surface soils. In recent years large areas have been successfully planted after deep ploughing with Cuthbertson, Clarke or other heavy ploughs.

Areas of forests in 1963:

Waterford		Tipperary		Cork	
	acres		acres		acres
Ballyduff	1,592½	Clogheen	5,422	Kilworth	3,525¼
Cappoquin	5,160¾				
TOTALS	6,753¼		5,422		3,525¼

Kilworth Forest dates from 1923 when 2,849 acres of the military camp on the Kilworth Mountains was taken over by the Department.

The area was famous as the site of a clump of Norway Spruce said to have been "as fine an example of Spruce growth in Britain as can be found anywhere." It stood in Glenseskin, a valley running into the hills, traversed by a small stream, and at one point, about 300' above sea level, an alluvial deposit had been formed about an acre in extent. On this deposit a patch of almost pure spruce was planted about 1830 and judging from appearances was never thinned as many of the trees in 1910 still stood 4' or 5' apart. In that year it was measured and was found to contain 255 stems, mean ht. 98', and volume 12,000 c. ft. to an acre.

Unfortunately the record of this altogether unique plot was taken as a head-line for planting done in the early twenties with the result that Scots Pine, Larch and even Douglas Fir was planted on the barren hill-sides above the valley and some of the Scots Pine 30 years later was only 4' high and it all failed miserably. The lucky Douglas Fir which followed the Spruce in the glen did exceptionally well and a sample tree measured in 1957, when it was 47 years old, had a total height of 107', Q.G.B.H. 15¼" and a volume of 67½ H. ft. Sitka Spruce on the grasslands of Ballinavoher and Mountain Barracks was a success.

Pinus Contorta came into fashion after 1927 and figures largely in the later planting on the poor slopes of Kilworth. In 1933 a plantation was laid down on an area with sparse vegetation of *Calluna*, *Molinia*, *Scirpus* and with a mat of *Cladonia* on a thin peat surface in full exposure. Measured 24 years later it had 1,020 stems, mean total height 35' and volume 1,785 H. ft. on an acre. Another stand of *Pinus Contorta* gave higher figures. They were: 660 stems, mean total height 61', volume 2,897 H. ft. at 29 years.

The failed areas have in recent years been deep ploughed and ribbon mounded and replanted mainly with *Pinus contorta* and Sitka Spruce, manured with Ground Mineral Phosphate and these plantations look promising.

The Dromana property of Cappoquin Forest occupies a low outlier on the south side of the Knockmealdown range. Norway Spruce has thrived remarkably in plantations dating from 1930. Glenshelane was acquired in 1943. It consists of narrow glens penetrating deep into the mountain-side near the town of Cappoquin. Here all conifers have made a good showing on soils of weathered sandstone.

Clogheen Forest on the northern slopes of Knockmealdown reaches from near Newcastle to Ballyporeen and includes part of the demesne of Shanbally Castle. Although much of the mountain land had carried trees before, early results were disappointing due to the poverty of the compact soil, especially on the bottom "flats." Intensive manual preparation ameliorated the condition somewhat and the plantations have developed in a rather patchy manner. The principal species are Scots Pine, *Pinus contorta* and Japanese Larch.

started by the direct planting of Scots Pine and other conifers in the impoverished soil where they languished and died over the next ten years. *Pinus contorta* was tried later and succeeded in patches, often on scree or where the soil was less compact than in other parts of the area.

Soil conditions have in recent years been ameliorated by deep ploughing, which breaks the hardpan and loosens and mixes the layers above and below it, and the subsequent plantations appear promising.

NAGLES' MOUNTAIN AND THE DISTRICT AROUND WATERGRASSHILL

This region is situated between the River Blackwater and Cork Harbour and has soils derived from Old Red Sandstone which have been planted with pines, mainly *Pinus Contorta* and Japanese Larch. The oldest forest is Tallow where planting started in 1930 and there are blocks 20 years and upwards totalling 2,000 acres.

Areas in 1963:

		Cork	acres
Ballyhooley		3,825
Killavullen		5,631½
Killeagh		3,858½
Lisgoold		3,329½
Rathduff		5,126½
Tallow		6,365½
TOTAL		28,135½

SILVERMINE, SLIEVEFELIM AND THE DEVIL'S BIT MOUNTAINS

This mountain mass between Nenagh and Thurles contains some of the best planting land in Co. Tipperary.

Areas in 1963:

Tipperary		Limerick	
Dundrum 2,724½	Cappamore 3,116½
Templemore 1,983½		
Silvermines 3,273		
Newport 4,143½		
TOTAL 12,124½		3,116½

The original part of Dundrum Forest, the former demesne woods of the Earl de Montalt, lies partly on the south slopes of the hills and partly in the adjacent plain. It was bought in 1909 and at that time its 1,200 acres was under Oak, Norway Spruce, Scots Pine and Larch except for

small tracts of swamp and poor agricultural land. Gortussa, 90 acres in extent, was planted between 1911 and 1914 — in 1950 the best of the Sitka Spruce was 68' high with a Q.G.B.H. of 13". A small block of Black Italian Poplar 25 years old had, in 1953, 435 stems, mean height 78' and volume 3,000 H. ft. on an acre.

All the other forests in the region were planted after 1935 with Sitka Spruce predominating.

DERRYNASAGGART, BOGGERAGH AND SHEHY MOUNTAINS

Between the Blackwater valley near Banteer and the south coast of Cork there is an extensive range of rugged mountain land of Old Red and Upper Old Red Sandstone with soils of fair quality for forestry although soil preparation and drainage are hindered by rock outcrops. This region includes the district of West Cork which was the subject of a survey by the Agricultural Institute in 1961. This survey recorded that 14,000 acres had been acquired for forestry and that prospects for expansion on sub-marginal farmland were good. At that time the existing State plantations in the survey area had the following age structure:

1 — 10 years	7,511 acres
11 — 20 „	809 „
21 and over	1,383 „
	<hr/>
TOTAL	9,703 „

The areas for the region on 31st March 1963 were:

Cork		acres
Ballydehob	1,632 $\frac{1}{4}$
Bandon	2,126 $\frac{1}{4}$
Banteer	3,016 $\frac{3}{4}$
Dunmanway	3,767 $\frac{1}{4}$
Glengarriff	2,173
Inchigeelagh	5,499 $\frac{1}{4}$
Macroom	8,367
Rosscarbery	1,481 $\frac{1}{2}$
		<hr/>
TOTAL	28,053 $\frac{1}{4}$

To the west of the shallow valley connecting Millstreet with Macroom, at the junction between the Boggeragh and Derrynasaggart Mountains, is Glenday, the oldest part of Macroom Forest. Planting commenced

about 1935 and consisted of Sitka Spruce on the low and *Pinus contorta* on the high ground. Measurements made in 1961 showed that a 25-year stand of Sitka Spruce had a top height of 57' and an estimated volume of 4,000 H. ft. on an acre. *Pinus contorta* grew well until a hurricane levelled nearly 200 acres which has been cleared and replanted.

Inchigeelagh Forest started with the purchase of Coomroe, Gougane Barra, in 1938, a wild rock-rimmed valley in the Shehy Mountains at the headwaters of the River Lee. This district is planned as a National Park and a view road has been built around the 1½ mile upper perimeter of the valley.

About 233 acres has been planted with Norway and Sitka Spruce, *Pinus contorta* and European Larch in the saucer-shaped valley bottom and is now about 25 years old.

Glengariff Forest has its nucleus in the wooded slopes above "The Lodge" where the Glengariff River flows down from its source in the Caha Mountains in Co. Kerry to meet the sea in Bantry Bay. The old woods here are nearly all Oak, some good, some little better than scrub, and a few scattered Scots Pine. These woods are being treated with the object of preserving and enhancing their amenity value. Tree clad knolls are left untouched, other parts have the oak opened out and interplanted with Silver Fir, Beech and *Tsuga* and large gaps are filled with groups of Eucalyptus. Open ground, mostly of a boggy nature, has been planted with Sitka Spruce and *Pinus contorta*. There is a plot of *Populus robusta* and *P. gelrica* planted in 1957 but considered disappointing four years later in spite of a massive dressing of lime put on after planting.

SLIEVEMISH, MULLAGHREIRK AND THE MACGILLICUDDY REEKS

This mountainous district in Co. Kerry and the Cork border contains a large area of forest and potential forest land but, unfortunately, also a high proportion of waste land too elevated, too poor and too exposed to be plantable. In 1963 forest areas were:

Kerry		Cork	
	acres		acres
Brosna	2,665	Mullaghreirk	4,557½
Cahirciveen	3,096½		
Castlegregory	1,223½		
Kenmare	2,781½		
Kilgarvan	3,259½		
Killarney	3,982		
Killorglin	1,541½		
TOTALS	18,548½		4,557½

Killarney is the most interesting forest in this region. Muckross Property is part of the Bourn-Vincent Memorial Park and the preservation of scenic beauty is an overriding consideration in its management, so much so that over half its area has been left for amenity. This includes good plantable ground at present under old, uneconomic scrub oak with an occasional *Arbutus* and other indigenous flora.

The forest started in 1933 when about 2,000 acres was taken over from the Board of Works which looks after the park, and additional acres have since been purchased. There are many fine old woods and middle-aged plantations from the days of the previous owners. Statistics collected in 1961 showed that at Ross Wood a plot of European Larch planted in 1913 had 130 stems with a volume of 3,333 H.ft. on an acre. In Compt. 13 a small area of Corsican Pine planted in 1917 had 372 stems, mean total height 60', volume per acre 4,884 H.ft. and in a nearby stand of Scots Pine aged 44 years there were 430 stems, mean total height 43½' and volume 2,055 H.ft. on an acre.

The Department's planting includes all the common conifers and also *Tsuga*, of which species there is a good plantation put in in 1936. About 700 *Eucalyptus* have been planted through the oak above the Torc Valley 15' to 18' apart in cleared strips along the contours and with individual tree guards. These are growing at a rate of six feet a year.

Mild and maritime is the climate of Dromore Property on the shores of the Kenmare River estuary. This portion of Kenmare Forest was bought in 1936 and consisted of 150 acres of Oak, Beech and Silver Fir and 350 acres of bare land. During the last 25 years 100 acres of the old woods have been cut down, first as clear felling to make way for replanting and later on the lines of the Selection System, encouraging young growth and leaving seed trees for restocking open spaces. The woods are notable for the natural regeneration of Silver Fir and there are thriving thickets of this species intermixed with Beech and some Oak.

Sitka Spruce and *Pinus radiata* have done well in the new plantations but Scots Pine and European Larch have fared badly. Statistics collected in 1961 showed, in Compt. 17, Sitka Spruce 23 years old had 560 stems, mean total height 53', and volume 4,289 H.ft., and in Compt. 2 at 24 years of age it had 460 stems, mean total height 65' and volume 6,739 H.ft. on an acre—this last stand had a Mean Annual Increment of 317 H.ft.

Of the 15,000 acres of plantation in the region over 12,000 acres are less than 10 years of age.

LOUGH DERG AND THE SHANNON

This region extends from Portumna at the head of Lough Derg down to Kilrush where the River Shannon meets the open sea. The forests are based on old estates, much of which were previously wooded, with purchases of poor agricultural land and some mountain areas added.

Areas on 31st March, 1963:

GALWAY	CLARE	LIMERICK
Portumna 1,488 $\frac{1}{4}$ ac.	Mountshannon 2,026 ac.	Adare 1,486 ac.
	Tuamgraney 1,064	
	Ennis 2,517	
	Broadford 3,870	
	Cratloe 1,417 $\frac{1}{2}$	
	Kilrush 914	
Totals: 1,488 $\frac{1}{4}$ ac.	11,808 $\frac{1}{2}$ ac.	1,486 ac.

About 1908 the Vandeleur estate in Co. Clare was divided by the Land Commission and the Forestry Division acquired the demesne lands, an area of 407 acres, outside the town of Kilrush, overlooking the Shannon estuary and fronting on the broad Atlantic. This is good soil, brown earths tending acid, with gleying, gleys and podzolised gleys, and peat over shale rock, and is excellent for tree growth. The previous owners had done extensive planting; starting in 1814 they planted 150 acres around the demesne perimeter, then a further 257 acres within this enclosed space and 40 acres of a friable peat soil, employing hardwoods on mineral soils and Scots Pine and Norway Spruce on peat. Some of the old trees which remain, Scots Pine, Norway Spruce, Silver Fir, Ash, Oak, Beech, Sycamore, Elm and Larch are short stemmed heavy trees, about 60' timber height and Q.G.B.H. running from 18" for the spruce up to 30" for the beech.

Planting began in 1913 and included complicated mixtures such as Ash/Silver Fir/Larch/Pine which had only limited success; simple mixtures were Sitka Spruce and Norway Spruce, the former grew so fast that it completely suppressed the Norway. These early plantings of Sitka Spruce were 80' high in 1947 and suffered greatly from storm damage from then until 1961. At that time it was about 20" Q.G.B.H. Pure Norway Spruce made a poor fight against the salt laden winds.

Some high knolls were planted with *Pinus radiata* which reached large dimensions as did also *Cupressus macrocarpa*—both species suited to the location. Poplar grew well for 30 years and then faded out. It was underplanted with Thuja which is now about 45' high. These early plantations are now being cleared and replanted and 150 acres has been done, mainly with Sitka Spruce.

Outlying properties of Kilrush Forest include Mount Shannon East, 120 acres, planted with pure Sitka Spruce since 1954, Cloghaunbeg, 108 acres of peat three miles from the coast, planted with Sitka Spruce/*Pinus contorta* since 1956 and Cahircon, 280 acres of old woodlands acquired since 1961.

Tuamgraney Forest started in 1925 with the purchase of 350 acres of Raheen where there were already large plantations. It lies on a series of low hills between the Tuamgraney-Killaloe road and Lough Derg and much of the lake-side land is swampy and subject to flooding (some of it was lost with the raising of the water level due to the Shannon Scheme). Statistics of growth in 1957 were:

Compt. 1 where 14 acres of Sitka Spruce was planted in 1926 had 350 stems, mean total height 74' and volume 6,313 H.ft. to an acre.

Compt. 8, 15½ ac. of Sitka Spruce planted on peat mounds in 1928 was 5,686 H.ft. on an acre.

Compt. 9, planted in 1912 with Sitka Spruce and Thuja, the latter being suppressed, had in 1956 198 stems, 87' tree height and 7,237 H.ft. on an acre. 1,700 H.ft. of thinnings had been removed.

At the neighbouring forest of Mountshannon Sitka Spruce was planted from 1928 onwards both on the low ground towards the lake and on the 700' high mountain slope of Bohatch where the following data applies to a 28 year old plantation in Compt. 13, measured in 1957: 680 stems, mean total height 33' and volume 2,542 H.ft. on an acre.

SLIEVE AUGHTY AND GALWAY BAY

This region reaches from the broad desolate hills of Slieve Aughty across the plains of Gort to the sea near Ballyvaughan and covers a wide variety of geological formations from Old Red Sandstone and its variations to carboniferous limestone in which subterranean streams appear and disappear.

Areas on 31st March, 1963.

GALWAY		CLARE	
Woodford	6,438 ac.	Ballyvaughan	604
Loughrea	3,956¾	Tulla	5,293¼ ac.
Castledaly	5,233¾		
Gort	4,250¾		
<hr/>		<hr/>	
Totals:	19,879¼		5,897¼

Coole property, bought in 1928 from Lady Gregory of Abbey Theatre fame, was the beginning of Gort Forest. It is on limestone, with a strongly calcareous soil, and is interesting for the natural regeneration of Beech, Ash and Silver Fir.

In Maghera, Tulla Forest, a 330 acre block of Sitka Spruce was planted about 1932 and made good growth on a wet area at 600' to 900' elevation. It suffered severely from hurricane damage in 1957 and again in 1961.

Loughrea Forest began with Kylebrack property in 1932 when nearly 1,000 acres, much of it blanketed with shallow peat over Old Red Sandstone, was acquired. Plantations are principally Sitka Spruce and *Pinus*

contorta but there are small areas of Norway Spruce, Scots Pine and European Larch. In Compt. 15 a plus *Pinus contorta* of Washington Coast origin, has been selected by virtue of its straightness of stem, taper, crown shape and length and form of branches for use as a source of scions which are grafted onto stocks in seed orchards for the production of seed.

The first acquisitions in Woodford Forest were parts of the old Clarrickarde estate taken over in 1913. They consisted of woods of rough oak over 100 years of age and probably the result of neglected coppice. Clearing and restocking with conifers, predominantly Norway Spruce and Scots Pine, started in 1933 and nearly all the oak woods in Derrycrag and Rosturra Woods have since been converted. In Derrygill a stand of Scots Pine planted in 1935 had a top height of 44' and an estimated volume of 1,860 H.ft. in 1961.

EAST GALWAY, ROSCOMMON, PART OF SLIGO AND EAST MAYO.

This region, east of Corrib and Mask and stretching to the hills beside Lough Allen, and to the sea at Sligo Bay is mainly limestone, Millstone grit and shales. The forests are based on old wooded estates partly on good mineral soils, partly on wet lowland peat and poor hill grazing areas.

Areas at 31st March, 1965

GALWAY		ROSCOMMON		MAYO		SLIGO	
	acres		acres		acres		acres
Athenry	2,264 $\frac{1}{4}$	Ballinalough		Cong	2,814 $\frac{3}{4}$	Colloney	4,319 $\frac{1}{2}$
Kiltullagh			1,290 $\frac{3}{4}$	Lough Carra		Lough Gill	
	1,216	Ballyfarnon			1,350 $\frac{3}{4}$		1,965 $\frac{3}{4}$
Ballygar	3,627 $\frac{1}{4}$		4,612 $\frac{3}{4}$				
Ballinasloe		Strokestown					
	1,725		1,934 $\frac{3}{4}$				
Mount Bellew							
	2,578 $\frac{1}{4}$						
Tuam	601 $\frac{1}{2}$						
Totals:	12,012$\frac{1}{4}$		7,838$\frac{1}{4}$		4,165$\frac{1}{2}$		6,285$\frac{1}{4}$

Ballygar, where the demesne land of Aughrane Castle was bought in 1910, is one of the oldest Irish State forests and one where for a variety of reasons second rotation plantations are fairly general. For example, a 7 $\frac{1}{2}$ acre stand of Sitka Spruce in Compt. 30, planted in 1916, was considered mature in 1958 and was sold and clear felled, yielding 100 trees and 3,300 H.ft. to an acre. A 1928 planting of Douglas Fir was partially storm blown in 1957 and was cleared and sold as transmission poles, netting £440 to an acre; £340 for poles and £100 for light tops as pulpwood. An unthrifty



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Intensive drainage by ploughing: Castledaly Forest, Co. Galway.



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Planting on plough ribbons at Castledaly Forest, Co. Galway.

stand of Scots Pine and European Larch planted in Compt. 19 in 1928 was cleared in 1952. All these areas have since been replanted.

A later acquisition was Mount Bellew Forest where a portion of the local demesne was bought in 1940. About 450 acres of this were good quality land and outstanding results have followed its planting. In 1961 Norway Spruce in Compartment 14, planted in 1941, had a top height of 45', 720 stems and 2,700 H.ft. on an acre. In the same compartment and no more than 50 yards away, is a stand of Sitka Spruce of the same age which in 1961 had 420 stems, top height 51' and 2,500 H.ft. on an acre. A crop of oak planted in 1941 on good soil with Japanese Larch as a nurse, removed in 1956, was 28' high when 20 years old.

In Rockingham, an 857 acre portion of Ballyfarnan Forest on the eastern shore of Lough Key, there is a 5 acre plot of Norway Spruce, 37 years old in Compartment 17. The soil is a brown earth drift over lower calciferous sandstone. There were in 1961 454 stems, mean height 60' and volume 5,176 H.ft. on an acre, putting the stand into Quality Class I of the British Yield Tables. Much of the soil of this property is a non-porous calcareous clay with poor drainage, not a good forestry subject, and the best tree crops are found on areas of mild peat. The area is predominantly a hardwood one with much natural ash and alder and there are mixed woods of Spruce, Larch, Ash and Sycamore; one such in 1960 was estimated to have 253 stems and a total volume of 7,800 H.ft. on an acre.

In Athenry Forest a block of 509 acres, Derrydonnell property, was bought in 1935 and planted in the next two years with Scots Pine, Beech, European Larch in mixture and pure plots of *Pinus radiata*, Lawson Cypress and Japanese Larch on soils mainly of a limestone nature with brown earth, boulder till and glacial gravels. Due to massive attacks by pine shoot beetle and pine sawfly the Scots Pine was nearly a complete failure and twelve years after planting was replaced by *Pinus radiata*, Beech, Corsican Pine and European Larch. In 1958 22 year-old *Pinus radiata* had 300 stems, mean height 49' and volume 3,390 H.ft. to an acre. Japanese Larch at the same age had 540 stems, mean height 42' and volume 1,720 H.ft. and had been thinned twice.

The best plot of Scots Pine on the area in 1958 had 640 stems, mean height 22' and a volume of only 480 H.ft. on an acre.

Cong Forest, between Corrib and Mask, when bought in 1939 was already a well-wooded estate with 3,164 acres of woods and plantations, famous throughout the country as a woodcock shoot. An 11 acres stand of Sitka Spruce planted in 1928 at 20 years produced as thinnings about 5,900 H.ft. and at 27 years had 500 stems, mean height 59' and a volume of 5,250 H.ft. on an acre. In 1963 a crop of 45 year-old Norway Spruce had 260 stems, mean height 72' and volume 6,600 H.ft. on an acre. In the grounds of Ashford Castle there are some large pines believed to be *Pinus contorta*, var. *Bolanderi*, planted in 1884 and from 80' to 97' high in 1961, the oldest and biggest of the species in Ireland.

Lough Gill Forest near the town of Sligo was started in 1939 with the

purchase of the demesne lands of Hazelwood, a lowland limestone area with deep fertile drift soils in parts and in others a mild alkaline peat. Plantations of a wide variety of species have since been laid down, including all the common conifers and Tsuga, Silver Firs and Cypresses. Much planting was done by the previous owner between 1785 and 1843. There is good natural Oak and Ash and in one block of 10 acres regeneration of Douglas Fir, *Cupressus macrocarpa* and Silver Fir has been sufficient to stock the ground. In Compartment 11 Ash groups were planted in 1942 at 26" centres in a matrix of Norway Spruce. At Slish wood, on acid metamorphic rock soils, there is the remnants of natural sessile Oak and also some indigenous Aspen and Whitebeam along the lake shore. At the neighbouring estate of Holywell, on limestone cliffs, another indigenous tree, *Arbutus*, occurs in its most northerly natural habitat in Europe.

GALWAY BAY TO CLEW BAY

This region takes in all the wild mountainous country west of Loughs Corrib and Mask, including Connemara, Iar-Connacht, Joyce's Country and the ranges from Killary to Croagh Patrick. It has a varied geological structure; there is a small area of limestone near lower Lough Corrib but the rest is all acid rocks, from the granite of Connemara to the schist and gneiss of the Clifden area, the quartzite of the Twelve Pins and Maamturk, Ordovician in the Sheffrey Hills and Partry Mountains and Silurian stretching to the base of the quartzite cone of Croagh Patrick. With the exception of 631 acres at Ross Forest the forests have been acquired since 1950. Nearly all consist of large areas of deep peat which needs intensive drainage to make it fit for planting. This is being done by mechanical equipment, crawler tractors and deep digging ploughs which open a drain and turn up a heavy ribbon on which the plants are set. Dressing with ground mineral phosphate is standard practice.

Areas on 31st March 1963:

Galway		Mayo	
	acres		acres
Ballinahinch	... 4,607½	Croagh Patrick	... 1,898
Cloosh Valley	... 10,797	Doolough	... 1,534½
Maam Valley	... 788½	Tourmakeady 1,123½
Ross	... 3,322		<hr/>
			4,555½
TOTALS	... 19,514½		

No account of forestry in Ireland, more especially forestry in Connemara, can omit mention of the abortive afforestation scheme at Knockboy near Carna. Here State Forestry made its debut in the most unpromising conditions imaginable. In 1880, under local pressure, the government purchased, 1,000 acres of a low hill, swept by the Atlantic

gales, partly wet peat up to 10' deep, partly outcrops of solid granite, and started in to plant it. The officials in charge ignored the many examples of coastal afforestation from Kerry to Donegal where for a hundred years planting had been done in a most enlightened way; for instance at Derreen, Kenmare, mounding on peat was practised in 1825 and at Mullaghmore near Bundoran Maritime Pine had been established on the sand dunes and on peat since 1850 on the lines of the famous French Landes. Plenty was known in this way about what species would and would not grow on exposed sites and on peat or other difficult soils and much might have been learnt by an examination of these places. Instead, the authorities acted, according to Henry Doran, the Chief Inspector of the Congested Districts Board, "all through under the advice of practical men" and ordered trees of many species, some imported, some bought from Irish nurserymen and some raised from seed sown on a specially prepared plot and then transplanted. Again in the words of Henry Doran: "the forester tried every way he knew to get trees to grow and the experiment must be declared a failure." Three million trees of thirty or forty different species were bought and notch-planted into the sour peat. As if to make assurance of their deaths doubly sure, these came in open boats from Galway and the bales and bundles lay for days on the local pier, drenched with sea-spray, before planting. The scheme dragged on until 1889 by which time £9,000 had been spent and 820 acres planted.

A few scattered clumps of Corsican Pine, Maritime Pine, Birch, Alder and Beech in shallow depressions where a little mineral soil and flush effects provided a slightly better medium are all that remain from this costly experiment.

Sitka Spruce and *Pinus radiata* were planted at Knockboy by a later owner and have grown fairly well on sites much better than average.

The oldest forest in the region, Ross Forest, was opened in 1929 when 360 acres of Roscahill were acquired. The soil is local drift over limestone which becomes progressively shallower until limestone pavement appears along the lake shores at the eastern side of the property. A stand of Norway Spruce about 50 years old had in 1955 350 stems, mean height 45' and volume 4,700 H. ft. on an acre. There are plantations of Sitka Spruce and Japanese Larch established by the Department and natural ash is plentiful.

Ballinahinch Forest dates from 1951. Already it had been the scene of planting and there were middle-aged woods of Austrian and Maritime Pine, Japanese Larch, Sitka Spruce and some *Picea alba* on 225 acres. A 50 year plot of Sitka Spruce in a sheltered valley had a total height of over 100' and a mean Q.G.B.H. of 16¾". Younger plantations, 35 years, of this species had grown remarkably but thinning was neglected and there were 600 stems 70' high on an acre and the trees were whippy and much wind-blow had occurred. Natural regeneration of Sitka Spruce was common at that time.

The Department has engaged in the ploughing and planting of deep blanket bog since 1952, keeping to Sitka Spruce and *Pinus contorta*, often in mixture and always treated with 2 oz. of Ground mineral Phosphate.

Cloosh Valley Forest, acquired in 1951, is an extensive peat area lying between 300' and 900' and with exposure to wind moderate to severe. Plantations of Sitka Spruce and *Pinus contorta* with belts of Birch have been formed by ploughing and ribbon planting, with phosphate fertilizer and in all 3,000 acres were completed by March 1963.

NORTH MAYO AND PART OF SLIGO FROM THE OX MOUNTAINS TO
THE ATLANTIC AT BELMULLET.

Except for the limestone plain which stretches from Crossmolina to Easky and Sligo Bay, this region is entirely on acid rocks. The Ox Mountains have a core of granite overlaid in part with schist and gneiss; Nephin to the west of Lough Conn is quartzite and this formation is continued through the Nephin Beg range to its northern extremity near Bangor Erris. To the north of this range shales and sandstones reach to the sea at Ballycastle and to the west schist and gneiss rocks extend to the western coast at Belmullet. The ground available to forestry is peat encumbered and the plantations are on blanket bog, which covers miles of desolate country, rising and falling with the lie of the land, forming deep basin peat on the site of old lakes and becoming thinner and tougher on knolls. It is an excessively wet district with little sun and much humidity and is liable to violent storms from the west and south-west. By and large it is a difficult subject for afforestation. Since 1951 over 11,000 acres has been deep ploughed, drained and planted on ribbons of upturned peat.

Total areas of forest on 31st March, 1963.

MAYO		SLIGO	
Ballycastle	4,589 ac.	Lough Talt	4,395 ac.
Foxford	1,570 $\frac{3}{4}$		
Glenamoy	3,395 $\frac{1}{4}$		
Glenisland	1,838		
Nephin Beg	8,970 $\frac{3}{4}$		
Nephin Mor	1,456 $\frac{1}{2}$		
Totals:	21,820$\frac{1}{4}$		4,395

The oldest part of Foxford Forest, the first State forest in Co. Mayo, is Drummin Wood, 245 acres, most of it granite drift, one of the rare bits of Mayo forest on mineral soil, bought in 1928 when it was under Oak with some Scots Pine, Silver Fir and Norway Spruce. In the three years 1933 to 1936 it was cleared and replanted; first thinnings were in 1951 and were repeated in 1957 and 1960.

In 1963 Japanese Larch 30 years old had 290 stems, mean height 65' and 4,234 H.ft. to an acre. Sitka Spruce of same age had 280 stems, mean height 66', 3,920 H.ft. on an acre.

Glenamoy Forest started in 1955 near the Agricultural Research Station and is run as a research forest; it is on blanket bog 4' to 24' deep overlying gneiss and mica-schist. Planting has been done since 1956 at a rate of about 100 acres a year. Acre plots of Sitka Spruce, *Pinus contorta*, Maritime Pine, Japanese Larch, *Abies procera* and *Picea omorica* were laid down and used for trials with 1 oz., 2 oz., 3 oz. applications per plant of Ground Mineral Phosphate.

In 1951 the first pilot plot was planted on deep blanket bog in Nephin Beg Forest, 7 miles north of Newport. The peat was deep, brown and fibrous for at least 20" down and it was ploughed to that depth with a double mould-board planting plough, opening furrows 10' apart and with the sods lying on their sides at 5' spacing. It was planted with *Pinus contorta*, Lulu Island origin, and each tree received 2 oz. of Basic Slag. First results were promising and plants grew up to 16" in height in the early years. Later growth slackened, as is usual with Lulu Island provenance, and extra fertiliser has been applied.

COUNTY DONEGAL.

The barrenness of the rugged hills of Donegal is unequalled in Ireland. Acid metamorphic rocks form its lofty mountains, quartzite, mica-schist and granite come to the surface in the north-west and from the quartzite have weathered many of the peaks which rise in the Blue Stack and Derryveagh ranges above the schist and the granite to heights of more than 2,000' above the sea. The soil, consisting of rock debris and occasional patches of glacial drift is thin on the hills, lowland bog is not extensive but mountain bog is widely developed.

Areas on 31st March, 1963.

DONEGAL

Ardara	1,058 ac.	Killygordon	1,703 $\frac{3}{4}$
Ards, Creeslough	1,924 $\frac{3}{4}$	Lough Eske, Donegal	2,080 $\frac{1}{4}$
Ballybofey	6,492 $\frac{1}{2}$	Meenirroy, Fintown	4,449 $\frac{3}{4}$
Ballyshannon	1,289 $\frac{3}{4}$	Mulroy, Milford	2,048 $\frac{1}{4}$
Buncrana	2,735 $\frac{3}{4}$	Pettigo	3,517 $\frac{1}{4}$
Gweebarra	1,577 $\frac{1}{4}$	Raphoe	2,694 $\frac{3}{4}$
Gweedore	2,700 $\frac{3}{4}$	Stranorlar	2,520 $\frac{3}{4}$
Kilcar	3,499 $\frac{1}{4}$		
		Total	40,292$\frac{3}{4}$

The first acquisition in this region, in 1930, was Ards Forest, situated on a hilly peninsula in Sheephaven and characterised by a winter mildness which equals that of southern Cork. Here, indeed, there is a Cork Oak, a native of the Mediterranean zone, 50' high, and large *Pinus radiata* and *Cupressus macrocarpa* in the grounds of Ards House. The Department's early planting was of Sitka Spruce, *Pinus contorta* and Japanese Larch, much of it on shallow, wet peat on exposed ridges and some on small pockets of mineral soils. A small area of sand dunes was sown with Maritime Pine.

The first part of Pettigo Forest was purchased in 1936 and only about one-third of the area of 3,380 acres was considered plantable at that time. These more fertile plots were drained and mounded by hand labour and planted with a core of Sitka Spruce, surrounded by a belt of *Pinus contorta* and with an outer rim of Mountain Pine. The *Pinus contorta* of those years have developed into straight, wind-firm trees with slender branches and are believed to be of inland origin. Since 1951 the ground left unplanted between these older blocks has been ploughed and planted with Sitka Spruce and *Pinus contorta*. Phosphate manure was added.

Croaghonagh, Ballybofey Forest, a peat-covered slope beside the road at the eastern end of Barnesmore, was planted after 1952 as was Meenirroy, between Glenties and Stranorlar, where the more fertile flush peat encouraged the use of pure Sitka Spruce.

Some old plantations were acquired at Louth Eske, in a valley penetrating into the south slopes of the Blue Stack Mountains. A mixed crop of Sitka Spruce, Thuja, European Larch and Scots Pine planted in 1912 had 240 stems, 112' high for average dominant and 7,200 H.ft. on an acre in 1956.

CAVAN, MONAGHAN, LEITRIM AND PART OF SLIGO

From the neighbourhood of Carrickmacross there stretches westwards a rolling country of low, steep-sided hills strewn with many lakes which extends across Monaghan, Cavan and Leitrim to the heights of Benbulbin. The rock formations are Ordovician and Silurian shales, carboniferous sandstones with intrusions of Millstone grits and flagstones, and on low ground, carboniferous limestone. The soils are heavy, wet and compact, deteriorating as they extend west into the sticky Leitrim "daub" type of grey coloured clay.

Forests in this region originally developed around the woods of former demesnes, on good hardwood soils which carried outstanding oak now largely turned over to Norway Spruce. The last ten years has witnessed a movement into the poor farmlands of north Monaghan, Cavan and Leitrim, a hilly terrain of heavy soils needing draining and mounding in order to render it capable of tree growth.

Forest areas at 31st March, 1963.

CAVAN	LEITRIM	MONAGHAN	SLIGO
acs.	acs.	acs.	acs.
Bailieboro 1,650	Cuilcagh 3,868½ Drumkeeran 4,485	Cootehill 2,375½ Monaghan 1,338¾	Benbulbin 1,099¼
Belturbet 699¼ Killeshandra 1,731	Glenfarne 2,009½	Scotstown 2,530½	
Swanlinbar 2,201	Manorhamilton 4,985¾		
Totals 6,281¼	15,348½	6,244¾	1,099¼

Bailieboro, the first of these northern forests, was established about 1911 in the wooded demesne of Bailieboro Castle on the shores of a small lake outside the town. The old woods of Oak, Beech, Silver Fir, Larch and Scots Pine were gradually cleared and replaced with Norway and Sitka Spruce, Douglas Fir, Scots Pine, European Larch and *Thuja plicata*. The Sitka Spruce, especially on the lake shore, suffered severely from frost in its youth but crept up slowly year by year to above the frost level and afterwards made rapid growth. Scots Pine and European Larch did not thrive on the heavy soils and were replaced by Norway Spruce.

In 1961 40 year old trees had these dimensions: Thuja 76' x 14" B.H.Q.G., Norway Spruce 88' x 9" and Sitka Spruce, Douglas Fir and Silver Fir were very much the same.

Amenity was a consideration at Virginia on Lake Ramor and some of the original good oak has been retained and oak groups planted through a matrix of Norway Spruce, Scots Pine and European Larch.

Cootehill Forest started with Bellamont property about 1935 and was augmented a couple of years later by Dartrey estate on the other side of the Town Lough which they adjoin. Both were noted for the high quality of their oak, 50' branch-free stems were not uncommon and long lengths for special purposes were exported to England at one time. Most of the ground has been turned over to conifers, Norway Spruce predominating with lesser amounts of Sitka Spruce and Scots Pine. An old wood of mixed hardwoods and with much Ash regeneration in Bellamont was tidied up and filled in with groups of the above species.

These plantations and the ones at nearby Annaghmakerrig are being thinned for pulp wood, wood wool and small sawlogs. The Norway Spruce has generally grown excellently, rating of Quality Classes I and II.

Killeshandra and Belturbet Forests lie on a series of small peninsulas and islands in Lough Oughter and part of the complex lakeland along the rambling course of Upper Lough Erne. Spruces have been the main species and there are impressive 30 year stands of Sitka Spruce at Gartna-

noul, Killeshandra, and of Norway Spruce at Castlesaunderson, the first part of Belturbet Forest.

Castleshane, Monaghan Forest, acquired in 1931, is a Norway Spruce area, intersected with belts of Sycamore, Oak and Elm and rimmed with Beech, both old trees and young natural growth. There are 190 acres of conifers and 90 acres of hardwoods. Compt. 4 in 1964 had 480 stems of Norway Spruce, 31 years old, on one acre, top height 47' and volume 2,700 H.ft. A pure plot of Elm in Compt. 8 had 570 H.ft. on an acre when 30 years old.

Swanlinbar, Scotstown, Cuilcagh and parts of Glenfarne Forests are on poor agricultural soils derived from carboniferous sandstones which form gritty, impermeable clays which allow only shallow root growth. Peat forms readily on this surface and, on slopes, is proving itself the best sites for plantations. *Pinus contorta* on the poorest, Sitka Spruce on the exposed and Norway Spruce on the lower, more sheltered areas has been the rule. None of them exceeds twelve years of age.

The Leitrim Forests (and Benbulbin) have in common a tenacious grey coloured hydromorphic soil of carboniferous origin, hard to drain and affording a precarious roothold especially to the shallow-rooting Sitka Spruce and to *Pinus contorta*, both of which are extremely unstable and liable to windthrow. Parts of Drumsna and Glenfarne Forests are old acquisitions and have plantations of Norway Spruce, Sitka Spruce, Scots Pine and Japanese Larch, dating from before 1938 on the sites of former woodlands, but the greater part of the 15,000 acres of plantations in the region are post 1952.

THE CARLINGFORD PENINSULA

Louth, the smallest county in Ireland, has one forest, Dundalk, on boulder strewn slopes of the granitic hills of the Carlingford peninsula—a region geologically similar to the Mourne range in County Down across the narrow lough.

Area on 31st March, 1963.

LOUTH

Dundalk ... 2,659½ acres

The oldest property is Ravensdale in the narrow defile between Dundalk and Newry, part of a former demesne bought about 1925. The soil is a free granite sand, suitable for all conifers. There are good stands of Douglas Fir, Larch and Spanish Chestnut. Bellurgan and Rockmarshal Properties, on poorer, more exposed sites, have Sitka Spruce, Japanese Larch and *Pinus contorta*, planted after 1938.

THE STATE FORESTS OF NORTHERN IRELAND

THE SPERRIN MOUNTAINS AND EASTWARDS TO LOUGH NEAGH
AND THE RIVER BANN

The long ridge of the Sperrin Mountains lies astride the Tyrone-Derry border from outside the city of Derry to Cookstown near the western shore of Lough Neagh. The underlying rock is of metamorphic character, schists and gneiss are very common, and this formation extends eastwards to meet the ridge of basalt through which the Sperrins descend to the broad fertile valley which runs northward from Lough Neagh and carries the Lower Bann river to the sea.

Forestry Areas on 31st March, 1963:

DERRY		TYRONE	
Ballyleighery	1,593 ac.	Baronscourt	3,076 ac.
Banagher	4,446	Cashel	825
Cam	3,133	Davagh	2,512
Campsey	148	Drumcairne	538
Derrynoyd	3,521	Goles	1,011
Garvagh	536	Killeter	7,635
Gortnamoyagh	2,086	Ligfordrum	612
Iniscarn	447	Lislap	3,827
Loughermore	2,069	Lough Bradon	2,904
Somerset	602	Pomeroy	289
Springwell	2,450		
Total:	21,031		23,229

This forest region extends from the north coast to the estuary of the Lower Bann, southwards to Pomeroy and westwards to Killeter Forest on the Donegal border near Barnesmore. The soils are partly drift of agricultural quality but there are large peat-covered areas where mechanical preparation before planting has been the practice since 1949.

The first forest property in this part of the country was Ballykelly Wood near the shores of Lough Foyle where 254 acres was acquired in 1910 following a local movement for its preservation. This wood, formerly the property of the Fishmongers' Company of London, is said to have supplied the timber for the building of Derry city at the time of the Ulster Plantation. In 1920 a part of the Baronscourt estate was taken on a long lease. This area, lying to the west of Bessy Bell, a 1,387' outlier of the main range of the Sperrins, and extending across some good, some peat-covered shallow valley land to the hill of Mullaghcroy, was the start of Baronscourt Forest which now covers 3,000 acres in four blocks. During the past 40 years new plantations have been composed mainly of

Sitka Spruce, 80%, with 7% Douglas Fir, 5% Japanese Larch and 8% of other species.

Pinus contorta has also been planted. In Compartment 236 a stand, 31 years old in 1961 had 420 stems, top height 58' and volume 1,802 H. ft. to an acre; volume of thinnings removed 329 H. ft. A neighbouring plot in Compartment 237 had 660 stems, top height 39' and volume 1,038' H. ft. on an acre, at 25 years of age.

Lislap Forest, north of Omagh, was taken over before 1930 and here the planting has consisted of 80% Sitka Spruce, 8% Larches and 12% other conifers. Trouble is experienced with frost in the hollows and the higher reaches of the forest suffer from exposure to the south-west winds.

Springwell Forest lies between Coleraine and Limavady and the first acquisition here was before 1930. There is much peat over basalt and investigations into the growth of Sitka Spruce on peat, 9" to 5' deep planted between 1933 and 1950 are in progress.

Quality Classes for Sitka and Norway Spruce and Japanese, including Hybrid Larch, have been assessed as on 1st October 1961 and show the following averages:

Quality Class	Sitka Spruce acres	Norway Spruce acres	Japanese Larch acres
I	—	—	—
II	—	11½	3½
III	28	107½	17¼
IV	438½	33	2
V	—	—	—
Other	369	44	44

Two other forests in Derry on similar sites have been assessed and the acreages of the Quality Classes as on 1st October 1960 were:

Forest	Quality Class	Sitka Spruce acres	Norway Spruce acres	Japanese Larch acres
Cam	I	—	—	—
	II	—	61½	21
	III	304½	196	60
	IV	505	44	9½
	V	347	—	—
	Other	302½	6	—
Gortnamoyagh	I	—	—	—
	II	4	2½	5
	III	13	42¾	137
	IV	522	46¾	24½
	V	233½	—	—
	Other	262	4½	7½

These figures are equivalent to a mean annual increment on a fifty

year rotation of, for Sitka Spruce 120 to 140 H. ft., for Norway Spruce 95 to 120 H. ft. and for Japanese Larch 65 to 100 H. ft. per acre.

THE LAKELANDS OF LOUGH ERNE.

This region, including all Fermanagh and parts of Tyrone and Armagh, covers the territory south of the Sperrins and lies mainly in the lowlands which stretch from Belleek across the Erne to Portadown and southwards to the border of Co. Monaghan. Soils range from fertile clays to deep peat and spruces rank high in the proportion of species planted.

Areas on 31 March 1963:

Fermanagh		Tyrone		Armagh	
	acres		acres		acres
Ballintempo ...	4,066	Favour Royal	960	Gosford Castle	831
Belmore ...	2,312	Caledon ...	453	Richill ...	311
Big Dog ...	1,700	Dromore ...	1,411		
Blackslee ...	1,204	Fardross ...	2,369		
Bunlougher ...	1,730	Knockmany	623		
Castle Archdale	1,258	Seskinore ...	693		
Castlecaldwell	919				
Clanawley ...	809				
Doon ...	2,773				
Ely Lodge ...	699				
Kesh ...	1,794				
Lough Navar	5,442				
Mullaghfad ...	4,153				
Pubble ...	409				
Rosslea ...	1,843				
TOTALS ...	31,111		6,509		1,142

In 1911 467 acres was acquired in Knockmany, Co. Tyrone, and in 1913 303 acres at Castlecaldwell, Co. Fermanagh. In 1963 a Sitka Spruce crop in the latter forest, in Legg's Wood planted in 1919, had yielded 6,247 H.ft. standing, making a total yield of 12,372 H.ft. in 44 years on an acre and at that time was laying on an increment of 400 H.ft. per acre per annum. A small stand planted in 1908 was bought in Castlecaldwell in 1959. It contained many species in three or four line mixtures, including Sitka Spruce, Norway Spruce, Douglas Fir, *Abies grandis*, Scots Pine, and European Larch, and they all, with the exception of the last, have grown remarkably well. A small block of pure Sitka Spruce which had never been thinned had 520 stems, 250 H. square feet B.A., and 12,500 H. ft. per acre with a top height of just under 100 ft. when measured in 1960. This stand withstood the onslaught of Hurricane Debbie in September 1961 much better than nearby plots which had been thinned.

Ballintempo Forest, on a deep peat, has been planted since 1956, following ploughing and mounding, with *Pinus contorta* and Sitka Spruce.

THE MOURNE MOUNTAINS, SLIEVE CROOB AND SLIEVE GULLION

The range of the Mourne Mountains occupies the southern end of Co. Down, stretching from Newcastle on the east to Rostrevor on the west, and at each extremity descending steeply into the sea. Flanking their granite domes is a covering of Silurian slate, meeting the sea at Kilkeel and linking with the granite mass which runs from Crossmaglen in Co. Armagh through Newry to the 1,755' summit of Slieve Croob in the centre of Co. Down. An intrusion of igneous gabbro forms the rugged peak of Slieve Gullion which rises in south Armagh near the border of Co. Louth.

Down		Armagh	
	acres		acres
Belvoir Park	201	Bond's Mountain	2,231
Castlewellan	576	Fathom	910
Hillsborough	433	Slieve Gullion	2,133
Kinelarty	832		
Mourne Park	662		
Newcastle	2,420		
Rostrevor	4,457		
	<hr/>		<hr/>
TOTALS	9,581		5,274

Tollymore Park, part of Newcastle Forest in the Mourne range, is a public forest park since 1955. The earliest plantations date from 1932 and were mainly European Larch which thrives on the stony soils of the district, famous at one time for the fine timber of this species. Oak and Beech were mixed through the Larch and Douglas Fir was used on areas overgrown with laurels and rhododendrons. There is an extensive arboretum which, as well as rare trees, has a fine collection of rhododendrons and azaleas.

Rostrevor Forest was purchased in 1928. On the lower ground, over Silurian slate, there is a sessile oak wood underplanted with Thuja, Tsuga, Sequoia and Cryptomeria.

CO. ANTRIM

The greater part of Antrim is a high flat-topped plateau composed of basaltic rocks which, along the coast, have been carved into deep glens towered over by lofty cliffs. The eastern part of the county contains high-moorland intervening between the lowland of the River Bann and the sea. A detached portion of the plateau extends to the south-west and rises to high summits in Divis, 1,574', and Wolf Hill, 1,215', on the western outskirts of Belfast. Some of the forests are in the famous "Glens of Antrim," most lie on the peat-covered plateau and a string of plantations border the

river Bann, growing on the spoil heaps excavated during arterial drainage works in the mid-1930's.

	acres		acres
Ballyboley	1,014	Glenarm	440
Ballybraddin	648	Muckamore	222
Ballycastle	987	North Carn	233
Ballypatrick	3,611	Parkmore	1,474
Beaghs	4,260	Portglenone	508
Benvardin	928	Randalstown	418
Breen	1,006	Tardree	829
Clare Park	919		
Craigs	657		
		TOTAL	18,154

Glenarm Forest occupies the steep sides of one of the coastal glens. There is a stand of natural Ash, now about 45 years old, underplanted in 1929 with Norway Spruce and Tsuga. Much of the early planting consisted of European Larch at the lower levels and Japanese Larch on the higher ground. Under-planting open Larch crops with Tsuga has been practised.

Ballypatrick, Ballyboley, Ballybraddin, Beaghs, Benvardin, Clare Park, Breen and Craigs Forests are extensive areas of peat-covered moorland which have been ploughed and planted with Sitka Spruce since 1950. Parkmore Forest at the head of Glenarriff is another peat area which has been drained, mounded and planted in the same period.

The Bann Dumps, now partly comprised in Portglenone Forest, were originally planted with the object of blotting out their grim aspect. Species included Scots Pine, *Pinus contorta*, Sitka Spruce, Norway Spruce, Japanese Larch, and Alder, with some Poplar and other hardwoods, and in spite of initial checks due to frost and very variable soils consisting of fine silts, sands and gravels, these now form valuable plantations.

PRACTICE IN THE ESTABLISHMENT, CARE AND UTILIZATION OF FORESTS:

Organisation, Management, Labour, Mechanisation, Working Plans, Roads, Nurseries and Protection

SEED SUPPLY

ESTABLISHMENT of forest crops in Ireland, for the present rotation at any rate, means artificial afforestation, putting trees on land which is bare or where regeneration of existing trees is impossible or undesirable. Not only are plantations going in places where no trees have grown for a long time, but Irish afforestation is done with foreign species raised from imported seed or, in a small way, from the seed of first generation importations.

Tree seed is bought from handlers in Britain, France, Holland, Denmark, Switzerland and a few other European countries and from firms in Washington and other states of Western North America and occasionally from Forest services in the U.S.A. and Canada. Japanese Larch comes directly from Japan or is got from European wholesalers. For many years attention has been given to the provenance of purchased seed. The question of the origins of *Pinus contorta* is still the subject of enquiry by our forest services and recently two officers travelled to North America to investigate it on the spot.

Home collections of the seeds or fruits of common hardwoods is usually ample for the limited acreage planted with these species but conifer seed from our own trees has so far supplied only a small proportion of the annual sowings. In 1930 a simple kiln was built at Avondale for the heat extraction of seeds from cones and it was operated successfully for several years. It was replaced by a more elaborate installation which supplies dry heat and steam from a boiler and extraction is done by heating and damping. In recent years it has been used only for the hard woody cones of the pines. All the soft coned species, that is Spruce, Larch, Douglas Fir and Tsuga, are passed through a threshing mill fitted with an awner and piler which breaks up the scales, shakes out, de-wings and cleans the seed in one operation. There is no need to use heat and, as a result, germination of the seed is much improved.

In 1954 the Northern service established two seed orchards, at Newcastle for Larch and at Pubble for Larch and Scots Pine. The object is to

obtain a quantity of seed of a superior parentage by grafting scions or clones, small branches from a single outstanding specimen, onto stocks of the same or a closely related species and inducing early fruiting by special treatment of the stocks. One method is root-pruning and a regular seed crop may be expected in from 4 to 8 years after grafting. All their needs of *Abies procera* are collected from local trees.

In 1955 seed orchards for European and Japanese Larch, Scots and Contorta Pine, Douglas Fir and Beech were set up in the Republic, and "plus" trees of these species have been selected and will be preserved as seed bearers.

NURSERIES

At one time it was customary to have a small nursery at every forest where a suitable plot could be got but since 1957 the policy has been to concentrate plant raising to a few centres with areas of 50 acres and upwards run by a specialised staff using up-to-date mechanical equipment. These nurseries are situated on free-working acid soils, on fairly level land at a moderate elevation in places not subject to severe wind exposure or heavy frosts. In 1963 the total nursery area in the Republic was 707 acres at 22 centres; 561 acres of this was in 10 large nurseries, all from 47 acres upwards, at Clonegal, Macroom, Rathluirc, Killygordon, Clogheen, Comeragh, Camolin, Glenealy, Shelton and Tinahely. In the North there was an area of 169 acres all told of nurseries in 1963, situated at 13 forests. Some of these nurseries were small plots of an acre or so and the work was concentrated mainly on six nurseries, ranging in area from 15 to 37 acres at Campsey, Drumcairne, Garvagh, Iniscarn, Muckamore and Pubble.

The annual out-turn of plants is about 10 million in Northern Ireland and 40 million in the Republic. The numbers of each species grown conform to normal planting needs; they are mostly conifer species with Sitka Spruce and *Pinus contorta* predominating. Planting-out ages run from 1 year—1 year for pines and Japanese Larch and 2 year—1 year for all others except Norway Spruce which is usually 2 year—2 year old for planting. In Northern Ireland they sometimes use 2 year Sitka Spruce seedlings which have been under-cut in the beds.

Nursery mechanical equipment consists of medium sized tractors fitted with hydraulic linkage for mounted implements. Preparation of seed beds is done by rotovator, bed shaper and roller, in separate operations by a tractor which travels astride the bed. Seed is sown broadcast by a "Rose" sowing machine and is covered by fine grit spread from a hopper, both carried by the tractor. Seedlings are root pruned in the beds or loosened for lifting by means of a horizontal steel blade which is drawn along a few inches beneath the surface of the bed.

Lining-out in some of the nurseries is being done by the Ledmore transplanting machine in conjunction with boards into which seedlings are placed by hand. The Ledmore plough turns over about 10" width of soil

against the line of seedlings, firms it on the roots with a small roller, levels off the surface of newly turned soil and cuts the "face" for the next line with a disc-coulter, all in one operation. Inter-row cultivation of transplant lines is also done by tractor, as well as the application of chemical weed killers; of these Simazine is commonly used on 2 year old seed beds and on transplant lines, and Paraquat as a pre-emergence spray on freshly sown beds. A plant lifter, also tractor operated, is employed to raise the transplants for their final shift to the forest.

Fallowing, both green and bare, is normal nursery practice to raise the humus content of the soil and to destroy weeds, and it may occupy up to 30 per cent of nursery ground.

PEAT PLANTING

The afforestation of blanket bog has become of great importance during the last fifteen years. Many peat areas had, of course, been planted before then and intensive drainage and mounding has long been practised. Reference has already been made to planting on bog land at Derreen, Co. Kerry, where in 1825 resource was had to the commonsense plan of placing trees on a little hillock of peaty sods to raise them from the wet. In the early 1920's it was done at Ballyhaise Agricultural College for Sitka Spruce in a low-lying place and the practice was employed for the Forestry Division in 1928 when preparing a swampy area beside Lough Derg in Tuamgraney Forest. This was hand-work, work with ordinary spades and shovels or, at most, Scottish hill-draining spades, and could be done only on a relatively small scale on pieces of peat land included in blocks of better ground. The cost of labour made it uneconomic for larger areas.

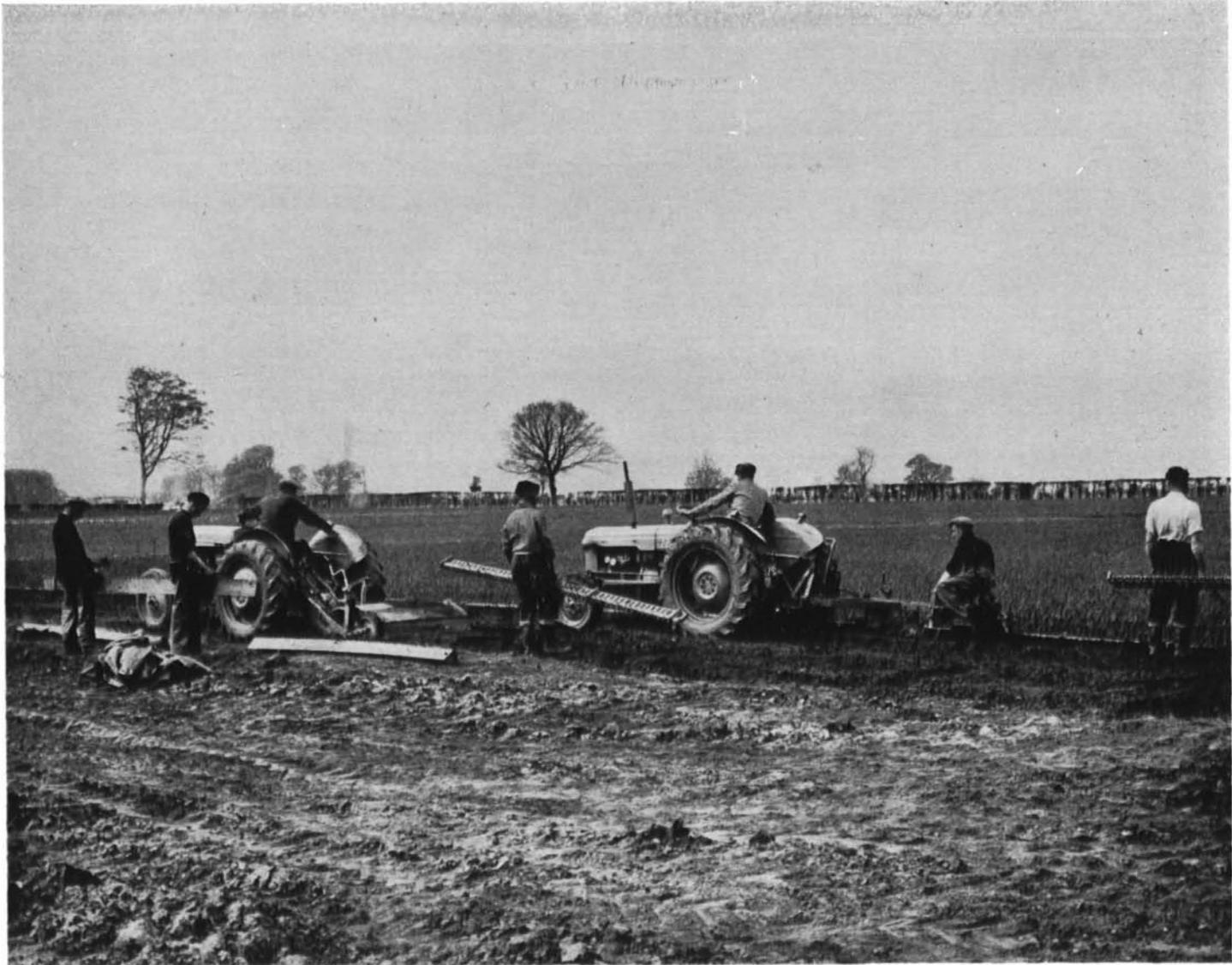
The big drive in bog planting came about 1950. In that year the sights were raised for the ultimate target for State forestry in both North and South. Large areas had to be found in the sub-marginal farmlands, the rough grazings of the hills and the bogs, and it was in the latter type of ground that substantial blocks could be most easily acquired. These blocks lie mainly in the western third of the county; they are to be found in West Cork, Kerry, parts of Limerick and Tipperary, all of Connacht and in Co. Donegal and in Northern Ireland in the western and northern counties. A peat covering results from low summer temperatures, high rainfall, constant high relative humidity and the presence of acidic rock. Known generally as "blanket bogs," these bogs rise and fall with the underlying surface of the ground, local development of deep basin peat forming in depressions and shallow, fibrous peat on knolls, either of moraine or rock, and with slopes and flats covered with varying thickness of peat. It is estimated that there are fully a million acres of these blanket bogs in this western part of the Republic and probably half a million acres in Northern Ireland. These figures exclude raised bog of which there is at least 500,000 acres in the South, most of it in the Midland bog area, and about 100,000 acres up North; this type presents afforestation difficulties



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One year-old Sitka Spruce seedlings in Portglenone Forest,
Co. Antrim.



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Lining-out in Campsey Nursery, Co. Derry. Rotovator (left)
and lining-out plough.

and in any case is being exploited for fuel and its planting must await the completion of its utilisation.

Only a small proportion of the blanket bog offers any possibilities of economic tree growth. Much of it is too exposed to wind or too wet and soft, or containing too many rock outcrops to be ploughable. Suitable sites are usually gentle slopes or undulating terrain firm enough to carry a tractor, and with land shelter from south-west winds and below 1,000' elevation, although 1,750' has been reached in Northern Ireland with success where sites are sheltered. By the end of March, 1963, about 200,000 acres had been acquired in the western counties of the Republic and about 150,000 acres of mostly peat covered land had been planted by that date. In Northern Ireland about 33,000 acres has been planted on deep peat.

The technique now in general use is essentially one of intensive drainage and the addition of phosphate. Drains are cut by large tractor-drawn ploughs and the trees are hand-planted along the continuous peat ribbons which are turned out to one or both sides of the drain. After planting a small amount, one to three ounces, of ground mineral or other phosphate is scattered around each plant.

General practice in Northern Ireland since 1963 has been to broadcast 4 cwt. of Ground Mineral Phosphate per acre before ploughing. In earlier years Basic Slag was usually applied at the rate of 3 to 4 ozs. per plant in the planting hole.

Since the work started, many makes of tractors and of ploughs have been tried. Northern Ireland began at Ballypatrick Forest with a Fordson drawing a Turnall plough. Then came a single-furrow Cuthbertson M.K. plough powered by a Fowler Mark V tractor. Later a Beggs' was substituted for the Cuthbertson and shortly after the Fordson and the Fowler made way for a David Brown D. 30 and D.50 Trackmaster Crawler tractors. A Cuthbertson Water Buffalo was purchased in 1953 and with it Cuthbertson Single (Type F) and Double Mouldboard (Type P) ploughs. Recent purchases have included double mouldboard (Type S) ploughs. The Water Buffalo has now given place to Fordson County Crawler wide gauge, swamp model tractors. These have 30 inch wide extended length tracks, front-mounted winches and ground anchor equipment and are now in universal use. Since 1962 Seahorse tractors have been tried and found satisfactory. These have four large wheels, all power driven, and can operate on ground previously suitable only for a crawler. It is cheaper to run, its operating costs are said to be about half those of the crawler type, and is more manoeuvrable and extremely versatile and can be used for scrub cutting and fertiliser spreading as well as for ploughing.

Twenty-two tractor and plough units were purchased by the forest service of the Republic in 1951. The tractors are the crawler type and the ploughs single or double mould-board Cuthbertsons. Drainage is usually done by ploughing at intervals with the F model single plough, followed by ploughing for planting with the P model double plough, opening furrows at 10' to 12' spacing and giving ribbons at 5' to 6' apart. In some areas

the F model is used all through, ploughing at 5' or 6' and resulting in deeper, closer drains and a larger ribbon on which to plant. In Northern Ireland the commonly employed procedure is to open drains with the F model following natural drainage channels and the lines of forest roads and rides, and adding cut-off drains as necessary: on excessively wet ground cross drains are made at 30' intervals and these may be deepened to 36" by hand. Ploughing for planting is done by P or S model ploughs at 11' intervals, resulting in a ribbon every 5½'.

Planting, in the Western areas at any rate, is done by making a single longitudinal slit with a spade and inserting the plant roots in this; where the inverted ribbon exposes a layer of decayed amorphous peat it is usual to cut this away and to slit-plant on the more fibrous peat below; a practice known as "step planting."

In Cloosh Forest planting has been done with a wedge-shaped dibble 3½" wide and 15" long. This tool is easy to carry, it opens a slit large enough to take the roots and one which readily closes after planting. It has proved itself a good implement and has led to cheap planting costs. In the North they favour a semi-circular spade which removes a plug 4" across and 9" deep from the ribbon. The plant roots are let down to the bottom of the hole so that they reach the layer of peat which was on the surface of the ground before the ribbon was turned over by ploughing. On thick sods, "stepping" is done in order to reach this layer. The job is finished by breaking up the plug and returning the fragments to the hole.

PLANTING ON OLD RED SANDSTONE SOILS

The successful planting of the extensive Old Red Sandstone hills of Munster calls for the same heavy ploughs as are used in the western bogs. The soils are formed of fine quartz, compact and impermeable to water and with a hardpan usually beyond the reach of ordinary ploughing equipment. Mechanical amelioration consists in ploughing deeply, either at 5' intervals or the whole area, breaking the hardpan and mixing the layers of soil; fertilising with lime and phosphates follows. This mixing of the surface layers is specially valuable when peat is present and it then can create fertile soil conditions. *Pinus contorta* is the usual selection for planting, with Sitka Spruce in places where the soil shows flush effects.

FERTILISING

Fertilising with phosphate was done at Glendalough in 1929 when two plots, one at the valley bottom between the lakes and a second on the mountain side of Lugduff property, were drained, mounded and planted with Sitka Spruce. The manures used were Basic Slag, 3 oz., Semsol, 3 oz. or Ground Rock Phosphate from County Clare, 4 oz. The addition of phosphate is now standard practice in peat planting and it may take the form of Basic Slag or Ground Mineral Phosphate. The southern foresters favour Ground Mineral and scatter from 1 oz. to 3 oz. on the surface around the

tree after planting. In Nephin Beg Forest, an early assessment of *Pinus contorta* showed that 2 oz. of Basic Slag resulted in annual growths of 10"—16" in a season, in contrast to 3"—4" for untreated plants. It is thought now that this forced growth may lead to eventual windfall and the tendency is to reduce the dressing per plant to 1 oz. for this species. Trials in the North have shown that without phosphates trees made practically no growth in peat.

In the Republic the foresters pin their faith to *Pinus contorta* for planting poor peat, either alone or in mixture with Sitka Spruce. When it does not succeed they often ascribe its failure to provenance—it may be an inland form of the species or if a coastal form, the seed may have come from poor trees, stunted by disease. Sitka Spruce they regard as having yet to prove itself. Up North the boot is on the other foot. There for many years the main species was Sitka Spruce with fluctuating proportions of *Pinus contorta* and until 1955 large areas were put down with this mixture. Policy now prohibits pine except on shallow peat over rock and Sitka Spruce is now universally the chief species and is planted pure.

PLANTING MINERAL SOILS

The afforestation of mountain bogs has been treated at some considerable length because of its newness and on account of its vital importance for the country's economy. By comparison, the establishment of plantations on mineral soils is simple and is now well understood in Ireland. They, too, however, have their difficulties. Lush, fertile lowlands, ideal for the most exacting hardwoods, are places where grass grows tall and rank and it is many years before it is overcome by trees. Areas of heavy wet clays, cold, impermeable and badly aerated, are not easy to convert into forest either. The usual technique on both these subjects is to raise grass mounds, sods about 3" or 4" thick, with spades or by ploughing, and to plant through them so that the roots spread between the grass of the surface and the grass of the inverted sod. Eskers of limestone gravel and limestone crags covered with drift soils suffer from want of humus due to excess alkalinity and it is never easy to get trees started on them; beech, which seems the most natural choice, will often stay in check for years, hardly able to surmount the grass. Northern Ireland technique is to plough on clay with a single mould board Beggs' plough and on stony soils with a tine plough. There heather and scrub covered areas are prepared for ploughing by the mechanical "chopping" of the vegetation. The average "good forest soil", however, is plain sailing and the ordinary run of species stuck in without any soil preparation get away quickly and need little in the way of cleaning after the first few years and soon reach the thicket stage. It will then be time to begin thinking about thinning.

THINNING

In this country early thinning practice was similar to that of the British Forestry Commission which in its turn followed the example of

the Germans where thinnings are light, growth slow, and rotations long. The general pattern in recent years has tended to be heavier, more in keeping with Danish ideas, especially for fast-growing Western American species, and in Britain and Southern Ireland is on the lines of a moderate "low thinning," that is, it removes some of the "co-dominants" which can be spared without seriously breaking the canopy, as well, of course, as all dead, suppressed, whips and some of the wolf trees. The following data of stocking in some of the plantations in the South indicates a tendency to thin slightly more heavily here than in Great Britain:

Forest	Species	Age	British Yield Tables. Stems	
			Stems per ac.	per acre
Anner	Douglas Fir	33	300	310
	Sitka Spruce	28	490	550
Cong	Norway Spruce	45	260	285
	Norway Spruce	21	720	750
Mount Bellew	Sitka Spruce	21	420	600
	Sitka Spruce	34	260	255
Glen Imaal	Douglas Fir	34	350	365
	Sitka Spruce	30	280	310
Ossory	Sitka Spruce	35	240	255
Killarney	Scots Pine	44	430	550

The current keen demand for chip and pulpwood is leading to the adoption of heavier grades of thinning and this tendency is justified by the need for material for industry, the importance of obtaining the largest possible annual returns from the plantations and the resultant speeding of the growth of the remaining trees towards saw-size timber. It is always accompanied by high pruning of selected stems. A certain amount of selection thinning is done—it consists of the removal of trees which have reached a saleable size in stands where smaller trees can take their place — in order to obtain stems suitable for sawlogs or transmission poles.

Calculated thinning grades as practised by Craib in South Africa for *Pinus radiata* and *Pinus patula* and advocated by Hiley in Great Britain, have not so far been taken up here, except on a trial basis by the Research Section (Chapter VIII). This mode of thinning is grounded on Möller's theory that, within limits, the volume increment of a plantation is not influenced by the density of stocking and that an equal volume can be obtained on a smaller number of trees by heavier thinning. Hiley has calculated that if stocking of Norway Spruce is reduced to 100 stems to the acre at 55 years, instead of the normal 250 to 500, there will then be a total volume of 5,555 H.ft., average 55 H.ft. per stem with a mean B.H.Q.G. of nearly 12 inches. (Quality Class I at normal spacing has an average volume per tree at 55 years of no more than 25 H.ft.). He points out that the timber will have annual rings of reasonable widths, from

about six to the inch at 25 years, to eight to the inch at maturity, which is acceptable in saw timber.

Mechanical thinning, which is simply the total removal of every third or fourth line of trees, was done in Great Britain and in a few places in Northern Ireland during the war. It saved marking thinnings and provided passages for extraction. Scottish eclectic thinning has been practised in Northern Ireland since 1961 for Norway and Sitka Spruce and Douglas Fir which is likely to produce saw timber and which had previously received one light low thinning. Stands which have been thinned more than once in accordance with low thinning ideas continue to be treated in that way. The eclectic method is started when a plantation is 25 feet to 30 feet in total height; 40 to 50 final crop trees are selected on an acre and progressively pruned to a height of 25 feet. A heavy thinning then isolates these dominant trees, to provide room for rapid growth, by removing dominants and sub-dominants which are competing but retaining smaller trees as ground cover. It is hoped that this practice will produce high grade timber in a short term.

PRUNING

Pruning is usually done on the fast-growing conifers with persistent branches, such as Douglas Fir, Sitka Spruce and Norway Spruce, and on Scots Pine considered to be worth the expense. Larch usually is left to shed its own branches. It starts early, at the time of the first thinning, preferably when the trees are no more than 3"—4" B.H.Q.G. With rare exceptions it is not done in plantations where the average Q.G. exceeds 6" and high pruning, to 20', is normally confined to selected trees, 50 in accordance to the eclectic practice and never more than 200 to the acre, distributed evenly over the ground, and likely to be kept until saw timber size. Double leaders are trimmed off hardwoods in the first few years after planting and sometimes whole stems are cut back to ground level to get new, straight growths.

WORKING PLANS

In Northern Ireland the first Working Plan was adopted in October 1955 for Glenarm Forest in Co. Antrim. It covers the area in charge of a forester and is in three parts: part one is historical, part two is the scheme of long-term management and part three is the short-term detailed plan for six years. The six year prescription is revised in the middle of that period so that there is always a detailed plan for at least three years ahead. By October 1965 forty working plans will be in operation in the forests in Northern Ireland. Specific Working Plans have not yet been prepared for the forests in the Republic. In 1962 an aerial survey was done over the Slieve Bloom with a view to the preparation of a Working Plan.

ORGANISATION

The technical organisation in Northern Ireland is centred in Belfast. There is a Chief and a Deputy Chief Forest Officer and two Divisional Officers dealing with the East and the West regions respectively. The East region is divided into five districts, Down, Armagh, North Antrim, South Antrim and Derry and the West into four, West Fermanagh, East Fermanagh, West Tyrone and Central, each under a District Officer.

In headquarters there is a Production Officer, a Nursery Officer, three Working Plan Officers, a Research Officer, a Sales Officer, a mechanical and a civil engineer.

The District Officers are in general responsible for the work of the district including private forestry and the acquisition of land. Some of them have a Junior District Officer or a Head Forester as an assistant. There are 69 forests (1961), in charge of an Assistant, Forester, or Head Forester, depending on the size of the forest. In 1962-63 there were seven Head Foresters, 75 Foresters and 43 Assistant Foresters.

The number of forest workers has risen steadily from 1922. In that year a total of 25 men were employed. Ten years later it was 150 and a further ten years saw it at 260 men. In 1950-51 there were 605 workers, in 1957-58 2,000 and in 1960-61 2,090. In these last two years there were included 500 and 600 men employed under a scheme to relieve unemployment. In 1961-62 the total labour force was 1,418 men, all classified as regular workers.

In the South, Headquarters is in Dublin.

The technical work is organised under two Inspectors General. One carries responsibility for applied forest management; the other for land acquisition, forest research and education.

The management Inspector General is assisted by two Senior Inspectors who divide the country on a geographical basis but, in addition, one deals with general matters relating to utilization and plant production and the other has a general responsibility for Work Study matters. The country is divided into seven Divisions under Divisional Inspectors who exercise control typically over three Districts, averaging nine forests of some 3,000 acres each. A District is manned normally by a District Inspector and one Assistant Inspector. Specialist aspects (utilization, plant production, work study and engineering) are organised under officers of Divisional rank each with appropriate specialist staff, e.g. a civil engineer and a work study inspector for each Division.

The other Inspector General also is assisted by two Senior Inspectors—one on land acquisition and the other on research—and he carries direct responsibility for education. Land acquisition is organised under two Divisional Inspectors with a geographical breakdown into seven acquisition zones coinciding with the management divisions, each staffed typically by a Forestry Inspector-in-charge, one assistant Inspector and one Land Commission Inspector.

Research has one Inspector of Divisional rank who controls its four

Sections, each under an Inspector-in-charge with one or two assistant inspectors and research foresters as necessary.

Education is concerned mainly with the training of foresters, some 30 qualifying each year after a three year course, first year in Kinnitty and the remaining two years in Shelton School of Forestry. The staff consists of one officer of Divisional rank, one of District rank and two assistant inspectors with foresters to assist as required.

In the three years up to the 31st March, 1963, the number of men directly employed in forestry work fluctuated between a minimum of 3,891 and a maximum of 5,168. The average for each of the years was: 4,653 in 1960-61, 4,803 in 1961-62 and 4,663 in 1962-63.

WORK STUDY AND INCENTIVE BONUS

A programme of Work Study was introduced in 1958 in the Republic when a team of forestry inspectors was given specialised training. With the Work Study was linked an Incentive Bonus Scheme which was applied to the forests one by one, following a survey of operations and conditions of work, and at the end of 1960 was operating in all forests. Bonus earnings over and above basic wages depend on output. Standard work values are set and allowance is made for rest, tool maintenance and all contingencies, e.g. in planting on ploughed ribbons the "Work Value" is 10 standard man hours for 1,000 plants, that is a rate of 100 plants an hour. These standards were arrived at after detailed examination of each operation and the best way of doing it and the best tools to use.

The Incentive Bonus Scheme is worked on a gang basis, all members sharing in the extra pay for work done in addition to the standard work value. The bonus is 10d. per hour and is paid in two parts: production bonus at 7½d. per hour is paid weekly in addition to the normal basic wage and quality bonus at 2½d. per hour is paid quarterly as a lump sum. This latter amount may be reduced for poor quality work.

It has been found that the scheme has raised the worker's earnings by 28 per cent, whilst increasing output by 60 per cent and reducing labour costs by 20 per cent.

A bonus scheme has been applied to workers of machinery in the last few years. It covers such jobs as drilling, chain saw-cutting, portable bench sawing and crawler tractor operating.

ROAD MAKING

As many Irish forests are on soft ground and in remote mountain areas with steep slopes, getting the produce to market presents a problem. With us, extraction of timber calls for roads. River floating, snow sledging, or railways are not practicable in Ireland—overhead wires only to a limited extent. What we must have is a firm forest road capable of bearing the weight of a fully loaded lorry and with a foundation and surface able to

withstand our rainfall. The ideal short-haul of produce to the nearest road should not exceed 150 yards and it follows that, in theory, the network on level land should be at 300 yard intervals and on steep gradients, where uphill haulage is out of the question, possibly as close as 150 yards. Roads are costly but economists show that a high road density, by reducing man-handling and horse snedding of poles, pays for itself and may work out at as little as 2½d. per H.ft. over a rotation.

At one time metalling and paving were standard practices, placing the paving stones on edge and spauling and blinding with broken stones, and finishing the surface with 2"—3" of coarse gravel. Present-day methods generally rely on gravel alone. Finished roads have a 9'—10' wide surface, on a 15' wide formation, in a clearing width of up to 30'. Gravel requirements are about one cubic yard per lineal yard of road, depending on the nature of the ground, and cost in 1961 was 6s. to 10s. per lineal yard when spread.

When a road runs across shallow peat this may be entirely removed. On deep peat it is usual to cover the surface vegetation with brushwood and to pile gravel on this, usually two cubic yards to a lineal yard. This makes a satisfactory, if flexible, running surface.

Drainage in advance is an important part of bog road construction and all roads need sufficient side drainage and on hills, cross culverts of concrete pipes at intervals to prevent erosion. Larger concrete pipes are used for bridging small streams and are encased in a solid mass of fine gravel in order to spread the weight of loads crossing over. Ravines and rivers require bridges, usually single span with concrete piers and timber superstructures, but occasionally elaborate four and five span bridges with steel girders are needed.

Roads are nearly always left half-made during the early life of plantations when they are wanted only by pedestrians and occasionally for fire-fighting. Final surfacing comes when they are needed for getting out first thinnings. Road making in all parts of the country is a highly mechanical operation employing bull-dozers and graders. In Fermanagh the Ministry uses a Well-rig drill in its blasting work in quarries.

In the Republic for the three years ended 31st March, 1963, 148, 199 and 164 miles of new roads were finished, 126, 148 and 167 miles were partially made and 139, 204 and 225 miles were repaired.

HOUSING

Forestry workers in the North are in some places provided with cottages built singly or in groups of two or three with a few Forest Villages of sixteen and twenty-two houses such as Derrynoyd and Baronscourt. Cottages are in the style of the traditional Ulster cottage with slated roofs and white-washed walls and cover 900 square feet. Slightly larger houses have been built for the foresters. In all, there are 206 houses for foremen and workers and 50 for foresters. In the Republic the workers live in

Co. Council cottages or in their own houses on farms; foresters' bungalows have been put up at many forests, some of timber prefabricated in the Dundrum and Cong sawmills. Bungalows may be seen at Delgany, Glenealy, Gorey, Donadea and Clogheen Forests. Five new houses were built in 1962-63, bringing the total of official residences owned by the Department to 83.

FENCING

Fencing against farm animals is a first necessity in afforestation. This is essentially a post and barbed wire affair although existing walls, hedges, or banks sometimes meet the case. Three and a half or four feet high is usual, with four or five strands of 3" barbed wire or, more often, with sheep mesh netting topped with one or two strands of barbed wire. Until ten years ago 1½" mesh netting, 42" wide with 6" let into the ground, was used to keep out rabbits but, following the virus disease, Myxomatosis, which almost wiped out these animals, it can now be dispensed with, except where hares are numerous. A four feet high fence will not stop a determined hare but it helps in controlling their numbers inside plantations.

Deer cause damage by browsing on leaves and shoots, the most serious harm being done by the rubbing of the antlers on the stems of young trees in spring in order to remove the velvet. Badly hit areas have the bark stripped from nearly all stems—smooth barked species such as Tsuga, Douglas Fir and hardwoods are favourites but all trees are liable to be damaged.

FIRES

Forest fires in Ireland are a menace chiefly to young plantations before the trees have formed canopy and smothered the ground vegetation. They occur most often in the spring and early summer before withered grass of the previous year is covered by fresh green growth; the danger is greatest in mountain areas and on peat bogs. Forests near roads and railways are vulnerable, although the latter are less likely to suffer since the replacement of the spark-scattering steam engine by the Diesel motor.

Common causes of fires are deliberate uncontrolled moor burning by sheep farmers anxious to provide young heather growth for grazing, bog fires starting as unquenched dinner fires or careless heather burning on banks before turf cutting, picnic fires, unquenched cigarettes or matches, or malice. The Forestry Act in the Republic provides penalties for negligent moor burning and obliges intending fire raisers to give notice to the police and to the owners of plantations within one mile of the place. Both forest services maintain "fire brigades," on special alert at danger periods, and make use of the official local brigades and occasionally of the army. "Fire lines," strips of up to 20' kept clear of vegetation, are usual on the perimeters of plantations where fires may be expected and besides, the lay-out of roads is such that it caters for the speedy arrival of fire-fighters

to danger spots. In the North fire look-out towers, equipped with telephones, have been built at twenty-five centres and overlook most of the State forests. In the western parts of Northern Ireland portable radio sets link fire fighting teams with a central control station. Additional fire-fighting precautions consist of reservoirs formed on streams by building small dams. These supply the water for fire pumps which in the North include mist spray pumps, mounted on 4-wheel drive trucks, which can put up a fine mist for an hour from a 45 gallon tank. There, and in the South, watchers and patrols are employed day and night at danger times and during holiday week-ends when there are large numbers of motorists and hikers in the country.

In the Republic during the three years to 31st March, 1963, 101 acres, 115 acres and 692 acres were destroyed by fire. In Northern Ireland in 1962-63, 182 fires threatened the plantations but only 18 gained entry and no more than 12 $\frac{3}{4}$ acres were burnt.

INSECT PESTS

Insects preying on trees are an ever-present menace but attacks are usually restricted in scope. Common insects include Pine Shoot Tortrix Moth which feeds on the leading bud of pines of all species and causes distorted growth and the Pine Weevil which does grave harm to newly-planted conifers by eating the bark. Several species of *Adelges*, a group of sucking aphids, damage trees. Chief amongst them are *Adelges abietis* on Spruce, with Larch as its secondary host, *Adelges Nüsslini* on Silver Fir, *Adelges Cooleyi* on Douglas Fir, with Sitka Spruce as its primary host, and the Green Spruce Aphid, *Neomyzaphis abietina*, which is often a serious pest on Sitka Spruce especially on soils which are too dry for this species and in the eastern part of Ireland. Other insects which do harm are the Pine Sawfly and leaf-eating weevils mainly on hardwoods. In some seasons Pine Shoot beetle does considerable damage to Scots Pine, *Pinus contorta* and other pines.

FUNGUS PESTS

Our most serious fungus pests include Honey Fungus, *Armillaria mellea*, which kills young conifers, *Fomes annosus* which is the most common cause of Conifer Heart-rot and *Dasyctypha willkommii*, the Canker disease of Larch. Group die-back of conifers, attributed to the fungus *Rhizina undulata* is found in plantations of Sitka Spruce and *Pinus contorta*, and Pine Blister Rust occurs in the small areas of White Pine in Camolin, Coolgreaney and Baronscourt Forests.

In nurseries "Damping-off" is found in densely stocked conifer seed beds, especially on heavy soils in a damp summer, Leaf-cast in Larch, due to *Meria*, is widespread as is Oak Mildew. Insects causing damage in nurseries include Cockchafer grubs and Green Spruce Aphid.

Control of diseases and pests consists primarily of "good hygiene"—a clean, vigorously growing plantation is seldom a victim—and the adoption of preventive measures which are practicable and economic. Attacks by Pine Weevils on newly planted ground are controlled by dipping bundles of plants in solutions of D.D.T. or B.H.G. and the build-up of *Fomes annosus* after thinning is prevented by creosoting the freshly cut stumps.

CHAPTER VII

THE PRIVATE FORESTRY SECTOR.

Private Woodlands and Commercial Nurseries

WOODLANDS

The private woodlands of Ireland are nearly all on old estates and amount to about 90,000 acres of woods, 60,000 acres or so in the South and, in the North, 30,000 acres when small woods of less than 5 acres are excluded. Although their stocking is low and their rate of growth insignificant, the mean annual increment for the quality of land must be the lowest on earth, these woodlands for many years have been, and are still, our only source of gross timber. Their area in 1906 was three-fold what it is now; it has dwindled yearly following the break-up of estates by the Land Commission, the demands of two world wars, the neglect of replanting and the depredations of animals which prevented natural regeneration.

These woods are chiefly hardwoods, partly because they date from a period when hardwood planting was fashionable and partly because any softwoods, as well as being shorter lived, being in greater demand, have all been cut. At the present time the old estates are the sole source of large Oak, Beech and Spanish Chestnut, and also occasional Walnut, with here and there an old Silver Fir, Scots Pine or Larch which has survived through chance or because of sentiment.

A few of these estates have foresters, others make use of the services of forest consultants, some have owners interested in forestry themselves, but in most cases the woods are just left to grow and receive no care. Estates in the North with well-tended woods and plantations include Shane's Castle at Antrim, Clandeboye in Co. Down, Caledon and Baronscourt in Co. Tyrone. In the Republic the list includes Powerscourt, Kiltruddery, Ballycurry, Coollattin in Co. Wicklow, Carton, Co. Kildare, Abbeyleix, Co. Laois, Birr Castle and Clonad in Co. Offaly, Castlepollard, Co. Westmeath, Lismore, Co. Waterford and Blarney, Co. Cork. One or two of the largest of these have woodlands running to 1,500 acres or so but in general they are from 300 to 600 acres in extent. An analysis of the area of 59 estates shows that 2 have woods extending to over 1,000 acres, 8 between 500 and 1,000, 14 between 250 and 500, 11 between 100 and 250 and 24 under 100 acres, an aggregate for the 59 of 15,099 acres.

As well as those belonging to the "landed gentry" there are non-State woods on properties owned by religious orders, county councils and colleges. In most cases these places were originally demesnes belonging

to landlords in the eighteenth and nineteenth centuries. The County Councils of Westmeath, Cavan and Kildare at one time had woods and plantations, handed over by the Land Commission or donated by the owners, but these have nearly all been sold to the Department.

In most of these private woodlands it is not usual to employ specialised woodmen, the work in plantations being done by farm labour. As these men are available only during slack periods on the farm it means that vital operations such as the cleaning of newly planted trees, which tends to come at a season of busy farmwork, gets neglected or postponed with disastrous results. Felling and extraction of timber by merchants often leaves the ground encumbered with lop and top and, as it may extend over years, a frightful growth of laurel, rhododendron, briar and stool shoots springs up over and through the debris which litters the ground. The resulting mess prevents replanting and, as it may cost as much as £60 an acre to clear up, the wood remains derelict and is an eye-sore and a liability ever after.

As well as the difficulties which arise from bad management, private woodlands present other problems. They tend to be in narrow belts and irregular blocks which are expensive to fence against trespass by farm stock and usually are too small or too narrow to qualify for a Planting Grant. There is excessive damage by wind and sun and by encroaching vegetation. As clear felling is normally considered undesirable, regeneration can only be by selection felling followed by group planting or natural seeding. With the ever-present threat of damage by grazing animals, rabbits, hares and grey squirrels, this form of silviculture is not easy, and the groves and screens on many private estates are sparsely stocked with decaying trees which fulfil none of their functions of amenity, shelter or timber production.

GRANTS

The planting of trees in the Republic is encouraged by a State grant of £20 an acre and by free advice from the Forest Service on the establishment of plantations. In Northern Ireland aid to private planters consists in supplying trees from State nurseries, and caters for owners looking for lots of 100 and 500 trees as well as those intending to plant 2 acres, who are entitled to a planting grant as well. Details are in Appendix IV. A somewhat analogous form of aid for the small owner operates in the South where nearly all county councils supply trees at reduced prices. All these schemes are, of course, availed of by farmers as well as by the traditional woodland owners and they have resulted in a limited amount of tree planting on farms.

Besides encouraging afforestation, legislation in the Republic provides for compulsory replacement of trees felled. Under the Forestry Act, 1946, the Minister may permit felling only on condition of replacing or, on lands with approved forestry management where replanting is the

normal procedure, grant General Felling Licences. In 1962-63 106,233 trees were felled on condition that 819,060 would be replanted and in the same year 40 General Felling licences were approved.

COMMERCIAL NURSERIES

There are no sales of young trees direct to the public from State Nurseries in the South. Supplies come from about fifty privately-owned nurseries, some large, some small, located in most counties. The small ones, many of which do not exceed half an acre, are usually run as a side-line by a tree-minded farmer or may be part of a general nursery. These little nurseries tend to develop in districts, without any apparent geographical or climatic reason. One such group of old standing is at Summerhill, Co. Meath, another exists in the Glen of Aherlow, Co. Tipperary, and a third in Co. Wicklow, and there are here and there in the early State forest districts one-man nurseries run by former forest workers, trained in the Department's nurseries. There are three or four large companies which specialise in forest tree growing and also undertake planting and other forest operations on contract for private woodland owners.

Total production from the commercial nurseries is estimated at 4 million trees a year, individual firms turning out from 50,000 up to 1,000,000 plants. All the common hardwoods and conifers are grown, the greatest numbers being Spruce, Pine and Larch which are in strong demand, but the larger nurseries carry a comprehensive stock which includes Austrian, Corsican, Radiata and Contorta Pine, *Abies grandis* and *procera*, *Tsuga heterophylla* and Canker-free Poplars.

WOODED ESTATES

There follow brief descriptions of a few wooded estates:

Pakenham Hall estate borders a bog area to the west of Castlepollard, a low lying district where frost is a problem. The working plan aims at clear felling and replanting 10 acres a year, concentrating on the less economic parts of the old woods. Norway Spruce has done best of the species planted, Sitka Spruce has been affected by frost even on the tops of ridges, Scots Pine pushed up vigorously in its first years but later suffered from suppression by laurel. Data collected in 1953 in pure Sitka Spruce gave 280 stems per acre at 30 years, mean total height 75' and volume 5,516 H.ft. Norway Spruce of the same age had 290 stems, mean total height 62' and volume 3,219 H.ft. on an acre.

Abbeyleix Estate has woods over 1,000 acres in extent on fertile limestone soil and on cut-away turf bogs. Park Hill Wood is over 300 years old and is thought to be part of the Native Nore Valley Woods of Pedunculate Oak. Records show that it was purchased for ship-building for the Royal Navy during the Napoleonic Wars but that the deal was cancelled after the defeat of the French Fleet at Trafalgar. There are fine mature woods of Scots Pine and Norway Spruce, younger plantations

of Japanese Larch, Sitka and Norway Spruce, Lawson Cypress and Scots Pine and natural stands of Oak, Ash and Birch.

Clonad Wood near Tullamore is the centre of a wooded estate of over 500 acres. The oldest parts consist of Oak, Larch and Scots Pine; middle-aged stands are of Douglas Fir, Japanese Larch and Norway Maple and young plantations of Norway Spruce, Douglas Fir, Japanese Larch and Scots Pine.

The woods of Birr Castle contain pedunculate Oak which may be an indigenous strain, Douglas Fir, Scots Pine, European Larch and Japanese Larch. The last species does well on the limestone gravel eskers and there are good plantations of 30 years and up. This Larch, Corsican Pine and *Pinus radiata* seem best suited to the difficult soil conditions, drought and extreme alkalinity.

Lismore Estate contains 2,000 acres of woodland, 1,700 acres of which is productive. There is excellent Scots Pine of up to 100 years old, standing 75 stems to the acre with a volume of up to 5,000 H.ft.

Coollattin Estate is one of the best wooded in the country with over 1,000 acres under trees. This is the home of the Shillelagh sessile Oak and there are some fine stands of this species. There are remarkable Scots Pine, Douglas Fir and plantations of Norway and Sitka Spruce, Scots Pine and Larch.

At Lissadell, Co. Sligo, are extensive middle-aged plantations of Scots Pine, Larch, Silver Fir, Norway Spruce and Sitka Spruce on good soil in wet climate and subject to ocean winds. Most of the younger plantations are Sitka Spruce.

To the north of Lissadell lies Mullaghmore estate, an area of coastal sand dunes and bog land which carry a crop of Maritime Pine up to 100 years old raised from seed sown directly.

Brownhall, Ballintra, Co. Donegal, has many old Lime, Silver Fir, Douglas Fir and Beech trees and plantations of Sitka Spruce, Japanese Larch, Douglas Fir, Norway Spruce, *Thuja plicata*, Poplar and Willow.

Drumheirney, Leitrim, is the centre of a number of plantations of Norway Spruce which are grown to provide Christmas trees; planting is done at close spacing and thinning to the normal density follows when the Spruce are marketable as Christmas trees. Some plantations there have admixture of Sitka Spruce and Poplar to form timber crops.

Willow growing along the river Suir below Carrick has gone on for hundreds of years, and sixty years ago the district was the centre of an important industry in the making of baskets, hampers, crates and hurdles. There are about 200 acres under willow along the Suir and Clodugh rivers, held by 70 owners in plots from $\frac{1}{4}$ acre to 35 acres. The Common Willow, *Salix viminalis*, is the principal species grown, and the practice is to harvest the rods annually. In recent years the demand has fallen greatly and local men in the trade say that the present market for basket and furniture making and for handicrafts could be met from 30 acres of well-managed willow beds.

EDUCATION AND RESEARCH

FORESTRY SCHOOLS

The Forestry School at Avondale was inaugurated in the autumn of 1904 with the object of training young men as working foresters and woodmen for employment in Ireland. The main idea in view was to teach them practical forestry "because", says an account written at the time, "before any advance towards the reforestation of Ireland can be made, men must exist who not only know the theory of planting, thinning and felling woods, but are also able to carry out these operations with their own hands." Practical work was the basis of the instruction: science and theory were included only to supplement practical work and "to destroy its monotony." It was clearly laid down at the outset that the student, or apprentice as he was called, was a workman first and foremost and the theoretical instruction was confined to after hours during the three years that he spent at Avondale. He was paid a labourer's wage and earned it by laying out the nursery, arboretum, pinetum, forest plots and planting about 300 acres of woodlands, all of which are now features of Avondale. Six apprentices were taken on each year and the first lot were "ready to go out" at the time of the Departmental Inquiry in 1907.

All the early State Foresters received their training at Avondale where the school ran for ten years until it was closed down at the outbreak of the First World War. In 1918 it started again at Dundrum, Co. Tipperary, and continued until 1931 when it was transferred to Emo Forest, Co. Laois. Neither Dundrum nor Emo had any facilities for theoretical instruction and the course was a purely practical one. From four to six "trainees" were recruited each year for a two-year course.

In July 1935 Avondale was re-opened. An instructor was appointed and a new scheme of training was inaugurated. The period again became three years. During the first year work was practical. In the second year the trainees were dispersed over the country to work as labourers under senior foresters in different centres, usually spending four months in each place. They returned to Avondale for the final year, which, according to the Department's Annual Report, was "devoted to more advanced training in theoretical subjects." The annual recruitment was stepped up to twelve after the re-opening of Avondale.

With the rapid expansion of forestry development in the fifties Avondale was found inadequate for the number of new foresters needed, and in October 1955 a second school was opened at Kinnitty Castle, Co.



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Seasoning timber in Baronscourt Forest, Co. Tyrone.



" IRISH INDEPENDENT " PHOTOGRAPH.

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Pony trekking through Rostrevor Forest, Co. Down.

Offaly. Here twenty trainees spend the first year of the three year course, concentrating on practical work in the neighbouring forests of Kinnitty, Clonaslee, Mountrath and Ossory.

In February 1957 the Avondale school was transferred to Shelton Abbey, Co. Wicklow, and here the trainees spend their second and third years, doing outdoor work but concentrating on the theoretical side of forestry. The annual recruitment was increased from twenty to thirty-two in 1962-63.

In Northern Ireland a forestry school was started in 1960 at Pomeroy, Co. Tyrone. Its purpose is to train foremen, leading labourers, woodmen, drivers and sawyers in practical forestry and they are given lectures in the fundamentals so that they may have a basic understanding of forestry. The courses are short-term, four weeks for foremen and leading labourers. There is accommodation for fourteen at a time. The school is also used for refresher courses for foresters and forest officers.

Trainees are sent to the British Forestry Commission Forestry Schools in Scotland and Wales, after a two year practical course in Northern Ireland.

HIGHER EDUCATION

Both forest services avail of special courses in Great Britain and further afield. In 1962-63 seventeen officers from the North attended the school in the New Forest. During the same year officers from the Republic went to Britain to see the tests with forest machinery and to study new techniques in nursery mechanisation. Specialists attended short courses in mensuration, work study, grafting techniques and basic research.

There is no faculty of forestry at Queen's University, Belfast, and most of the graduate staff employed in the North are from British, mainly Scottish, universities.

A Chair of Forestry was established in the Royal College of Science in Dublin in 1912 with Dr. Augustine Henry as its first holder. The number of students was small and between 1912 and Henry's death in 1930 only six graduated. In 1930 the Chair of Forestry was replaced by a statutory lectureship and between 1934 and 1942 a total of seventeen students completed the degree course. Some of these found difficulty in getting jobs and as a result the numbers studying forestry fell away. After 1948 there was a marked increase in the demand for forest graduates and in 1959 the Chair of Forestry was re-established and Mr. Thomas Clear was appointed Professor. Extra accommodation and teaching staff was provided and the entrants to the course increased from one or two, or occasionally none, to six or seven each year.

Students may commence at any one of the Colleges of the National University, Dublin, Cork or Galway or at Trinity College, Dublin. The first two years are spent studying the fundamental sciences—chemistry, physics, mathematics, botany, zoology, geology, etc. In the third year

the student goes out to work at practical forestry, usually in a State Forest, and in the fourth and fifth years, actually the third and fourth academic years, he attends courses in the Faculty of Agriculture, University College, Dublin. Here the facilities of the Biological Departments (Botany, Pathology, Entomology, Microbiology) and the Chemistry, Soils, Engineering and other departments are at his disposal for specialised forestry courses. Instruction in forestry subjects is given by the professor and an assistant lecturer.

Dublin is well placed for forestry studies. The National Botanic Gardens, the Timber and Seed Testing Institutes, Timber Museum and the Herbarium are within easy reach, as are pulp and paper factories, large sawmills, pole yards and impregnation plant. The State Forests of most parts of Leinster can be visited in day trips for practical instruction, also private estates such as Kilruddery, Powerscourt and Headfort, and arboreta at Avondale, Mount Usher and other places. The course is a practical one and the students spend much of their time out-of-doors in arboreta and in State and private plantations where they are able to do surveys and draw up working-plans.

RESEARCH

Forestry research in the sense of investigation has gone on in Ireland for 200 years. Early planting was largely of an exploratory nature and much was learned in an empirical way about raising trees from seed and afforesting new ground. This applied especially to the planting of exotics—many species were tried on a variety of sites and their success or failure is reflected in the dozen or so species which are to-day the back-bone of our afforestation. This testing of new trees came to a head in 1904 by the establishment of Avondale Forest Garden. Avondale was at one time owned by Samuel Hayes who planted all the old trees there to-day and who wrote a book on forestry, *Planting*, in 1794. Later it became the property of Charles S. Parnell, leader of the Irish Party in the House of Commons. It is about 530 acres in extent and lies mainly on the west bank of the River Avonmore to within one mile of Rathdrum on the north and extends to the "Meeting of the Waters" on the south, the total length being about 2 miles. When bought, the place had nearly 200 acres of woodland, chiefly confined to the banks of the river and on the rough hill slopes leading down to it, covered with hazel coppice and a few oak, ash and other trees. An outside wood was at Ballyteigue, 66 acres, about 2 miles away. The rest of the land was pasture with many large park trees.

Elevation rises from 250' at the river to over 400' and there is a steep slope down from the plateau now occupied by the experimental plots to the ravine where the river and railway run. The soil is a thin, gravelly loam resting on slate or schist. A few acres of alluvial sand and gravel occur along the course of the river.

The laying out of the estate was commenced in the winter of 1904/05 by the removal of old fences and hedges, the clearing of part of the woodland and the planting of a few acres below Avondale House. In the years which followed the forest plots were planted. They were intended to demonstrate the growth of all the more important species under silvicultural conditions. At that time the suitability of the soil and climate for growing the commoner species had been amply demonstrated elsewhere, but the rarer species had as yet been cultivated on a small scale only, and in most cases on purely arboricultural lines and little was known of their behaviour or commercial value when planted as forest crops. The chief object of the plots was to furnish information on this point and to prove, as far as this can be done in any one place, their value in the proposed afforestation of Ireland. All species which had shown any indication of proving useful as timber producers were planted in plots of about one acre in size, the more important ones being repeated in mixture with other trees.

The plots cover more than 120 acres and are grouped in sections as follows:

Section	Species	No. of Plots	Total Area
I	Maples	4	3
II	Elms	4	3
III	Beech, Spanish Chestnut and Hornbeam	8	8
IV	Oaks	14	13
V	Silver Fir	7	7
VI	Spruce	7	7
VII	Pine	14	12
VIII	Larch	7	14
IX	Cedars	2	2½
X	Ash	9	6¾
XI	Spanish Chestnut	1	11
XII	Robinia	1	6
XIII	Douglas Fir	2	7
XIV	Tsuga	2	3
XV	Cypress and Juniper	4	4
XVI	Thuja, Sequoia and Cryptomeria	4	4
XVII	Hickory, Walnut, Plane, Tulip Tree	10	5
XVIII	Cherry	2	4
XIX	Poplar	3	2
TOTALS		104	121¼

The general idea behind the mixtures was to have at least 25% consisting of the main species, the balance being nurses, either closely related to the main species or capable of producing valuable early thinnings such as Larch. Larch and Norway spruce were employed as nurses to all the important forest trees. Most species were also planted

as pure crops. Scots Pine was used as a nurse for most of the scarcer pines and Common Silver Fir for the Silver Fir section. Beech was used with Larch and Oak; Ash with Oak, Walnut, American Ash, Hickory and Tulip Tree.

Spring frost caused serious damage to the newly planted plots in the years 1907, 1911 and 1914. The worst year was 1911 when frost occurred as late as June 15th, and this killed many of the Common Silver Fir and permanently deformed other Silver Firs, Douglas Fir, Ash, Oak, Spanish Chestnut and Sitka Spruce.

First thinnings which were due before 1920 were delayed on account of the dislocation of the forest services brought about by the First World War when many of the staff were engaged in other work. This delay upset the basic object of many of the mixtures by allowing the nurse species to dominate and suppress the main crop species. Thinning when it came was often too late and in many instances nurses have had to be accepted as final crop trees.

Many of the plots have reached maturity and have been clear-felled since 1960. The ground has been replanted, and where this has happened the only indications of the experiment are the solitary trees flanking the broad ride, each representing the main species of the adjacent plot as it was when planted.

Points of interest in the development of some of the plots:

Abies procera plot: 1 acre planted 1905 onwards.

Originally *A. procera* and *A. alba* 25% 75% at 4'. Both species severely frosted and 700 of the "nurses" had to be replanted in 1910. In 1944 303 *A. procera* remained with a volume of 4,696 H.ft. By 1950 number was 273, total height 66' and volume 6,504 H.ft.

Abies grandis. 1 acre. Planted 1905.

Planted 25% with *A. alba* 75% at 4'. The latter suffered from frost and eventually was suppressed by the *A. grandis*. In 1944 there were 328 stems, volume 7,872 H.ft. Later 93 trees were wind-blown. In 1949 there were 235 stems, total height 102' and volume 12,064 H.ft.

The total production of this acre has been estimated at 16,268 H.ft. at 45 years or 360 H.ft. M.A.I.

Sitka Spruce. 2 acres. Planted 1905. Mixed with Japanese Larch 50% at 4'. The spruce was badly frosted during the first six years and suffered from aphids. As a result it was overgrown by the Larch and in 1917 it was decided that it was beyond recovery as most of the trees were mere bushes owing to frost and overshadowing. However, some tentative thinning and pruning of the Japanese Larch had a surprising effect as the Spruce responded at once. In two or three years the leaderless and apparently doomed Sitka Spruce were developing leading shoots of 2 feet to 3 feet. From 1918 to 1923 1,784 Japanese Larch poles with

a volume of 2,373 H.ft. were taken out, leaving 288 trees of this species. In 1950 the position was that there were 283 stems of Sitka Spruce, total height 82', volume 4,905 H.ft. on an acre and 5 Japanese Larch, 84' total height, volume 96 H.ft. on an acre. This plot has been clear-felled.

Thuja plicata. 1 acre planted 1906. Planted 25% with European Larch 75%. In 1950 there were 343 stems of Thuja, total height 53' and volume 2,976 H.ft., 45 stems of Larch, total height 69' and volume 873 H.ft.

Sequoiadendron giganteum.

1 acre. Planted 1906. The main species was spaced at 12' x 12' and European Larch nurses were filled in at 4' x 4'. In 1948 there were 168 Sequoiadendrons, total height 70' and the volume 4,560 H.ft.

Douglas Fir (Colorado variety).

3½ acres. Planted 1906. The original planting was Douglas Fir 25%, Norway Spruce 75% at 3½' x 3½'. The Douglas Fir lagged behind from the start and was suppressed by the Spruce which by 1924 were up to 30' high with a volume per acre of 1,200 H.ft. Between 1944 and 1948 344 Spruce, volume 4,220 H.ft. were cut from the 3½ acres. In 1950 there were 317 stems, total height 78', volume 7,084 H.ft. on an acre. At that time there remained 7 Douglas Fir. This plot has been clear-felled.

Douglas Fir (Oregon).

Area 6 acres. Planted 1905. Planted 25% with Norway Spruce 75% at 3½' x 3½'.

Between 1944 and 1948 2,560 Norway Spruce, volume 10,098 H.ft. and 398 Douglas Fir, volume 1,737 H.ft. were removed in thinning. In 1950 there were 188 Norway Spruce, total height 77', volume 2,918 H.ft. and 65 Douglas Fir total height 91' and volume 1,837 H.ft. on an acre. This plot has been clear-felled.

Tsuga heterophylla. 2½ acres. Planted 1906.

The Tsuga was spaced at 12' x 12' and filled in with European Larch at 6' x 6'. In 1950 there were 319 stems with a volume of 9,693 H.ft. standing on the plot.

Eucalyptus.

The principal species in the group of Eucalyptus are *E. johnsoni* (muelleri), *E. urnigera*, *E. ovata* and *E. coccifera*, planted in 1909. Others planted later were *E. gigantea*, *E. globulus* and *E. regnans*, of which *E. gigantea* was the only one to survive.

In 1950 the average dimensions of the 1909 planted trees were:

- E. urnigera* 109' high and 54 H.ft. volume.
- E. johnsoni* 110' high and 47 H.ft. volume.
- E. ovata* 113' high and 55 H.ft. volume.
- E. coccifera* 70' high and 33 H.ft. volume.

In 1959 the following were the measurements:

- E. urnigera* 114' high, girth 96".
- E. johnsoni* (muelleri) 119' high, girth 60½".
- E. obliqua* 81' high, girth 71".
- E. viminalis* (known as *E. ovata* in 1950) 120' high, girth 131".

More Eucalypti were planted in Avondale in 1950 in Compartment 1. They include *E. pauciflora*, *E. gigantea*, *E. cinerea*, *E. obliqua*, *E. cordieri*, *E. huberiana*, *E. blakelyi* and *E. manifera*.

In Compartment 5 there were planted at the same time: *E. urnigera*, *E. muelleri*, *E. rubida*, *E. bicostata*, *E. dalrympleana*, *E. dives*, *E. phellandra*, *E. radiata* and *E. elaeophora*. Japanese Larch was planted 75% at 6' x 6' as a nurse.

In Compartment 1 only one *E. manifera* and six *E. gigantea* survived, the latter reaching 35' in height by 1959. In Compartment 5 only 17 *E. muelleri* and *E. urnigera*, 3 *E. rubida*, 6 *E. dalrympleana* and 3 *E. phellandra* survived.

A Research Section was set up in the Forestry Division, Department of Lands, in 1957. Before that time experimental work consisted of a few unco-ordinated trials of fertiliser application, provenance of species and peat afforestation done by the management staff in the course of normal establishment of plantations. The Cameron Report (1951) drew attention to the need for "a strong forestry research organisation" and listed some of its first tasks. They included the investigation of the behaviour of Sitka Spruce and *Pinus contorta* in mass plantations, the study of mechanised preparation of ground for planting and the introduction of machinery into the nurseries, research into seed origins, the use of fertilisers and trials with hybrid poplars.

By 1957 an urgent need which confronted forest management in the Republic was for an inventory of the composition and condition of the timber crops. A Census of Woodlands was carried out in the two years 1958 and 1959, dealing with all plantations planted prior to 1948/49. It covered 136,463 acres in 144 forests and disclosed the existence of 115 million H. feet of "industrial timber," divided into 103 million H.ft. of conifers, 6 million H.ft. Hardwoods and 6 million H. feet mixed conifers and hardwoods.

For purposes of correction the general census was followed by a volume sampling survey on 71,000 acres.

Aerial Survey covering 15,000 acres was done as part of the general census and gave satisfactory results. See Chapter IX.

Investigations have been started into the duration of the annual period of growth in Sitka Spruce, Norway Spruce and *Pinus contorta*, using aluminium bands which record girth increases of 0.01 inch. During 1961-62 measurements were made fortnightly in twenty-one forests. Norway Spruce was found to grow steadily from the last week in April until August 1st and then to taper off to a final stop on 10th October. Sitka Spruce reached its peak by July 18th, followed by a lesser peak by August 15th, after which it fell off rapidly and ceased for the season on 10th October. *Pinus contorta* reached a high peak by June 6th after which growth declined to August 15th and continued at a level higher than Sitka Spruce until 10th October.

In order to make a long-term yield forecast a survey of 103,000 acres of young plantations, between 6 and 15 years, was started in 1962.

A volume Table for *Pinus contorta* (coastal) has been published which gives volumes for stems 2¼ to 19¾ inches Q.G.B.H. and from 20 to 75 feet high.

A provisional Yield Table for *Pinus contorta* with Age/Height graphs based on the measurement of 101 plots has been prepared. This table recognises three Quality Classes from 16 to 37 years and from 27 to 60 feet high. See Chapter IV.

Investigations into Thinning regimes with *Pinus contorta* have commenced at Rathdrum and Killavullen Forests. Trials follow the South African Correlated Curve Trend experiments and entail the application of a number of predetermined periodic thinning intensities to young crops. Other trials are with the Scottish eclectic thinning system and with different thinning densities under orthodox methods.

A number of plots have been planted with Sitka Spruce, Norway Spruce, *Pinus contorta* and Douglas Fir at spacings of 3' x 3' up to 12' x 12' in order to get information on tree form, branch development, stability, root development and suppression of ground vegetation.

Crop establishment on difficult soils has been investigated on climatic peats at Glenamoy, Cloosh Valley and Nephin Beg and on Old Red Sandstone Podsol and Iron Pan types at Cappoquin, Ballyhoura and Ballyhooley. Experiments deal mainly with the effects of applications of the major nutrients, types and amounts of phosphate and the micro-nutrients. Work has also been started to find the effects of fertilisers on moribund older plantations. Different ploughing methods and different species have also been tried. The latter include unusual species such as *Pinus nigra*, *Pinus peuce*, *Abies nordmanniana*, and *Picea omorica*. These species trials have been extended to Limestone Pavement types at Athenry Forest and include Norway and Sitka Spruce, Japanese Larch, Douglas Fir, *Abies procera*, Oak, Ash, Beech and Spanish Chestnut.

The planting of cut-away bog is being investigated at Clonsast in conjunction with Bord na Mona. See Chapter V — "Forests of the Midland Plain."

Provenance, tree improvement and seed orchards are receiving attention from the Research Section. Elite stands of *Pinus contorta* have been selected in counties Tipperary and Cork and are being managed for seed production. Plus trees of this species are used as sources of grafting scions in seed orchards. Work is also being done on Scots Pine, Douglas Fir and Sitka Spruce to test provenance. At Killarney ten provenances of Sitka Spruce are under trial.

Control of furze and heather by chemical sprays has been tried. Other lines of research cover growth studies of eucalyptus, poplars, Sitka and Norway Spruce, fungus diseases and insect pests. A start has been made in Timber Testing in co-operation with the Institute for Industrial Research and Standards.

The overall responsibility for Forestry Research rests with the Agricultural Institute, An Foras Talúntais, which works in co-operation with the Forestry Division.

The Northern Ireland Forestry Division relies to a great extent on the research carried out by the British Forestry Commission. But research into aspects which are of special importance to their conditions has been done by their own officers. This applies to peat afforestation problems and the work is controlled by an informal advisory committee consisting of representatives of the Soil Section of the Ministry of Agriculture, the Botany and Geography Departments of Queen's University, and Forestry Division staff which meets twice a year. The Soil Section is primarily concerned with tree nutrition and is working on fertiliser type and placement. The Botany Department also worked on tree nutrition, particularly on the growth, vegetation and soil nutrient relations and on a peat classification based on vegetations. A study of wind regimes by Forestry Division staff is under way and other projects include a study of soil temperatures under canopy and in the open.

Two research forests have been established, one at Beaghs and one at Ballintempo Forest and most future field experiments on peat will be done at these centres.

General research, most of which is done on plantations of Sitka Spruce, covers drainage and the treatment of checked areas which includes fertilising from the air. Other lines of research are in the chemical control of weed growth in plantations and plant spacing. Trials have been made on the provenance of *Tsuga* and *Pinus contorta*. A comparison in the rates of run-off of rainfall from bare land and forest has been initiated as well as trials to find out the value of wind-firm belts of trees within plantations.

CHAPTER IX.

THE PRODUCE OF THE FOREST

TIMBER NEEDS AND SUPPLIES

For many years the fundamental objective of forestry in the Republic was to "fulfil from native sources the country's requirements of timber to the extent that it is possible to grow in this country the types of timber required." The development of a profitable export trade in timber and forest products was not envisaged.

In the report on the Forestry Mission to Ireland (1951) Cameron deals with the potential home use of timber as follows:

"It would appear to be a safe assumption that the use of forest products in Ireland will not increase beyond the current per capita use in the United Kingdom and Denmark. In terms of sawn softwood this would mean the use of about fifty standards per 1,000 capita. On the basis of present population of 3 million, some 150,000 standards would be required. A population increase of 50% in the long term would only increase this use to 225,000 standards. So far as can be determined at present this seems an excessive calculation and it is proposed to establish as a basic figure that 200,000 standards of sawn softwood per annum would meet any possible need of the population of the twenty-six counties now comprising the Republic of Ireland.

The Petrograd standard of lumber, which is the recognised European unit of measurement, equals 165 cubic feet true measure; expressed in terms of round timber this means 330 cubic feet true measure or 259 cubic feet quarter girth. Adding the conversion loss of at least 20% from tree volume of standing timber the amount required to produce one standard of lumber would be, therefore approximately 325 cubic feet quarter girth (i.e. Hoppus feet or H.ft.).

A production of 200,000 standards per annum would, therefore, require a total tree volume production of 65 million cubic feet quarter girth."

The Forestry Division contributes to our annual needs of wood by clear fellings and thinnings in their own plantations which are mature or on the way to maturity, and by clearings in private woods purchased by them. These latter amounted to 82,551 acres on 31st March 1963 of which 72,362 acres have been felled and replanted. The oldest State plantations, 50 years or so, now considered mature, are at Avondale, Kiltrush, Camolin, Mountrath, Ballygar, Coolgreaney and Dundrum and

at these forests a total area of 1,000 acres has been clear felled and marketed.

The standing volume of millable timber sold in recent years came to 1,757,650 H. feet in 1960-61, 2,165,878 H.ft. in 1961-62, and 2,578,617 H.ft. in 1962-63.

To these totals of home-grown timber must be added sales from privately owned woods. A limited amount of information can be derived from the published statistics of the Control of Felling under the Forestry Acts. The number of trees which may be felled under licence is in the region of 100,000 annually. A break-down of species for the years 1953 to 1958 shows that it consists of approximately two-thirds conifers and one-third hardwoods. Assuming an average tree volume of 30 H.ft. for the conifers, this adds a further 2,000,000 H.ft. to the national harvest of softwood.

A merchant dealing in home-grown timber writes: "It is difficult to estimate the actual production of home-grown timber but it can be accepted that an estimated 2 million H. feet per annum in native sawn timber (hardwoods and softwoods) would correspond with the figures shown in the Forestry Division's Annual Report which for the year 1960-61 showed sales of round timber '8" quarter-girth and over' at 1,757,000 H.ft. Allowing for a further 250,000 H.ft. of small saw logs from the materials sold in the under 8" category, to which can be added a further 750,000 H.ft. approximately of saw-logs from private estates, we get an approximate volume of 2,000,000 H.feet, having allowed for approximately one-third wastage in conversion."

In the early years of this century the area now comprising the Republic was importing 35,000 standards of sawn softwood timber each year. By 1937 the figure had risen to 80,000 standards; during the immediate post-war it dropped, in 1947, to 21,000 standards and later, in 1949, it spurted forward to 58,000 standards. Since then it has moved up and down with the fluctuations of demand, mainly for constructional work which is principally house building, and in 1960 the imports listed as "conifer deals, battens, scantlings and boards" came to 46,000 standards and cost £3,500,000. In 1964 the same category totalled 59,000 standards and cost nearly £5,000,000 delivered to Irish ports. Calculating from Cameron's assumption that it takes 325 H.feet to produce one standard of lumber, this 59,000 standards represents 19,000,000 H.ft. of round timber.

Our recent annual consumption of softwood timber suitable for sawing is, therefore, something like this:

	Hoppus feet
Department's Forests	2,500,000
Private woodlands	2,000,000
Imports	19,000,000
TOTAL	23,500,000

On the subject of our timber imports a Dublin importer writes:

The figures for 1962 show that 45,000 standards (approximately 100,000 tons) of softwood were purchased abroad. Of this amount Finland was by far the biggest supplier with 22,200 standards; next came Canada, 8,600 standards, Sweden 5,900 standards, U.S.S.R. 4,900 standards, Brazil 1,200 standards and U.S.A. 300 standards. These were the main sources of our imports. Whitewood (Norway Spruce) made up 75% and Redwood (Scots Pine) 15% of this timber. The remaining 10% comprised Douglas Fir, Tsuga, Parana Pine (*Araucaria* species), Thuja, Pitch Pine (*Pinus palustris*) and Sitka Spruce. About 90% of the redwood is used for joinery but only about 10% of the whitewood is employed for this purpose. The average moisture content of the imported timber is about 20%."

Of the quality of Irish timber the home-grown timber merchant quoted earlier has this to say:

"Despite an understandable resistance to home-grown timber which resulted from the inevitable variation in quality due to the scarcity of saw-logs, Irish timber in recent years is finding a more ready acceptance in the building industry and for commercial uses. It can be said to be replacing imported timber within the limits of available supplies; in 1962, in spite of increased consumption, the volume of imported timber was less than in previous years."

On this subject a builders' provider who handles both native and imported timber adds:

"The demand for home-grown timber of suitable quality continues to be keen, but supplies are inadequate in the lengths and sizes required by the building trade. Lengths of 15' and over are highly desirable and the most popular sizes are: 4½" x 1½" and 3" x 1½". The species most in demand is Norway Spruce, followed by Sitka Spruce and Scots Pine. Seasoning could be improved so that a moisture content of 20-22% was reached. This can be achieved by proper stacking and air drying over a period of two to three months. Uniform standards of grading are overdue."

At present about 15,000 acres are under production in the State forests of Northern Ireland. Yields from thinning and clear felling rose slightly from 2,058,112 H.feet in 1957 to 2,184,583 H.feet in 1962. They were distorted by the storm damage of 1957, 1959 and 1961 and it is not expected that they will remain at the two million H.feet level. Sales of

round timber, pulp, pit and chipwood and poles in 1963 came to about 1½ million H.ft. For the three years shown produce was as follows:

	1960-61	1961-62	1962-63
Pitwood	8,916 tons	383 tons	1,800 tons
Chipwood	3,650 "	16,098 "	10,500 "
Pulpwood	19,312 "	13,263 "	9,900 "
Round Timber	11,987 "	16,214 "	7,400 "
Fencing material	7,823 "	6,780 "	8,000 (est.)
Firewood	6,802 "	5,322 "	5,000 (est.)
TOTALS ...	58,490 "	58,060 "	42,600

Output still consists chiefly of conifer thinnings which are in great demand for stakes and fencing posts in a predominantly agricultural community.

No accurate figures are available for the output of private woodlands. Eleven felling licences were granted in 1960 permitting the felling of 277,500 H.feet of timber. As a licence is not required when an individual landowner wishes to fell less than 825 H.ft. in three months the above figure is incomplete.

Imports of softwood into the North have remained fairly constant since the War. Expressed as roundwood they came to about 9½ million H.feet annually and indicate a consumption which is below the per capita rate for the United Kingdom or Europe generally.

In 1961 imports of softwood lumber, sawn, planed or dressed, into Northern Ireland were 12,178,331 cubic feet. This equals 73,808 standards and is equivalent to about 24 million H.feet of round timber.

SAWMILLS

At the present time there are about 100 sawmills in the Republic which handle home-grown material, including two mills operated by the Department at Dundrum and Cong Forests. As well, some private estates have their own sawmills. The commercial mills vary greatly in size—some are four man units and smaller, handling no more than 300 cubic feet weekly; the largest employ twenty to thirty workers and have a weekly production of over 3,000 cubic feet. The traditional set-up consists of one or two rack benches and a few smaller circular saws driven by steam, diesel or electric power. Some mills are portable and shift from place to place as new lots of trees are purchased, but these are becoming rare and the tendency today is towards large central mills with band saws and re-saws.

Now that there is an increasing supply of uniform saw-logs coming from the State forests some of the mills have installed Swedish frame

saws, fast cutting band-mills with mechanical log hauls and other forms of mechanisation. There are about thirty modern drying kilns in the country of which half a dozen belong to home-grown timber mills. These are used principally for hardwoods and for wood intended for further manufacture. Softwood is generally sold air dried which is frequently a perfunctory process and much constructional timber is employed in an almost fresh condition.

Wood is manufactured for a variety of uses. Oak is sawn for boat-building, block and parquet flooring, barrel staves, telephone and electricity wire cross-arms and railway keys. Beech and Sycamore goes for furniture, flooring, brushes etc., and joinery. Elm finds its way to the coffin maker, Ash for vehicle body building, sports goods and tool handles. Norway and Sitka Spruce are sawn for house building and box making. Norway is preferred in the building trade; Scots Pine also goes for house construction; good quality is used for joinery, ladder making and so on, poor quality is sawn into railway sleepers and boxwood. European Larch is used for boats, trailers, waggon bottoms, stakes and rails. Douglas Fir goes for building work and Silver Fir and miscellaneous conifers for boxes and all sorts of things like concrete casings and crawler tractor mats. See Chapter IV.

The use of powered chain-saws for felling and cross-cutting is general. In the North the Forestry Division use four-wheel drive tractors for extraction of timber. These machines are fitted with 1,100 x 28 size tyres and are able to work in dense forests over soft mud and up steep hills with loads of 3 tons. Wire ropeways are in limited use.

TRANSMISSION POLES

The sale of transmission poles provides a lucrative market. The Electricity Supply Board in the Republic bought 60,000 poles annually during the time when their Rural Scheme was in full progress and it is expected that in the future they will need annually 12,000 to 15,000 of the small sizes for the 10 KV lines, about 2,500 heavier ones for 38 KV lines and about 1,000 of the largest size for the 110 KV network. At the present time they are buying 40,000 of the lighter poles each year and it is probable that this demand will persist until 1967. The Post Office also use large numbers of poles for the telephone network and are likely to require many thousands for the projected extension of the service.

All poles are pressure treated with creosote. Outer bark is peeled off in the woods, the inner bark is removed by a pole dressing machine at the creosoting depot. They are cut to length and stacked on wooden skids in the forest and will not be accepted unless they comply with specifications of dimension, straightness, freedom from rot, canker and other defects. The lengths range from 28' to 40' for Rural Electrification uses, most of them being required in the 30' and 33' classes with top diameters 6" to 8". The Post office look for a lighter pole altogether

—18' with top diameter of $4\frac{3}{4}$ "—, 26', 28' and 34' and sometimes longer with top diameters running from $6\frac{1}{4}$ " to $7\frac{3}{4}$ ".

For many years Scots Pine and European Larch were the only species covered by the British Standard Specifications for wooden poles for overhead lines but since 1953 the terms apply also to Japanese Larch, Douglas Fir, Thuja and *Pinus contorta*.

Scots Pine has always predominated in the imported poles and it is usually straight, clean and free from knots and with a breaking strength of 7,800 lbs. per sq. inch. A nice balance between the width of sapwood and heartwood is sought, as it is only the former which absorbs creosote; a desirable thickness of sapwood is considered to be about one-third of the radius of the pole. In recent years the proportion of sapwood in the imported article has increased and is now reaching the level in home grown Scots Pine poles.

Other pines such as Corsican sometimes find their way into consignments of native Scots Pine but are not liked as they have too much sapwood and absorb too much creosote and are weak. *Pinus contorta* and *Pinus radiata* also have too much sapwood.

European Larch produces clean, straight poles of considerable strength and is well liked by the users. Supplies of it are scarce and instead the Electricity Supply Board and the Post Office use Japanese Larch which they find to be strong enough and capable of taking a reasonable amount of creosote into the sapwood which is somewhat resistant to impregnation.

For heavy 110 KV lines, Douglas Fir ranks second only to Scots Pine and in recent years has supplied the bulk of the large poles used. For smaller sizes it is used too, but is found to be hard to creosote—it takes four to five times as long in the pressure tanks as Scots Pine—and is not popular on that account; the Post Office do not accept it but it is understood that this attitude may change.

Thuja, although included in the British Standard Specification, is not taken by the Electricity Supply Board or the Post Office as it is found to be weak and difficult to creosote.

Here is a note on the defects and tolerance governing the sale of transmission poles:

Crookedness. A one-sided bend of 1 cm. per metre length of pole may be permitted, or even more in that part of the pole which will be buried.

Rot. The butt of the pole should be sound and sawing off a decayed length is usually permitted.

Canker. European Larch poles having obvious deformity due to canker are usually not accepted.

Knots. Generally, knots constitute a defect especially if they form a complete ring, and may lead to rejection if situated at about 7' to 10' from the butt where they seriously take from the strength of a pole.

Dimensions. The Electricity Supply Board require poles to be of specified lengths or a few inches longer and with top diameters not more than 1" above specified minimum. The Post Office allow a tolerance in length of 3" above or below in poles up to 40' and 6" above or below in longer ones.

Preparation. Outer bark to be removed and all branches and stubs trimmed flush. Post Office poles are expected to be sawn straight across at top and bottom, the Electricity Supply Board ask for the top to be sloped at 30°.

The price of transmission poles have gone up since 1950 and it can be said there is no use which pays a higher price per cubic foot. In spite of the somewhat rigid specification it provides an attractive market for better-quality trees.

THINNINGS IN THE REPUBLIC

Cameron in 1951 was concerned about the disposal of thinnings from the forests of the Republic. In his report he speaks of "three important problems which loom up . . . the most pressing is the disposal of the first thinnings and the second concerns the disposal of later thinnings which are of sufficient size to provide raw materials for industrial use." He says that "fibre board mills and pulp and paper plants producing for export markets must be envisaged."

Shortly afterwards the Bowaters Wallboard Factory at Athy, originally intended to utilise straw from the surrounding cereal farmers, switched to the use of timber. A few years later, Clondalkin Paper Mills installed mechanical wood pulp machinery and became buyers of timber. They were followed by the Scarriff Chipboard industry and in 1963 the Munster Chipboard factory was established at Waterford. All these users look for thinnings, light poles from 12" diameter down to about 2½" and the opening of this market has had a profound effect on management and utilisation which is now pressed to produce annually about 120,000 tons, 3,600,000 H.feet, to keep these four factories going. Some of this comes from private land but the bulk is drawn from the State forests. Here, in recent years, about 9,000 acres was thinned at 100 forests, yielding over one million poles of a total volume of 3 million H.ft. Nearly half of this is Sitka Spruce, one-fifth Norway Spruce, one-tenth *Pinus contorta* and one-tenth Japanese Larch and Scots Pine.

VOLUME ASSESSMENT IN THE REPUBLIC

An assessment of the growing stock in the Department's plantations over 14 years old was made in 1960. This dealt with "industrial volume" of timber, defined as trees with a minimum Q.G.B.H. of 2½" In all 136,463 acres was covered and it turned out that 90,681 acres had industrial

volume which amounted to 115,705,200 H.ft. Conifers accounted for 102,941,600 H.ft. standing on 72,760 acres and hardwoods 5,717,400 H.ft. on 8,929 acres. There was 7,920 acres of mixed woods with an industrial volume of 6,841,700 H.ft. The balance of the measured stands were poor areas partly clear felled and partly windblown.

The above assessment was largely an ocular estimate. It was later checked by measuring 743 one-tenth acre random sample plots. This check resulted in a total volume of 95,246,075 H.ft.—a difference of 4.45% from the basic estimate.

On the question of supply and demand of pulpwood, the Second Programme for Economic Expansion (July 1964) says:

The development of pulpwood-based industries has in recent years overtaken and kept generally in pace with the increasing supply of thinnings coming from the State forests. The demand for thinnings has more than doubled in the past five years, rising from 1.4 million cubic feet Hoppus in 1958-59 to over 3 million cu. ft. in 1963-64. The main users now consist of a wallboard factory, a paper mill (making mechanical pulp for newsprint) and two chipboard factories which came into operation within the last three years. The wallboard and chipboard factories export substantial proportions of their output.

Although thinnings account for less than one quarter of current receipts from the sale of State forest produce, their importance both as a source of revenue and as an industrial raw material continues to increase.

If State forestry is to pay its way it must receive remunerative prices for its produce. Although sawlog prices have shown reasonable increases, pulpwood prices, delivered to factory, are still on the same level as they were ten years ago. All the processing factories continue to pay virtually a common price, irrespective of the differences in the end use of the raw material. It underlines the importance for the future of the aim pursued by the Industrial Development Authority of concentrating on those processing industries which, as well as being competitive, will ensure a fair return to the State forests for raw material.

In 1960 a report of the wallboard and paper manufacturers on the future supplies of native pulpwood indicated that the expansion plans of the existing processors would ensure that there would be no surplus of thinnings before the early 1970's at least.

The long-term thinning forecast shows that supplies should rise from about 3½ million cubic feet in 1964 to about 6 million by 1970, to 8 million by 1974 and to over 12 million by 1980.

THINNINGS IN NORTHERN IRELAND

At one time pulpwood from Northern Ireland was sent to Athy and more recently fairly substantial quantities have been shipped to a paper

mill on Merseyside. Now a chipboard factory is working in Coleraine and consumes supplies hitherto exported and, indeed, imports chipwood from the Monaghan and Cavan forests south of the border. Small sawlogs now coming from the forests are welcomed by the sawmillers unable to satisfy their wants from private estates and about 300,000 H.feet is sold each year. Most of this is for boxes and packing cases but some is used for building work, mainly on farms. A new factory is looking for 5"—7" top diameter logs for the manufacture of wood-wool building slabs and this provides another outlet for thinnings.

Future production from State forests in the North is difficult to assess as not enough is known about yields. For the immediate future output is likely to remain at around 50,000 tons a year. This will increase sharply in five or seven years' time but it will be fifteen to twenty years before the production of native timber makes much difference to the amount imported. The present chipboard factory could well be expanded but the economic timber requirements of other woodpulp mills is still the subject of argument. It is possible that a substantial proportion of the home demand for sawn timber may eventually be met from the Northern forests, but the time is distant.

Even though comprehensive figures of the standing volume of timber in Northern Ireland cannot be supplied, details of the Quality Classes of plantations are available for forests which have Working Plans. An estimate made for the Commonwealth Forestry Conference in 1962 indicated that the growing stock of both State and private plantations over 20 years old amounted to 38,750,000 H.ft. conifers and 19,300,000 H.ft. hardwoods.

EXPORTS AND IMPORTS

There are substantial exports of timber and timber products from Ireland. The Trade Statistics for the Republic for the year 1964 show:

EXPORTS

Pitprops and pitwood	454 standards	£15,142
Lumber, sawn and planed	—	£78,956
Other wood, lumber and cork	—	£24,231
Veneer sheets	28½ million sq. ft.	£367,290
Particle boards etc.	306,128 cwts.	£645,052
Cooperage products	14,710 cwts.	£117,821
Kraft paper and paperboard	85,322 cwts.	£476,554
Wrapping paper	5,148 cwts.	£10,196
Fibreboard and hardboard	218,079 cwts.	£446,819
Other paper and paperboard	230,913 cwts.	£667,076
Bags and sacks	32,855 cwts.	£199,956
Paper boxes, cases, cartons	99,933 cwts.	£533,606
Other paper manufactures	10,567 cwts.	£150,707

TOTAL £3,733,406

IMPORTS

In this connection it may be useful to mention that in the same year imports of veneer sheets, plywood, wood manufactures, paper, cardboard, kraft paper, bags and sacks and other paper and paperboard cost us £11,170,691. Lumber brought in came to £8,898,652 for that year.

Northern Ireland's exports for a recent year are:

EXPORTS

Charcoal	6,820 cubic feet	£2,833
Pulpwood	376,670 " "	£92,920
Conifer logs	176,150 " "	£141,684
Pitwood	607,686 " "	£47,702
Sleepers	1,493 " "	£372
Lumber Conifer	475,416 " "	£140,628
Wood pulp	1,016,658 " "	£217,763
Other wood	2,414 " "	£1,254
Chipboard	752,615 " "	£863,098
TOTAL		£1,508,254

IMPORTS

Imports into Northern Ireland for 1963 were:

	Cubic feet*	Value
Wood and other vegetable charcoal	120,000	£36,000
Wood in the round or roughly squared	413,000	£205,000
Sawn sleepers	226,000	£58,000
Sawn wood	12,600	£3,704,000

* Round wood equivalents.

NOTE: Above figures do not include any pulp, paper, manufactured wooden goods etc. In 1963 these other items had a value of £1,659,000 for wood and cork manufacture, £11,699,000 for pulp, paper and paperboard manufactures etc. and £4,217,000 for furniture and personal effects.

THE FOREST AND RECREATION.

National Forest Parks

NORTHERN IRELAND

A brochure published by the Northern Ministry of Agriculture speaks of the intangible benefits of forests, the most important of all being, perhaps, the refreshment of spirit derived from a sojourn amongst trees. "Those who feel oppressed," it goes on—"as who does not from time to time—by the spider's web of urban civilisation on which we depend, need some direct contact with the primal forces of earth from which to draw a cleansing of the spirit and a new strength of purpose."

The Forestry Act (Northern Ireland) 1953, is mindful of the amenity value of forests and provides for the establishment of National Forest Parks. In 1955 the first of a number of projected parks was opened at Tollymore, beside Newcastle, Co. Down.

Tollymore Forest Park has an area of 1,192 acres. Planting started in 1932 and was completed in 1950 when a total of 1,071 acres all told, including 130 acres of old woods, was under trees. The principal species is European Larch, interspersed with groups of Oak and Beech. Douglas Fir is planted on the extensive area overgrown with laurel and rhododendron and Tsuga is underplanted in some old Oak stands.

The old pleasure grounds have been restored and are now an arboretum with a good collection of conifers and hardwoods as well as rare rhododendrons and azaleas.

There is a small café run by a Newcastle caterer.

Paths have been made and provided with seats and rustic shelters and the routes to beauty spots, archaeological remains and points of interest are sign-posted. Many circular walks have been planned, one, two, three and four miles long, each route indicated by a distinctive colour which is marked in stones, trees or on wooden arrows. A self-guiding nature trail was established in 1965.

There is a caravan site with a piped water supply and the open park and old woodlands by the river have been turned into camping sites for boys' and girls' organisations.

All State Forests in the North are open to the public who are permitted to walk on the roads and rides and through the older woods. It is hoped eventually to develop several as Forest Parks and likely ones are Lislip in the Gortin Glen near Omagh, Down Hill at Castlerock in Co. Derry, Gosford Castle, beside Markethill in Co. Armagh, Rostrevor Forest, Co. Down, Castlecaldwell, Castle Archdale and Lough Navar in Co. Fermanagh, Belvoir Park near Belfast, Ballycastle and Ballypatrick in north Co. Antrim.

A popular walk is the one through Rostrevor Forest to the Cloughmore—the “Big Stone” of Finn McCool—and paths through this area are used by pony trekkers from the nearby hotel.

SPORTING

Fishing and shooting rights in the northern forests are let, usually for terms of five years, and often are taken by game preservation societies and gun clubs who in some cases stock the land. The foresters encourage bird life by the provision of nesting boxes. A pinemarten was seen in Tollymore Park in 1959 and red squirrels are plentiful at many forests. The destructive grey squirrel invaded Crom Castle estate and Ely Lodge Forest in Co. Fermanagh from over the border in Co. Cavan in 1960 but does not appear to have established itself.

There are herds of Red Deer at Montalt, Ballynahinch Forest, and at Caledon where it is interbred with Canadian caribou. The dark Fallow Deer are plentiful at Favour Royal and Randalstown Forests, at Clondeboye and Caledon estates, and Japanese Sika Deer are at Baronscourt Forest.

REPUBLIC

The Forestry Acts of the Republic do not mention aesthetic consideration in connection with State Forests but they make specific provision for the retention of trees on private lands in order to preserve scenic amenities. Powers are given to Planning Authorities, usually corporations or county councils, in the Local Government (Planning and Development Act 1963 to preserve trees and to plant, or to assist any person or body in planting trees and shrubs for the purpose of enhancing the natural beauty of any land.

There are no specific National Forest Parks in the Republic but many of the State Forests have been developed with a view to access by the public. Killarney Forest roads and woodland paths are open, Gougane Barra has a scenic road around the rim of Glencolumbkille, the avenues of Glenbower near the village of Killeagh provide a popular walk for local people, and the famous rhododendron drive at Glenart Forest at Arklow is now a public road. The older plantings of Co. Wicklow have altered the landscape—extensive woods line the roads and clothe the hills for miles between Aughrim and Aughavannagh, they cover the slopes of Glencree, Glendalough, Glenmalur and Glen Imaal and the river valleys by the Meetings, Woodenbridge and down to Arklow. The northern and southern faces of the Slieve Bloom range have many forests, some of which can be viewed from the road which joins Mountrath and Clonaslee through the “Cut” at the eastern end of the ridge.

The Blackwater has long been famous for its sylvan beauty and provides woodland scenery from its outlet at Youghal, through Cappoquin, Lismore, Fermoy, Ballyhooly, Killavullen, Mallow and Banteer to its source in the Kerry Mountains. Woods line the Suir from Waterford to Cahir and beyond, the Nore from New Ross by Inistioge and Bennetts-

bridge to Kilkenny, the Barrow through the hills near Graiguenamanagh to the plains of Carlow and Laois. In West Cork the large new plantations will in a few years form striking features and this applies to Galway, Mayo, Donegal and other counties where extensive afforestation has been done since 1950.

SPORTING

The ancient woods, the inspiration of the ballad *Sean O Duibhir an Gleanna*, were of hardwood species and harboured game of all sorts. Our new forests, which are chiefly conifer, cannot be as hospitable to wild life and generally speaking birds and beasts are scarce in the present day plantations. Encouragement and preservation of game is not undertaken by the Department but is left to the lessors of shooting rights which are often syndicates or local gun clubs with a lease of a few years.

Of the various species of deer found here only one, the Red Deer, is a native. At one time fairly plentiful, by 1750 it had become scarce and is said to have been on the verge of extinction in the Knockmealdown, Galtees and Glengarriff districts. From 1750, with the development of estates, deer of different kinds were introduced including Fallow, Roe, and, much later, Japanese Sika deer. Some authorities think the Fallow deer came in the thirteenth century, and it is generally believed that the sole surviving Irish Red deer are those at Killarney, albeit inter-mixed with some Scottish blood brought in after 1880. In 1952 it was estimated that there were sixty or so Red Deer in the Wicklow Mountains and three hundred in Killarney. At that time Fallow Deer were fairly numerous in the midlands, Cavan, Monaghan, Waterford and Tipperary and through Cork to the mountains of Kerry. Japanese Deer are numerous in Wicklow and the Killarney district of Kerry. Roe deer seem to have died out.

Red squirrels are plentiful in all forests and the grey squirrel, in spite of constant war by the foresters, still persists, possibly augmented by re-infestation across the land frontier from Northern Ireland.

YOUTH HOSTELS

Many of the Youth Hostels run by An Oige are situated in the midst of State Forests—those of Glenmalure, Aughavannagh, Glen Imaal, Glengarra and Killarney are a few of them. In the North there is a Youth Hostel in Gortin Glen Forest, Co. Tyrone.

The Northern Forestry Division assists educational authorities, the Central Council for Physical Recreation and the Duke of Edinburgh's award scheme with facilities for field study and outdoor pursuits.

APPENDIX I.

LEGISLATION AFFECTING FORESTRY

The Acts of Parliament governing Forestry
in the Republic

FORESTRY ACTS

Three Acts have regulated State forestry and ancillary matters at different times.

The Forestry Act, 1919, established the British Forestry Commission, at that time operating in the United Kingdom of Great Britain and Ireland, and gave certain powers and duties to the Commissioners; they were entrusted with the promotion of afforestation and were empowered to acquire land by agreement or compulsorily, utilise and manage land for purposes connected with forestry, make advances by way of grant or loan in respect of the afforestation of land not their property, establish or aid in the establishment of woodland industries, authorise entry on land adjoining forest land for the purpose of destroying rabbits, hares or vermin, and provide for the compulsory provision of facilities for the haulage of timber from or to any road, etc.

The functions of the Forestry Commission in regard to the Twenty-six counties were subsequently vested in the Minister for Lands.

The Forestry Act, 1928, extended the powers of the Minister for Agriculture, who was at that time charged with the administration of the forestry service, by enabling him to require sawmillers and timber exporters to furnish information to him in regard to the timber handled by them; it amended the provision of the Forestry Act, 1919, in relation to the compulsory acquisition of land, principally with a view to bringing those provisions into alignment with the Land Purchase Code; it empowered the Minister to control, by prohibition and licence, the felling of trees on land in private ownership and to require, if he thought fit, persons authorised by him to fell trees, to plant other trees in lieu; and it provided certain safeguards against damage to any forest by fire originating on adjoining land.

REPEALED

The Forestry Act, 1946, replaced the two earlier Acts which it repealed. It did not introduce any new principles or confer new powers in any major sense. Its purposes were to provide better machinery for compulsory acquisition of land for forestry; to rectify flaws in the 1928 Act regarding the felling of trees on private lands; to provide additional powers to the Minister to extinguish rights on State forestry land and to create rights-of-way necessary for the working of the forests and to prevent damage to trees by hares and by fires originating on adjoining land.

The Forestry Act, 1956, was an amending Act which clarifies parts of the 1946 Act dealing with land acquisition for afforestation. It provides for the payment of compensation in the case of compulsory acquisition and gives the Minister powers to make regulations concerning the taking over of commonages and the provision of rights-of-way.

ELECTRICITY SUPPLY ACTS

The Electricity Supply Acts give the Board certain powers in respect of trees growing along the route of their transmission lines and they have the right to lop or to fell trees.

LOCAL GOVERNMENT ACTS

The Local Government (Planning and Development) Act, 1963, makes provision for the planning of urban and rural areas and the preservation and improvement of amenities. This Act gives Planning Authorities the power to prohibit the cutting down, lopping, topping or destruction of trees and enables them to plant trees for amenity and to assist other people to do so.

AGRICULTURE (AN FORAS TALUNTAIS) ACT, 1957

This Act provides for the establishment of an Institute for agricultural research; in this context agriculture includes horticulture and forestry. The functions of the Institute are to review, facilitate encourage, assist, co-ordinate, promote and undertake agricultural research. Forestry is linked with horticulture in the five main divisions of the organisational structure of the Institute and research work is done in close association with the Forestry Division, Department of Lands.

AGRICULTURE AND TECHNICAL INSTRUCTION (IRELAND) ACT 1899

The County Councils, through their Committees of Agriculture, operate schemes to assist farmers in planting shelter-belts. These schemes are handled by the horticultural instructors and include advice on the siting of belts, the selection of species, planting and protection and the provision of young trees at a reduced price.

The Acts of Parliament affecting Forestry in Northern Ireland

FORESTRY ACTS

The Forestry Act, 1919, already mentioned, at that time applied to Ireland and the powers of the Forestry Commission were later vested in the Minister of Agriculture for Northern Ireland.

The Forestry Act (Northern Ireland) 1953, conferred powers on the Minister of Agriculture to acquire land, but not compulsorily, to manage land for the purposes of forestry and to help private persons and public bodies to plant trees on their own land by providing money grants and free technical advice. In addition the Minister has powers to introduce measures for the protection of woodlands against over-cutting, fire and vermin, to promote forestry education, to create forest parks, to promote the sale and utilisation of timber, to grant felling licences and to carry on or aid in the establishment of woodland industries.

AMENITY LANDS ACT 1965

This legislation brings under public ownership or control areas of natural beauty, amenity or scientific interest. The Act provides for the public acquisition of areas of natural beauty or amenity, the designation of National Parks, the establishment of Nature Reserves, the provision of facilities in such areas and in State forests and the cleaning up of derelict sites.

APPENDIX II.

"The Society of Irish Foresters" was inaugurated at a meeting in Dublin on the twenty-first of September, 1942. The following thirty-one Foundation Members were enrolled:

M. L. Anderson	D. G. Hayes	D. McGlynn
P. Barry	F. McMahon	S. McMenamin
T. J. Briody	T. Moloney	M. O'Beirne
W. J. Chisholm	O. V. Mooney	J. O'Leary
T. Clear	G. Muir	S. M. O'Sullivan
R. J. Crerand	F. J. Murphy	S. M. Petrie
M. Dalton	J. McCarthy	D. A. Quirke
P. Delaney	M. McCarthy	M. Swan
T. Donovan	T. McCarthy	M. Swords
J. P. Dowds	D. McCaw	P. Verling
H. M. FitzPatrick		

All the above were technical members and all, except six, were officers in the Forestry Division, Department of Lands.

The stated object of the new society was to advance and spread in Ireland a knowledge of forestry in all its aspects. It was intended primarily as a professional society, but any person desirous of furthering the object, who was not qualified to become a professional or technical member, was open to join as an associate member.

At the Annual General Meeting in 1944 it was announced that there were 115 technical members and 21 associates. By 1948 members had risen to 88 associates but there had occurred a diminution of technical members to 77. Seven years later there were 93 associates and 100 technical members. In 1958 the position was 85 and 112 respectively for the two membership classes. A drive to increase membership was initiated in 1960 and three years later total members numbered 258. Members come from both sides of the Border and from both Forest Services.

In spite of the difficulties of travelling and the shortage of paper created by the Second World War, the society quickly got down to its work of arranging meetings and study tours and publishing a journal, activities which in later years became the principal means of reaching the object of "advancing and spreading a knowledge of forestry." An Annual General Meeting was held in Dublin in 1943 and in the same year a three-day study tour took place in the Suir Valley which with

minimal wheeled transport managed to cover a lot of ground between Carrick-on-Suir and Caher. The crowning achievement of that year of scarcity was the appearance in November of the first number of "Irish Forestry," a booklet of forty-eight pages with original articles on history, shelter belts, handling timber and thinning, notes on species and planting methods, accounts of the meeting and the tour, the record of the election of A. C. Forbes as first honorary member and an obituary notice.

This first year set the headline which later years were to follow. Since then three and four day summer study tours have been held to all parts of Ireland, to Wales, Scotland, England, Germany, Denmark and Brittany. One-day outings to Irish forests and forest industries take place at all seasons. Lectures and discussions are arranged as part of the Annual General Meetings or as separate events. The format of the journal is much as in 1943 and usually two numbers appear in a year.

OTHER SOCIETIES AND ASSOCIATIONS WHICH HAVE FORESTRY AMONGST THEIR INTERESTS

"Trees for Ireland," 30 Westmoreland Street, Dublin.

Royal Dublin Society.

Royal Forestry Society of England, Wales and Northern Ireland.

Ulster Timber Growers' Organisation.

Irish Landowners' Convention.

An Taisce, The National Trust for Ireland, 19 Dawson Street, Dublin.

Home Timber Merchants' Association of Northern Ireland.

Timber Importers' Association (Northern Ireland).

Native Timber Merchants' Federation (Ireland).

Ulster Society for the Preservation of the Countryside.

Northern Ireland Committee of the National Trust.

Belfast Naturalist Field Club.

APPENDIX III

FORESTRY OFFICERS IN THE STATE DEPARTMENTS

NORTHERN IRELAND

In 1963-64 the following were the Forestry Officers in the Ministry of Agriculture, Forestry Division.

K. F. Parkin, M.Sc., Chief Forest Officer; C. S. Kilpatrick, B.Sc., Deputy Chief Forest Officer; E. G. Clark, B.E.M., Production Officer; G. N. L. Coates, B.Sc., Nursery Officer; A. W. Simpson, B.A., Working Plans Officer; J. C. L. Phillips, B.Sc., Divisional Officer; W. H. Jack, B.Sc., Ph.D., Research Officer; D. Simms, Sales Officer; N. Deveria, A.M.I., Mech.E., Divisional Engineer; W. H. B. Forbes, B.Sc., Forest Engineer, and the following District Officers: T. M. Black, B.Sc., Ph.D.; J. A. Busby, B.Sc.; W. G. Dallas, B.A., Agr.B.; J. M. Elliott, B.Sc.; J. K. Fotheringham; G. B. Jones, B.A.; R. S. Lamb, B.Sc.; M. Macpherson; J. W. Moffett, B.Sc.; C. N. Parker, B.Sc.; R. T. Sherwood, B.Sc.; D. Woolfenden, B.Sc.; W. J. Wright, B.Sc.; M.F.

There were 7 head foresters, 75 foresters, 36 assistant foresters, 6 senior foremen, 30 foremen and 1,229 forest workers.

REPUBLIC

In December, 1964, the following forestry officers were the staff of the Forestry Division, Department of Lands.

MANAGEMENT

Inspector General, T. Manning; Senior Inspector for Divisions I, II, III and VI and Nurseries and Utilization, T. McCarthy. Senior Inspector for Divisions IV, V and VII and Work Study, D. McGlynn.

Division I, H.Q. Bray—Divisional Inspector, J. J. Maher; District Inspectors: D. McGuire, L. Condon, J. F. Durand and T. Enright.

Division II, H.Q. Kilkenny—Divisional Inspector, P. F. Ryan. District Inspectors: P. V. Delaney, E. V. Gaffey and E. Munnely.

Division III, H.Q. Cork—Divisional Inspector, C. A. McCormack. District Inspectors: P. Verling, W. Shine, D. Allman.

Division IV, H.Q. Galway—Divisional Inspector, J. O'Carroll. District Inspectors: S. MacMeanman, T. de Gruineil.

Division V, H.Q. Sligo—Divisional Inspector, G. McCool. District Inspectors: P. Finnerty, C. Curran, M. F. O'Donovan.

Division VI, H.Q. Limerick—Divisional Inspector, G. Haas. District Inspectors: J. B. Gibbons, P. Collins and T. H. Moore.

Division VII, H.Q. Mullingar — Divisional Inspector, W. J. Breslin. District Inspectors: T. F. Mulloy, F. P. Clarke, T. Prior.

Utilization—Inspector-in-charge, J. A. Crammond. Inspectors: T. Donovan, F. Moriarty, M. C. Flanagan and D. J. Gilroy.

Nurseries—Inspector-in-Charge: T. Moloney. Inspectors: J. J. Deasy, M. McCarthy.

Amenity—Inspector: J. F. Durand.

Work Study — Inspector-in-charge: P. P. O'Grady. Inspectors: S. Quinn, J. J. Thornhill, P. Flynn, T. O Mathghamhna, B. Moloney, E. Leahy, R. J. Griffin.

Engineering and Housing—Supervising Engineer: K. F. McGarry. Mechanical Engineer: J. P. Fletcher. Assistant Mech. Engineer: J. F. Marks. District Engineers: C. J. Browner, J. E. Downes, C. Lynch, J. Murray, J. J. Lally, J. D. McDonnell. Housing Inspectors: S. Madigan, D. Bolton. Housing Supervisor: M. Aherne. Surveyors: D. Richardson, P. Healy, J. Synnott, C. Boyd, E. V. Shalvey, B. McAuley.

LAND ACQUISITION, RESEARCH AND EDUCATION

Inspector-General: M. S. O Fiachain.

Land Acquisition—Senior Inspector: T. McEvoy. Inspector-in-Charge, Eastern Division, with H.Q. in Dublin: M. Swan. Inspectors: M. McNamara, P. J. Butler, S. P. O Riain, M. J. Sheridan. Assistant Inspectors: E. S. Flanagan, E. Burns.

Inspector-in-charge Western Division with H.Q. in Galway: A. J. Hanahoe. Inspectors: J. Kearney, J. E. Johnston, P. J. White. Assistant Inspectors: E. McGuinness, B. O'Sullivan, G. Scully, J. P. Carrigy.

Research — Senior Inspector: O. V. Mooney. Inspector-in-charge: N. O Muirgheasa. Inspectors: R. N. O'Carroll, A. M. S. Hanan, G. Gallagher, L. P. Flanagan. Assistant Inspectors: J. O'Driscoll, G. de Britt, P. Hand, J. D. Robinson.

Education—Shelton Abbey School—Superintendent: T. Ua Cearbhaill. Assistant Superintendent: F. Watson. Kinnitty Castle School—Superintendent: T. Prior.

In 1962/63 the minimum, maximum and average number of men directly employed on forestry work was 3,891, 5,168 and 4,663 respectively.

APPENDIX IV

ASSISTANCE FOR PRIVATE FORESTRY

NORTHERN IRELAND

The Ministry of Agriculture in Northern Ireland operates several schemes which are intended to promote forestry.

Leaflet 62 is an illustrated brochure of 20 pages which gives information on many aspects of tree planting—it ranges over the practical work of preparation of ground, draining, mounding, selection of species, planting and so on—and tells of the grants and other forms of encouragement for planters.

Free advice on any silvicultural subject may be obtained from any District Forest Officers or from the Forestry Division of the Ministry of Agriculture, Dundonald House, Upper Newtownards Road, Belfast 4.

Lots of at least 500 young forest trees or at least 50 poplars may be obtained at about cost price from the State nurseries on condition that they are not re-sold, that they are intended for the applicant's own holding and that he undertakes to protect them against farm stock, etc.

Smaller lots, in bundles of 100 trees of some species, are available to small-holders at a low cost.

Planting grants for areas of not less than 2 acres either planted or naturally regenerated are eligible for grants of £22 4s. 0d. an acre payable in two instalments, the first of £15 15s. 0d. soon after planting and the balance five years later, subject to satisfactory maintenance.

Thinning grants of £3 15s. 0d. an acre are available for the first and second thinnings in a plantation of not less than 2 acres, the trees being below a specified quarter-girth or height.

Where an area has been approved for a planting grant a further grant may be payable for scrub clearance estimated to cost £17 or more per acre. The grants are roughly 50%—£8 10s. 0d. where the cost ranges from £17 to under £27 and £13 10s. 0d. where it is £27 or more. It is paid in two instalments—75% when the area is planted and 25% five years later, subject to satisfactory maintenance.

Poplar planting is encouraged by a grant of £8 10s. 0d. an acre for an acre plot with trees spaced 18' to 30' or 2s. per tree for at least 100 trees in lines or avenues. Both are paid 50% after planting and 50% 5 years later.

AID TO PRIVATE OWNERS

Grants may be paid of up to 50% of the approved cost of establishing shelter-belts on a stock-rearing hill farm as part of a general scheme of improvement or grants of one-third of the approved cost when it is done under the Farm Improvement Scheme. This grant scheme is operated by the farm improvement section of the Ministry of Agriculture.

Loans may be obtained from the Ministry of Agriculture for approved schemes of tree planting. They range from £100 to £3,000 and may be for a term of up to 50 years.

The areas planted under these schemes in Northern Ireland in recent years were:

	Poplar planting	Other Species	Total
	acres	acres	acres
1957/58	98.5	394.1	492.6
1958/59	46.5	432.0	478.5
1959/60	40.0	504.1	544.1
1960/61	15.8	267.0	582.8
1961/62	6.4	418.0	424.4
Total for 5 years	<u>207.2</u>	<u>2,015.2</u>	<u>2,222.4</u>

In the same 5 years the following numbers of young trees were supplied from the Ministry's nurseries for Grant Schemes, Shelter-Belts and Amenity Planting:

1957/58	691,027 trees
1958/59	764,627
1959/60	801,968
1960/61	700,588
1961/62	907,043
Total ...	<u>3,865,253</u>

REPUBLIC

In the Republic tree planters may obtain money grants and free technical advice from the Forestry Division, Department of Lands, 22 Upper Merrion Street, Dublin 2. In 1964 the following conditions applied to the payment of grants

Outside the Congested Districts at least one statute acre must be planted and it may consist of two blocks of half an acre each, which are not less than 44 yards in width.

In the Congested Districts half acre plots are eligible for grants.

The amount of planting grants in 1964 is £20 an acre, payable in two instalments, £10 after planting and £10 5 years later, subject to satisfactory maintenance.

A condition is that Sitka Spruce, Douglas Fir, Japanese Larch, *Pinus radiata*, *Abies procera*, *Cupressus macrocarpa*, Lawson Cypress, *Abies grandis* and Ash must be spaced not more than 6' apart, 1210 to an acre. European Larch, Scots Pine, *Pinus contorta*, Norway Spruce, Oak, Beech and other species of forest trees must normally be planted not more than 5' apart or 1,750 to an acre.

There is a scheme for poplars which provides grants of £15 an acre for block planting, and 3s. a tree for row planting, at spacings of 20' to 26' apart in each case. The plants must be of a canker resisting strain and in recent years the following varieties of poplar have been approved:

Populus serotina, *P. eugenei*, *P. gelrica*, *P. deltoides*, var. *missouriensis*, *P. serotina*, var. *erecta*, and *P. robusta*.

In the three years 1960/61, 61/62 and 62/63 the planting of 986 acres, 1,069 acres and 1,307 acres respectively was grant-aided. In 1962/63 grants were paid for 14½ acres of poplars and the row planting of 53 trees.

RESTRICTIONS ON PLANTING

The E.S.B. do not permit trees to be planted under or near their 10 KV, 38 KV or 110 KV lines.

Most county councils do not permit planting within 30 feet of a road.

COUNTY COUNCIL SCHEMES

All county councils with the exception of Meath operate schemes to encourage the planting of shelter belts on farms by supplying trees to farmers at reduced prices.

LITERATURE

The Department of Agriculture and Fisheries and "Trees for Ireland" provide leaflets and booklets on tree planting and forestry.

APPENDIX V

TAXATION OF WOODLANDS

REPUBLIC

INCOME TAX

There is liability for tax under:

1. Schedule A for ownership of the land.
2. Schedule B for the presumed income derived from occupation of the land.
3. Schedule D if the owner so elects instead of Schedule B on or before 5th June in the year of assessment.

In the event of an owner keeping his woodlands in hand he has to pay tax under Schedule A, also under Schedule B or Schedule D.

If he lets his woodlands he pays under Schedule A only, and the occupier pays under Schedule B.

Basis of Assessment under Schedule A
(for ownership of the land)

This is based on the Poor Law Valuation of the land and is assessed at the full rate. Off the gross Schedule A assessment come the following allowances:

1. One-eighth of the annual valuation to cover expenditure on repairs to boundary fences, gates, roads, water-courses, insurance and management. If the cost of repairs, etc., exceeds the one-eighth allowance on the average of the five preceding years, tax on excess is recoverable through a Maintenance Claim.
2. The interest portion of the annuity paid on the land.
3. Any other annual charge.

In estimating the Annual Valuation of land no notice is taken of the crop on the ground—the value is the figure that the land could ordinarily be let at if bare.

Basis of Assessment under Schedule B

The gross Schedule B assessment may be taken as one-third of the gross Schedule A assessment or of the original Land Commission annuity.

If it can be shown that the woodlands are managed on a commercial basis with a view to profit, and not merely for sport and amenity, an amount of one-fourth is claimable by individuals, as distinct from companies, as earned income allowance.

No additional liability to income tax arises whatever the amount of timber sold.

Basis of Assessment under Schedule D

If an occupier can prove that his woodlands are managed on a commercial basis with a view to profit he may elect to be assessed under Schedule D instead of Schedule B on the actual results of the year preceding the year of assessment. This may apply to all his woodlands, or be confined to each new plantation as it is planted or replanted. If receipts are in excess of expenditure, the owner has to pay tax on the excess. If expenditure is in excess of receipts this deficit may be treated as a loss and set against the owner's other income.

It follows from this that it may be an advantage to transfer each new plantation to Schedule D: the cost of planting will be allowed and the inevitable excess of expenses over receipts in the early years may be set against income from other sources. A loss in any year can be carried forward.

It is not wise to put mature or semi-mature woodlands under Schedule D because income tax would be payable on the net proceeds of sale, without any allowance for income tax already paid under Schedule B during part of the period of growth. These older areas can be treated as a separate unit under Schedule B. Any area placed under Schedule D will remain under that Schedule so long as it is occupied by the person who made the election. Where woodlands under Schedule D are transferred to an estate company the company can revert to assessment under Schedule B.

No capital valuations are necessary for the accounts returnable under Schedule D—only records of receipts and expenses need be kept. Planting grants must be shown as a receipt and earned income allowance may be claimed in respect of any profit.

Where woodlands are cut and replanted, the cost of clearing up the old crop, and of cleaning and preparing the ground, is normally allowed as an expense; in the case of re-planting, these costs therefore should be shown as an expense, income tax being recoverable on any excess of expenses over income.

In the case of a new plantation the initial cost of its establishment, including the cost of clearing and preparing the ground, is normally not allowed as it is regarded as capital expenditure. In this case the amount of any planting grant received is ignored, whereas in the case of replanting the grant is shown as a receipt.

ESTATE DUTY (DEATH DUTY)

Land on which timber, trees, wood or underwood is growing is subject to estate duty on the value of the land.

Estate duty is not payable at death on the timber itself but has to be paid later as and when cut during the period which may elapse until another death makes the estate again liable to duty. The value of the

timber is not taken into account in estimating the principal value of the estate or in determining the rate of estate duty chargeable on the whole estate.

It is advisable to agree the value of the timber at date of death as the amount so agreed would be the maximum sum liable to duty, even though receipts from sales may exceed that amount. If no such value is settled, then all proceeds from sales of timber, less outgoings since the death, without limit would be subject to estate duty until the next death.

The rate paid on timber is the same as the rate on the principal value of the remainder of the estate.

The estate duty may be paid in a lump sum on the value agreed at the time of death.

New plantations are, of course, not liable until the next death and any outstanding portion of estate duty is cancelled on the death of the successor.

NORTHERN IRELAND

Northern Ireland taxation is levied by the United Kingdom Government at the same rates as in Britain. Estate Duty is, however, levied by the Northern Government.

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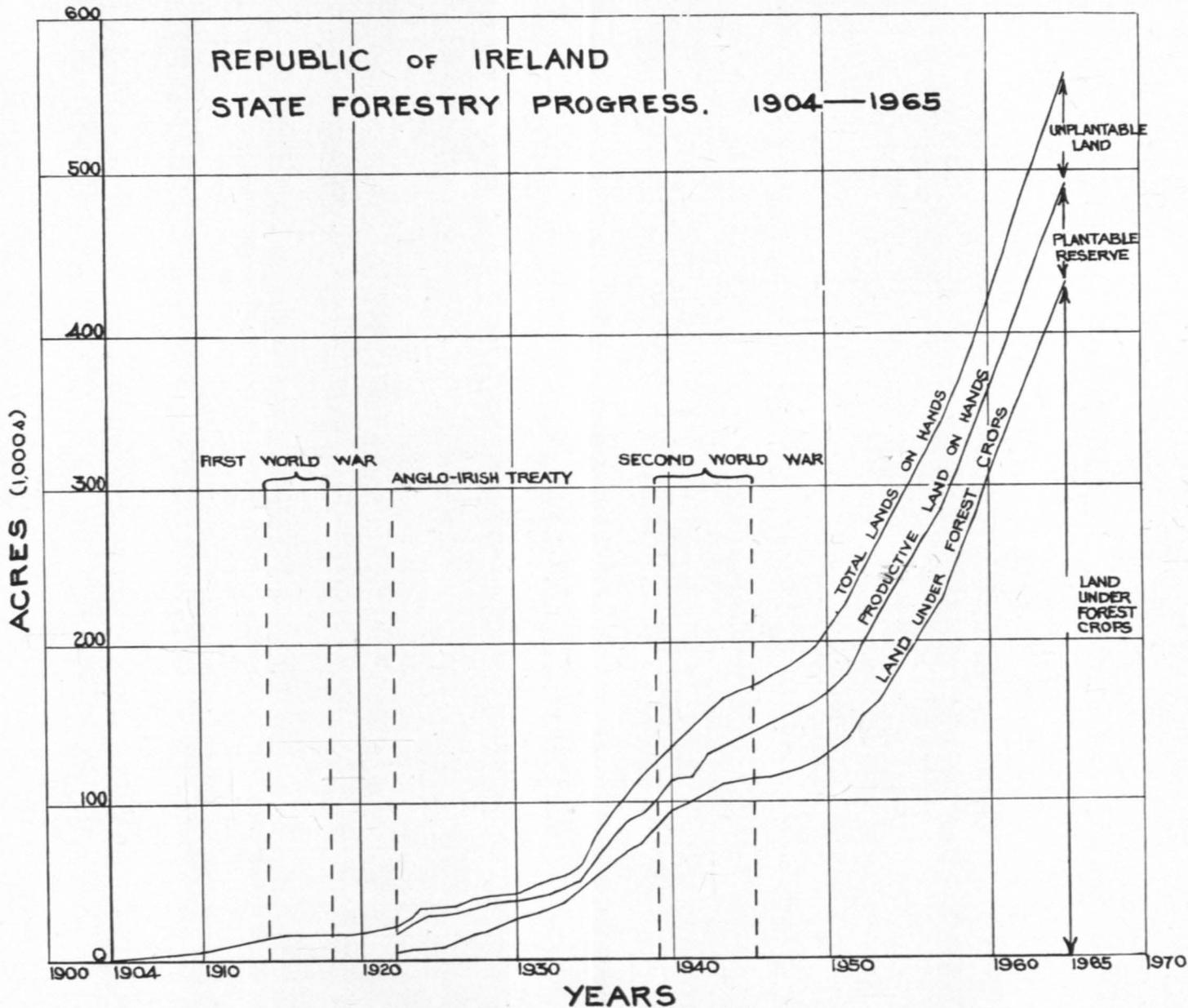
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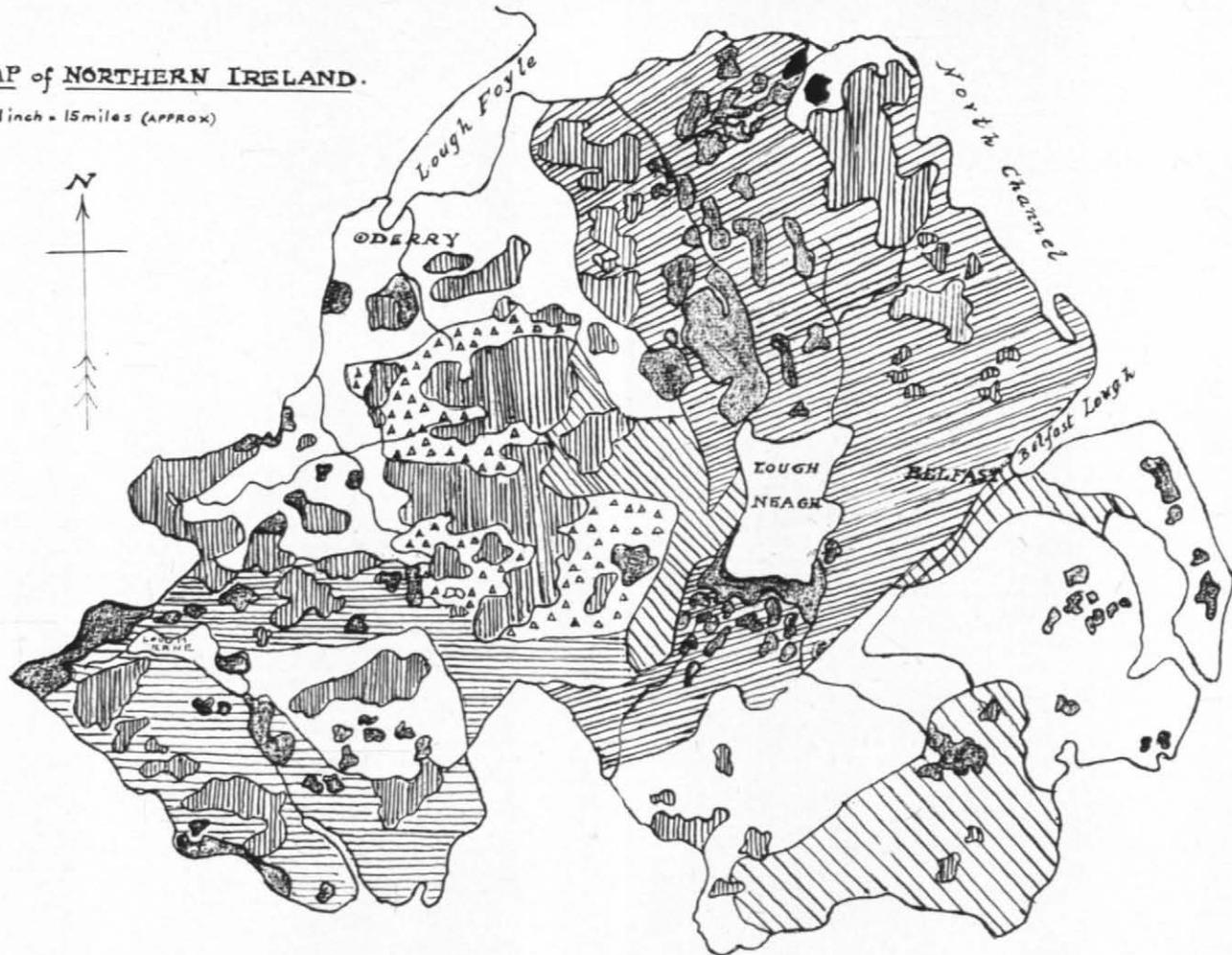
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REPUBLIC OF IRELAND STATE FORESTRY PROGRESS. 1904—1965



SOIL MAP of NORTHERN IRELAND.

Scale: 1 inch = 15 miles (APPROX)

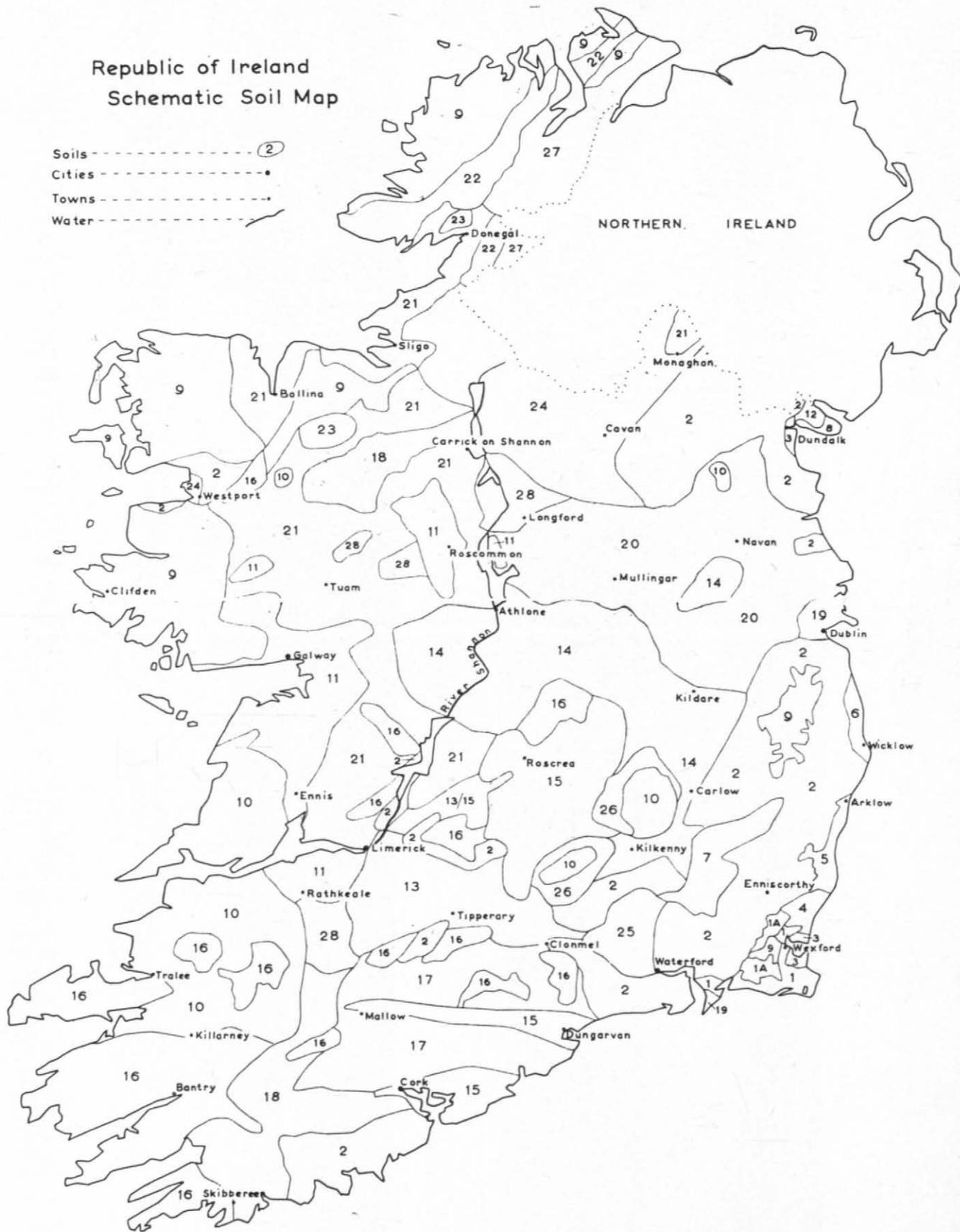


-  peats & humic gleys
-  upland peat
-  podsoils
-  brown podsollic
-  brown earths of low base status

-  brown earths of high base status
-  hydromorphic soils - gleys etc.

Republic of Ireland Schematic Soil Map

- Soils ----- (2)
- Cities ----- •
- Towns ----- •
- Water -----



SOIL MAPS

Republic of Ireland

Legend

1. Acid Brown Earths and Grey Brown Podzolics with some Gleys derived from Ordovician-Cambrian-Quartzite parent materials, mostly as glacial drift cover.
- 1a. Surface-water Gleys and slightly gleyed Acid Brown Earths derived from Cambrian-Ordovician-Quartzite parent materials mainly as a dense glacial drift cover.
2. Acid Brown Earths and related Brown Podzolics derived from Ordovician and Cambrian shales, (igneous intrusions in places) or from Silurian or Avonian shales, with thin mixed glacial drift cover.
3. Deep ground-water Gleys of alluvial origin.
4. Acid Brown Earths and Brown Podzolics and some Podzols derived from coarse-textured glacial morainic deposits.
5. Deep surface-water Gleys with some slightly gleyed Brown Earths derived from dense, mixed glacial drift of marine origin.
6. Grey Brown Podzolics and mixed Brown Earths derived from mixed coarse-textured glacial drift.
7. Acid Brown Earths and Brown Podzolics derived from Granite and Granite glacial drift.
8. Mixed Brown Earths and Grey-Brown Podzolics derived from a mixed Limestone-Dolerite-Diorite glacial drift.
9. Climatic Peats, Podzols, Skeletal Soils and Brown Podzolics, on acid igneous and metamorphic formations with mixed glacial drift cover in places.
10. Acid Brown Earths (many with gleying), Gleys, podzolised Gleys and Climatic Peats on Coal Measure and Yoredale shale formations with mixed glacial drift cover in most places.
11. Rendzina-like soils and Brown Earths of high base status derived from Carboniferous Limestone with dominantly limestone glacial drift cover (usually thin). Also some Basin Peats.
12. Grey-Brown Podzolics, Acid Brown Earths and surface-water Gleys derived from glacial drift mainly of Silurian-Felsite-Dolerite-Granite source.
13. Brown Earths (mostly medium base status) and Grey-Brown Podzolics derived from Limestone-Old Red Sandstone glacial drift with igneous influence in parts. Also some Gleys and Basin Peats.
14. Podzolised Grey-Brown Podzolics, Brown Earths of high base status and Grey-Brown Podzolics derived from mixed coarse, fluvio-glacial drift mostly of Limestone origin. Extensive Basin Peats also.
15. Brown Earths (medium-high base status) and Grey-Brown Podzolics derived from mixed, mostly Limestone, glacial drift. Some Basin Peats and Gleys also.
16. Climatic Peats, Podzols, Skeletal soils, Gley-Podzols and Brown Podzolics mostly on Old Red Sandstone rock and glacial drift.
17. Acid Brown Earths, Brown Podzolics and some Gley-Podzols derived from mixed, mostly Old Red Sandstone, glacial drift.
18. Acid Brown Earths, Brown Podzolics, Podzols, Gley-Podzols, Gleys and mixed Peats mostly on old Red Sandstone and Avonian Shale rock and glacial drift.
19. Very deep black and brown calcareous soils derived from Limestone glacial drift.
20. Deep Brown Earths (medium and high base status) and Grey Brown Podzolics derived from mixed, mostly Limestone glacial drift. Also extensive areas of Basin Peats and Gleys.
21. Brown Earths (medium-high base status), Grey-Brown Podzolics and some Peats on impure Limestone and mixed, mostly Limestone, glacial drift.
22. Brown Podzolics, Podzols and Climatic Peats with some gley-podzols on Mica-Schist and Gneiss materials.
23. Gleys and mixed Peats on mixed glacial drift.
24. Extensive areas of Gleys with Acid Brown Earths and Grey-Brown Podzolics (with and without gleying) and some Basin Peats on mixed glacial drift (mostly dense boulder-clay) associated with the Drumlins.
25. Grey-Brown Podzolics and Brown Earths (medium base status) on Limestone-Old Red Sandstone-Silurian glacial drift with some igneous influence.
26. Acid Brown Earths, Brown Podzolics and Gleys on mixed shales and glacial drift of similar origin.
27. Brown Podzolics and Acid Brown Earths on mixed predominantly Mica-Schist and Gneiss materials.
28. Grey-Brown Podzolics, Gleys and some Basin Peats on mixed sandstone-limestone drift and on glacial lake deposits.

Northern Ireland

Legend

The interpretation of the map markings is given on the map.

