THE VEGETATION OF IRISH NATIVE WOODLAND

By T. McEvoy.

The present century has seen a revolution in the approach to the study of plant life. Previously field botanists had used what we might call the analytical method—vegetation was divided up into its component species each of which was given its binomial specific name and its general distribution was studied in meticulous detail. The country was divided up into 12 botanical districts and the occurrence of species carefully recorded with reference to these districts (e.g., a plant is said to occur in Districts 1, 4, 6). Thus was built up an elaborate and most useful mass of information covering each species and its occurrence here. The credit for this work is due to such botanists as Alexander Goodman Moore, Nathaniel Colgan, Reginald Scully, Harte and R. L. Praeger. The work is summarised in *Cybele Hibernica* (1898) and Praeger's *Irish Topographical Botany*. Recent work has been mainly confined to the distinction of critical species (roses, whitebeams, etc.) and the picture of distribution is now reasonably complete.

Recent years have seen the emphasis of field work turn to the next stage—the deeper investigation of the reasons underlying present distribution, the interrelation of soil, local climate and flora and fauna; and the plants themselves are treated not as isolated individuals but as members of a community mutually affecting one another and interdependent. This particular type of botanical study is known as ecology—a name which for some unknown reason seems to frighten off many people. The development of ecological work owes much to the remarkable progress made during the present century in the study of soils. Looked at in this light this paper on vegetation follows logically Dr. Gallagher's paper on Soils which in turn was the natural successor to Mr. Mitchell's paper on Geology.

As ecological work progressed it became increasingly clear that any particular plant community should not be regarded as a stable, more or less unalterable, entity, but that whatever degree of stability or permanence it had was the result of a delicate balance or equilibrium of many forces which we lump together under the name locality or habitat factors. A change in any one of these factors—soil, climate, animal population, etc.—will set in train a series of reactions which alter and may completely destroy, the pre-existing community. This brings us to the theory of PLANT SUCCESSION which is now generally accepted. Expressed briefly and in its widest terms, it is as follows:—Given an area under given conditions of climate and soil, natural vegetation is different according to its actual age in that area. Suppose we start with bare ground. The bare space is occupied successively by a number of different plant communities, each of which is capable of ousting its predecessor. Eventually a more permanent community is established usually dominated by the tallest growing species capable of survival in the

area. Normally, preceding communities are unable to oust this final or *climax* type as it is called. The earlier stages are *seral stages*, the whole movement or succession being a *sere*. In the case of Ireland, the climax type in favourable situations is " deciduous summer forest," the dominant tree species being oak and ash.

A concrete example will help to illustrate the process of succession. Many of you must be familiar with the valley of Glencree in Co. Wicklow. In Glencree the lower hill slopes, when this district was heavily populated, were farmed intensively and the fields formed a patchwork of tillage and grass, interspersed with woods. The population has now decreased, very little tillage is carried on; many of these fields—in common with the unenclosed mountain—are used as permanent pasture, mainly for sheep. But without man's interference with nature, without tillage, manuring, grazing and the grubbing of furze, grass pasture is unable to maintain itself. To-day grass occupies a small and steadily diminishing space in the centre of many fields; bracken is spreading by its rhizomes from the fences and has encroached over most of the area so that in summer its interlacing fronds close over and shade the surviving grasses. The shade cast by the bracken reduces the vigour of grass and provides ideal conditions for the entry of several woodland plants such as wood sorrel (oxalis) and bluebell (scilla)—vernal or prevernal species which flower and have their active growing season before the bracken casts its densest shade. Even without the invasion of woody species we have there an approach to woodland conditions. Elsewhere, European furze, its seeds probably carried by ants from ditch-tops, establishes itself in the old pasture. It grows slowly, grazed by sheep into a thick close cushion resembling topiary work until the bush becomes so large that its upper branches are out of reach. It then grows rapidly and forms thickets. The blackberry (or bramble) too, invades the pasture and grass becomes less and less important. Birch seedling spring up at an early stage often sheltered from grazing by furze, and mountain ash, and holly also put in an appearance. Occasional oak seedlings develop and it is these that would, given time under natural conditions, form the climax woodland type. Some of the old native woods of sessile oak still survive in the Glen as examples, albeit altered, of this climax. These various seral stages—these transient communities—are typical of succession on the acidic soils of the Cambrian, Silurian and granitic formations of the East and the Old Red Sandstone of the South.

In studying the development of communities it is seen that certain species act as pioneers; others can only enter at later stages in the succession. The place of each species is determined by its equipment, e.g., seed production capacity, fertility demands, hardiness against frost, height growth, shade-bearing capacity, liability to grazing. In the sere illustrated, bramble and furze have good protective devices against grazing in their thorns. Holly is rather less well equipped and the young tender shoots are sought after by many animals. It is also frost-tender, its bark is thin and relished by animals. Birch is a mobile opportunist species, very hardy, making little demands on soil, fast-growing, producing seed within 10 years of establishment; this seed is produced in great

quantity—millions per tree—and carried far by wind and water. The oak does not produce seed until about the 40th year; most of the acorns fall around the parent tree and are liable to be eaten by mice, squirrels, etc. It is frost tender. On the other hand it can grow under the shade cast by a mature birch stand whereas birch will not thrive under oaks in close canopy. It is much longer lived and in favourable situations its total height growth is superior. It is also more fire-resistant than birch.

When we come to look at the examples we have of climax woodland we must again consider the impact of the various habitat factors. Since these include a number of factors of artificial origin, we must ask ourselves how far the present climax differs from the natural. In fact we have to see how far man has altered the type—to study, in fact, what is known as the " biotic factor."

All our oakwoods have been subject to utilization; they have not been allowed to follow their own sweet will. In this connection it is interesting to note that Turner and Watt consider the Killarney woods on the mountain slopes as the closest approach to natural conditions. They mention that there are no records of exploitation; that felling, legitimate and otherwise, has been spasmodic and that cattle, deer, and ponies graze in the woods; that no record of planting or sowing of oak are known, but that overgrown charcoal hearths are present. I might add an addendum in view of our presence here in Killarney. Dr. Smith in his *History of Kerry* (1756) says the yew " grew in prodigious quantities in the mountains of all our southern baronies " until it was destroyed for making coals for the iron works; it is now quite rare outside the Killarney district. Samuel Hayes of Avondale in his *On Planting* mentions the sowing of acorns at Mr. Herbert's, Killarney, in 1760; also the cutting of Irish Elms for layering (1766). Young (*c.* 1777), referring to Derrycunnihy where Turner and Watt carried out their investigation, speaks of the " great sweep of mountain covered partly with wood hanging in a very noble fashion, but part cut down, much of it mangled, and the rest inhabited by coopers, boat-builders, carpenters and turners, a sacriligeous tribe who have turned the Dryades from their ancient habitations." There are records also of the importation from Britain of iron ore to Killarney for smelting with the local charcoal. So even in this out of the way corner of our island remote and inaccessible woods have suffered exploitation and can be classed as only semi-natural.

Biotic Factors.

What are the effects of exploitation on natural woodland? The prevailing Irish method was, as I have elsewhere stated, coppicing on short rotations without leaving standards, resulting in an even-aged closely-spaced crop of oaks of stool origin. On the other hand under natural conditions trees of all ages from seedling to over-mature trees would occur in the wood and spacing would normally be wide and irregular. However, while coppicing and grazing alter only the type of oak dominant produced, its effect on the subsidiary vegetation—minor trees, shrubs and herbs—is much greater.

A rather striking example of this is to be seen at Greenane Wood, near Rathdrum. This wood, up to the 1914-18 war, was a native coppice oakwood on acidic soil. A public road runs through the wood cutting off one corner from the main block. During that war the main block was felled except for a belt of mature oak on the southern boundary. Replanting took place in 1927—20 years ago almost—and the whole area, including the belt, was protected from grazing by stock and rabbits were kept down. To-day this belt has a complete continuous understorey of young holly, about 6 feet high with occasional older hollies, parents of the younger generation. Fraughan and woodrush are struggling to exist in the dense shade. On the other side of the road, the oakwood, with similar aspect, exposure and soil, has been allowed to stand but has been subject to constant grazing by farm stock. Here no shrubs of any kind have survived, the ground floor is well lighted and grasses (Agrostis, Anthoxanthum and Holcus mollis mainly) predominate with bracken also present. Woodrush is absent and tiny plants of fraughan can be found but sheep grazing prevents their forming a cover.

Incidentally this example proves the ability of holly to form a continuous understorey to oakwood in Eastern Ireland—a fact concerning which Turner and Watt appear to have had doubts. Another example of the importance of a biotic factor in oakwood was observed in the 300 acre Croneybyrne oakwood, also near Rathdrum. It was noticed that in the heart of this wood hollies and other shrubs were very rare while near its boundaries hollies were quite frequent and sometimes (as where it bounded a public road) formed continuous canopy. This was related to the habits of the fallow deer with which, up to about 5 years ago, this wood was infested. They kept mainly to the heart of the wood and avoided the edges—except when engaged on a raid on adjoining farm crops. The old hollies have been grazed bare of branches to a height of 5 feet and the stems in cross-section show signs of repeated barking throughout life. Now that the deer are reduced to a mere half-dozen or so, young hollies are pushing up through the fraughan in large quantities and promise, if undisturbed, to close canopy in many parts in another 10-15 years. Invasion of hollies is slower where the soil is covered by woodrush, but indications are that hollies will at least be numerous over the woodrush which would then be broken up and not present the dense uninterrupted cover it now forms.

The elimination of a species of shrub from the wood may not appear, at first sight, to be serious in itself; yet the consequences may be far-reaching and may involve the capacity of the wood to regenerate itself naturally. Foresters are familiar with woodrush in particular as an enemy of all regeneration. It prevents seed reaching the soil, exposes it to risk of dessication, and smothers seedlings by its dense cover. In addition it forms a raw humus which induces leaching and podsolisation of the soil. It is my belief that owing to the disturbance of biotic factors this species has attained an unnatural dominance in the ground or field layer of our acidic oakwoods—a dominance which is bad for both soil and regeneration. The holly in fact is probably an essential constituent of this type of

oakwood both for the maintainance of soil fertility and for the mechanism of natural regeneration.

To continue our study of the biotic factor: on the Slieve-na-Muck range, foothills of the Galtees the effect of moorburning on an adjoining oakwood was studied. A mountain heath was regularly burned there and the fire swept up to the edge of an oakwood, penetrating some distance in under the canopy. The woodrush groundfloor did not carry fire well, however, and the fire soon petered out. However, the thin-barked hollies were easily killed, regeneration destroyed and the canopy opened so that with increased light, heathers (Calluna and Erica cinerea) formed part of the ground vegetation. This carried succeeding fires farther into the wood and the process is progressive, the woodland edge retreating gradually.

The enclosure of woods, too, often results in the elimination of pioneer and minor species of trees and shrubs. When an enclosed oakwood, surrounded by cultivated land, is in the mature stage such species as aspen may be completely killed out. Aspen has not the height growth to compete with the oak and has not the shade bearing capacity to survive beneath the canopy.

CLIMATE.

As Counties Kerry and W. Cork have an unusually mild climate, some discussion of local climate and its effect on woodland vegetation is, I suppose, topical. All botanists have been struck by the remarkable luxuriance of evergreens and Mediteranean species in the South-west. Rainfall averages 97 inches on Mangerton, 87 inches at Gearhameen near the south end of the Upper Lake—a lowland situation. This compares with 29 inches in Dublin, and an average of 40 inches for the whole of Ireland. Extremely low temperatures are rare and snow seldom remains long on the ground. Arbutus, a Mediterranean species, attains greater height (35 feet) here than in its southern home. It is confined to the South-west except for one station near sea level at Lough Gill in Sligo; it reaches over 500 feet above sea level in Kerry. The evergreen yew is more abundant than elsewhere—it is extremely rare in natural situations in the East but is found most of all in Kerry—but also in the Woodford woods and in limestone scrub, ash-oak and oakwoods of the west. Holly is very luxuriant here and often forms continuous understorey and even forms pure woods. Rhododendron ponticium and laurels generally run wild in the woods. Calluna and Vaccinium exceed in size anything in the British Isles (5 feet), and mosses, and ferns are very luxuriant and epiphytes are very numerous. The Killarney type of oakwood has been compared to the evergreen important forest of Corsica and Teneriffe—in fact the oak is the only deciduous species.

SOILS.

Now that we have spent some time examining the effects of biotic and local climatic factors on woodland, due importance must be attached to the effect of the soil which more than any other factor within a particular climatic region, decides the course of the sere and the nature of the climax which eventually develops. In fact the

classification of our natural climax types is based almost entirely on soil. These climax types in Ireland are as follows:—

A. Oakwoods of acidic soils—on O.R.S., Metamorphic, Cambrian, Silurian and granitic rocks. Sessile oak is always dominant. There are three main sub-divisions:—
   (i) Vaccinium Type.
   (ii) Luzula type.
   (iii) Fern type.

B. Woods of Calcareous Soils, e.g., limestone and basalt—these soils account for two-thirds of the country, but owing to their greater agricultural value and low-lying position clearance has been almost complete and few natural woods exist to-day on them. There are again three sub-divisions:—
   (i) Oak-Ashwood of deep soils.
   (ii) Ashwood of shallower soils.
   (iii) Hazel scrub of the bare limestone pavements.

In addition there are two more or less permanent types dependent on high water-table in the soil. (*a*) Alderwood—with or without ash; (*b*) Birchwood. Taking these types in turn:—

A (i) *Vaccinium Type:* This is found on the driest poorer sites with shallow soil over rock or on glacial gravels along river valleys. There is usually a slight surface layer of raw humus (Ao layer in profile); the soil is a podsol without "hardpan" or a podsolised "brown earth." P.H. is around 4·0 at the mineral surface and the B horizon usually shows an ochreous colour. Sessile Oak is dominant, usually with crooked stems—except in very sheltered hollows. Diameter growth is slow and epicormic branches frequent. Height growth is poor, seldom exceeding 55 feet even in close grown sheltered woods. Birch, usually Betula pubescens, is occasional in the canopy but where oak stems are closely spaced it becomes less and less frequent as the wood grows older. Rowan is occasional and holly is the typical species of the shrub layer beneath the canopy. Vaccinium is the typical under-shrub, 16-30 inches high with an extreme height of 5 feet. Bracken, Luzula, oxalis, Aira flexuosa. Wood sage, Hard fern are usually present in the field layer.

Under extreme conditions of exposure or on very shallow soil, the type degenerates into scrub and the canopy may be only 10-20 feet high formed of oak (with multiple stems), birch, rowan and holly. There is then no separate shrub layer. The floor is well lighted and Calluna, Erica cinerea, Ulex species and Cytisus scoparius may maintain themselves—also hummocks of a whitish "cushion" moss, Leucobryum glaucum.

A(ii) *Luzula type:* This is intermediate in fertility and moisture content between the fern and Vacc. types. Owing to the wide range of tolerance of Luzula in our humid climate it is extremely widespread on acid soils. The soil is usually a brown earth with slight surface raw humus due to decomposition of Luzula which roots only in the surface soil. A bleached layer 1-2 inches deep is often found at the mineral surface due to leaching. P.H. at mineral surface varies from 4·0 to 5·0 with less acid reactions in the B. and C horizons.

Oak reaches heights of 50-70 feet on the average and although diameter growth is still slow good straight stems are frequent in

close woods. Birch is the principal seral tree—as in Vaccinium type—but is gradually suppressed by oak. Rowan, holly and hazel form the shrub layer, hazel becoming important on the richer types. Where the shrub layer is thin Luzula forms the dense mat already referred to with very few other species present in the field layer. Of these bracken and vaccinium are the most constant associates. Hard Fern is frequent in moister acid parts but the presence of Male fern, Broad buckler, etc., in any abundance denote an approach to the more fertile " fern " type.

A (iii) *Fern types :* On the valley floor sand over basic igneous intrusions—as seen at the Aughrim excursion in 1945—more fertile soils occur and the woods are distinguished by the appearance of ash, wych elm and gean (cherry) in the canopy; by a shrub layer dominated by hazel with euonymus, elder and holly sometimes present; and a field layer in which ferns are abundant (Male, Broad buckler, etc.) Vaccinium, Luzula are scarce or absent and no raw humus is present. Horizons are less easily distinguished in the more uniform soil profile and surface P.H. values vary usually between 5-6·5. The less acid values are associated with the presence of calcicole (lime-loving) species, e.g., Polystichum angulare (Prickly Shield), Hartstongue (Phyllitis), Melica uniflora, Brachyopodium, Allium ursinum (Garlic). Other common field layer species are Scilla (bluebell), Circaea lutetiana, Nepeta, Sanicula, Lysimachia nemorum, Ajuga, Arum maculatum, Asperula odorata (woodruff). The oak is the dominant tree and may reach in exceptional cases (as at Curraghmore) 95 feet–it is usually from 70 feet up at maturity. Ash is particularly prominent in seral stages, birch less so. This site is capable of producing excellent oak on reasonable rotations and economically.

Birch-wood : Climax birchwood above the altitudinal limit of the oak does not now occur here. Pure birchwood of climax type now occurs only on acid peats with a high water-table. These are usually restricted in area and the type often occurs within the boundaries of oakwoods as a society. In the strictest sense it is not " climax " since it is to be presumed that the peat would gradually dry out and a drier type of woodland supplant the birch type.

Molinia in tussocks is the usual field dominant. There is no shrub layer. The birches seldom exceed 40 feet in height, have crooked stems and are shortlived. Even where Betula verrucosa is present on drier ground in the surrounding locality only Betula pubescens seems to occur in the wet Molinia ground. It appears to be a more suitable tree for these conditions although Betula verrucosa is capable of greater height growth and has a better stem-form on dry ground. This point may have an importance for foresters.

Species usually associated with the Molinia are Sphagnum and Polytrichum mosses, Ranunculus flammula, sedges, Juncus articulatus, Viola palustris, Galium palustre, Blechnum, Athyrium felix-fœmina, Erica tetralix with Scutellaria minor and Cephalanthera ensifolia as rare species.

Oak seedlings, 1 and 2 years, have been found and the sphagnum bed seem to provide excellent conditions for acorn germination. In the first year the tap root develops normally but in the second,

apparently owing to lack of aeration in the depth of the cushion, it dies back and adventitious roots are developed at the root collar. The oak fails to survive on the site after exhausting the food supply of its fleshy cotyledons.

Alderwoods: These occur on similarly waterlogged soils but the soil, whether mineral or peat, is distinctly less acid—indeed often alkaline—and richer in bases. In birchwoods alder occurs only along streams and drains where aeration and fertility are better and does not thrive on acid peat. Foresters in planting seem often to underestimate its soil requirements—it is quite exacting. Alder is rarely dominant over Molinia, but is usually associated with a field layer in which Juncus communis is abundant. Other species frequent are Angelica sylvestris, Spiræa ulmaria (Meadowsweet) Mentha aquatica, Lythrum salicaria (Purple loosetrife), Lychnis dioica (Red Campion), Sium angustifolium (Water parsnip), Pulicaria dysenterica, Athyrium felix-fœmina, Lastrea thelypteris and L. oreopteris. Sally, (S. cinerea) and Guelder (Viburnum aquilis) shrubs often occur. Ash is frequently a constituent.

Calcareous Woodland Types.

B(i) *Ash-Oakwood:* Deep calcareous soils are the typical sites for the type—rendzinas with Silica-sesquioxide ratios of 4 upwards—usually where calcareous drift covers limestone. The colour may be black; sometimes grey-brown—never the ochreous colour of the brown earths. Examples of this woodland type are found at Abbeyleix, Clonbrock, the deeper soils at Garryland, Borris and Oakpark in Co. Carlow and woods on the Nore near Thomastown. Seral ashwoods also occur on this type. It is confined to demesnes where it is protected from grazing. The high agricultural value led to early clearance of most of this type of land. Oak and ash are co-dominant, 70-90 feet usually; ash is often more frequent in the canopy than oak and its regeneration is extremely vigorous. Wych elm is a constant though never very frequent species and regenerates adequately. Gean is also occasional. Both birches may occur and also hybrids—though these are usually ousted in the later stages by ash. A seral ash-birch stage sometimes occurs.

Euonymus is the most characteristic shrub; hazel the most abundant and vigorous; elder is occasional, privet locally frequent, although not regarded as native. Rowan, Cornus sanguinea, Rhamnus catharthicus, Prunus padus, Yew (in west) occur also. Ferns are abundant in a matrix of calcicolous herbs similar to those mentioned for the "fern" type in acidic woodland—Allium, Vicia cracca, Melica, Hartstongue, etc.; also Listera ovata, Ivy, Garlic mustard, Ophioglossum vulgatum (Adderstongue).

B (ii) *Ashwood.* These exist on the shallow rendzinas of the drift-free areas. The soil is usually derived directly from the limestone underneath; drainage is better than in the previous type—there is a tendency to drought and surface acidification. Juniper is common on grassland on this soil type. Ash, 25-50 feet high, regenerates abundantly. Oak is never more than frequent, usually Quercus pedunculata of limited height growth. Its presence may

be associated with soil acidification when Scilla, oxalis and even Luzula may appear. These species in woodland correspond to Calluna which often appears on the sheep-grazed light limestone pastures.

Both birches may be present especially in exposed woods. Elm, rowan and gean may occur. Yew, aspen and whitebeam increase in frequency especially on the shallower soil. Shrubs present are similar to the previous type but more vigorous owing to the lighter canopy. In the field layer some of the more distinctly calcicolous species occur such as Geranium lucidum, G. sanguineum, Gentiana verna, Briza media, Thymus serpyllum, Rubia peregrina, Sesleria cœrulea—as well as the usual species of ash-oakwood.

B (iii) *Hazel scrub.* This is typical of the " pavements "—limestone without mineral soil as in North Clare. The distinguishing feature is the inability of tree species to dominate the shrub species, i.e., reduce them to the status of an understorey. Ash, rowan, birch, hazel, euonymus, Cratægus, whitethorn, yew, Rhamnus catharticus, Juniper, Ulex europæus, Aspen, privet, holly may all be present. The height is seldom over 15 feet, usually much less, due to exposure and drought. It should not be confused with the seral hazel scrub of shallow soils which is capable of developing into Ashwood.

I hope, in this paper, I have done something towards elucidating the relationship of geology to soil and natural vegetation and that, in doing so, I have given you a somewhat clearer picture of what the vegetation of our lowlands would be under natural conditions. An understanding of these relationships and of the artificial origin of many of the communities with which he has from time to time to deal is, I believe, a most useful knowledge for the forester.

OBSERVATIONS ON DAMAGE BY HARES AT CLONEGAL FOREST.

In view of the statements occasionally met with in forestry literature that Corsican Pine is less liable to damage by hares than other pines, the following observations may be of interest.

Over several acres at Drumderry property of Clonegal State Forest, where the species are Corsican and Scots Pine, planted in a 50 % mixture with a few belts of pure Contorta Pine, there is, what I consider, unusual damage caused by hares. The area was planted in 1944, and height growth is from 2½′ to 5′.

The hares have almost ignored both the Scots and Contorta Pines—even when alternate in the lines with Corsican—and have nipped the needles from the main stem and side branches of a large number of Corsican Pine. Apparently, this species has, by instinct, been chosen for destruction, and I can only conclude that their needles are more palatable to hares than those of the other pines mentioned.

At a first glance the damage resembles that caused by pine saw-fly.

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