

THE BOTANIST IN IRELAND

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PREFACE

IRELAND is a pleasant country for the botanist. It is true that its flora offers less variety than that of England, and still less than that of equal Continental areas. But this comparative paucity of species is richly compensated by the occurrence, often over a wide range, of plants of high interest and often of great beauty, whose analogues in England or Scotland are few and of very restricted distribution, while in the parts of Europe next adjoining they are almost all unknown. These peculiar features are due mainly to the position of Ireland on the extreme western edge of the Old World, a fact which in itself, for the student of European or Eurasian geography or botany, gives to this country a special interest.

Again, the extraordinary diversity of rocks in Ireland produces a corresponding variety of land-forms, with repercussions on the character of the flora and fauna. Geological diversity increases as one passes across Europe from east to west, from the interior of the great land-mass to its unstable oceanic edge. In Russia, areas far larger than Ireland are built up of a single type of rock, stretching featureless from horizon to horizon. Within the fretted coast-line of Ireland, almost every sedimentary rock which has gone to building up the crust of the Earth is represented, from Archean to Neolithic, as well as many of igneous origin. The Irish mountains are exceeded in elevation by the loftiest summits in Wales and in Scotland, but they offer within a smaller area an equal variety of rock and consequently of scenery. The Scottish Highlands have their analogue in Donegal and Connemara, the Welsh Silurian mountains and the English Lake District find an echo in the Galtees and the Wicklow foot-hills, Devon is matched and surpassed by Kerry, as the limestone dints of Ingleborough are by the "pavements" of Clare and Galway. If Ireland lacks the Chalk downs, it has the remarkable Tertiary basalt plateau of the north-east with its characteristic flora, and if it has not got the Norfolk Broads it has a great and varied array of large lakes with many interesting plants on their shores and islands.

Another charm of Ireland is the freedom with which one may wander over its hills and plains. Seldom is one arrested by a notice forbidding access, and a friendly word will work wonders on ground preserved for game or kept for private purposes.

To the botanist studying the vegetation of a country as a whole, or the distribution within a country of any plant or group of plants, a Flora arranged on the usual plan, under which the species are enumerated according to their botanical affinities and the information relative to each is given under the plant's name, is the most convenient presentation of the subject. For Ireland as a whole two such works have been compiled since its flora became well known. In "Cybele Hibernica" (2nd ed., 1898, by N. COLGAN and R. W. SCULLY; 12s. 6d., now 4s. 6d.), under each plant its range is shown with reference to twelve Districts into which the country is divided, as in the previous edition of the same work; specially detailed treatment, geographical and historical, being awarded to the rarer species. In "Irish Topographical Botany," compiled by the present writer (1901, 12s.

6d.), distribution is shown with reference to forty Divisions or Vice-counties of about the area of those used by H. C. Watson for Great Britain, and a more uniform treatment is awarded to the plants, whether rare or common, the latest known record alone being usually given, even in the case of rare species, with a brief indication of the scope of other records. No Supplement to "Cybele Hibernica" has as yet appeared. "Irish Topographical Botany" has been brought up to date or nearly so by the publication of three Supplements – the first for the period 1901-5 (Proc. Roy. Irish Acad., 26, Sect. B, 1906), the second for 1906-28 (ibid., 39, Sect. B, 1929), and the third for 1929-34 (ibid., 42, Sect. B, 1934). For shorter general accounts of the flora the five geographical volumes ("Ireland," "Ulster," "Leinster," "Connaught," "Munster," reduced to 2s. 6d. per volume), issued in 1921-2 by the Cambridge University Press under the editorship of George FLETCHER, may be consulted. With information as to the distribution of the Higher Plants in Ireland, therefore, the student is well equipped.

But for the botanist resident in this country, or visiting it and finding himself here or there within it, a question very likely to arise is – What interesting plants grow in this or that neighbourhood, or in the vicinity of this or that town or hotel, or on this or that island or mountain or lake? It is to supply information on this basis that the present book is compiled, plants being arranged under localities instead of localities under plants. This scheme or treatment leads to a restriction as to the species dealt with, all those of general distribution being necessarily omitted (just as, conversely, the stations for them are omitted from the works previously mentioned). The commoner species, indeed, appear only when some plant association or other natural group requires for its description a list of the species occurring. In the Introduction, however (79207), opportunity is taken briefly to indicate the whole range, not only within Ireland but outside it, of a selection of the more interesting plants which are included in the Irish flora. At the end of the book a Census List of the Irish Flora (species, subspecies, and hybrids) is added, the distribution of each plant, native or naturalized, being shown according to the forty "Divisions" used in "Irish Topographical Botany." This is desirable especially because the Irish range of many of the rarer species has been extended, and nomenclature has suffered many changes, since the publication of "Cybele Hibernica" and "Irish Topographical Botany."

The book, therefore, aims at giving, with a different orientation, the bulk of the information supplied by the works mentioned, with the inclusion of the large amount of additional matter, published or unpublished, which has accumulated within the last thirty years or more. In "A Tourist's Flora of the West of Ireland" which appeared in 1909, the plan of the present work was used in the "Topographical Section." But that book dealt with only eleven out of the forty Irish County-divisions, and within that area, as well as outside it, a good deal of botanical exploration has been done in recent years. So far as this western district is concerned, the matter in the "Tourist's Flora" has been included, revised and considerably enlarged. The works which have appeared dealing with the flora of restricted areas in Ireland are limited in number and of varied date, and all are arranged in the localities-underspecies plan of the typical Flora. A few of them are of recent date and of comprehensive scope, and form invaluable companions to the botanist visiting the districts with which they are concerned. This applies especially to COLGAN'S "Flora of the County Dublin" (1904, 12s. 6d.) and SCULLY'S "Flora of County Kerry" (1912, 12s. 6d.). HART'S "Flora of the County Donegal" (1898, 7s. 6d., now out of print) is somewhat earlier; STEWART and CORRY'S "Flora of the North-east of Ireland" (1888, reduced price, 2s. 6d.), dealing with the counties of Down, Antrim, and Londonderry, has been brought up to date by the issue by the Belfast Naturalists' Field Club of two Supplements, the first in 1895, the second (a "Second Supplement and Summary") in 1923. HART'S "Flora of Howth" (1887. o.p.) deals with a quite small but rich and interesting area near Dublin. The remaining Irish local or general Floras are of earlier date; the

information which they supply is naturally incomplete, and all of importance has been incorporated in later books.

An inconvenience of the plan of the present work is that names of finders and other authorities for the records are of necessity omitted. This hiatus is met to some extent by a list of the principal workers at the Irish-flora, with a note of their chief publications, and the names and dates of their most important finds (78). Further information may be obtained from the works quoted above, as well as from the numerous subsequent papers and notes referred to in the pages which follow. Cross-references (by paragraph numbers) are inserted freely, to facilitate the bringing together of information relative to both plants and places.

In the matter of botanical nomenclature, the eleventh edition (1925) of the "London Catalogue of British Plants" is for convenience followed, save in the case of a few genera where revision has been lately carried out.

It has not been found possible to include in this book maps adequate for use over so wide an area as Ireland, but six of the most important districts – northern Donegal, eastern Antrim, the Sligo neighbourhood, western Galway – Mayo, the Wicklow mountain region, and southern Kerry – are illustrated by excerpts from Messrs. Bartholomew's quarter-inch map. For field work, the one-inch map of the Ordnance Survey (contoured edition) is indispensable. For more general purposes the beautiful contour-coloured half-inch Ordnance map, and the already quoted similar quarter-inch map issued by Messrs. Bartholomew, supply all that is required.

All that I have to say at the conclusion of fifty years' field-work in Ireland, during which I have explored the flora of every county, of every important mountain-range, lake, river, and island, is embodied in condensed form in the present work. The last four seasons have been devoted to study of those areas and those plants which a general survey of the field of work showed to be most in need of further investigation. So while much remains to be done by future generations of field botanists, it is hoped that the present account will be found to offer a tolerably balanced view of the flora of Ireland as it is at present known. The claims of ecology as contrasted with purely floristic work have been recognized, and an endeavour has been made all through to correlate vegetation with geography and geology. The human element in local botany has also been kept in view, and in the topographical notes certain non-botanical features of the land, such as its more important antiquities, have not been altogether ignored.

As to the illustrations, their chief value lies in the series of excellent photographs of rare native plants in the field taken by Mr. R. J. Welch during visits with me to many places, and reproduced here. For these and some others illustrating habitat and scenery my best thanks are due to him.

For the loan of blocks illustrating geographical features I am indebted to the Syndics of the Cambridge University Press; for help in various directions thanks are tendered to Dr. R. W. Scully and Messrs. J. P. Brunner, A. Farrington, T. Hallissy, R. A. Phillips, A. W. Stelfox, and a number of other friends.

As the book is intended for use in the field as much as in the study, it has been made as portable and compact as possible.

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1. Ireland presents several features which give it a special interest for the botanist. It is the most westerly portion of Eurasian land, extending to 10° 29' W longitude. Portugal and N Spain come next, falling short by some 65 miles of the Kerry headlands. But this approximation in longitude does not find a parallel in the general character of its vegetation. Ireland, being separated by two sea-channels from the Continent, suffers all the botanical penalties of insularity, in the form of a flora considerably reduced when compared even with England, and more when contrasted with the Peninsula. And again, the prevalence in Ireland of W and SW winds, blowing in off the warm Atlantic, results in a climate of extraordinarily small annual range in temperature, and of high humidity (22-26), unlike the comparatively Continental climate of the greater part of Spain and Portugal. The flora more nearly akin to that which prevails over the greater part of Ireland will be found by moving eastward into N England, and thence across Holland into N Germany, though the more Continental climate encountered as one goes E introduces increasing divergence in the vegetation as compared with this country. A NE course across Scotland into Scandinavia is productive of a greater amount of diversity, though it tends to retain in the flora a number of species which are lost along the eastern line.

2. The island itself is unusual in several respects: notably in having the central portion occupied by a low plain of limestone (10, 240-5) – the largest continuous area of Carboniferous limestone in Europe – of only some 200 ft. average elevation, while mountains, of 1500 to 3000 ft. in height, occupy much of the margin, and only occasionally rise far from the sea. The surface, from sea-level to the tops of the hills, is occupied by peat-bog to an extent not found elsewhere in Europe (28, 52). The most marked characters of the Irish flora are its reduction due to insularity, and the presence, due to mildness of climate, of southern plants, which have in past times crept along the warm coast from the Mediterranean and the Peninsula, and which are not found so far north anywhere else (35, 37). A less conspicuous but more startling feature is the presence of some North American plants, which find their European headquarters in Ireland, and die out in west Scotland and the NW parts of the Continent (35, 37). All of these features, it is important to note, characterize the fauna also (37).

GEOLOGICAL HISTORY IN RELATION TO PRESENT SURFACE

3. The nature of the vegetation of any part of the Earth's surface is governed primarily by conditions of temperature and precipitation, resulting in tropical rainforest or daisy-starred grassland or cactus desert or other types as the case may be. But within any area of uniform climatic conditions, such as Ireland, vegetation is influenced chiefly by the nature of the substratum – the soil in which the plants are fixed. The soil results mainly from the wasting of the rocks of which the Earth's surface is locally composed; this detritus, mixed with the disintegrated remains of past generations of plants, produces the clayey or loamy or sandy material which is the first essential of a vegetation, and the basis of all agriculture and horticulture. Hence, if we are to understand the distribution of the flora of a restricted area, we must first direct our attention to the rocks of which it is built up. This is the more essential in the case of Ireland, since its geological features are remarkably varied, its surface displaying a greater diversity of rocks, as regards both age and composition, than is to be found in almost any similar area in Europe. It is true that, climatic conditions being the same, the operation of the soil-forming processes tends to produce similar soils from totally dissimilar materials. But, generally speaking, the soils of Ireland have not yet reached an advanced stage of development. Like the soils of all glaciated countries they are immature, and retain many of their original lithological features.

4. That the present surface is so varied in its Ethology is due to several causes, the most important of which is the frequent fluctuations of level to which it has been subject. Again and again this area has sunk below the sea, and beds of mud, sand, &c. (the detritus of adjoining lands), now hardened into slate or shale, limestone or sandstone, have been laid down upon it. Again and again the surface has risen above the sea, and its burden of deposits has been exposed to the forces of denudation – rain, frost, sun, wind – and in part or whole destroyed and carried by rivers back into the ocean. An equally potent factor has been lateral earth-movements to which the crust has been subjected at intervals, causing extensive crumpling of the rocks. These foldings, by elevating certain regions, mostly in the form of ridges, have exposed them to especially severe denudation, resulting in the laying bare of underlying deposits; by depressing other areas, the beds occupying them have been protected; the great pressure produced has often melted the rocks partly or even completely, and entirely altered their character; and the weakening of the Earth's crust resulting from these movements has sometimes allowed molten material to rise from below into the arching folds, where it has solidified as granite, or to break through and pour as lava over the surface of the country. The result of the interplay of all these natural forces is that the present surface of much of Ireland resembles a patchwork quilt in which a score or more of patches, many of them frequently recurring in varying size and shape, have each a quite different tale to tell. Even in the great limestone plain, which is the largest continuous area of any one kind of rock occurring in the country, there is no point from which a walk of twenty miles in a chosen direction will not bring one to some area large or small occupied by a different geological formation. The surface rocks of Ireland, then, are extremely varied, and represent an immensely long geological history – running back, it may be, a hundred million years or more. And though this history as told by Irish rocks is very fragmentary, there are few complete gaps of any magnitude, save when we come to those comparatively late formations which are well developed, for instance, in SE England, the product of submergences which Ireland escaped.

5. The oldest rocks which now lie exposed anywhere on the surface of Ireland occupy extensive areas in the N and W, and are of late pre-Cambrian age, belonging to the series known as Dalradian. In the N they form an almost continuous mass extending from Lough Neagh and Lough Foyle westward and south-westward to the sea at Donegal Bay. To their presence is due most of the mountainous country which occupies a great deal of the counties of Londonderry, Tyrone, and Donegal. The rocks consist of gneisses, schists, greenstones, quartzites, pebble-beds, slates, and intrusive granites, of very unequal hardness. Their strongly folded character, and the heavy and long-continued denudation, both aerial and marine, which they have suffered have produced, alike inland and along the coast, highly picturesque features. In the W, the great Galway – Mayo butress (384), which protects the limestones of the Central Plain from the fury of the Atlantic, is formed mainly of rocks of the same age and of the same types. These ancient rocks, folded and metamorphosed, uplifted and denuded, are connected with much of the finest scenery in Ireland. They support a calcifuge vegetation, of grassy or more usually heathy type. Bands of primitive limestone and other basic rocks occur, but not in quantity sufficient to modify appreciably the flora; one such band, however, is responsible for the appearance of the Maidenhair (*Adiantum capillus-veneris*) in its only Connemara station (to a similar cause is probably also due the presence of this fern in Achill and on Slieve League in Donegal (see 106, 193), though this has been a subject of controversy). A small area of these Dalradian rocks S of Fair Head in Antrim (460) produces a change of coastal scenery, and causes the flora to lose some of the calcicole elements which characterize the surrounding basalts.

6. The succeeding Cambrian period has left but small impress on the Ireland of to-day – merely a few patches of slates and quartzites along the SE coast, but these are of local importance, as they

form those two bold sentinels of Dublin Bay, the high promontory of Howth (231) on the N, and on the S the precipitous Bray Head (267) with the Little and Great Sugarloaf (1660 ft.) behind it. The heathery upland of Howth, formerly an island but now joined to the limestone mainland by a Neolithic raised beach, is classic ground for the botanist and furnishes the most varied flora of any area of its size in Ireland.

7. Next in order of age among Irish strata come the Ordovician and Gotlandian rocks, representing the Silurian Period (in the wide sense of the term). Like the older beds just mentioned, they were long buried under subsequent deposits of various ages, but these have been removed to a considerable extent by denudation, so that the slaty rocks which are so characteristic of the Silurian system now occupy two rather large tracts in E Ireland as well as a number of smaller areas. In the N, they cover a wedge-shaped area extending from Belfast Lough S-W to the Shannon, and back to Drogheda. They form the low rolling lands of Down, and much of Louth, Armagh, Monaghan, Cavan, and Longford. Disintegration yields a light friable soil, which even on the mountains supports a grassy rather than a heathery vegetation. This is an undulating fertile area, with more tillage than is found in most parts of Ireland, and many small lakes set among the fields; it is occupied by a characteristic calcifuge vegetation (472). South of Dublin, Ordovician strata lap up against both flanks of the granite core of the Leinster Chain, attaining a considerable development on the E side, in Wicklow and Wexford; much of the most beautiful scenery of Wicklow has been carved out of these rocks (261). In the southern midlands, on many of the ridges which rise out of the Limestone Plain, rain and frost have removed the Carboniferous strata from the summits, exposing the core of Gotlandian slates and Devonian conglomerates, elsewhere buried deeply. This is the characteristic structure of all the south-central hill – masses Slieve Bloom, Devil's Bit, Keeper, Slieve Bernagh, Slieve Aughty, Slievenaman, the Galtees, Knockmealdowns, and Comeraghs. The change of rock thus produced, from limestone to sandstone and slate, is accompanied by a marked change of flora, from calcicole to calcifuge.

8. At the close of Silurian times, extensive earth-movements began, resulting in crumplings of the crust which threw the Silurian and older rocks into a series of folds running NE from Ireland towards the Arctic Circle. (Long previously, Irish rocks had been subjected to intensive folding (Huronian) with a similar trend, as may be traced in western Scotland; but in Ireland this phenomenon has been obscured by the superimposed folds of the Caledonian series, with which we are now dealing.) The results of these stresses and of subsequent uplift are seen in the uplands which characterize not only Donegal and Mayo, Wicklow, and the area around Newry, but the Highlands of Scotland and the great raised mass of Scandinavia. In Mayo, Galway, and Donegal, denudation has laid bare over wide areas the ancient pre-Cambrian strata already referred to (5), which now form a heathery mountainous surface. In the Leinster Chain, weathering has revealed a massive core of granite, which rose in a molten mass under the Silurian rocks as they became arched by lateral pressure, so that we have in Wicklow a broad heathery granite range lapped round by the denuded edges of the former overlying Ordovician dome. The uniform nature of the granite has caused it to wear down into rather similar rounded hills, now deeply peat-covered; while the slates which encircle them present a more diversified surface, with picturesque glens and a less uniform flora.

9. The Devonian Period, which was ushered in by these mountain-building movements, has left a series of thick beds of conglomerate, slate and sandstone which are a conspicuous feature of S Ireland, occupying large areas of Waterford, Cork, and Kerry. These rocks were formed not in ancient seas, like most of those with which we have been dealing, but in large lakes and deserts. Extensive “inliers” of the same rocks, resulting from denudation of upthrust hills, have been

already referred to (7) as occurring over the southern part of the great limestone area of central Ireland (to be dealt with immediately); in Tyrone Devonian rocks cover an area of several hundred square miles stretching NW from Enniskillen. The soils derived from these rocks usually take the form of red clays; their flora is distinctly calcifuge.

10. We now approach that period – the Carboniferous – which has left an impress on Ireland and its flora greater than any other of the many epochs of geological history. A large area of Europe, including that part which we now call Ireland, sank below the sea, and, remaining submerged for a very long time, received on its surface first beds of mud (now hardened into slate), then thick deposits of a very limy nature composed largely of the shells of marine animals (now limestone); next, as the sea-bottom rose, layers of sand and mud (now appearing as sandstones and shales) and finally other deposits (the well-known Coal-measures) laid down under swamp conditions, where beds of river-mud and sand alternated with layers of vegetable matter, the debris of ancient forests, now forming strata of shale, sandstone, and coal. Elevation continued, and, to premise, the “Ireland” thus produced has in the main remained a land area throughout almost the whole of the immense period intervening between Carboniferous times and our own day. As a consequence, this great series of strata has been exposed almost continually to the agents of denudation, and frost, wind, and water have played havoc with it. The first beds to go were the uppermost, the soft Coal-measures, and with them perished the possibility of Ireland's ever becoming a great manufacturing country. The largest area of these deposits remaining lies in N Kerry (330) and the adjoining part of Limerick (332), but here they do not contain coal of workable amount. Outlying patches extend northward into S Clare (340). Another relic of these once wide-spread deposits forms the Leinster coalfield (255) in Co. Kilkenny, now a plateau of about a hundred square miles, lying between the ancient granite chain of Wicklow and the newer fold of Slieve Bloom. In this area a small amount of coal is mined, but its rural character remains unaffected. The shales weather down into a heavy clayey soil, supporting a rather monotonous and uninteresting rushy calcifuge flora. Smaller areas of Coal-measures lying on the hills around Lough Allen (428) in Leitrim and at Coalisland in Tyrone need only be mentioned here.

Next, the underlying series of sandstones and shales, constituting the Millstone Grit, Yoredale and Pendleside beds, were attacked and to a great extent removed. In the areas mentioned they crop out from under the remaining Coal-measures, and extend to a considerable degree the area of the calcifuge flora.

Over the wide tracts in the Central Plain from which the Coal-measures and the beds just referred to have been removed, the Carboniferous limestone now extends. Ever since it was laid down, earth-movements have not disturbed, save to a small amount, its horizontal beds. The limestone now forms a slightly undulating plain stretching from Dublin to Galway and far to the N and S. In these latter directions its edges get more and more broken up by patches of older or newer rocks, but outlying fragments of the limestone reach Cork on the S and Donegal in the N. The most characteristic part of the plain lies between two east-and-west lines drawn respectively from Dublin to Galway Bay and from Skerries to Westport, an area of close on 4,000 square miles. Across this one may pass from the Irish Sea to the Atlantic without rising more than 300 ft. (Only occasionally, indeed, as in Sligo and N Clare, does the limestone form hills of any noticeable height.) Heavily covered with drift in the E, it is occupied there by rich pasture with many trees; in the midlands it is often marshy, with great swelling bogs; while in the W, the rock often lies quite bare (240-245).

Since the presence or absence of lime in the soil determines more than any other chemical factor the nature of the vegetation which the soil supports, this mass of limestone constitutes from a botanical

standpoint the most important geological feature of the country. Its floral characters are dealt with later (41, 59).

11. After the end of Carboniferous times, an important epoch of earth-movement, known as the Hercynian, resulted, as at the close of the Silurian Period, in a general uplifting and folding of the Irish area. These foldings ran normally E and W, and in southern Ireland have given us the striking scenery of Kerry and Cork, and the bold ranges of the Galtees and Knockmeeldowns a little to the N. Further N the folding was deflected by the older Caledonian axes such as the Leinster Chain, so that Slieve Bloom and other hill-ranges formed at this time have a NE and SW trend. In Cork and Kerry, denudation of the folded Carboniferous and Devonian rocks has left a series of high ribs of slate and sandstone, while the more soluble limestone has been preserved only in the intervening valleys. In Slieve Bloom and Devil's Bit we have ridges formed of the older rocks (Devonian and Ordovician) from which the limestone covering has been denuded. In the Leinster coalfield adjoining we see how a syncline or down-fold has preserved to us the beds which lay over the limestone.

With the close of Carboniferous times both the sedimentation and the folding which have produced the Ireland of to-day had to a great degree been accomplished, and during almost the whole of the time which has intervened Ireland has remained above the sea, and at the mercy of the forces of denudation, which have worn down mountain and plain alike, exposing older and older rocks.

The Permian period, which followed the Carboniferous, has left scarcely a trace in Ireland; only a few very limited patches of limestone, etc., in the N, supply evidence of a local submergence.

12. The whole of the Secondary (Mesozoic) and Tertiary (Cainozoic) epochs, during which the SE half of the England of to-day was built up of bed after bed of marine sediments, has left an imprint only in one corner of Ireland, which, like Scotland and Wales, has remained essentially a Palæozoic area. But that corner, the NE (455), continues for us the geological history. There we still have, very locally developed, the red sandstones and gypsum-bearing marls of the Trias, the fossiliferous Rhætic, the grey shales and clays of the Lias, the glauconitic rocks and white Chalk of the Cretaceous. The Antrim Chalk differs from that of southern England in being a much harder rock, and it forms nothing approaching the English Chalk Downs, with their interesting and peculiar flora. There is reason to believe that the Chalk sea extended far over Ireland, but its deposits are now limited to Antrim and the immediate vicinity. Even there, it and the other Mesozoic strata would probably have perished completely owing to long-continued sub-aerial waste, had it not been for the intervention of volcanic outbursts, which poured lavas over the old Chalk land, and thus preserved it; in Eocene times this corner of Ireland was involved in eruptions which buried the Mesozoic rocks under hundreds of feet of dark basalt, forming a high plateau. This plateau, though broken-backed and much denuded, still persists, a peat-covered moorland with a rugged scarp edge which overhangs Belfast and extends round the coast to Lough Foyle; and from under it the buried Secondary rocks peep out. The basalt weathers into a deep heavy soil rich in calcium carbonate, and supports a varied flora which includes a number of plants elsewhere in Ireland found only on the limestone (455). The same convulsions caused depressions of the surface which produced the deep hollow, now mostly filled with clay, in which Lough Neagh (463), the largest lake in the British Isles, is situated. Near by, in the S part of the adjoining county of Down, a great mass of granite rose under the Silurian rocks, to form the Mourne Mountains (479).

13. The next event of importance (after a long interval), and one which profoundly affected the whole country, especially as regards its biological history, was the oncoming of the Pleistocene glacial period. Ice, extending from the Poles, accumulated over the area till, at the time of maximum

glaciation, almost the whole country was deeply buried. Once or more than once the ice-front retreated and advanced again. When the land was at last freed, its surface was greatly altered. Hills had been lowered, valleys filled up or deepened, and a vast amount of detritus, including the pre-existing soft covering of the rocks, redistributed over the country. In some places limy gravels were left spread over areas of acid rocks, or lime-free material over calcareous rocks. The sands and gravels which had previously accumulated on the bed of the Irish Sea, full of marine shells, were gouged out by a great glacier coming down channel from Scotland, and plastered up against the basalts of the NE, the Cambrian rocks of Howth, the granites of the Dublin Mountains, and pushed over much of the low grounds. The relation between the "solid geology" and the "drift geology" was no longer direct, especially along the boundary-lines of the former, a matter of importance to the botanist in Ireland, where the leading feature of the flora is the contrast between the limy and non-limy areas: between a calcicole and a calcifuge flora. The greater part of the lowlands was left covered by a thick deposit of tough clay, mostly full of ice-scratched stones; and in the final stages of retreat the ice left behind, upon the surface of these clays, great dumps and ridges of gravel stretching especially across the middle of Ireland. The face of the country to-day bears everywhere the impress of this period of glacial erosion and deposition.

14. When the climate returned towards the conditions at present prevailing, a period rather colder and wetter than to-day favoured the growth and accumulation of peat, which attained so wide a development that it forms still one of the most conspicuous features of the surface of the country. In Neolithic times, a depression and subsequent re-elevation of the northern half of Ireland left beds of gravel (raised beaches) fringing the sea, and in the estuaries flat areas of low land formed of muds which accumulated in shallow water. The final act of the drama of our country's evolution has been something more than a mere geological episode. In the latest changes that have taken place in the Irish area civilised man has played the most important part. As a result of his agricultural and other activities native woodlands, formerly extensive, have diminished, lakes and marshes have been drained, bogs cut away for fuel, and the land tessellated by a multitude of fences and hedges, and traversed by a network of roads, canals and railways.

It will be seen that the present surface of Ireland is the result of a very long and varied history. Persistent emergence from the sea following periods of depression, and long-maintained land-surfaces, have allowed of very heavy denudation, so that a mere patchwork of rocks remains, fragments of once wide-spread formations. The ancient Caledonian and Hercynian periods of stress, which by some chance affected the margins more than the centre of our island, impressed themselves so profoundly that the sculpture of the whole country is still dominated by the foldings which they produced.

The ultimate product of the action and interaction of these forces is the Ireland of to-day.

Consult G. A. J. COLE and T. HALLISSY: "Handbook of the Geology of Ireland." London: Murby, 1924. 8s. 6d. Also section "Geology" in the series of provincial geographies (Cambridge University Press) referred to in 3.

TOPOGRAPHY

15. Ireland is separated from Great Britain by a channel of very variable width, the narrowest points being 134 miles between Antrim and Kintire, 234 miles between Down and Wigton, and 47 miles between Wexford and S Wales. The depth of this channel along its centre varies from 45 to 150 fathoms; the deepest and coldest water found along the coast lies off the Antrim shore. This sea-barrier may be contrasted with that which exists between England and France, which narrows to a

width of 23 miles and a depth of 20-25 fathoms at the Straits of Dover, widening rapidly northwards into the broad but shallow North Sea, and more gradually southward along the deeper St. George's Channel. It is important to bear in mind that all these waters lie on a broad shelf, which surrounds Great Britain and Ireland (fig. 1). Along the coasts of Scandinavia, of Spain and Portugal, and of Africa the sea-bottom falls rapidly to oceanic depths – 1000 to 2000 fathoms. But if we trace the isobaths of 100 or 200 fathoms northward from the Peninsula, we find they project in a broad curve which passes some 40 miles westward of Ireland, to approach the Continent again on the Norwegian coast. Ireland, like Britain, is essentially a portion of European land, and a slight uplift would re-join both to the Continent.

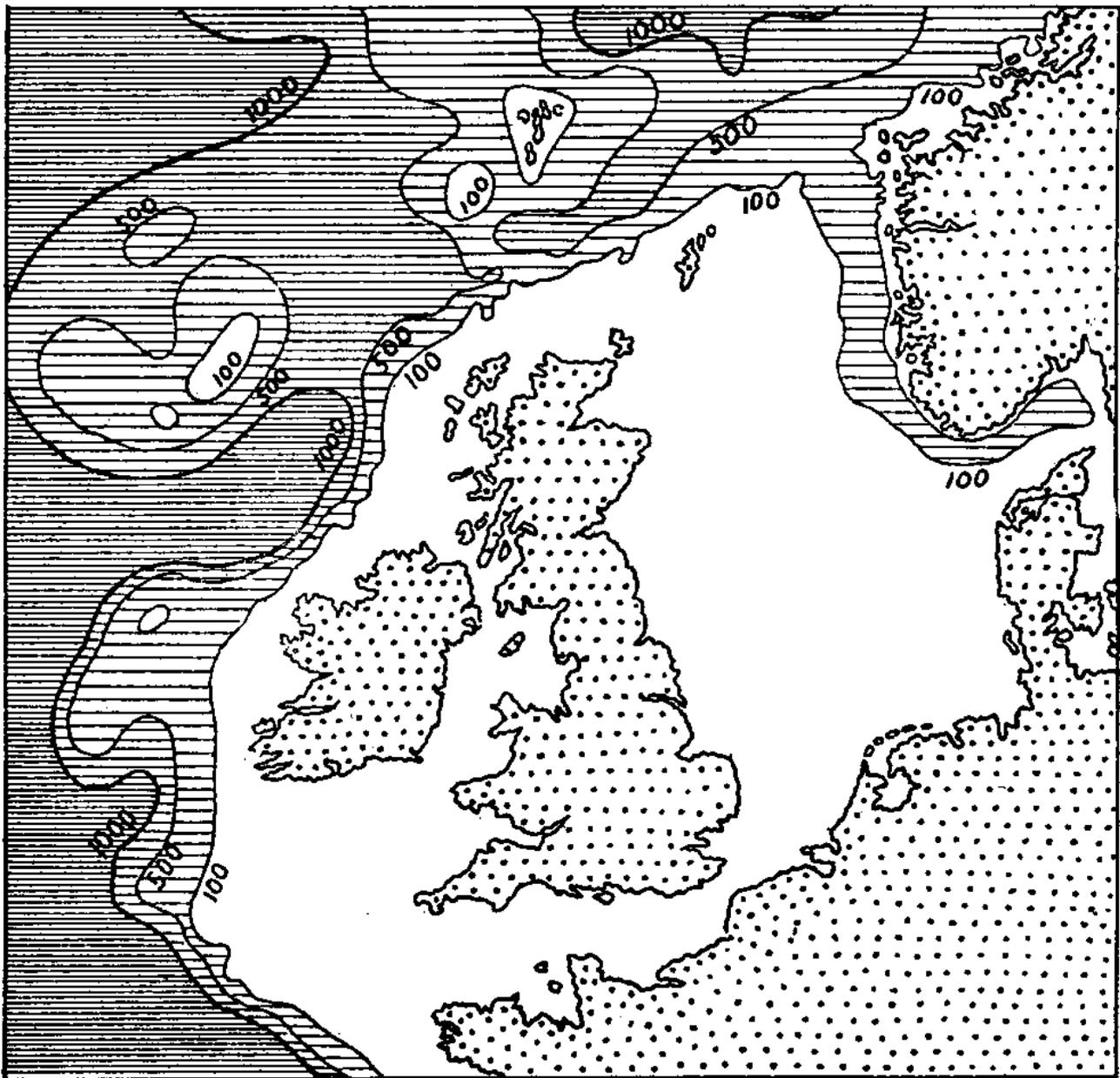


Fig. 1. – The Continental Shelf.

16. Ireland is an island roughly elliptical in outline, with a longer axis (NNE and SSW) of about 300 miles, and a shorter axis (WNW and ESE) of about 185 miles, and an area of 32,524 square miles. Its limits of latitude are $51^{\circ} 26' N$ and $55^{\circ} 23' N$ (about the same as Holland, N Germany and Poland), and of longitude $5^{\circ} 26' W$ and $10^{\circ} 29' W$. It is on the whole a very flat island, saucer-shaped owing to its marginal mountain-ranges, and devoid of any distinguishable median watershed

(fig. 2). The Limestone Plain stretches across the centre from horizon to horizon, encumbered with great swelling peat-bogs and embosoming many extensive lakes – a feature unlike anything found in Great Britain. The mountain regions, on the other hand, often recall those of Wales or the Lake District or W Scotland, the most unusual Irish feature being the cliff-walled limestone plateau of the Ben Bulbin region in Sligo and the basaltic plateau of Antrim; also the scarped mountains in the W, which drop into the Atlantic in grand precipices, like Brandon in Kerry, Croaghnaun on Achill Island, and Slieve League in Donegal.

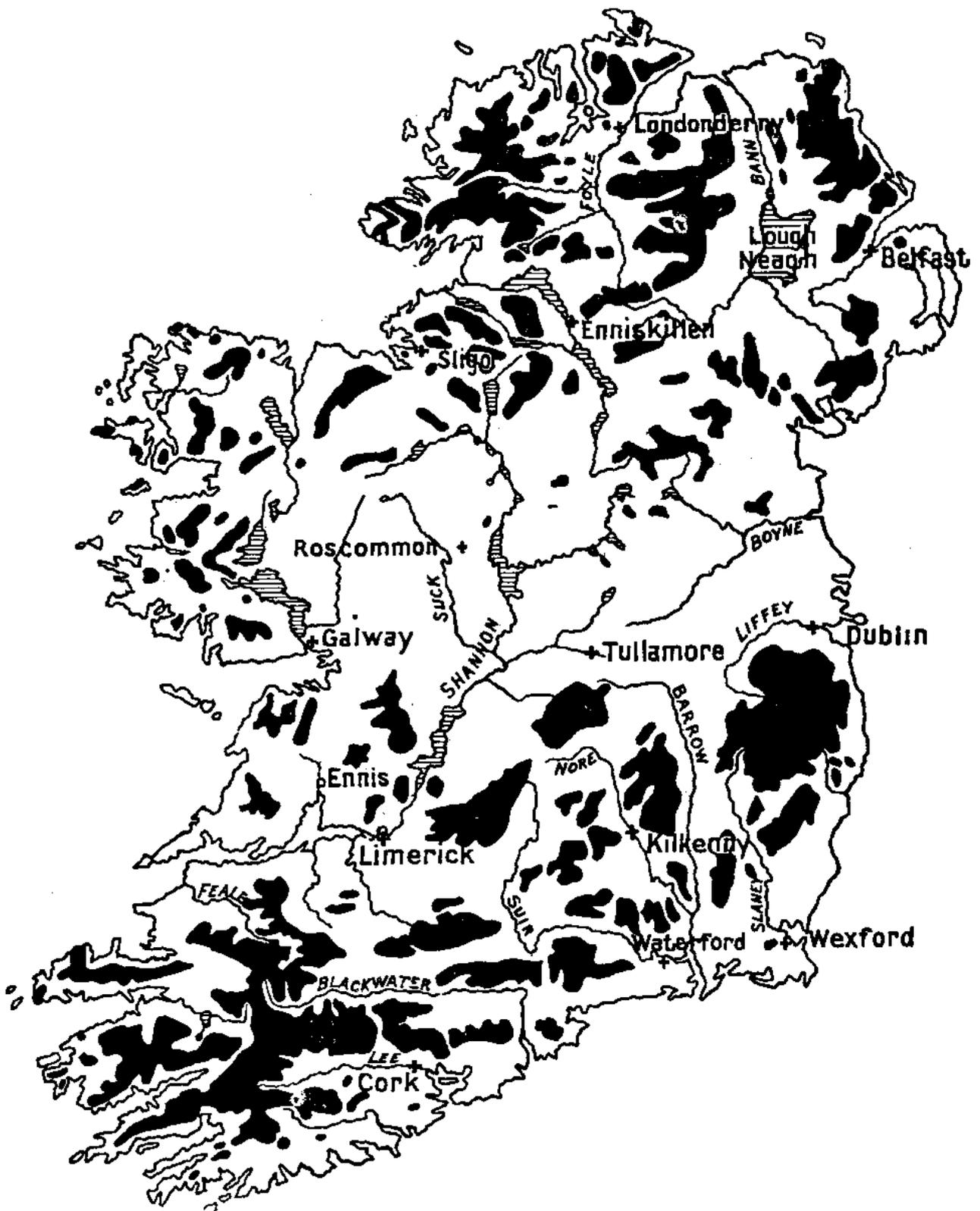


Fig. 2. – Land over 500 feet above sea – level.

17. The marginal position of most of the high grounds affects the topography in many ways. In most islands a central backbone, more or less pronounced, causes the rivers to flow radially towards the sea, from near the centre to the margin. In Ireland the streams that rise on the seaward side of the mountain masses have short and mostly steep courses, while those whose sources lie on the inland side travel far before they reach an outlet. Most of the larger Irish rivers – Blackwater, Suir, Nore, Barrow, Liffey, Bann, Erne, Shannon – rise from 10 to 60 miles inland, but none of them flows

towards the nearest sea; after devious courses of 100 to 200 miles, they debouch at quite other points (fig. 3). The Shannon, longest river in the British-Irish area, with a course of 214 miles, rising on the hills near Lough Allen 25 miles from Donegal Bay, flows S from that lake for 130 miles with a fall of only 51 feet, forming at intervals great lake-like expanses. Then it cuts through hills of Old Red Sandstone and Silurian rocks, and drops 97 ft. in 18 miles to reach tidal waters at Limerick. Thence it continues its course for 55 miles more through a broadening submerged valley to meet the Atlantic at Loop Head. The course of this river, and those of the Barrow, Nore, and Suir in the SE, give testimony of the great denudation to which the Carboniferous limestone of the Central Plain has been subjected, for after descending to the plain from their mountain sources they flow not towards what are now the lowest areas, but towards the southern hills of sandstone and slate, and cut through them in deep gorges which they have worn in these resistant rocks as the

surface of the Limestone Plain was being lowered by denudation.

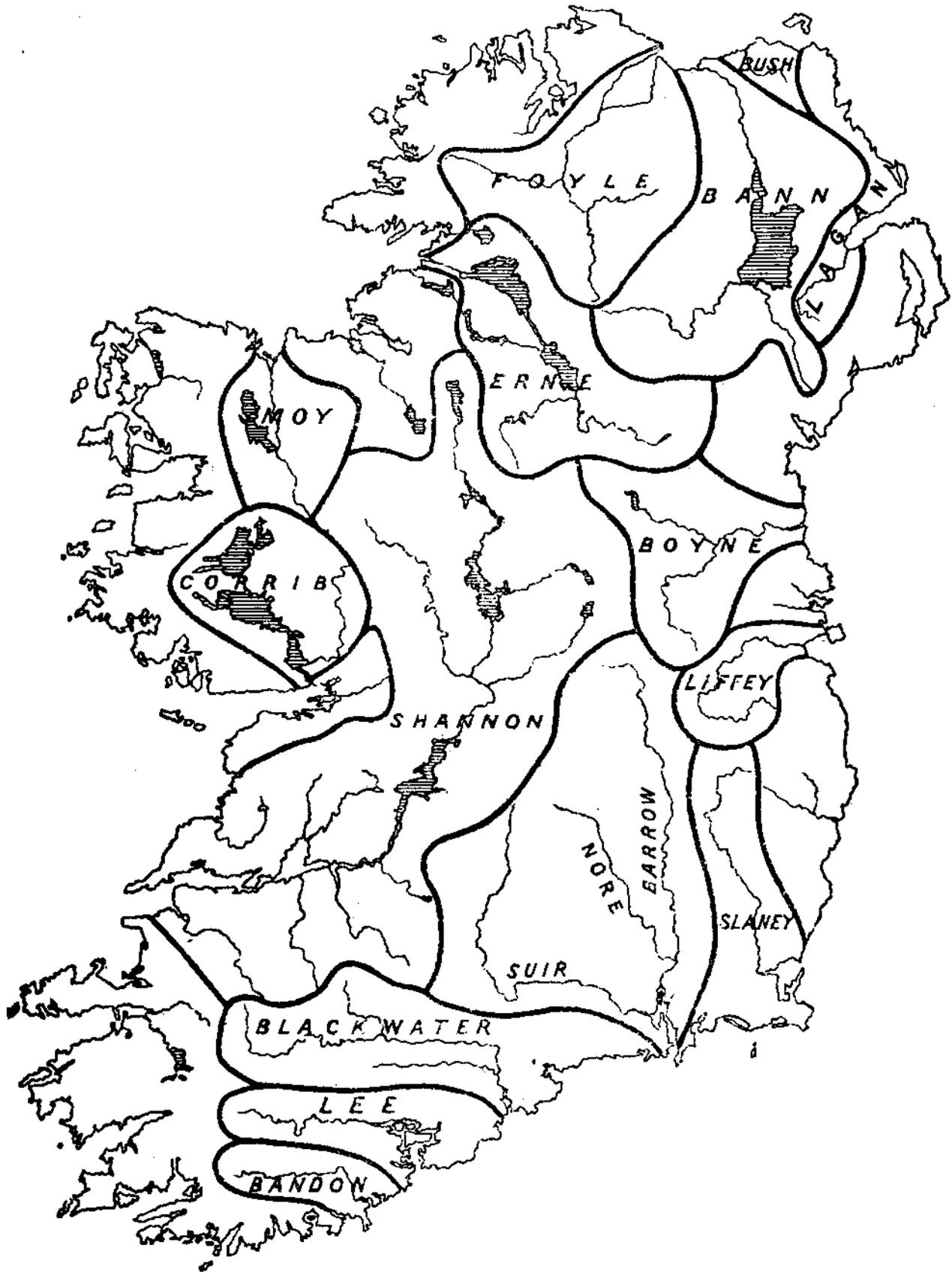


Fig. 3. – River – Basins.

18. The southern rivers, Blackwater, Lee, and Bandon, with marked W–E courses changing abruptly to S near their mouths, furnish evidence of having undergone considerable natural development since they originated as “consequent” streams. In the early stages of their history they flowed S along the slope of the uplifted peneplain in channels unrelated to the geological sub-structure. But soon after, the drainage became complicated by the development of “subsequent” tributary streams. E-and-W tributaries, working along the strike of the softer Carboniferous rocks which, in consequence of folding and subsequent denudation, alternate with the more resistant beds of Old Red Sandstone, rapidly deepened their channels and eventually became predominant. Only in their lower reaches have the streams managed to retain their original N–S channels across the anticlinal ridges. In Ulster, Lough Neagh and the present course of the Bann owe their origin to a collapse caused by the outpourings of basalt in that region. Further W, the Erne has a singularly sluggish course – a mere succession of island-filled lakes – till at Belleek it plunges over a lip of limestone and rushes down to meet the sea below Ballyshannon. In the E, the Liffey, rising on the inland side of the Leinster Chain, performs a semicircular course of 72 miles before it enters the sea at Dublin, only 14 miles from its source. Among the larger 'streams, only the Boyne, Lagan, and Foyle have courses that can be described as normal.

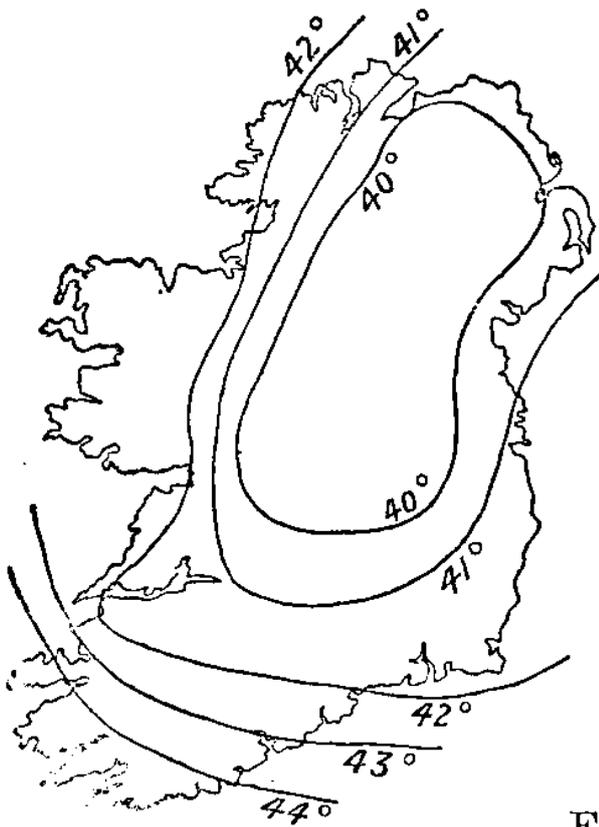
19. The Erne is not alone among Irish rivers in being, characterized by lake-like expansions. Owing to the soluble nature of the limestone, several of those flowing in the Central Plain show this peculiarity, the lakes being often of considerable size. Thus we have Lough Ree and Lough Derg on the Shannon, and Loughs Carra, Mask, and Corrib on the river Corrib. The quite different origin of Lough Neagh in the north has been referred to already (12). That lake covers an area of no less than 153 square miles, and has a very uniform depth of 50 ft. or less. Around its margin, especially in the SW, a broad band of freshwater clays of great depth testifies to a considerable former extension of its waters and to a long-continued subsidence of its floor.

20. The coast of Ireland in the N, W, and S is in general bold, deeply indented by drowned river-valleys and broader bays, and the influence of the Atlantic everywhere makes itself felt. In Donegal, Mayo, and Galway the ancient folded pre-Cambrian rocks produce an exceedingly broken coast-line, sometimes low, sometimes projecting in bold headlands and magnificent cliff-ranges, everywhere so exposed that the maritime flora is much reduced, though its vertical limit is greatly increased. Wherever, on the other hand, limestone prevails, the land is usually low, and the sea has penetrated deeply, as in Donegal Bay, Sligo Bay, Killala Bay, Clew Bay, and Galway Bay. In Clare the horizontal shales and sandstones of the Upper Carboniferous still withstand the onslaught of the Atlantic and form precipices which in the Cliffs of Moher rise vertically to a height of over 650 ft. In Kerry and W Cork the coast attains its boldest development. Here the great ribs of Old Red Sandstone project far into the ocean, the summits of the mountains often continuing seaward as high craggy islets. Between these Devonian buttresses the erosion of the weaker Carboniferous rocks of the troughs, coupled with submergence, has allowed the sea to flow far into the former river-valleys in deep wedge-shaped bays, producing very lovely scenery. Throughout E Cork and Waterford a less magnificent but high and broken coast-line prevails, with inlets at the river-mouths due to sunken valleys. In the E, and there alone, the coast is usually low. The shore of Wexford and Wicklow is characterized by gravel beaches and stretches of sand, where the flora belonging to such ground attains its maximum for Ireland, and several species have their only station (270-9). In Dublin and Louth also sandy beaches prevail, broken by occasional rocky headlands. The coast of Down is low, with alternating stretches of sand and of jagged slaty rock. N of Belfast Lough (the drowned valley of the Lagan) the basaltic plateau of the NE presents to the sea a lofty and picturesque scarp.

21. As compared with the greater part of Europe, the most striking feature of Ireland (which it shares with Scotland, Wales, and Scandinavia) is the great age of the main features of the country and of the rocks which produce them. This is especially true of most of Ireland's mountain-ranges. Compared with the heathery granite domes of Wicklow and the ridges and peaks of Donegal, Connemara, and Kerry, the Mourne Mountains are happen ings of yesterday: yet the rising of the Mournes heralded the great and long-continued earth-movements from which sprang the Pyrenees, the Alps, the wide Carpathian ring, the Balkans, the snowy Caucasus, and the lordly Himalayas themselves.

CLIMATE

22. Ireland lies in about the same latitude as Berlin, Kamtschatka, Alberta, and Labrador. A comparison with the climatic conditions prevailing in any of these areas shows the extraordinary effect of the warm seas and sea-winds which envelop Ireland. The mean annual temperature over the whole island is above 50° F. (10° C.). The annual range is singularly small. The warmest area (the centre and SE) in July (the hottest month) has a mean of barely over 60° F. (15.5° C.), and the coldest area (the centre and NE) in January (the coldest month), a little under 40° F. (4.4° C.) (fig. 4). This may be compared with the 23° F. average range prevailing in England, itself possessing an insular climate in contrast to Continental countries. Most marked are the winter temperatures in the W. The isotherms there, running parallel with the coast, show a January mean of 40° to 42° F. in Donegal, 42° to 43° F. in the Mayo – Galway projection, and over 44° F. in SW Kerry and W Cork – warmer than Bordeaux or Rome. The January isotherm of 42° F. (5.5° C.), which passes through the whole length of W Ireland from N to S, fringes the Welsh coast, cuts across Devon, runs along the W and S coasts of France, and thence through N Italy and Greece. The July isotherm of 59° F. (15° C.) runs likewise across “W Ireland from S to N; then along the Cheviots, up the backbone of Scandinavia, and across the head of the White Sea into Siberia. Frost is rare in the W, and almost unknown on some of the islands. These high winter temperatures, combined with great humidity all the year round, have a marked effect on the vegetation, particularly in the W and S.



JANUARY ISOTHERMS.

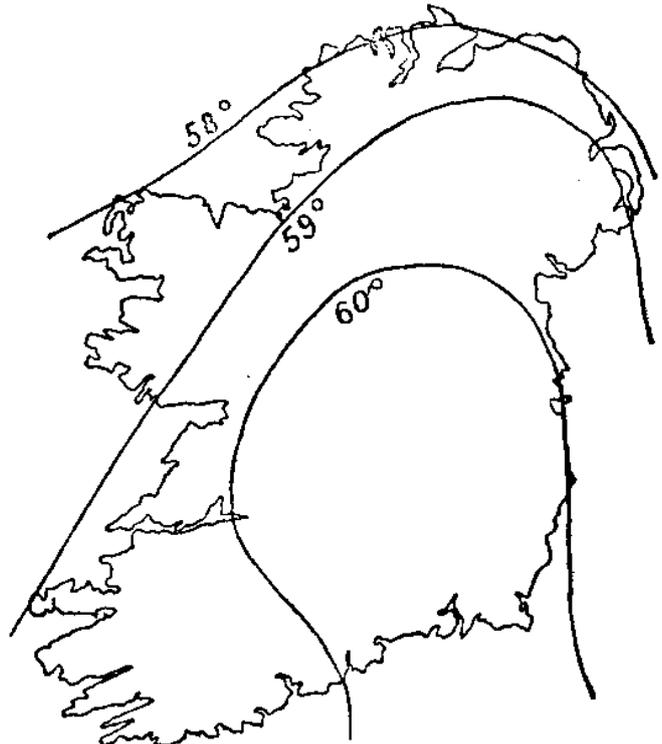
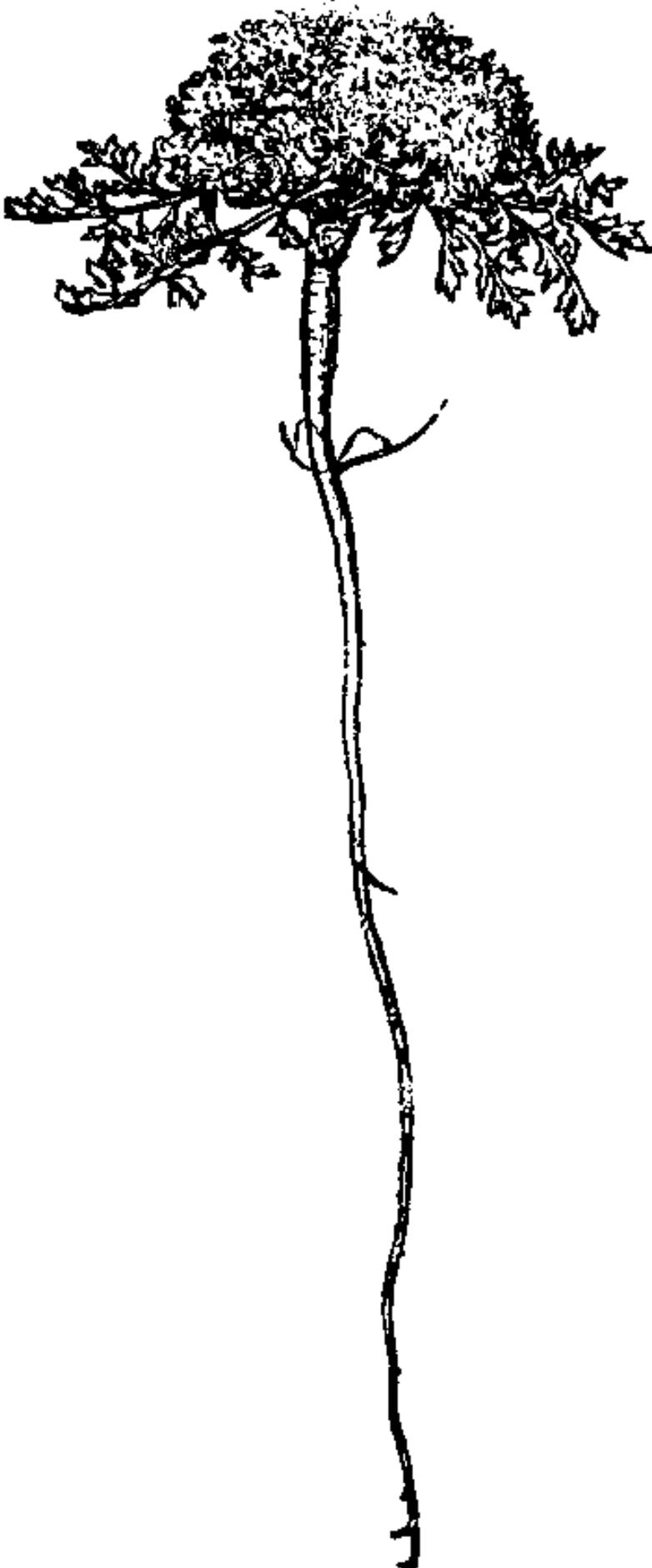


FIG. 4.

JULY ISOTHERMS.



But there is also a high degree of exposure. Winter on the W coast might be described as a succession of westerly gales with westerly winds between. The influence of these conditions on the vegetation is clearly seen. In exposed ground, as in S Clare, not a native tree is to be found for miles inland; and everywhere in the western district (as indeed more or less over the whole of Ireland) the bending of trees towards the E is very noticeable (Plate 1 and fig. 17). On the western islands the vegetation is often extremely wind-shorn. On Achill, *Eryngium nmrutum*, with spreading rhizomes an inches roots 3 to 4 ft. long, produces annual shoots from 3 to 4 inches high. On Inishkea, *Daucus Carota* grows quite stemless, with a sessile umbel nestling among a rosette of leaves (fig. 5 **see right**). See also the description of *Plantago sward* (63) for an example of dwarfing by exposure. On the other hand, the bitter easterly winds which retard the spring flora along the Irish Sea are scarcely felt on the W coast, and exercise no influence on the vegetation. But even in the Dublin area, *Cochlearia danica* and *Ranunculus Lenormandi* commence flowering in January the latter at 1000 ft. elevation; and on a midwinter walk, blossoms of 30 to 50 wild flowers may be seen, except after an unusual spell of frost.

24. Rainfall in Ireland increases from E to W. Along the E coast generally it corresponds to that prevailing on the British side of the Irish Sea. Along the line of the Shannon (roughly) it has risen from about 30 to about 40 inches (say 750-1000 mm.); and thence to the W coast it rises to 70 to 90 inches (1750-2250 mm.), while in the wettest spots in the western mountains (e.g., Galway, Kerry) precipitation as high as 100 inches (2500 mm.) may occur (fig. 6). The average for sixteen years at Kylemore in Connemara is given as 81.79 inches. The S end of the Upper Lake at Killarney, 75 ft. above sea-level, showed an average of 87.36 inches for 17 years. The station at 1760 ft. on Mangerton in Kerry gave an average for 15 years of 97.40 inches – minimum 63 inches in 1887, maximum 1409 inches in 1903. But it is the high humidity prevailing in the W, and large amount of showery or drizzly weather, rather than heavy downpours, which produce the almost tropical luxuriance which characterizes the vegetation of sheltered spots, especially in Kerry.

The constancy of moist atmosphere on the W coast may be judged from the fact that, on the north side of Slievemore on Achill (408) *Hymenophyllum peltatum* forms an abundant ingredient of the sward covering the slope, growing fully exposed and open to the sky, among *Sphagnum* and stunted *Calluna*; while *Nymphacea alba* grows hard by in a marsh as a terrestrial plant, with short-stalked aerial leaves. The perennial nature of the precipitation in Ireland is seen in the rarity of parched vegetation during summer, causing that intense greenness which astonishes the American or S Continental visitor. In a normal season parching is confined to wall-tops, dry gravels, and places where the rock is a very few inches below the surface. On a well-drained hill-top in Westmeath in August of an unusually dry summer, it was noticed that rank pasture on loamy soil gave no indication of the presence of foundations and slabs of stone buried six inches below the surface – suggesting that in Ireland aerial survey will not prove an efficient means of discovering buried monuments, as it has in drier countries.

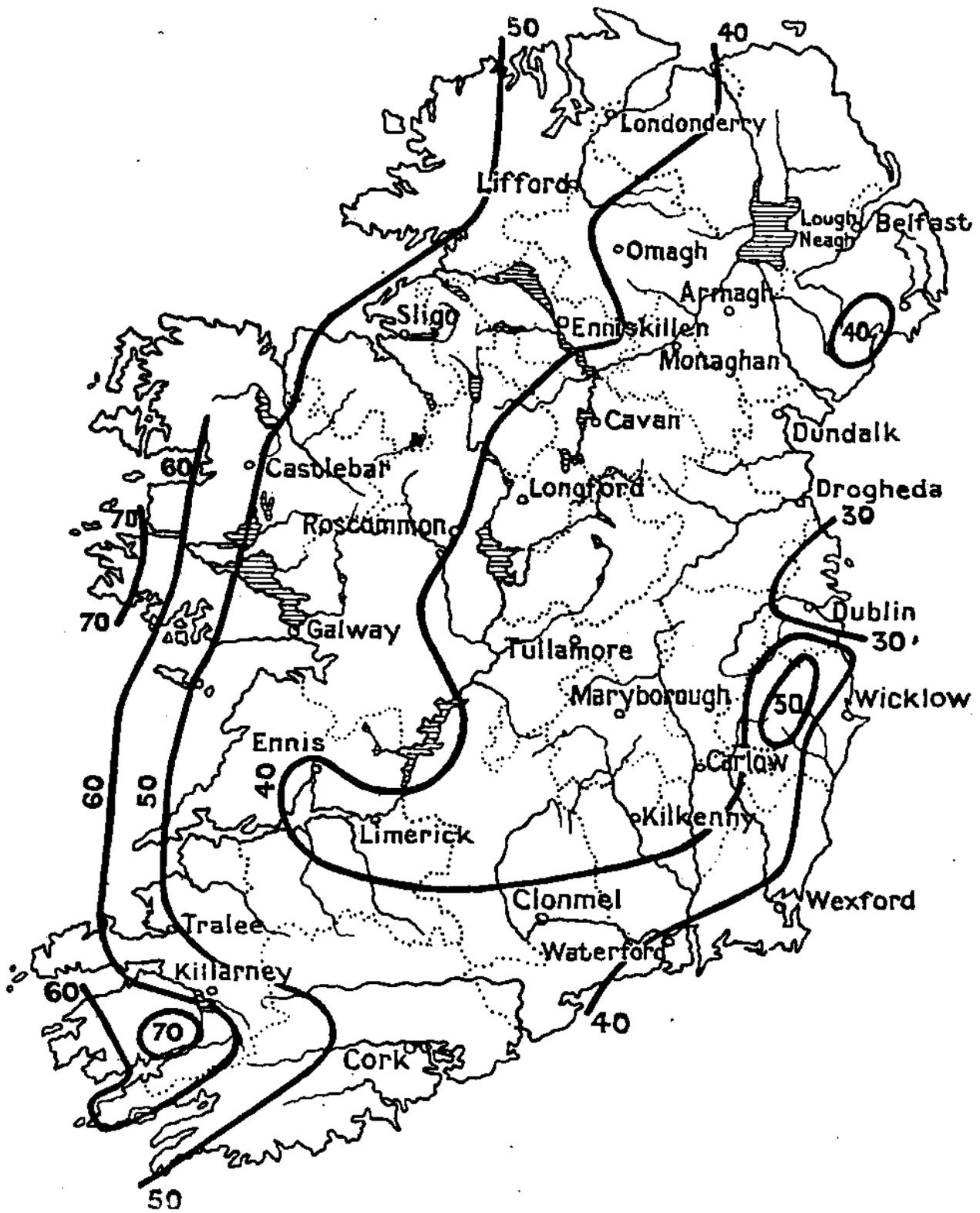


Fig.6. – Rainfall.

25. The general effect of climate and soils in Ireland is to render the country specially suitable for pasture. The forests of oak which once covered much of its surface have under the influence of man given way, not to tillage, but to grass-lands, often very rich, which, apart from mountain grazing, occupy more than half of the entire area of the country (fig. 10). An important effect of the exposure is a reduction of the elevation up to which agricultural operations can be carried on. While in sheltered inland districts tillage may range as high as 1000 ft., in W Mayo and W Galway its limit

does not exceed 400 ft., and is usually only about 200 ft.; on sheltered slopes in the E it may ascend to 1200 ft.

26. While the exposure has a dwarfing effect on vegetation, and on trees in particular, the mild, moist climate, and also the rich, warm soil that prevails on the limestone, produce a remarkable luxuriance of vegetation where shelter from wind is afforded. Thus, in Burren (346), *Asplenium marinum* may be seen with fronds 3 ft. in length; *Ceterach*, exuberantly crenated (fig. 16), attains a length of 1 ft.; *Adiantum*, nearly 2 ft. On Aran (352), *Allium babingtonii* attains a height of 6 ft. On the islands in Lough Erne (435), *Solidago virgaurea* grows 4 ft. in height, *Campanula rotundifolia* 3 ft., and *Polygala vulgaris* forms clumps with a hundred upright stems a foot high. On islands in L. Mask (371) *Campanula rotundifolia* grows 3 ft. 3 in. high, and *Orchis maculata* attains a height of 3 ft. By Lough Gill (420), *Digitalis* and *Heracleum* have been measured nearly 10 ft. high, *Agrimonia odorata* 7 ft., *Coeloglossum viride* 14 in.; and at Portlaw *Polypodium vulgare* on a wall with fronds over 2 ft. 3 in. long. H. C. Hart records from the banks of the Suir *Apium nodiflorum* 6 ft. high with leaves 3 ft. long, and *Oenanthe crocata* 7 ft. high. In the Killarney woods *Hymenophyllum tunbridgense* forms on rocks sheets of greenery up to 50 sq. ft. in area.

Another effect of the moist conditions is the abundance of epiphytes in sheltered places in the W, unexpected plants like *Saxifraga spathularis* (*umbrosa* auct.) perching on boughs 20 or 30 ft. above the ground (Blackwater near Kenmare). In more than one place in Kerry *Scrophularia aquatica* may be seen growing 6 to 8 ft. high on the top of 10ft. walls.

GENERAL HISTORY OF THE FLORA.

27. In the history of Europe, Ireland appears to have possessed – save for the interlude of the Ice Age – a far longer period of continuous vegetation than most parts of the Continent, stretching back in all probability (unless interrupted by the Chalk sea) to the uplift that took place in late Carboniferous times (11). In this place we are concerned only with the plants which occupy the country at present and their immediate predecessors; and the history of these began in the Pliocene period. But of the Pliocene flora in Ireland we know as yet nothing. The subsequent changes in the vegetation owing to the oncoming of the cold of the Pleistocene period have not so far been traced, nor have deposits yet been found which throw light upon the flora of the mild Interglacial period or periods which alternated with the Glacial phases. Recent research indicates that the Aurignacian mitigation of climate that preceded the final advance of the ice-sheet was of long duration, and that it was accompanied by a considerable uplift of the land. This would have offered opportunity for extensive re-migration into Ireland of plants driven out by the main advance of the ice, and probably many elements arrived at that time. In spite of geological evidence of the presence of ice in every part of Ireland, and the frequent assumption that at the period of maximum glaciation this ice was confluent over the whole country, leaving no portion unexposed, it does not seem by any means certain that the Interglacial immigrant plants did not find in the country survivors of the Glacial and Preglacial floras – rather the reverse. Nor is it certain how far the subsequent and final less severe glaciation may have reduced or exterminated the reconstructed Interglacial vegetation. The geological and the biological interpretations of the evidence relating to these questions are not as yet in accord on many points, and widely different views are still expressed regarding both the time and the mode of arrival of our present plants and our present animals*. Controversy on these points has raged particularly with regard to certain ingredients of the Irish flora which have their home in the Pyrenean and Mediterranean region on the one hand, and in North America on the other. These are specially referred to below (37), when the plants composing them are considered.

It is not disputed that a full reconstructed flora and fauna, little different from those which occupy the country at present, were domiciled in Ireland in early Postglacial times. Probably belonging to the beginning of this period, one may note the occurrence of *Naias marina* at L. Gur in Limerick in beds which yield remains of the extinct Great Irish Deer, which is assumed to have browsed a vegetation of tundra type. This plant is extinct in Ireland, and has now only one station in Britain (Norfolk). At Ballybetagh in Dublin *Salix herbacea* has been found in beds similarly associated with *Cervus giganteus*, at 750 ft. elevation, its nearest existing stations (in Wicklow) being at over 2000 ft*. A high land-level would seem to have persisted after the final passing away of the ice, allowing free re-colonization from the Continent. The break-down of the Irish-British land-connection prior to the disruption of a similar landbridge between England and the Continent accounts for the absence from Ireland of many common British plants (see 32) and animals – they were able to migrate overland into England, but found the way to Ireland blocked by the newly-formed Irish Sea.

* The following mostly recent papers on the Ice Age and its relations to the fauna and flora will illustrate some of the points of view: –

E. FORBES: "On the Connexion between the Distribution of the Existing Fauna and Flora of the British Isles, and the Geological Changes which have affected their area, especially during the epoch of the Northern Drift." Mem. Geol. Survey Gt. Britain 1 336-432. 1846.

C. REID: "The Relations of the present Plant Population of the British Isles to the Glacial Period." Brit. Assoc. Report, 1911, 573-577.

J. K. CHARLESWORTH: "Some Geological Observations on the Origin of the Irish Fauna and Flora." Proc. Roy. Irish Acad., 39 B 358-390. 1930.

M. L. FERNALD: "Some Relationships of the Floras of the Northern Hemisphere." Proc. Internat. Congress Plant Studies 2 1487-1507. 1929.

J. R. MATTHEWS: "The Distribution of certain members of the British Flora. III. Irish and Anglo-Irish Plants." Annals of Bot. 1926, 773-797.

R. LL. PRAEGER: "Phanerogamia and Pteridophyta" (Biol. Survey of Clare Island). Proc. Roy. Irish Acad. 31, part 10. 1911.

R. F. SCHARFF: "The History of the European Fauna." London. 1899.

G. C. SIMPSON: "Past Climates." Manchester Memoirs 1929-30, 1-34.

O. STAPP: "The Southern Element in the British Flora." Englers Bot. Jahrb, 50 (Suppl. Band) 509-525. 1914.

A. J. WILLMORR: "Concerning the History of the British Flora." In Contribution a l'Etude du Peuplement des Iles Britanniques 163-193 (Societe de Biogeographie III). 1930.

These and other papers are briefly summarized and discussed in PRAEGER: "Recent Views bearing on the Problem of the Irish Flora and Fauna," in Proc. Roy. Irish Acad. 41 B 125-145. 1932.

C. REID, Irish Nat. 1904, 162.

A. W. STELFOX in Nature 1927, 781.

28. Since the separation of Ireland from England there have been minor fluctuations both of land-level and of temperature. The forests of *Pinus* and *Betula* which characterized early Postglacial times gave way to *Quercus* when a slightly higher temperature prevailed. A few records of plants belonging to these more recent times have been given by Erdtman*. The main growth of the peat bogs represents a somewhat colder and wetter phase than that which prevails at present. The white marl which so often underlies the bogs shows already a flora of present-day type*. An amelioration of climate in Neolithic times allowed the forests to extend up the flanks of the mountains several hundred feet above the present tree-limit, and permitted the growth of woods on western coasts and islands where now their descendants survive – if at all – as mere bushes. In quite recent times *Quercus* has supplanted *Pinus* completely; but previous to this *Pinus* would appear to have become

rare owing to the encroachment of the all-conquering peat, the deterioration of the climate, and finally to grazing in pre-historic and historic times*. The peat bogs in their turn have now passed their zenith. On the mountains they are being denuded by wind and rain, and in the plain their increase has usually slackened or ceased, and the operations of man are steadily reducing their area, just as his influence has much lessened the area of lake and marsh in the country, owing to drainage.

* G. ERDTMAN: "Traces of the History of the Forests of Ireland." Irish Nat. Journ. 1 242-5. 1927.
G. REID, Irish Nat. 1895, 131-2.

A. C. FORBES: "Some Legendary and Historical References to Irish Woods, and their Significance." Proc. Roy. Irish Acad. 41 B 15-36. 1932.

CHARACTER OF THE FLORA

From a European point of view, Ireland, on account of its western position and insularity, is the home of an intensely "Atlantic" flora.

THE ATLANTIC FLORA

29 "Atlantic Flora" is a relative term, dependent on the area which is being dealt with by the user of it, but signifying in all cases a flora developed under conditions of greater humidity and more uniform temperature throughout the year than those which prevail in adjoining areas. To the botanist of eastern Europe the flora of all the western European countries is essentially Atlantic. The central European worker might exclude E Spain, E France and much of Sweden from his Atlantic area, the indefiniteness of boundary being recognised by the addition of such terms as "Subatlantic" and "Pseudoatlantic." For Britain, Watson's "Atlantic" type signifies "species chiefly seen in W England" ; half of the 62 species to which he awards full "Atlantic" status do not occur in Ireland, these being mostly of S English range, and the remainder have a quite irregular distribution in this country. The Irish botanist using the term "Atlantic" would in turn apply it to those 'plants which had in Ireland a range corresponding to the maximum climatic influence, within the island, of the neighbouring ocean – in other words, a W and S distribution. The focus of this flora is in Kerry, to which area many of the most interesting are confined (35); while some of its members of wider S and W range are:–

<i>Thalictrum minus</i>	<i>Euphorbia hiberna</i>
<i>Arabis brownii</i>	<i>Juniperus communis</i>
<i>Draba incana</i>	<i>Juniperus sibirica</i>
<i>Saxifraga spathularis</i>	<i>Taxus baccata</i>
<i>Drosera longifolia</i>	<i>Neotinea intacta</i>
<i>Galium sylvestre</i>	<i>Sisyrinchium angustifolium</i>
<i>Asperula cynanchica</i>	<i>Naias flexilis</i>
<i>Hieracium iricum</i>	<i>Eriocaulon septangulare</i>
<i>Arctostaphylos uva-ursi</i>	<i>Sesleria caerulea</i>
<i>Gentiana verna</i>	<i>Adiantum capillus-veneris</i>
<i>Euphrasia salisburgensis</i>	<i>Asplenium viride</i>
<i>Bartsia viscosa</i>	<i>Polystichum lonchitis</i>

This is by no means a group of "Atlantic" facies in a European sense. Half of these plants, while a few may be rather western inside Europe, extend beyond European confines into Asia and Africa; some are circumpolar. Three are members of the Lusitanian-Mediterranean migration along the W

European coast (37); two belong to the N American immigration (37). On the British standard, the list contains only two “Atlantic” species, and while Watson's Atlantic plants are mostly southern in Britain, this list contains more of a northern than of a southern facies. From the point of view of distribution it is clear that the group in the list above is homogeneous only in one respect – its western range within Ireland. To many of the plants, the bare limestone “craggs” of the Galway Bay area are the attraction; to others, the mountains; others again, truly Atlantic in a sense, are members of the Lusitanian and American immigrations.

Consult e.g. M. TROLL: “Ozeanische Ziige in Pflanzenkleid Mitteleuropas,” in Festgabe Erich von Drygalski, 1925;

H. CZECZOTT: “The Atlantic Element in the Flora of Poland.” Bull. Acad. Polon. Sc. & Lettr. (Cl. Sc. Nat.), 1926.

Cyb. Brit. 1 43 (1847), 4 409 (185),

30. The most genuine Atlantic group in the European (not American) sense consists of those whose world-range is confined to W Europe (a few extending to the Atlantic islands). Irish members of this group include :–

Ranunculus hederaceus	Ulex europaeus
Corydalis claviculata	Vicia orobus
Cerastium tetrandrum	Erica cinerea
Hypericum elodes	Wahlenbergia hederacea
Carum verticillatum	Digitalis purpurea
Conopodium majus	Scilla verna
Saxifraga hypnoides	

This list, selected as representative of the plants exclusively W European in range, shows in Ireland, as might be expected, no general “Atlantic” tendency. They are equally spread on the E and on the W sides of this island. In Britain, 4 of the 13 belong to Watson's “Atlantic” type. This means that Atlantic conditions (in the Continental sense) being prevalent over the whole of Britain and Ireland, these plants can grow equally in E and W, so far as climate is concerned. But that even in Ireland some of them are near the limit of their temperature-range is shown by the behaviour of *Ulex europaeus* and *Digitalis purpurea*. The former extends N to Denmark, the latter to the Trondjem fiord in Norway. During hard winters in Ireland both suffer severely. In 1894-5 and again in 1916-7, in Wicklow and Down for instance, large quantities of both species were killed.

THE BRITISH AND IRISH FLORAS COMPARED

31. The present vegetation of Ireland, as has been seen, was derived largely by immigration from W Europe through Britain subsequent to the passing of the ice. We may now consider the results of this and any previous immigrations, as represented by the flora of to-day. The flora of Britain is so well worked and so widely known that comparative notes as between the two islands are the simplest way of bringing out the salient features of the Irish flora. The representation of total floras by numbers tends to be misleading on account of varying practice as to the validity of critical plants as species, subspecies, or varieties, and also as regards the inclusion or exclusion of alien plants of various degrees of permanency. On the conservative estimate used in “*Cybele Hibernica*” and “*Irish Topographical Botany*,” the flora of Ireland (species and subspecies of Phanerogams and Vascular Cryptogams, native or naturalized) may be taken as a little over 1000. The figure for Great Britain on the same basis is in the neighbourhood of 1500. On the basis of the “*London Catalogue of*

British Plants,” 11th edition, the Irish total is slightly under 1300, the corresponding figure for Great Britain being 2300. The difference of proportion in these aggregate and segregate figures shows the greater extent to which critical plants have been worked out in the larger island.

British Plants Absent from Ireland

32. Great Britain extends through a range of latitude nearly three times greater than does Ireland (50° to 61° instead of 51° to 55°) and N Scotland and especially the dry gravelly soils of S England support many plants unknown in Ireland, so it is not surprising to find in the latter area a smaller diversity of plants than in the larger island; but nevertheless the reduction in the Irish flora is due largely to its insularity: the Irish Sea has proved a serious barrier to immigration from the E, whence almost the whole of our flora is derived. This is clear from the fact that many common plants which extend from S England far up into Scotland have nevertheless failed to reach Ireland. Such for instance are :-

<i>Genista anglica</i>	89	(or 80 per cent.)
<i>Ononis spinosa</i>	71	63
<i>Astragalus glycyphyllos</i>	68	61
<i>Lathyrus sylvestris</i>	67	60
<i>Chrysosplenium alterniflorum</i>	79	71
<i>Scabiosa Columbaria</i>	72	64
<i>Paris quadrifolia</i>	77	69
<i>Convallaria majalis</i> ...	67	60
<i>Avena pratensis</i>	81	72

The numerals following the names show in how many of the 112 vice-counties into which H. C. Watson divided Great Britain each species is found. The majority of these plants have a rather wider range in England than in Scotland, thus approximating to the “British” range of the bulk of the Irish flora, from which they are nevertheless absent.

Common British Plants Rare in Ireland

33. A more subtle problem is presented by the case of a number of species which have succeeded in arriving in Ireland, but for some reason have not made good, being much rarer on the Irish than on the English side of the Channel. Some no doubt are recent arrivals (“recent” on a plant-migration time-scale), and will in due course extend their range. Others are more or less manifestly relict species, which for one reason or another are decreasing, and in the absence of reinforcements (one of the disadvantages of insularity) will die out. A few of the more striking cases are cited below. The numbers appended to the species express the number of Irish divisions (40 in all) and British vice-counties (112 in all) in which each occurs.

Plants rare in Ireland, widespread in Britain			
A. Plants extending from N to S in Britain.			
	No. of V.C.'s.		Same in % of V.C.'s.
	Ireland	Britain	Irish British

<i>Trollius europaeus</i>	3	53	7	47
<i>Corydalis claviculata</i>	6	96	15	88
<i>Helianthemum chamaecistus</i>	1	93	2	83
<i>Geranium pratense</i>	1	97	2	87
<i>Hypericum hirsutum</i>	4	92	10	82
<i>Astragalus danicus</i>	1	47	2	42
<i>Ornithopus perpusillus</i>	5	86	12	77
<i>Spiraea filipendula</i>	2	65	5	58
<i>Adoxa moschatellina</i>	1	101	2	90
<i>Galium cruciata</i>	2	95	5	85
<i>Calamagrostis epigejos</i>	3	72	7	64
<i>Cryptogramme crispa</i>	7	55	17	50
<i>Lycopodium inundatum</i>	5	60	12	54
B. Plants of Northern Range in Britain				
<i>Geranium sylvaticum</i>	1	54	2	48
<i>Carex pauciflora</i>	1	32	2	29
C. Plants of Southern Range in Britain.				
<i>Ranunculus fluitans</i>	1	59	2	53
<i>Teesdalia nudicaulis</i>	4	82	10	73
<i>Trifolium subterraneum</i>	1	46	2	41
<i>Trifolium glomeratum</i>	2	21	5	19
<i>Poterium officinale</i>	4	69	10	62
<i>Serratula tinctoria</i>	1	68	2	61
<i>Senecio erucifolius</i>	5	69	12	62
<i>Picris hieracioides</i>	5	62	12	55
<i>Hypochaeris glabra</i>	1	55	2	50
<i>Campanula trachelium</i>	5	59	12	53
<i>Limosella aquatica</i>	2	53	5	47
<i>Lamium galeobdolon</i>	4	63	10	56
<i>Colchicum autumnale</i>	3	53	7	47
<i>Phegopteris robertiana</i>	1	29	2	26

The majority of the plants in these lists have in Ireland a continuous if limited range. In a few cases some reason edaphic, or climatic, or both – can be suggested for their restriction in this country, as in the case of three E coast species – *Ornithopus*, *Trifolium subterraneum*, and *T. glomeratum*; but most are puzzling. A few show in Ireland a widely discontinuous range – *Poterium officinale* (Mayo and the NE counties), *Lycopodium inundatum* (Kerry, Cork, Wicklow, Galway, Mayo). Such discontinuities of range are not uncommon in the flora in general, and are difficult to explain. In some cases they undoubtedly represent relict distribution.

Plants Commoner in Ireland than in Britain

34. Interesting also is the case of plants which, found both in Britain and in Ireland, have achieved greater success here than in the neighbouring island. The facts in regard to some of the more striking cases may be displayed as follows :—

	Distribution		No. of V.C.'s.		Same in %	
	Irel.	Brit.	Irel.	Brit.	Irel.	Brit.
<i>Spergularia rupicola</i>	G	G	20	31	50	28
<i>Lathyrus palustris</i>	n	s	14	21	35	18
<i>Rubia peregrina</i>	S	SW	17	25	42	22
<i>Andromeda polifolia</i>	G	s	27	35	67	31
<i>Orobanche hederæ</i>	s	S	27	23	67	21
<i>Euphrasia salisburgensis</i>	W	N	10	2	25	2
<i>Pinguicula lusitanica</i>	G	W	34	31	85	28
<i>Utricularia intermedia</i>	W	G	23	8	57	7
<i>Euphorbia hiberna</i>	S & W	SW	11	3	27	3
<i>Scirpus filiformis</i>	W & S	W & S	26	31	65	28
<i>Rhynchospora fusca</i>	SW & S	SW & S	20	12	50	11
<i>Trichomanes radicans</i>	W	W	15	5	38	4
<i>Lastrea aemula</i>	G	G	37	36	92	32
<i>Equisetum trachyodon</i>	N	N	16	1	40	1
<i>Chara aculeolata</i>	G	G	27	18	67	16
<i>Chara desmacantha</i>	G	G	24	13	60	12

G = General, N = northern, n = rather northern, and so on.

In the case of a few of these plants a reasonable suggestion can be advanced to explain their greater abundance in Ireland. Thus the higher humidity of air and soil may be held to account for the much wider range here of *Trichomanes* and *Lastrea aemula*, and the wide distribution of bog for *Andromeda*, *Pinguicula lusitanica*, *Utricularia intermedia*, *Rhynchospora fusca*. In other cases the advantages which Ireland offers as a habitat as compared with Britain are not obvious.

Irish Plants Absent from Britain.

35. One of the main interests that Ireland offers to the botanical geographer lies in the presence of a number of plants, of diverse origin, which are absent from the neighbouring island. To put the matter in proper perspective we must add to these a few others, clearly of similar class, which are not wholly absent from Britain, though very rare therein – such as *Euphorbia hiberna* and *Naias flexilis*; and also one or two belonging to the same migrations, which have colonized Britain but failed to reach Ireland – notably *Erica ciliaris* and *E. vagans*. The Irish plants absent from Britain and their companions just referred to group themselves as follows :—

1. Plants of Pyrenean - Mediterranean Facies.

	Ireland.	Britain.	Continent.	
<i>Saxifraga spathularis</i> (umbrosa auct.)	S,E,W&NW		SW	
<i>Saxifraga geum</i>	SW ct W		SW	
<i>Arbutus Unedo</i>	SW & W		SW & S	
<i>Erica mediterranea</i>	W		SW	
<i>Erica Mackaii</i>	W		SW	
<i>Erica ciliaris</i>		SW	SW	
<i>Erica vagans</i>		SW	SW	
<i>Dabeocia polifolia</i>	W		SW	
<i>Sibthorpia europtea</i>	SW	SW & S	SW	
<i>Pinguicula grandiflora</i>	SW		SW & Alps	
<i>Pinguicula lusitanica</i>	G	SW & W.Scot.	SW	
<i>Euphorbia hiberna</i>	S,W&NW	SW	SW	
<i>Euphorbia Peplis</i>	S	SW&S	SW&S	
<i>Neotinea intacta...</i>	W		S	
<i>Simethis planifolia</i>	SW	SW	SW & S	
<i>Glyceria Foucaudii</i>	SW & NE	S	S	

The terms S, SW, etc., are here employed in a quite strict sense. SW Europe for instance means at most Spain, Portugal, and the W coast of France

2. Plants of N American Facies

	Ireland	Britain	Continent	N.Amer
<i>Spiranthes gemmipara</i>	SW	-	-	NW
<i>Spiranthes stricta</i>	NE	W.Scot.	-	N
<i>Sisyrinchium angustifolium</i>	SW - NW	-	-	G
<i>Juncus macer</i>	S,W,& E	Intrd.	Intrd.	G
<i>Juncus Dudleyii</i>	-	Scot.	-	N
<i>Naias flexilis</i>	SW - NW	Scot.N.Eng.	N	G
<i>Eriocaulon septangulare</i>	SW - NW	W.Scot.	-	N



Hiberno-Lusitanian Plants.



Hiberno-American Plants.

Fig. 7.

DISTRIBUTION OF THE PLANTS IN TABLES 1 AND 2.

Pinguicula lusitanica is omitted in the left-hand map, as it has a wide range in Ireland.

3. Other Species.

	Ireland.	Britain.	Continent.
<i>Arenaria ciliata</i>	W		Arctic-alpine
<i>Inula salicina</i>	Shannon		Widespread, also Asia.
<i>Chars tomentosa</i>	Shannon and Westmeath		Widespread, also Asia, N.Africa

36. There are also a number of critical Irish plants which as at present known are absent from Britain, and some of them apparently endemic in Ireland; but the progress of field-work may yet reveal them in other places. Among these are :-

<i>Arabis Brownii</i>	<i>Hieracium Scullyi</i>
<i>Alchemilla colorata</i>	<i>Hieracium Stewartii</i>
<i>Saxifraga Drucei</i>	<i>Hieracium subintegrum</i>
<i>Saxifraga Sternbergii</i>	<i>Orchis majalis</i>
<i>Saxifraga hirta</i>	<i>Equisetum Moorei</i>
<i>Saxifraga affinis</i>	<i>Equisetum Wilsoni</i>
<i>Saxifraga incurvifolia</i>	<i>Chara denudata</i>

37. As regards the Pyrenean-Mediterranean group above, their curious range, mostly along the W coast, and their discontinuous distribution, have led many phytogeographers to assign a very early date for their arrival – either Preglacial, Interglacial, or early Postglacial. By others this is not admitted, and even quite recent arrival across existing seas has been advocated. It is impossible here to go into the pros and cons of a very debatable question; some of the leading contributions to the discussion of this subject have been given in a previous paragraph (27); but it should be borne in mind in all consideration of this matter that a fauna, small but varied, of similar distribution, is associated with the plants, and cannot be left out of account when the origin of the latter is being discussed. This fauna includes Mollusks (*Helix pisana*, *Geomalacus maculosus*), Beetles (*Otiorrhynchus auropunctatus*), False-Scorpions (*Obisium carpenteri*), Woodlice (*Metoponorthus melanurus*, *M. cingendus*, *Philoscia couchii*, *Eluma purpurascens*, *Trichoniscus vividus*), and Earthworms (*Lumbricus friendi*). The migration of these species across water-barriers offers much greater difficulties than in the case of the plants, and their Hiberno-Pyrenean or HibernoMediterranean range suggests early overland migration. The American list can be materially reinforced in Scandinavia, where a number of additional northern North American plants, absent from W Siberia but present in Greenland, etc., are found; such are *Ranunculus Cymbalaria*, *Rhododendron lapponicum*, *Campanula uniflora*, *Pedicularis fiammea*, *Carex scirpoidea*, *C. nadina*. The occurrence of the American *Dulichium* spathaceum, now unknown in Europe, in deposits of the last Interglacial period in Denmark, and also in Poland, suggests that some at least of these plants were early arrivals. *Naias flexilis* also is a NW European Interglacial fossil. The presence of the American group, which also includes at least one animal (the fresh-water sponge *Heteronteyenia ryderi*), offers great difficulties to any theory of recent or of trans-marine dispersal, and points to early migration, presumably via Iceland and Greenland, when the intervening seas were at least much narrower than they are at present. It should be remembered that in North America a corresponding group of European organisms is found along the NE coasts, pointing to reciprocal migration eastward and westward. For different views by geologists and biologists as to the time and mode of migration of these groups, the literature quoted in 27 should be studied.

38. Another element which makes its presence felt, especially on the W coast, which is the headquarters of all the peculiar groups in the Irish flora, is the Arctic-alpine. The alpine flora of Ireland is in general poor, but in the W especially certain plants characteristically alpine on the Continent become abundant down to sea-level (66-69). *Dryas octopetala* (Plate 20), *Arctostaphylos Uvaursi*, *Gentiana verna* (Plate 23), *Euphrasia salisburgensis* (Plate 27) may be mentioned as examples. And so, when studying the flora of W Ireland, we are dealing with a startling mixture of types, not to be found elsewhere in the British Islands or in Europe. The pool from which we gather the American *Eriocaulon* is fringed with Pyrenean *Erica*. The cracks which are filled with the delicate green foam of *Adiantum* (Plate 24) are set in *Arctostaphylos* and *Gentiana, verna*; *Neotinea intacta*, far from its Mediterranean home, sends up its flower-spikes through carpets of *Dryas* (Plate 2); and *Dabeocia* and *Juniperus sibirica* straggle together over the rocky knolls.

Relict and Incipient Species.

39. Assuming, as seems justified, that very limited range mostly signifies either incipient or relict distribution, we may analyse the single-station plants of Ireland, and by taking cognisance of their general range in Europe, attempt to determine where are the head-quarters from which they are advancing or the last refuges to which they are retreating; the single-station plants we may believe to be either the latest corners, or else the last remaining indication of former wider range. For this purpose we leave out of account plants in any way critical, of which the full range may not yet be determined: also any which are under suspicion of owing their presence to man. We find that of 21 plants so selected . . .

twelve are northern in their general range, namely:–

<i>Arenaria ciliata</i>	<i>Saxifraga nivalis</i>
<i>Geranium pratense</i>	<i>Epilobium alsinifolium</i>
<i>Geranium sylvaticum</i>	<i>Pyrola rotundifolia</i>
<i>Astragalus danicus</i>	<i>Carex pauciflora</i>
<i>Lathyrus maritimus</i>	<i>Carex fusca</i>
<i>Rubus chamaemorus</i>	<i>Carex magellanica</i>
Only four are southern:-	
<i>Trifolium subterraneum</i>	<i>Euphorbia Peplis</i>
<i>Erica Mackaii</i>	<i>Simethis planifolia</i>
And five have a general range:-	
<i>Ranunculus fluitans</i>	<i>Scirpus triqueter</i>
<i>Helianthemum chamaecistus</i>	<i>Phegopteris robertiana</i>
<i>Adoxa. Moschatellina</i>	

If we take plants of somewhat wider Irish range, which either occupy a rather limited continuous area or have not more than two or three separated stations, we add 35 more. Of these nine have a distinctly northern range outside Ireland:–

<i>Arabis petraea</i>	<i>Carex paradoxa</i>
<i>Potentilla fruticosa</i>	<i>Carex elongata</i>
<i>Alchermilla alpina</i>	<i>Calamagrostis epigejos</i>
<i>Pyrola secunda</i>	<i>Poa alpina</i>
<i>Melampyrum sylvaticum</i>	

while no less than 16 are of southern type:–

<i>Matthiola sinuata</i>	<i>Erica mediterranea</i>
<i>Helianthemum guttatum</i>	<i>Dabeocia polifolia</i>
<i>Helianthemum canum</i>	<i>Microcala filiformis</i>
<i>Arenaria verna</i>	<i>Sibthorpia europma</i>
<i>Trifolium glomeratum</i>	<i>Pinguicula grandiflora</i>
<i>Saxifraga geum</i>	<i>Colchicum autumnale</i>
<i>Diotis maritima</i>	<i>Carex divisa</i>
<i>Arbutus unedo</i>	<i>Glyceria foucaudii</i>

leaving six which are neutral in this respect:–

<i>Elatine hydropiper</i>	<i>Ajuga pyramidalis</i>
<i>Spiraea filipendula</i>	<i>Asparagus maritimus</i>

The first northern list, and to a less extent the second, is rich in alpine plants which are clearly relict from Glacial or Subglacial times. "Disintegration of area" is in some cases – e.g., *Potentilla fruticosa* – evident far beyond their Irish territory*. Presumably the Neolithic climatic optimum seriously affected them, and many are now in Ireland on the verge of extinction – for instance, *Lathyrus maritimus*, *Rubus chamaemorus*, *Saxifraga nivalis*, *Carex fusca* (? already gone) – whose solitary Irish station can in each case now be reckoned in square yards. Other plants whose Irish station or stations are far removed from the nearest adjoining one, whether in Ireland or in Britain – e.g., *Astragalus danicus*, *Epilobium alsinefolium*, *Calamagrostis epigejos* – are no doubt also relict. But some others, whose Irish stations adjoin those in Britain, are probably incipient natives of recent arrival. The best examples are a NE group of Scottish immigrants – *Geranium pratense*, *G. sylvaticum*, *Melampyrum sylvaticum*, etc. (See also 43.) The Dublin area supplies good similar examples in *Senecio erucifolius* and *Lamium galeobdolon*, and some of the south-eastern plants, such as *Juncus acutus*, also suggest incipient colonization.

* See for instance G. DRUCE in *New Phytologist*, 1913, 245.

The same explanations suggest themselves as regards the southern groups. Those members of the SW or Lusitanian group which are included in the table in 35 are to my mind clearly relict. Vanishing species also are *Euphorbia peplis* (apparently gone), *Matthiola sinuata*, *Diotis maritima*. Probably relict, in view of the wide gap between their Irish and next stations, are also *Helianthemum chamaecistus*, *H. guttatum*, *H. canum*, *Glyceria foucaudii*, etc. Beyond these few suggestions it does not seem very safe to go.

In viewing these facts, it should be remembered that a number of other species have a wider range in Ireland than in Britain, whence they must have come to us. A list of some of these is given elsewhere (34). Whether the present disproportion is due to decrease in England or to more suitable conditions prevailing in Ireland is difficult to guess. Possibly they should rank in Ireland as incipient species in an advanced stage of success, possibly as decaying species in Britain, possibly as both.

40. SUMMARY. – We may summarize the foregoing paragraphs as follows:– the leading feature of the Irish flora as compared with that of Britain is its great reduction, about one-third of the flora of Britain failing to re-appear in Ireland. Among those plants which have colonized Ireland, there are notable examples of species which have not succeeded, and appear near extinction, or which, arriving recently (in a comparative sense), have not yet had time to extend their range. There are others which have achieved conspicuous success in Ireland, so that they are here actually or relatively more abundant than in Britain. Finally, there is a number of species in Ireland not found in Britain. These belong especially to southern (mostly Pyrenean) and to north-western (N. American) immigrations, both of which have affected also to a slight extent the flora of Britain and the adjoining parts of Europe.

DISTRIBUTION OF PLANTS WITHIN IRELAND

41. In Ireland two general types of distribution govern the flora*. The first is primarily edaphic in character, caused by the general geological structure of the country – a central plain of limestone surrounded by groups of hills formed of non-calcareous rocks. This produces a Central and a Marginal type. The Central plants are largely calcicole species, inhabiting dry ground, marshes, and lakes; a few belong to the great peat bogs. Characteristic members of this group are:–

Ranunculus circinatus	Gentiana Amarella
Stellaria glauca	Tecrium Scordium
Rhamnus catharticus	Orchis morio
Myriophyllum verticillatum	Ophrys apifera
Sium latifolium	Ophrys muscifera
Carlina vulgaris	Potamogeton coloratus
Crepis taraxacifolia	Chara aculeolata
Andromeda Polifolia	Chara tomentosa

* R. LL. PRAEGER: "On Types of Distribution in the Irish Flora." Proc. Roy. Irish Acad. 24 B, 1-60, 1902.

An interesting feature in connection with this group is the tendency of a number of its members to extend their boundaries in a NE direction, forming an arm as far as Lough Neagh. This appears to be due to an absence of hill-barriers in that direction, combined with NE extension of the Carboniferous limestone almost to the shores of that lake. Similarly a few penetrate SW into Kerry. The plants of Marginal distribution (other than halophytes, which have no choice), while of homogeneous range, are of heterogeneous habitat; they comprise many alpine and montane species, and many of calcifuge tendency; also some xerophytes for which the light or sandy soils found near the sea are an attraction. Representative species are :-

Cerastium tetrandrum	Filago minima
Hypericum elodes	Hieracia
Radiola linoides	Jasione montana
Erodium moschatum	Scleranthus annuus
Trifolium striatum	Salix herbacea
Trifolium arvense	Carex dioica
Vicia sylvatica	Milium effusum
Sedum roseum	Lycopodium alpinum
Callitriche intermedia	Nitella translucens

42. The other general type of distribution, which is partly due to topography, partly in all probability to the general direction of Postglacial immigration, and largely climatic, tends to produce isophytic boundaries running NE and SW, as suggested by fig. 8. In this connection fig. 4 should also be borne in mind, where both summer and winter isotherms are seen to follow similar directions, at least on the W coast. Precipitation also, in a broad sense, follows corresponding lines (fig. 6). See 47.

North – western Plants.

The plants of general northern and alpine range (Watson's "Scottish" and "Highland" types, the former especially), while concentrated in northern Ulster, run down the W coast in much larger

numbers than down the E, though the E possesses plenty of high ground and a lower winter temperature. Examples of such range are:—

	Watsonian type.	Irish range.
<i>Silene acaulis</i>	H	Derry, Don., Leit., Sligo, Mayo.
<i>Saxifraga oppositifolia</i>	H	Derry, Don., Leit., Sligo, Mayo, Galway.
<i>Saxifraga aizoides</i>	H	Antrim, Don., Ferm., Leit., Sligo.
<i>Callitriche autumnalis</i>	S	Mainly in the N. and NW.
<i>Circa alpina</i>	S - H	Ulster (exc. Cavan and Mon.), Louth, Leit., Sligo.
<i>Hieracium lasiophyllum</i>		Down, Antrim, Derry, Don., Ferm., Galway.
<i>Pyrola media</i>	S	Down, Antr., Derry, Tyr., Ferm., Don., Sligo, Leit., Mayo. Clare.
<i>Lamium molucellifolium</i>	S	Mainly in the N. and NW.
<i>Salix phylicifolia</i>	S - H	Antr., Derry, Don., Leit., Sligo, Mayo.
<i>Potamogeton filiformis</i>	S	N. half of Ireland, mainly western.

Very few “Scottish” or “Highland” plants can be found which prefer the E coast.

43. The presence in Ulster only (with head-quarters in Antrim) of a number of species mostly “Scottish” in their distribution in Britain, strongly suggests direct and probably recent colonization from Scotland. Examples are :—

	Watsonian type.	Irish range.
<i>Ranunculus fluitans</i>	English	Antrim.
<i>Trollius europaeus</i>	Scottish	Donegal, Fermanagh.
<i>Geranium sylvaticum</i>	Scottish	Antrim.
<i>Geranium pratense</i>	British – Eng.	Antrim.
<i>Rubus chamaemorus</i>	Highland	Tyrone.
<i>Ligusticum scoticum</i>	Scottish	Don., Derry, Antrim, Down.
<i>Pyrola secunda</i>	Scottish	Ferm., Antrim, Derry.
<i>Melampyrum sylvaticum</i>	Scottish	Antrim, Derry.
<i>Equisetum pratense</i>	Scottish	Ferm., Don., Antrim.

On the E side of Ireland we find no corresponding group of “English” type plants of limited range save species confined to the coast. The bulk of the “English” and “British” plants have swept right across Ireland. The “British” plants are everywhere, each of the forty Irish Divisions possessing 90 to 100 per cent. of the species present in this country. The “English” plants, also very widespread, show some tendency to decrease towards the NW, especially in inland areas.

44. As regards the maritime flora, it is worthy of note that a number of plants which are by no means confined to the coast in Britain are essentially or exclusively maritime in Ireland. These are largely but not entirely “English” plants, widespread especially on the light soils which prevail in S England. In Ireland they are found mainly on the E side (“E” in the last column of the succeeding table), but some range round the whole coast (“EW”). Those marked * have also one inland station, and those marked ** two, mostly on lake shores. The second column indicates the Watsonian type of distribution in Britain.

<i>Cerastium semidecandrum</i>	BE	EW
* <i>Sagina subulata</i>	SB	W
<i>Trigonella ornithopodioides</i>	E	E
<i>Trifolium subterraneum</i>	E	E
<i>Trifolium arvense</i>	BE	EW
<i>Trifolium striatum</i>	E	E
<i>Trifolium scabrum</i>	E	E
<i>Trifolium glomeratum</i>	E	E
** <i>Trifolium fragiferum</i>	E	EW
<i>Ornithopus perpusillus</i>	BE	E
<i>Vicia lathyroides</i>	BE	E
<i>Oenanthe lachenalii</i>	EB	EW
<i>Plantago coronopus</i>	B	EW
** <i>Carex distans</i>	B	EW

45. There is a group of East Coast species, largely maritime, which tends to range S rather than N. Exclusive of these, there is a fairly well-marked group with headquarters in the S, which tends to range up the E coast more than the W. Examples of the latter group are :-

	Watsonian type	Irish type
<i>Linum bienne</i>	A - E	Kerry to Boyne, Limk., Clare.
<i>Wahlenbergia hederacea</i>	A	Kerry, Cork, Wexf., Wickl., Dubl., Mayo.
<i>Erythraea pulchella</i>	E	Cork, Waterf., Wexf., Dubl., Leix.
<i>Orobanche major</i>	S - A	Cork, Wexford, Wicklow.
<i>Salvia horminoides</i>	G - L	Coast Cork to Louth, Kilk., Clare.
<i>Juncus acutus</i>	E - A	Cork, Waterf., Kilk., Wexf., Wickl.

It might be thought, in view of what one might call super-Atlantic conditions which find their maximum in Kerry and W Cork, whence they continue with slowly diminishing intensity up the W coast, that a marked group of plants of corresponding range would be found. This is true only in a

general sense. The Lusitanian and American groups as a whole show this range, but individually they display considerable diversity of distribution. Conditions all along the W coast are sufficiently similar to allow a wide dispersal of the W coast species, and as a whole the plants southern in Ireland tend to range up the E rather than the W coast.

46. If we analyze the Irish flora according to Watson's well-known Types of Distribution we do not get far. His classification, based on the range of plants in Great Britain, fails in many respects if applied to Ireland. His "English" group is irregularly spread in this country, showing a general SE trend; "Germanic" plants are almost non-existent here, as might be expected from the definition; the "Scottish" plants are in Ireland northern and western, the "Highland" species the same, but more western and less northern, while "Atlantic" species range all round the coast of Ireland, being rather more plentiful in the S half. But if we take Watson's "English" type as representing broadly the southern element in the Britannic flora, and his "Scottish" plants as representing the northern, we find that the limits of these groups in Britain and Ireland may be represented by rather suggestive curves as shown in the accompanying diagram (fig. 8).

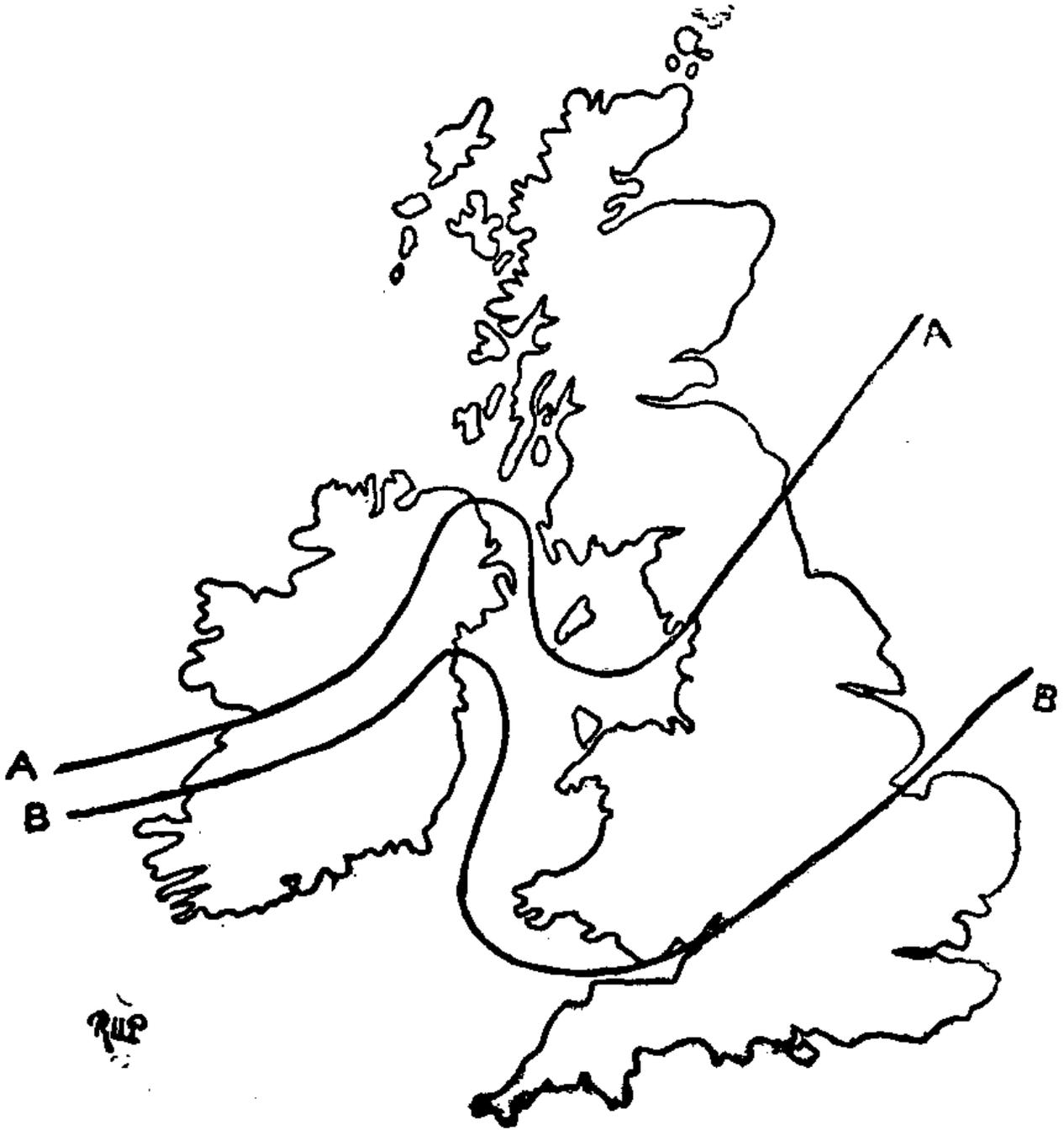


FIG. 8. – ISOPHYTIC LINES IN THE BRITANNIC FLORA.

AA. Northern limit of the “English” flora. BB. Southern limit of the “Scottish” flora.

From Praeger, *Types of Distribution, &c.*, loc. cit.

47. This general NE-SW trend represents a feature which recurs in many connections. It is the direction of the ancient “Caledonian” folding which produced the leading topographical features of Scotland and of much of Ireland; and a glance at a geological map shows that it suggests also the main boundaries of the rocks of the southern half of England. These physical features are reflected in the distribution of the vegetation. Meteorological maps will show that it has besides a considerable climatic significance (see figs. 4, 7). It represents also the main front along which invasion advanced from the SE after the passing away of the ice, spreading W and N from a land-connection in the region of the Straits of Dover, and another across the Irish Sea. Its prevalence in

the distribution of the flora is well shown for Britain in the maps illustrating J. R. Matthews' papers, and for Ireland in a paper of my own.

J. R. MATTHEWS: "The Distribution of certain portions of the British Flora." I-III. *Annals of Bot.* 37, 38, 40 (1923, '24, '26).

R. LL. PRAEGER: "On Types of Distribution in the Irish Flora." *Proc. Roy. Irish Acad.* 24 B, 1-60, 1902.

VEGETATIONAL SUBDIVISIONS.

Woodland

48. The *Pinus* forests that long dominated the Irish landscape gave way to *Quercus*, and the *Quercus* woods under human influence have been replaced largely by grassland, and now are seen only where the ground is unsuitable for pasture. But in certain areas – for instance in Kerry at Killarney and Loo Bridge, in Mayo about Pontoon, in Sligo on Lough Gill, in Wicklow in the Vale of Clara – the aboriginal Oak woods still occupy considerable areas, and may be studied to advantage. The native trees which mix as equals with *Quercus* (usually *sessiliflora*), which is often completely dominant, are *Betula* (frequently) and less often *Fraxinus**. A number of smaller trees often form a lower stratum in the *Quercetum* – *Ilex*, *Corylus*, *Sorbus aucuparia*; and more rarely *Crataegus*, *Populus tremula*, *Taxus*, and about Killarney *Arbutus* (Plate 13); where the *Quercus* is dwarfed, these may equal it in stature and form a mixed wood.

**Ulmus montana*, the only other large indigenous tree, can seldom be claimed as native except on cliffs and rough ground, mostly limestone.

In damp places *Alnus* and *Salices* abound. On the western limestone "craggs" dense *Corylus* scrub is often strongly developed, as along the eastern base of the Burren hills in Clare; it may be accompanied by *Euonymus*, *Cornus*, and the two species of *Rhamnus* (348, 350). In addition to *Quercus*, *Betula pubescens* alone ever forms pure woods, as at Correl Glen in Fermanagh (438) and near Pontoon in Mayo (374), Mixed woods usually include a good deal of planted trees, particularly *Pinus sylvestris* and *Fagus sylvatica*. The native woods of the hills are being replaced largely by *Pinus*, *Picea*, and *Larix* under the aegis of the Forestry Department. Some of the exotic trees, particularly *Pinus*, *Fagus*, and *Acer Pseudoplatanus*, seed freely and tend to extend their boundaries. The ground-flora varies, that of acid soils being the more pronounced, often with a great abundance of *Scilla nonscripta*, *Vaccinium Myrtillus*, *Luzula sylvatica*, *Melampyrum pratense*, and a profusion of ferns. The saprophytic and parasitic flora of old forests is poorly represented in Ireland. Many even of the English members of these groups are missing, and *Neottia*, *Monotropa*, and *Lathrec* are here in sole possession. Among the few other essentially old forest species of Ireland are *Cephalanthera ensifolia*, *Milium effusum*, *Festuca sylvatica*, *Pyrola media*, *P. minor*.

Descriptions of different types of native woodland will be found below, as in 266, 312, 313, 320-2, 348-9, 362, 372, 374, 420, etc.

48 a. The history of Irish forests has not yet been fully worked out. For the earlier (Postglacial) periods, Erdtman has supplied some information by means of pollen analysis. While this method is invaluable for historical purposes, in tracing the changes of vegetation in successive strata, its results, when applied geographically, have to be interpreted in a broad sense, since pollen may be and is carried for long distances by wind. For instance, *Tilia* pollen has been obtained in Ireland,

though it is very doubtful if any species of Lime was ever a native of Ireland. Augustine Henry has made useful contributions to the subject as regards medieval times (Louth Archteol. Journ., 3, 237-245). A good discussion of Irish woods in relation to early human influence will be found in the paper by A. C. Forbes already quoted (28). For the study of the more recent developments in this matter, and especially the question of the, introduction of exotic trees of various kinds into Ireland, the best material is another paper by A. C. Forbes*. He finds that the Church was probably the earliest planter of trees in Ireland, as far back as the 15th century, *Taxus* being the tree mostly used. The laying down of plantations did not take place on an appreciable scale, he demonstrates, until the 18th century, and then chiefly in conjunction with the creation and improvement of demesnes. The present tendency in tree planting is that of using Western American conifers in place of European species. This, he states, will undoubtedly alter the appearance of the country during the present century.

A. C. FORBES: "Tree Planting in Ireland during Four Centuries." Proc. Roy. Irish Acad. 41 C 168-199. 1933.

While State planting is not proceeding nearly so quickly as was envisaged by the Irish Forestry Committee of 1908, and while owing to the breaking up of estates under the Land Commission and unsatisfactory general financial conditions private planting has steadily declined, nevertheless in many parts of the country dense areas of conifers are replacing natural *Quercus* and *Betula* woods, and tracts of rough pasture and heath, all to the detriment of the indigenous flora.

49. The tree-limit is extremely variable, on account of the accentuated effect of aspect caused by the prevalence of strong westerly winds. Along the exposed W coast it is at sea-level, but shelter at once raises it to from 600 to 800 ft. even in Kerry, as about the Upper Lake of Killarney. On sheltered slopes in the E it may lie at about 1200 ft. or more, but the natural Baumgrenze is seldom seen on account of cutting, planting, enclosing, and grazing. As mentioned above (28), it has shifted both eastward (in the west of Ireland) and downward since the climatic optimum of Neolithic times, and may be descending still. In the extreme west, intensive grazing has combined with deterioration of climate to reduce arboreal vegetation to the condition of rare stunted bushes; and in some districts it is only on cliffs and on islets in lakes that trees are seen at all. Grassland.

50. There is a good deal of evidence to show that considerable areas in Ireland were never under forest, but have been occupied by a grassy vegetation throughout the Postglacial period. This appears to be true especially of the centre and west. A progressive change in the composition of the grassland flora may be noted as one passes across Ireland from the rich pastures of Dublin and Meath, growing on deep soil derived from a thick mantle of calcareous Boulder-clay, to the rock-pastures which fringe Galway Bay. In the former areas – for instance, around the famous Hill of Tara, the ancient residence of the kings of Ireland – the grass is dense and luxuriant, and harbours a quite limited number of other plants; while in the vilest the grasses of the cragland are mixed with a nongramineous flora rich in numbers and variety, and of high botanical interest (344, 346, 352, etc.). Over large areas in the centre the subsoil is wet, as along the Shannon, and deep meadow-land prevails, with an admixture of paludal species – *Orchidacete*, *Juncacete*, and so on – often a quite rich flora. The vegetation of a very flat area liable to flooding, near Monasterevan, is described in 239. The basalts of Antrim weather into a deep rich clay, with heavy grass; the Coal-measures likewise, but poor, and their rushy calcifuge vegetation is mostly monotonous in the extreme. The Silurian slates of the NE yield a light loam which produces a short sward, with much *Agrostis tenuis*, *Aira caryophyllea*, etc., and a flora limited in variety.

51. An average low-level old grassland, well-drained, not particularly calcareous nor the reverse, gave the following list of plants :

Ranunculus acris	Hypochaeris radicata
Ranunculus bulbosus	Centaurea nigra
Lotus corniculatus	Veronica chamaedrys
Trifolium pratense	Prunella vulgaris
Trifolium repens	Plantago lanceolata
Potentilla anserine	Rumex acetosa
Potentilla sterilis	Orchis maculata
Heracleum sphondylium	Briza media
Pimpinella saxifraga	Anthoxanthum odoratum
Galium verum	Cynosurus cristatus
Chrysanthemum leucanthemum	Dactylis glomerata
Achillea millefolium	Holcus lanatus
Senecio jacobaea	Festuca rubra
Cnicus palustris	Agrostis tenuis
Cnicus pratensis	

This was a pasture with a foot of soil overlying flattish esker material containing a good deal of limestone, resting on Silurian rock, a mile west of Dunlavin in Wicklow.

Peat – Bog

52. More than one-seventeenth of the whole area of Ireland is returned as being covered with peat-bog. While mountain bog accounts for a fair share of this, the greater part lies on the lowlands, forming the “red bogs” of the Central Plain. The question of the date and growth of the peat-bogs has already been mentioned (28). While on the mountains decay is often manifest, and the peat and its flora are in places being destroyed by wind and rain, on the plain, while growth has often practically ceased, the only enemy is man; turf-cutting is slowly reducing the characteristic flora, first by drainage and then by the obliteration of the bog by turf-cutting. In areas where bogs were few, as in Dublin and Down, the bog flora is almost extinct; but over the greater part of Ireland it is still abundant and highly characteristic of the country.

The mountain bogs differ from the “red bogs” chiefly in their better drainage and its effects, the most conspicuous of which is the stronger growth of Calluna; but where the mountain bogs are flattish, with pools, the difference in flora is less, and plants like Andromeda, Oxycoccus, Rhynchospora alba, Schoenus and Carex lasiocarpa, typical members of the vegetation of the lowland bogs or swamps, may come up from the plain and colonize them at 1000 to 1500 feet.

53. The great red bogs are very interesting, and form a remarkable feature in the Central Plain. Rising from the edges to the centre, like inverted saucers, they present brown, treeless, smooth tracts, 15 to 25 ft. higher than the surrounding farm-land. Their edges have almost invariably been nibbled into by man, and a floor of peat is often left, used for drying and stacking turf, on which the

bog flora has been temporarily destroyed. *Rumex acetosella*, *Holcus mollis*, *Agrostis tenuis* colonize this ground; and on rougher parts *Digitalis* and other characteristic calcifuge species, *Betula alba* (*verrucosa*), *Lastrea spinulosa*, *Osmunda* are often abundant*. Turf-cutting drains to a greater or less extent the fringe of the bogs, and encourages the growth of *Calluna*, while injuriously affecting most of the bog species. Beyond this influence, we get the characteristic bog flora; *Calluna*, though stunted, is usually dominant; *Erica Tetralix*, *Scirpus ccespitosus*, *Narthecium*, *Eriophorum vaginatum*, *E. angustifolium* are abundant, with much *Sphagnum*, among which ramble the straggling stems of *Andromeda* and *Oxycoccus*; and often bosses of *Racomitrium uliginosum*. The shallow sinuous pools and depressions are full of *Sphagnum*, *Rhynchospora alba*, *R. fusca*, the three species of *Drosera*, *Menyanthes*, *Utricularia minor*, *Carex limosa**.

* See J. M. WHITE: "Re-colonization after Peat-cutting." *Proc. Roy. Irish Acad.* 39 B 453-476, Pl. V-IX. 1930.

* See also *Irish Top. Bot.*, pp. xxx-xxxii.

The bogs display here and there, in the midst of their typical vegetation, colonies of relict plants revealing a former condition of the now uniform flora. Thus thin *Phragmites*, *Cladium*, *Jitneys subnodulosus*, or *Carex lasiocarpa* growing on the bog betray the sites of former lakelets.

Sometimes a marked change of vegetation occurs over a limited area which shows perhaps the site of a swallow-hole in the limestone under the bog or other cause of better drainage and less acid and saturated conditions. For instance, among the stunted flora of the large bog where *Sarracenia* flourishes near Termonbarry in Roscommon (380) is a sudden patch of tall *Calluna* and *Lastrea spinulosa* 3 ft. high, with *Salix aurita*, *Rubus idaeus*, *Menyanthes*, *Cnicus palustris*, *Athyrium*, *Lastrea Filix-mas*, *L. aristata*, *Andromeda*, *Eriophorum*, *Anthoxanthum*, *Holcus lanatus* – a rather peculiar assemblage.

54. Lists showing the flora of typical small areas of some selected bogs in different parts of the country may be of interest.

Extensive Bog one mile north of Newbridge, Kildare.

This bog represents the most easterly extension of the typical Central Plain "red bogs." It had a smooth wet surface with many shallow *Rhynchospora*-filled depressions.

Calluna dominant, with much *Eriophorum vaginatum*, giving a grassy surface. Also:–

<i>Sphagna</i> , c.	<i>Aulocomnium palustre</i> , f.
<i>Rhynchospora alba</i> , c. in pools	<i>Drosera anglica</i> , r.
<i>Erica Tetralix</i> , f.	<i>Eriophorum angustifolium</i> , r.
<i>Narthecium ossifragum</i> , f.	<i>Scirpus caspitosus</i> , r.
<i>Drosera rotundifolia</i> , f.	<i>Cladonia</i> , r.

The cut-away fringe was invaded by luxuriant *Juncus effuses*, *Lastrea aristata*, *L. spinulosa*, and *Pteris*.

It will be noted that two of the most abundant plants of the Central Plain bogs – *Andromeda* and *Oxycoccus* – are absent here in the east.

Bog near Killashee, Longford. Very smooth surface, with great abundance of *Rhynchospora alba*.

<i>Rhynchospora alba</i> , v.c.	<i>Drosera rotundifolia</i>
<i>Calluna vulgaris</i> , v.c.	<i>Drosera anglica</i>
<i>Narthecium ossifragum</i> , v.c.	<i>Andromeda polifolia</i>
<i>Rhynchospora fusca</i> , c.	<i>Scirpus caespitosus</i>
<i>Erica tetralix</i>	<i>Carex diversicolor</i>
<i>Eriophorum angustifolium</i>	<i>Lycopodium selago</i>

Bog near Frankford, Offaly. Flora poor and stunted, apparently dying out.

<i>Calluna vulgaris</i>	<i>Eriophorum angustifolium</i>
<i>Scirpus caespitosus</i>	<i>Narthecium ossifragum</i>
<i>Erica tetralix</i>	<i>Drosera rotundifolia</i>
<i>Eriophorum vaginatum</i>	<i>Rhynchospora alba</i>

Monmor Bog, Clare. Extensive bog. Surface smooth, with low grassy vegetation. Fully exposed to the Atlantic.

<i>Calluna vulgaris</i> , c.	<i>Erica tetralix</i> , f.
<i>Narthecium ossifragum</i> , c.	<i>Drosera</i> , 3 species.
<i>Rhynchospora alba</i> , c.	<i>Menyanthes trifoliata</i>
<i>Eriophorum vaginatum</i> , c.	<i>Orchis maculata</i>
<i>Cladonia rangiferina</i> , c.	<i>Scirpus caespitosus</i>
<i>Campylopus fragilis</i> , c.	<i>Sphagnum</i> spp.

No pools, and hence absence of *Rhynchospora fusca*, etc. Great uniformity of vegetation. Occasional patches of *Myrica* and *Molinia*. *Large Bog by Cashen River, N. Kerry.*

<i>Myrica gale</i> dom.	<i>Erica tetralix</i> , f.
<i>Rhynchospora alba</i> dom.	<i>Orchis maculata</i>
	<i>Schoenus nigricans</i>
<i>Narthecium ossifragum</i> , v.c.	<i>Molinia caerulea</i>
<i>Drosera</i> , 3 species, c.	<i>Cladonia</i>
<i>Eriophorum</i> , 2 species, f.	<i>Sphagna</i>

The frequent great abundance of *Myrica* is a characteristic feature of the Kerry bogs. Analysis of bog vegetation in Connemara, where *Molinia* moor is the prevailing type, will be found elsewhere (387): and an extended study of the same is in the paper quoted in 385. Some notes on the bog flora of the Dublin mountains appear in PETHYBRIDGE and PRAEGER: "The Vegetation of the District lying south of Dublin" (Proc. Roy. Irish Acad., 25 B 124-180, pl. vii-xi, coloured map). Other useful notes will be found in A. G. TANSLEY and others: "The British Vegetation Committee's Excursion to the West of Ireland" (New Phytol., 1908, 253-260); and R. LI. PRAEGER: "The Flora of Achill Island" (Irish Nat., 1904, 272-3). 55. Where bogs become the site of colonies of breeding gulls a remarkable change in the flora may occur, the trampling and guano of the birds killing out the natural vegetation, their place being taken by a rank vegetation brought by the birds in their crops or on their feet. A study of this as exemplified by a great colony of Black-

headed Gulls on a bog near Tullamore in Offaly will be found in “Irish Naturalist,” 1894, 175. **56.** The flora of bogs and of their vicinity is sometimes altered by the interesting phenomenon of bog-slides or bog-bursts, whereby a portion of a bog may suddenly discharge its lower semi-liquid portion, leaving the upper crust much fissured and drained, if not actually removed; the ejected material being deposited in a viscid layer at lower points. The chief effect of this occurrence is to encourage the growth of Calluna on the affected area of the bog owing to the improved drainage, and the sites of former flows can be sometimes plainly seen in flattish saucer-shaped depressions with a rough surface and increased amount of Ling. Where farm-land has been covered by the flowing peat, this has been cut for fuel as soon as it has consolidated, and the land restored to its former use.

Ireland is pre-eminently the country of bog-flows, a greater number being recorded from Ireland alone than from the rest of the world. An account of the most catastrophic slide which has happened, with a summary of previous occurrences of the kind, will be found in PRAEGER and SOLLAS: “Report of the Committee . . . to investigate the recent Bog-flow in Kerry” (Sci. Proc. Roy. Dublin Soc., n.s. 8, 475-508, pl. xviii–xix, 1897). Reference may also be made to PRAEGER: “A Bog-burst seven years after” (“Irish Nat.,” 1897, 20) and “Report on the recent Bog-flow at Glencullin, Co. Mayo,” by A. D. DELAP, A. FARRINGTON, R. LLOYD PRAEGER, and L. B. SMYTH, in Sci. Proc. Roy. Dublin Soc. 20, 181-192. 1932.

Marshes. **57.** Before systematic draining dried the land, marshes and swamps occupied much of the surface of Ireland. The deposits of the Ice Age, laid down on the flatter areas irrespective of the previous drainage system, tended to the production of much standing water in the form of shallow lakes. The silting up of these, owing to the formation of marl, accumulation of detritus brought by streams, and vegetable growth, produced many areas of marsh, of which a considerable part still remains, especially in the Central Plain. The wetter undrainable portions form one of the few sanctuaries of an undisturbed flora, since cattle cannot readily penetrate, and they often yield a number of rare plants. The substratum may be acid or alkaline, but it is the marshes on the limestone which yield the more varied and more interesting flora. The presence of lime in wet grassland is mostly made conspicuous at once by the replacement of *Juncus effusus* by *J. inflexus* and *J. subnodulosus*; with them are often much *Parnassia*, *Cnicus pratensis*, *Orchis maculata*, *Gymnadenia conopsea*, *Platanthera bifolia*, *P. chlorantha*, *Selaginella*; and when the meadow degenerates into marsh, limy or boggy, a taller, coarser vegetation comes in – much *Schoenus*, *Carex lasiocarpa*, *C. acutiformis*, with colonies of *Thalictrum flavum*, *Lysimachia vulgaris*, *Epipactis palustris*, and sometimes the rare *Lathyrus palustris*. The edges of pools, which gleam white in summer with limy incrustation, are tenanted by tall groves of *Cladium* and *Phragmites*, while in the water *Ranunculus circinatus*, *Potamogeton coloratus*, *Chara aculeolata*, are characteristic species, often heavily incrustated with lime. To give an extreme example, Lough Cloughballymore, 2 miles N of Kinvarra on Galway Bay, consists, in summer at least, of a flat expanse of pinkish limy mud set with stools of *Schoenus*, patches of thinly spread *Cladium* and *Phragmites*, and occasional clumps of *Carex Hudsonii*, and scarcely any other vegetation.

By some small lakes on the limestone in S Clare, the change from ordinary pasture to water some four ft. in depth was indicated by the following succession of index plants :–

Juncus inflexus	
Iris pseudacorus	
Juncus subnodulosus	

Schoenus nigricans	
Carex lasiocarpa	
----- -----	Water Level..
Carex inflata	
Phragmites communis	
Sparganium ramosum	
Typha latifolia	
Equisetum limosum	
Nuphar lutea	

In some places in the Central Plain, vegetation has not yet succeeded in colonizing the stretches of marl left bare by drainage, and the latter still extends white and bare, covered along its margin by black peat. Phragmites is usually the first plant to invade it, growing dwarf and sparse.

Around Lough Neagh, marshy land mostly flooded in winter by alkaline or neutral water produces well-marked fen, the flora of which has been lately the subject of careful study*.

* J. SMALL: "The Fenlands of Lough Neagh." Journ. Ecol. 19 383-388, 1931. T. M. WHITE: "The Fenlands of North Armagh." Proc. Roy. Irish Acad., 40 B 233-283, P1. VI. 1932.

58. Ireland is essentially a country of lakes, varying from lowland pools or mountain tarns to Lough Neagh, the most extensive area of fresh water in Ireland, and larger than any in Britain. Their number is to be reckoned in thousands rather than hundreds, and in some areas – SW Connemara, the Rosses in Donegal, and the valley of the Erne – there are bewildering networks of land and water. The flora of most of the larger lakes is dealt with in the Topographical Part. In general, it may be said that the pH factor is usually of much importance in relation to the flora. Certain aquatic species are essentially calcicole: *Ranunculus circinatus*, *Potamogeton coloratus*, *Chara aculeolata*, *C. tomentosa*, are seldom or never seen save in alkaline water. On the other hand, *Elatine hexandra*, *Callitriche intermedia*, *Lobelia Dortmanna*, *Juncus bulbosus*, *Potamogeton polygonifolius*, *P. obtusifolius*, *Isoetes lacustris*, *Nitella translucens*, show a marked preference for acid waters. As a consequence, the former group shows in Ireland a decidedly "Central" range, and the latter a decidedly "Marginal" one (41).

The largest lake, Lough Neagh, very open, with shores often sandy, and fed by both acid and alkaline rivers, has a flora peculiar in several respects (463). Most of the major lakes – Loughs Corrib, Mask, Conn, Derg, Ree, Erne, as well as the Lower Lake at Killarney and the lakes a Westmeath, lie mostly or wholly on the limestone; Lough Allen is a notable exception. But many hundreds of smaller lakes, as in Kerry, W Galway, W Mayo, Donegal, Down, Cavan, lie on non-calcareous rocks. They produce a flora which is not encrusted with lime, unlike that of the limestone lakes, and which is much richer in Charophyta, often beautifully clean. Very little dredging has so far been done in any of the Irish lakes, and no doubt the discovery of some new plants and the extension of the range of others will ensue when this has been carried out.

Of special interest is the flora of the turloughs, the lakelets lying on the driftless fissured limestones of the west, which fill in rain and are empty in dry weather. A note on their vegetation is given later (360).

The Calcicole Flora.

59. The calcicole flora finds its best expression on the limy gravels of the eskers of the Central Plain (240-3) and on the limestone crag-lands of the west (346, 352, etc.). Some of the characteristic plants re-appear on the basalts of the NE (455), and limy sea-sands often enable these or others to extend their range far over the non-calcareous rocks, as in S Connemara (386). The ice of Pleistocene times has sometimes pushed calcareous material far over the boundary of the acid rocks, as on the northern slopes of the Dublin mountains (235, 268); and the converse phenomenon also occurs.

On the eskers and limestone pavements of the centre and west the most characteristic and abundant species include *Arabis hirsuta*, *Poterium Sanguisorba*, *Galium sylvestre*, *Asperula cynanchica*, *Antennaria dioica*, *Carlina*, *Blackstonia*, *Gentiana Amarella*, *Ophrys apifera*, *O. muscifera*, *Gymnadenia conopsea*, *Sesleria*. The limy marshes and pools, often lying on thick soft calcareous white marl, have also a flora which includes many calcicole plants – *Ranunculus circinatus*, *Thalictrum flavum*, *Stellaxia glauca*, *Lathyrus palustris*, *Myriophyllum verticillatum*, *Galium uliginosum*, *Epipactis palustris*, *Juncus inflexus*, *J. subnodulosus*, *Potamogeton coloratus*, *Scirpus pauciflorus*, *Carex acutiformis*, *C. Pseudo-Cyperus*, *Chara aculeolata*. The following are also characteristic of the limestones of the Central Plain:– *Hypericum perforatum*, *Geranium lucidum*, *Rhamnus catharticus*, *Euonymus*, *Anthyllis*, *Sorbus Aria segregata*, *Erigeron acris*, *Leontodon hispidus*, *Centourea Scabiosa*, *Primula veris*, *Origanum*, *Anacamptis pyramidalis*, *Orchis morio*, *Trisetum*, *Avena pubescens*; many of these are also widely if thinly spread over much of Ireland, finding a sufficiency of alkalies in local sources, on sea sands, and so on.

It may be noted that while distinctly calcicole in Ireland, many of these plants would not enter into this category in countries on the Continent, and some not even in England. This is a well-known phenomenon, due presumably to the fact that with increase of precipitation neutral soils tend to become acid owing to the accumulation of humus compounds, driving basiphilous and neutrophilous plants to the limestone in order to escape from inimical edaphic conditions. (See also 61.)

The penetration into outlying limestones or limy-soil areas by the characteristic Central Plain flora offers some points of interest. Two of the most marked cases are the Killarney lakes and E Down. Killarney (320) and the band of limestone that zigzags northward from it is cut off from the broken-up edge of the Central Plain limestones by a minimum of 20 miles of hilly Coal-measures and Devonian slates: E Down (477) has 40 miles of Silurian slates between it and the nearest tongue of the main area of Carboniferous limestone, and only a quite small and local outcrop of this rock; yet both possess a number of the most characteristic calcicoles of the Central Plain flora (see 322, 477). The converse is seen in the much commoner phenomenon of the presence of a characteristic calcifuge flora on even quite small outcrops, from under the limestone, of slates or sandstones, as is well exemplified in the minor foldings in the southern portion of the Central Plain, where inliers of this nature are frequent. These cases merely illustrate the dictum of A. R. Wallace, that plants have migrated long enough to have been carried to all suitable localities, and the determining factor in their distribution is to be found in their power of adaptation to their new conditions.

The continuity of the calcicole flora in the Central Plain is much obscured by the abundance of peat-bog on the limestone, with its essentially calcifuge flora. Distribution-maps of species, say by counties, may thus be very misleading, just as the presence of limy shell-sands in areas of acid rocks upsets the continuity of the calcifuge flora when mapped except in a very detailed manner.

The range of the calcicole flora has been extended, as mentioned below (75), by the use of lime mortar in walls, which has allowed some of the calcicole ferns, for instance, to spread into every part of the country.

The most remarkable calcicole flora in Ireland is that which colonizes the bare limestone “craggs,” “dints,” or “pavements” which stretch with little interruption from Lough Carra in Mayo south to Askeaton in Limerick, and attain their main development in the Burren region of Clare, on the S side of Galway Bay (Plates 19, 23) They yield a number of plants unknown elsewhere in Ireland, and an amazing profusion of some others rare in the country. They offer a surprising mixture of types, from Mediterranean (e.g., Neotinea) to Arctic-alpine (e.g., Dryas). Their flora is dealt with especially in 346, 352, and also in 338, 344, 359-363, 365, etc.

The lowlying parts of this area are characterized by turloughs-depressions in the limestone which fill with water in wet weather by subterranean passages, and empty by the same means. They yield a peculiar flora (characterized especially by *Viola stagnina*), which is referred to in 360.

The Calcifuge Flora.

60. The calcifuge flora occupies a much wider range of geological formations than the calcicole. While the latter attains its main development on the Carboniferous limestone and soils derived from it (the Chalk of NE Ireland being too limited in area to have more than a quite slight effect), calcifuge plants find a home equally on the wide areas of metamorphic rocks (NW and W Ireland), granite; (E especially), Silurian slates (NE), Devonian sandstones and slates (S), and Coal-measure shales (SW, etc.). The Central Plain is in fact ringed round with a calcifuge flora. This is of two types – the, familiar peat flora, found equally in the Central Plain and elsewhere, and the flora of non-calcareous soils, wide-spread outside the Central Plain wherever peat is absent, and occupying in characteristic form the lowlands such as those on N Kerry (Coal-measures), Cork (Devonian), Wexford and Down (Silurian), Donegal (metamorphic). Here we find abundance of:–

Ranunculus hederaceus	Jasione montana
Lepidium heterophyllum	Vaccinium Myrtillus
Raphanus raphanistrum	Digitalis purpurea
Polygala serpyllacea	Stachys arvensis
Spergula vulgaris	Teucrium Scorodonia
Montia fontana	Polygonum Hydropiper
Hypericum humifusum	Rumex Acetosella
Radiola linoides	Juncus squarrosus
Cytisus scoparius	Juncus bulbosus
Cytisus Gallii	Potamogeton
Lotus uliginosus	Juncus polygonifolius
Lathyrus montanus	Scirpus fluitans
Cotyledon umbilicus	Deschampsia flexuosa
Veneris Sedum anglicum	Nardus stricta
Peplis Portula	Blechnum Spicant

Galium saxatile	Athyrium Filix-foemina
Gnaphalium uliginosum	Lastrea aristata
Chrysanthemum segetum	Equisetum sylvaticum
Senecio sylvaticus	

It is to be noted that old woods on the limestone, with a humus soil, tend like bogland to introduce a calcifuge flora as islands. This applies for instance to the occurrence of *Scilla non-scripta* and some of the ferns.

The general change of vegetation observed as one passes from non-calcareous to calcareous soils is illustrated in 472 by contrasting the flora of the NE Silurian area with that of the Carboniferous limestone to the south of it.

Where the drift is absent at the junction of the alkaline and acid rocks, as about Lough Corrib and Lough Mask, the abrupt change of flora may form a very remarkable and striking feature (371). The same phenomenon is seen on a grand scale in the contrasting floras of the N and S shores of the deep indentation of Galway Bay – on one side the brown heath vegetation of the vast bogs of Connemara with its rare *Ericacem*, etc. (385, 386); on the other the gaunt grey limestone hills of Burren with *Sesleria* dominating a gramineous formation, also full of rare and interesting plants (346-350).

61. Sometimes there are found puzzling transgressions between the calcicole and calcifuge floras in areas markedly acid or alkaline as regards their rocks. The presence of a large group of calcicole plants on the metamorphic area of SW Connemara, referred to elsewhere (388), is sufficiently accounted for by the highly calcareous nature of the sea-sands in the vicinity; but the explanation of the presence of *Erica cinerea* and *Calluna* on bare limestone tracts here and there is not so obvious, and, like the other cases quoted below, calls for a series of close observations and chemical experiments not yet carried out. A few other exceptional occurrences of calcifuge plants on limestone, or vice versa, may be quoted:–

At the E base of Keshcorran in Sligo, on drumlins formed of limestone drift lying on the Limestone Plain, *Cytisus*, *Digitalis*, *Blechnum*, *Athyrium*, and other characteristic calcifuge species flourish; here, probably, the lime has been leached out of the soil in which the plants grow (382).

On scarps of Yoredale sandstone in the Carrick district of Fermanagh, *Sesleria*, *Arabis hirsuta*, *Asplenium Rutamuraria*, all conspicuous calcicoles, grow mixed with such calcifuge species as *Vaccinium Vitis-Idcea*, *V. Myrtillus*, *Calluna*, *Erica*, *Digitalis*, and *Blechnum* (438). About New Ross the calcicole *Origanum*, *Sedum acre*, *Ceterach*, and the calcifuge *Erica cinerea*, *Sedum anglicum*, etc., grow together on Gotlandian slates (259). The strongly calcicole *Euphrasia salisburgensis* furnishes other examples (344). Of the Galway – Clare calcicoles, *Neotinea* has been found at Mount Gable near Cong on the metamorphic rocks, and also on the Coal-measures near Ennistymon 6 to 8 miles from the nearest limestone; *Gentiana verna* flourishes on peaty banks on similar shales between Ballyvaughan and Lisdoonvarna, amid a calcifuge vegetation.

Near Corco Gap in Maam Turk *Saxifraga spathularis*, *Athyrium*, and *Blechnum* grow with *Asplenium Rutamuraria* in dry almost soil-less chinks of primitive limestone. On L. Corrib and L. Cullin the last-named flourishes in chinks of wave-washed slates and gneisses.

In these and similar cases actual soil-analysis alone can throw light on the relations between plant and substratum, and this has not yet been done. But it is clear that the question is seldom simple. To calcicolous plants the attraction of the limestone may be its chemical qualities, or its physical: and

the upper layers (d a limy soil may be neutral or even acid, owing to leaching or to the accumulation of humus. See for instance E. J. SALISBURY: The "Significance of the Calcicolous Habit" (Journ. Ecology, 8 202-215, 1921 – with good bibliography).

Coasts.

62. There is a rather marked contrast between the seaside flora of the E and W sides of Ireland. That of the E coast is much the richer, attaining its optimum in Wicklow and Wexford (272), and including among its rarer members *Matthiola sinuata*, *Trifolium glomeratum*, *Diotis*, *Asparagus*, *Glyceria Borreri*, and the endemic *Equisetum Moorei*. The cause of the difference between E and W is partly edaphic, in the larger amount of gravelly and sandy beaches which prevail in the east, and partly climatic, in the very great exposure prevailing on the western sea-board. Quite a number of E coast plants – for instance, *Thalictrum dunense*, *Trigonella*, *Trifolium glomratum*, *T. scabrum*, *T. subterraneum*, *Inula crithmoides*, *Diotis*, *Atriplex maritima*, *Asparagus*, *Scilla verna*, *Iuncus acutus*, some of them widely spread there – do not venture into the west, or at most make a rare and tentative appearance in Donegal or Kerry.

On the other hand, very few maritime plants prefer the W coast. *Cochlearia groenlandica*, which ranges from Antrim to W Cork, appears to be the only well – marked example.

The poverty of maritime species in the west is illustrated by the sand – dune plants much more than by those inhabiting rocks or salt-arshes. While in some favoured spots in the west, as on the Mullet, at Strandhill in Sligo, and Killala in West Mayo, we find well-developed dunes, backed by undulating stable moss-grown sandy ground, in other parts the sands are reduced by exposure to mere deserts. The great tracts beyond Bunowen in SW Connemara, at Keel strand in Achill, and on North Inishkea will serve as examples. These large level areas are quite bare of vegetation, or support a miserably poor and starved flora. But even where the sands are well colonized, the characteristic flora is much reduced as compared with the east. Among the dunes we miss the blue spires of *Echium*, the grey leaves of *Cynoglossum*; *Thalictrum dunense*, *Lychnis alba*, *Trifolium arvense* are likewise absent from the sands. *Lycopsis*, *Euphorbia portlandica*, *E. Paralias* are quite rare; and on the beaches, *Cakile*, *Eryngium maritimum*, *Salsola*, *Polygonum Raii* are but seldom found. The sand is often blown up adjoining hill-sides to a height of several hundred feet; elsewhere, as at Keel Lough in Achill, its advance has dammed the natural drainage and flooded a considerable extent of country, or has buried houses and demesne lands, as at Dunfanaghy and Rosapenna in Donegal.

Semi-exposure to the Atlantic sometimes produces the phenomenon of a salt-marsh flora at the foot of a storm-beach of boulders, as below Mountcharles on Donegal Bay, where a sward of *Glyceria maritima* with *Limonium humile* and *Atriplex* occupies such a position.

The flora of the western sea-rocks and cliffs, as contrasted with the east coast, compares favourably with it, yielding, in addition to all the common species, such plants as *Spergularia rupicola* in abundance, *Lavatera*, *Limonium binervosum*, and other local species.

On the cliff-ranges (and down to sea-level on beaches) *Sedum roseum* joins the maritime group, and is often profuse, with quantities of *Angelica*, *Eupatorium*, *Matricaria inodora*, *Beta*, and other rank-growing species on the damp ledges. The salt-marsh flora is likewise similar to that of the E coast, but rather poorer.

63. Plantago Sward. – One of the most distinct formations of the extreme west is a very close dwarf maritime sward, occupying wind-swept cliff-tops and exposed slopes by the sea, composed

mainly, often almost wholly, of *Plantago maritima* and *P. Coronopus*, growing extremely small. As noted on Clare Island*, this association consists mainly of the two species named, with *P. lanceolata*, *Thymus Serpyllum*, and *Euphrasia*, and in small quantity nearly thirty other species, all forming a dense sward about ½-inch in height, with flower-stems (even of the taller species like *Scabiosa succisa* and *Hypochaeris*), rising about 2 inches). *Radiola* grows ½-inch high, usually unbranched; *Ophioglossum* the same height, and barren. The flowers of the majority of the plants rise level with those of *Angallis tenella* and *Radiola*. At the west end of Inishkea. *Plantago* sward, consisting almost entirely of the two species first named, growing extremely minute, covers a considerable area; it forms a shining green carpet, so close that no lawn-mower, however close-set, could cut a leaf off it, and as smooth to the hand as a newly-ironed table-cloth. *Plantago* sward is characteristic of areas of particularly great exposure close to the sea. It occurs all along the W coast, and ranges from sea-level to about 400 feet.

* R. LL. PRAEGER: "The Flora of Clare Island." *Irish Nat.*, 1903, 281.

64. The occurrence of maritime plants in alpine or inland situations in Ireland is a feature almost confined to the western mountains, from W Cork to Donegal, the species involved there being *Cochlearia officinalis* (alpina), *Silene maritima*, *Armeria maritima* (not *planifolia*), *Plantago maritima*. *Cochlearia* extends to the Galtees, in the southern midlands; in Derry the fine cliff of Benevenagh shelters all four species (as also *Cerastium semidecandrum*), and *Silene* continues along the basaltic scarp to Cave Hill overlooking Belfast. In the west, *P. maritima* has in addition a wide inland range over the low limestones and along the shores of Loughs Derg (up to 25 miles from the sea), Corrib, Mask, Carra, Conn, etc. Rather unexpected also is the occurrence of *Carex distans* in two stations near Tuam in NE Galway. The Lakes of Killarney harbour a curious outlier of the maritime flora, embracing *Silene maritima*, *Cerastium semidecandrum*, *Armeria maritima*, and *Asplenium marinum*. The most interesting inland outlier of the maritime flora is on L. Neagh, where are found *Viola Curtisii*, *Spergularia rupicola*, *Cerastium semidecandrum*, *Erodium cicutarium*, *Trifolium arvense*, *Plantago maritima*, *Scirpus maritimus*, *S. Taberncemontani*, and *Carex extensa* (see 464). Most of these are elsewhere in Ireland exclusively maritime.

Islands.

65. The islands off the west coast – e.g., Inishbofin, Inishturk, Clare I. – offer some points of interest. They have larger floras than most equal areas of the adjoining mainland, insularity being more than compensated by the variety of habitat which they afford. None of them possesses any limestone. They are less smothered in bog than the mainland, and tend to yield drier soils – and I believe have a smaller rainfall, though this has not been fully tested*. Frost and snow are practically unknown. The mean annual range of temperature is only about 15i° F. The following points regarding their flora may be mentioned:–

1. They furnish, owing to limy sands or lime-built walls, a home for some calcicole plants, e.g., *Arabis Brownii*, *Centaurea Scabiosa*, *Ophrys apifera* (all on Bofin), *Ceterach* (on Bofin and Clare I.).
2. They possess a few representatives of the Lusitanian and American groups – *Saxifraga spathularis* is on all three, *S. Geum* (in a hybridized state) and *Erica mediterranea* on Clare I., *Euphorbia hiberna* on Turk, *Eriocaulon* on Bofin.
3. They offer refuges for some plants very sparsely distributed in Ireland, some of them probably relict *Helianthemum guttatum* on Bofin and Turk (elsewhere only in Cork), *Orobanche rubra* and *Cephalanthera. ensifolia* on Clare I., *Calamagrostis epigejos* and

Lycopodium inundatum on Bofin. These would appear to be at least local relicts, swamped out of their parent stations on the mainland by the spread of the overmastering peat.

4. Their flora shows an interesting mixture of plants of great exposure and others of damp shady places. Thus all three islands possess *Cochlearia grwnlanctica*, *Sedum roseum*, *Juniperus sibirica*, *Lastrea cemula*, *Athyrium Filixfemina*, all growing close to sea-level.

Achill is not included in the above comparison, as it is scarcely separated from the mainland.

The Great Blasket, a desperately exposed high narrow ridge of slate, has *Cochlearia greenlandica*, *Saxifraga spathularis*, *Lastrea CrMitia*, *Athyrium*, *Hymenophyllum peltatum*, and as an index to the degree of oceanic influence, *Asplenium marinum* on walls at 750 ft. above the sea (329). The Aran Islands, large reefs mostly of bare fissured limestone, yield a very different flora, of high interest (352).

* See W. J. LYONS: "Climatology," In Biological Survey of Clare Island, Proc. Roy. Irish Acad., 31, part 6. 1914.

Mountains.

. 66. The mountainous areas in Ireland are situated mainly in the maritime counties, the only exception of importance being the fine range of the Galtees (3015 ft.) rising from the rich limestone plain of southern Tipperary. A number of other hill-groups – mostly NE and SW ridges – have been formed, like these, by folding, which has brought up the underlying Devonian and Silurian slates and sandstones; this results in wide heathery moorlands, but the hills do not generally rise high enough to effect much other change in the vegetation, which is usually of a conventional calcifuge type. Wicklow possesses the largest continuous area of high land (over 200 sq. m. are above 1000 ft.), with Lugnaquilla rising to 3039 ft., but like that other fine eastern range, the Mourne Mountains in Down (2796 ft.), it is poorer in alpine plants than many lower and smaller areas in the west. Thus, Slieve League in Donegal (1972 ft.) yields on a quite restricted area more plants of alpine type than Wicklow and Down taken together. The Irish mountain-groups are formed of granites, schists, slates, sandstones, and shales, mostly of pre-Permian age (the Eocene Mournes being a marked exception). The only limestone mountains are the interesting Ben Bulbin group – a plateau standing up some 2000 ft. (fig. 24), with cliff-walls rich in alpine plants. An upland somewhat similar to the last in being cliff-walled and yielding a rich flora of calcicole proclivities, is formed by the Eocene basalts of Antrim and Londonderry. In view of the perennial interest of "alpines," the mountain plants are dealt with rather fully in the Topographical Section below, and only a few general considerations need detain us here.

In the first place, the Irish alpine flora is poor. But the general scarcity of alpine plants need not diminish the interest of mountain botanizing. "It may sound like a paradox" writes one of the most critical of Irish botanists* "to say that the botanical survey of an Irish mountain region derives a peculiar zest from the very poverty of our flora in alpine species. Yet the assertion may be made with perfect truthfulness. That the rapture of discovery varies directly with the rarity of the object sought for, that the value of the thing attained is measured by the labour of attainment – these are time-honoured truisms in every system of proverbial philosophy; and their essential truth is daily borne in upon the mind of the botanist who devotes himself to the exploration of any of the mountain-groups of Ireland. The fans of the Alpine Club-moss, which he spurns with callous feet on the slopes of Snowdon, he half worships when they meet his longing eyes in the Wicklow or Kerry highlands; and so with many others of our alpine species – unconsidered trifles abroad, they become for him objects of enthusiasm at home."

* N. COLGAN: “Botanical Notes on the Galway and Mayo Highlands.” Irish Nat., 1900, 111-118. **67.** Out of 67 species comprising Watson's “Highland” type in Britain, 42 occur in Ireland*. This is a not unduly small number when we consider especially the area and height of mountainous country in Scotland and Wales; but in Ireland the plants are mostly thinly distributed and rare. Seven of the rarest – *Arabis petraea*, *Alchemilla alpina*, *Rubus chamaemorus*, *Saxifraga nivalis*, *Epilobium alsinefolium*, *Carex pauciflora*, *Poa alpina*, have only eleven stations between them all. Against this, the following are relatively much more widespread in Ireland than in Britain (but it is to be noted that in Ireland all of them but *Salix herbacea* descend to sea-level, and attain their increase of range not by their abundance on the mountains, but by widespread occurrence on the lowlands:–

* In addition, there is in Ireland *Arenttria ciliata* on the Ben Bulbin range, 1000-1950 ft., unknown in Britain; and *Euphrasia salisburgensis*, recently found in Yorkshire, which Watson would have included in his Highland type: it is in western Ireland widespread and mainly quite lowland (to sea-level) though ascending to 1000 ft. on Ben Bulbin.

The “Highland” plants of Watson as a group do not in Ireland fit well with his definition, “Species chiefly seen about the mountains.” Much less do they constitute the alpine flora in this country. Taking the Highland Type flora as set down in “Cybele Hibernica,” p. xliv (the Hieracia are a difficulty, and one may for convenience accept the compromise there used), we find that 16 of the 42 occur down to sea-level, often not in the proximity of mountains. These are :–	<i>Carex aquatilis</i>
<i>Dryas octopetala</i>	<i>Sesleria caerulea</i>
<i>Hieracium anglicum</i>	<i>Selaginella selaginoides</i>
<i>Hieracium iricum</i>	<i>Isoetes lacustris</i>
<i>Salix herbacea</i>	
<i>Draba incana</i>	<i>Hieracium gothicum</i>
<i>Dryas octopetala</i>	<i>Arctostaphylos Uva-ursi</i>
<i>Saxifraga oppositifolia</i>	<i>Vaccinium</i>
<i>Saxifraga aizoides</i>	<i>Juniperus sibirica</i>
<i>Sedum roseum</i>	<i>Carex aquatilis</i>
<i>Galium boreale</i>	<i>Sesleria ccerulea</i>
<i>Hieracium anglicum</i>	<i>Selaginella selaginoides</i>
<i>Hieracium iricum</i>	<i>Isoetes lacustris</i>
Sixteen more come in before the 1000 ft. contour is exceeded :–	
<i>Thalictrum alpinum</i>	<i>Hieracium strictum</i>
<i>Subularia aquatica</i>	<i>Polygonum viviparum</i>

<i>Silene acaulis</i>	<i>Oxyria digyna</i>
<i>Saxifraga stellaris</i>	<i>Salix herbacea</i>
<i>Epilobium alsinifolium</i>	<i>Carex rigida</i>
<i>Saussurea alpina</i>	<i>Carex pauciflora</i>
<i>Hieracium prenanthoides</i>	<i>Cryptogramme crispa</i>
<i>Hieracium senescens</i>	<i>Asplenium viride</i>

Between 1000 and 2000 ft. seven more have appeared:–

<i>Arabis petraea</i>	<i>Poa alpina</i>
<i>Saxifraga nivalis</i>	<i>Polystichum Lonchitis</i>
<i>Alchemilla alpina</i>	<i>Lycopodium alpinum</i>
<i>Rubus Chamaemorus</i>	

and no less than twelve more have died out.

No new species appears above 2000 ft. except *Deschampsia alpina*, and of the 21 plants which continue upwards all but eight:–

<i>Saxifraga stellaris</i> ,	3400
<i>Sedum roseum</i> ,	3150
<i>Oxyria digyna</i> ,	3130
<i>Salix herbacea</i> ,	3050
<i>Carex rigida</i> ,	3300
<i>Deschampsia alpina</i> ,	3370
<i>Poa alpina</i> ,	3100
<i>Asplenium viride</i> ,	3150

are gone when 3000 ft. is reached. (The figure attached to each shows its extreme limit.) These last are all on Macgillicuddy's Reeks. It is to be remembered that the Reeks (Carrantual 3414 ft.) is the only range that exceeds 3000 by more than at most 127 ft. The accompanying graph (fig. 9) exhibits the increase in the number of "Highland" plants on the Irish hills up to a maximum at 1000-1200 ft., and their steady diminution with greater elevation.

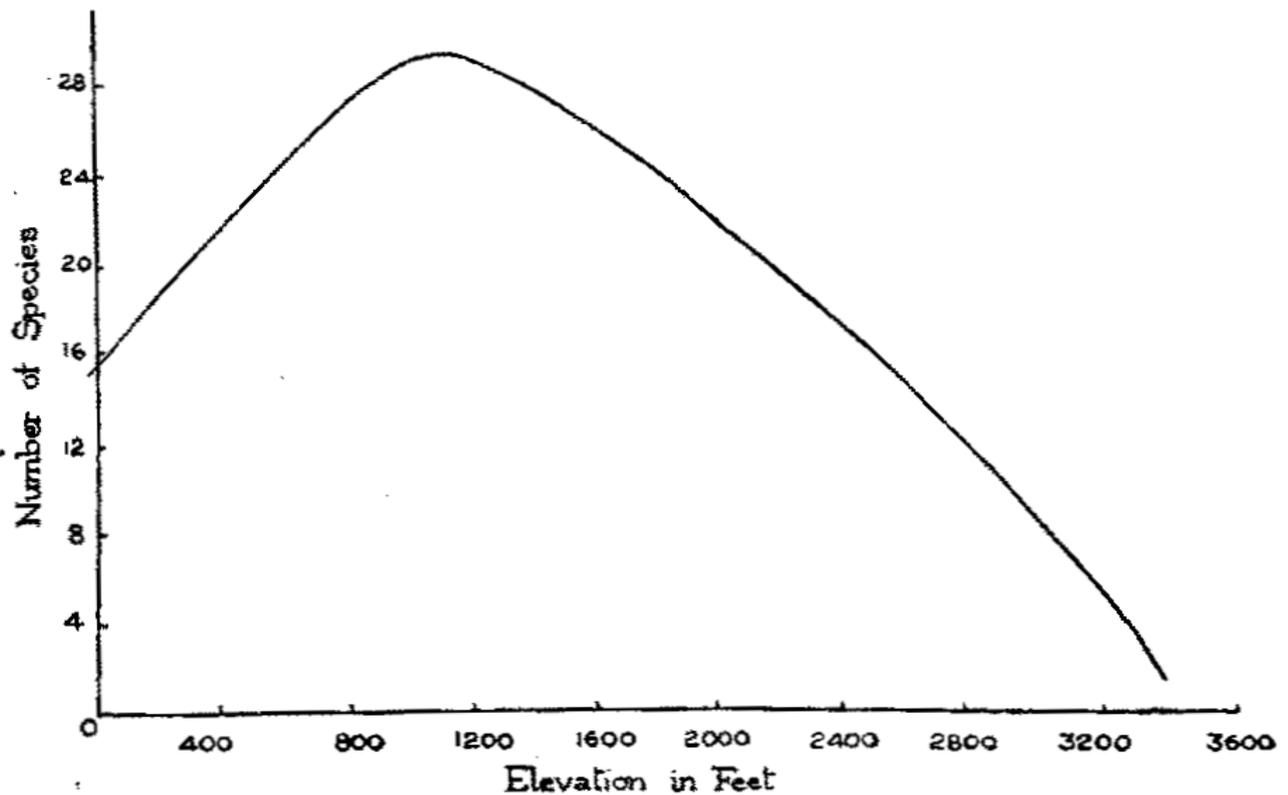


FIG. 9. – IRISH ALPINE PLANTS IN RELATION TO ELEVATION.

68. As regards their general distribution in Ireland, the “Highland” plants tend, like the mountains, to be marginal. With a maximum in the N, they range down either coast – much more plentifully over Ben Bulbin and the Mayo-Galway highlands into Kerry than over the Mourne into Wicklow. The height at which they occur increases from N to S, and is greater in the E than in the W. Comparing the Donegal-Derry area with Kerry-Cork (data for 17 species are available), we find that the “Highland” plants common to both have a mean lower limit in the N of 550 ft., which rises in the S to about double that amount. This is one of the few definite effects of latitude that one can find in the Irish flora.

A similar comparison of the behaviour of the “Highland” plants of west and east – of the Mayo-Galway mountains with those of Down-Wicklow – shows a corresponding decrease in elevation towards the west. Of 25 species in the western area and 18 in the eastern, 13 are common to both, of which data are available for 12. These 12 show a mean lower limit of 1070 ft. in Down-Wicklow, Mid of 720 ft. in Mayo-Galway. This effect is climatic, and illustrates the manner in which the whole flora is depressed in altitude on account of the conditions prevailing on the Atlantic seaboard.

69. None of our mountains is high enough to reach the region of an alpine-plateau vegetation. Indeed, the summits, commonly covered with peat, are usually very poor in alpinism compared with rocky scarps on the flanks of the hills, especially where the latter face northward. Taking the highest points in Donegal (2466 ft.), Down (2796), Sligo (2115), Mayo (2688), Wicklow (3039), Tipperary (3015), and Kerry (3414), we find that the average summit-flora numbers about 16 species, of which not more than two are usually alpinism. These figures remain very uniform all over Ireland. The prevailing summit plants are species of wide vertical range, all descending to sea-level :–

Potentilla erecta

Luzula sylvatica

Galium saxatile	Eriophorum vaginatum
Vaccinium Myrtillus	Deschampsia cespitosa
Calluna vulgaris	Anthoxanthum odoratum
Rumex Acetosella	Festuca ovina
Empetrum nigrum	Lycopodium Selago
Juncus squarrosus	

The alpine which may occur with these on the summits named are *Saxifraga stellaris*, *Vaccinium vitis-idaea*, *Salix herbacea*, *Carex rigida*, and *Lycopodium alpinum*.

The nearest approaches to an alpine sward are found here and there in exposed ground in the west – on Curraun Achill, at about 1200 ft., where *Arctostaphylos Uva-ursi*, *Empetrum*, and *Juniperus sibirica* form a dense carpet and on the Meenawn range on Achill Island, where a very close sward formed mainly of *Calluna* and the three species before mentioned, with a little *Salix herbacea*, occupies the ground at 1300-1500 ft. But indeed an almost equally alpine faeies is supplied by the sheets of *Arctostaphylos Uva-ursi*, *Dryas*, *Gentiana verna*, *Sesleria*, that in Burren range from over 1000 ft. down to sea-level, though mixed with such southern types as *Neotinea* and *Adiantum* (see Plate 2).

HUMAN INFLUENCE ON THE FLORA.

70. The natural climax vegetation of Ireland – forest, now chiefly of *Quercus* and *Betula* – has long since passed away save in places unsuitable for grazing, and has been replaced by grassland, its boundaries further extended by drainage and the removal of peat-bog. Tillage furnishes a further step in the destruction of the native flora, but, fortunately for the botanist, Ireland is not essentially a tillage country. Potatoes, oats, turnips furnish the principal crops: all crops put together do not occupy half the area which is covered by grass (see 76). The amount of tillage increases from west to east, and reaches a maximum in certain NE counties, mostly in the Silurian area (fig. 10). Tillage has brought with it the introduction of a great number of extraneous species, largely annual plants of Central European and Mediterranean origin. These reach their maximum around Dublin and in the SE, which is the region of maximum summer temperature. The indigenous vegetation of the lowland rich soils has been almost obliterated; the flora becomes more and more aboriginal as the soil becomes unsuitable for agricultural operations, as on bogs, marshes, and mountains. The native plants are in general very persistent, clinging to any remnant of primitive ground, whence, if allowed, they tend to spread back into their old territory. But many others, more sensitive, have shrunk back or disappeared before the changes induced by man. Thus, for instance, the poverty of the woodland flora of Ireland is conspicuous as compared with England or Scotland – no *Helleborus*, *Linnaea*, *Trientalis*, *Daphne*, *Corallorhiza*, *Goodyera*, *Cephalanthera grandiflora*, *Maianthemum*, *Ruscus*, *Convallaria*, *Paris*. This is one of the prices Ireland has paid for being a cattle country, for probably at least a few of these were here formerly.

The plants of the seashore seem especially sensitive. *Euphorbia Peplis* is gone, and *Crambe*, *Matthiola*, *Diotis*, *Asparagus*, *Mertensia* and others are decreasing.

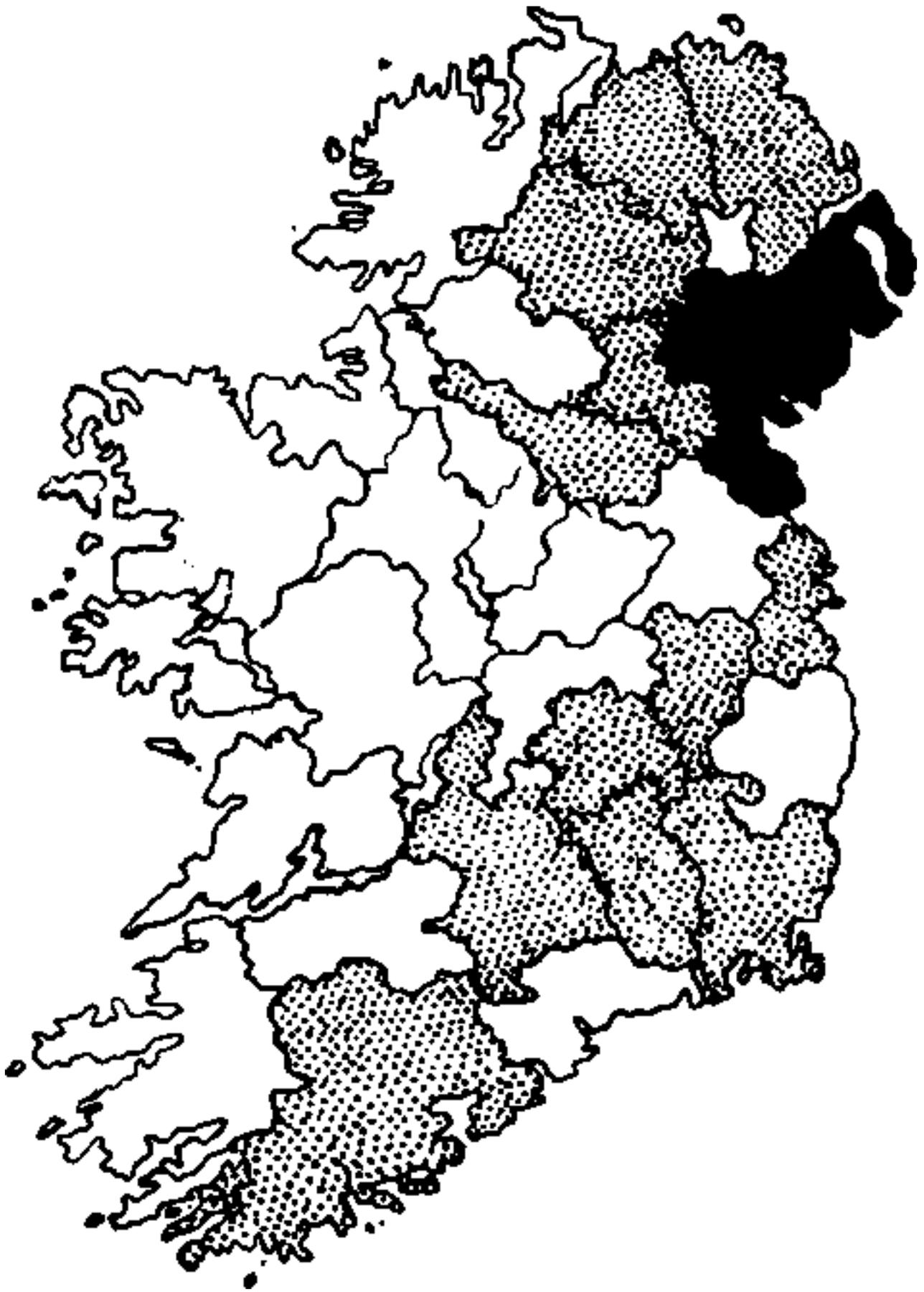


FIG. 10. - TILLAGE IN IRELAND.

White = under 25 per cent.

Black = over 35 per cent.

71. The medley of introduced plants includes some vigorous species which spread and colonize; many of these are mentioned in the succeeding paragraphs. One of the most difficult tasks, therefore, of the botanical geographer, endeavouring to trace the routes and dates of the immigrations of the flora, and its reactions to soil, climate, and so on, is set by this destruction of the broad features of especially the lowland vegetation, and the intricate mixture of native and introduced plants which now prevails. Various definitions of a NATIVE PLANT have been proposed: I use that employed by Dunn*:- A species is only held to be native in a natural locality to which it has spread by natural means. This excludes all interference by man, direct or indirect, as regards either the origin of the seed or plant, its transport, or its subsequent development. But these tests are not easy to apply, and cannot mostly be applied directly. We have to rely rather on the absence of any evidence of introduction, making "native," in its application, a purely negative term, as H. C. Watson has pointed out. By most botanists, "native" is not used in so strict a sense as that quoted above, and generally includes individuals of species truly native in the district or country, which are growing by natural spreading either in natural or in artificial habitats; and in view of the fact that these two categories comprise the limits which the native plants have achieved by natural dissemination, there is a good deal to be said for the practice, which is adopted in the pages which follow.

* S. T. DUNN: "Alien Flora of Britain," p. x. 1905.

Dunn's definition involves three points: (1) the origin of the plant; (2) the means by which it reached its present habitat; (3) the nature of the habitat. I have elsewhere²⁷ proposed a formula for indicating the standing of plants according to these tests. If we use N as meaning uncontaminated conditions, whether of source, dispersal, or habitat, and * for contaminated conditions, then NNN, and only that combination, fulfils Dunn's formula for a fully native plant. To this one adds NN* – native plants which have spread by natural means to a non-natural habitat, like *Lonicera* in a roadside hedge, *Ceterach* on a wall, or the many native plants in drained land or planted woods. All other combinations involve either a contaminated source or artificial introduction, and while plants thus defined may be fully naturalized, they cannot be reckoned as native. Thus, the American garden *Mimulus* by a mountain stream is *NN, having spread by natural means to a natural habitat, and *Pinguicula grandiflora* brought from Kerry into wild ground in Wexford is N*N. The plants of our gardens are mostly ***. This matter will be found more fully discussed in the place indicated*.

* R. LL. PRAEGER: "Phanerogamia." (Clare Island Survey) Proc. Roy. Irish Acad. 31, part 10. 1911.

There has been much loose thinking and loose practice as regards this admittedly difficult matter, and I think it will be found that appeal to this formula tends to clarify one's ideas.

72. The most obviously introduced plants in our flora (excluding exotic species deliberately planted) are the many casuals which occur especially about centres of industry – docks, railway yards, factories, etc. While the majority of these are mere fleeting waifs, a few of them establish themselves, and have become permanent members of our flora. Examples of such in Ireland are :-

<i>Diplotaxis muralis</i>	<i>Valerianella carinata</i>
<i>Coronopus didymus</i>	<i>Matricaria suaveolens</i>

Lepidium latifolium	Senecio squalidus
Arenaria tenuifolia	Linaria minor
Malva rotundifolia	Poa compressa

But though these may spread widely, only seldom do they succeed in penetrating into the native vegetation on wild ground. Most of them continue to be denizens of waysides, railways, tilled land, walls, and other artificial habitats, and remain *N*. Their tenure is dependent on the continuance of the artificial conditions under which they live, which tend to restrain the native vegetation from ousting them. Along with the crops of the farmland and the flowers of our gardens, they are quite alien to the native flora; but being often unfamiliar, and offering interesting problems regarding their mode of introduction and possible acclimatization, they are well worthy of attention. As an example of the number of plants which are unsuccessfully introduced in this way into our country, see KNOWLES in Irish Nat. 1906, 143-150.

A large section of the introduced flora, in Ireland as elsewhere, owes its presence to agricultural and garden seed, and to arrival in soil on the roots of planted shrubs and herbs. To this category belong all or most of the species of Papaver, Fumaria, Brassica, Valerianella, Lamium, Galeopsis, some species of Veronica and Euphorbia, and so on – at least 60 or 70 in all. Some of these are at present spreading rapidly, like Draba muralis, Crepis biennis, Orobanche minor; but like the last group they usually do not mix with the undisturbed native flora, and a large number are dependent for their continuance on the annual turning over of the soil, an operation which holds the indigenous flora in check. Almost without exception they remain *N*.

73. Another group consists of ornamental plants, or species formerly used as pot-herbs or for medicinal purposes. Many of these are aggressive or at least persistent perennials, with great staying qualities, but again with little power of competing on equal terms with the native flora; as a consequence, they are still mainly found about houses and villages, on old walls, or on disturbed ground. Examples of successful colonizers among the kitchen-garden plants are :–

Chelidonium majus	Tanacetum vulgare
Cochlearia Armoracia	Inactuca muralis
Saponaria officinalis	Verbena officinalis
Smyrniololus Olusatrum	Lycium chinense
Aegopodium Podagraria	Mentha spp.
Myrrhis odorata	Ballota nigra
Foeniculum vulgare	Chenopodium Bonus-henricus
Sambucus Ebulus	Allium spp.
Inula Helenium	

and 20 or more others. The garden plants in this category include:–

Clematis Vitalba	Petasites fragrans
Corydalis lutea	Campanula rapunculoides
Cheiranthus Cheiri	Mimulus Langsdorffii
Hypericum hircinum	Elodea canadensis
Sedum spp.	Stratiotes Aloides

<i>Centranthus ruber</i>	<i>Narcissus biflorus</i>
<i>Aster</i> spp.	

and a number of others. One or two of them – *Centranthus*, *Aster*, *Mimulus*, and *Elodea*, for example – have spread into quite wild ground, and, mixing on equal terms with the native flora, merit *NN. But most remain *** or *N*. The naturalization of alien plants goes on slowly but steadily. Among those which appear to be at present establishing themselves as members of the permanent flora of wild ground are. the Himalayan *Impatiens glandulifera* (river-sides in Dublin, Sligo, etc.), the Himalayan *Cotoneaster microphyllus* (mountain rocks in Mayo, river gravels in Dublin, railway banks W of Athenry, etc.), the New Zealand *Epilobium nummularifolium* (Blackstairs at 1200 ft., bank by the sea S of Killybegs, railway ballast for ½ mile at Helen's Bay (Down), roadside at Loughaveema and Ramore Head, (Antrim), Portsalon (Donegal), etc.), the Australian *Aceena Sanguisorbce* (woods in Cork, Dublin, Down), the S. American *Fuchsia gracilis* (Berehaven district, Co. Cork), the West Asiatic *Lactuca tatarica* (shore near Galway), the South European *Calystegia sylvestris* (L. Gill), the N. American *Mimulus moschatus* (wet ground in Wicklow, Armagh, Down, Antrim), and the S. African *Montbretia Pottsii* (rocky shores of L. Gill in Sligo and many other places).

74. As to many other aliens, the means by which they reached their present stations is not clear, and they can only be classed as “followers of man.” For instance:–

<i>Sisymbrium Irio</i>	<i>Rumex pulcher</i>
<i>Reseda lutea</i>	<i>Mercurialis annua</i>
<i>Galium Cruciata</i>	<i>Urtica urens</i>
<i>Picris hieracioides</i>	<i>Urtica dioica</i>
<i>Hieracium</i> , several spp.	<i>Hordeum murinum</i>

and 20 or 30 others. They mostly remain as dependents on human activities, but some of them spread into the native flora.

75. Another aspect of the question of human influence is the obvious fact that man's operations have often encouraged a material extension of the range of native plants. Mortar-built walls, for instance, arising during the last thousand years all over the country, have allowed lime-loving species to extend far beyond their natural boundaries. There seems little doubt, for instance, that *Ceterach* was formerly confined to Clare and the adjoining limestone tracts; now it is found, frequently in abundance, in all the 40 Irish vice-counties, and often in every part of them. *Asplenium Ruta-muraria*, with an original range not so restricted (it occurs, for instance, on basalt in Antrim, and on metamorphic and slate rocks (on lake-shores) in Mayo) is now much more universally distributed even than *Ceterach*. The ferns, indeed, on account of the abundance and lightness of their spores, are especially enterprising colonists. Many of the extreme outposts of Ireland – Inishbofin, Inishturk, the W end of Achill – now support one or both of those just mentioned. At least six species have penetrated to the centre of Dublin City (see Irish Nat. 1920, 108).

Spores, possibly from a local garden, possibly native and from a long distance, are responsible for the fleeting appearance of *Asplenium septentrionale* in Down (Irish Nat. 1912, 154) and *Lastrea rigida* near Drogheda (Cyb. Hib. ed. I, 371). Similar cases are *Asplenium viride* on old walls at Convoy (about 200 ft. elevation), and *Polystichum Lonchitis* close to sea-level at Killybegs, both in Donegal (Hart Fl. Don. 286, 288), and (if the records may be trusted) the same fern at Edgeworthstown and Dungannon (Cyb. Hib. ed. I, 372). *Cryptogramme* has in Down been twice

found at quite low elevations on walls or stone-heaps (Irish Nat. 1903, 36, and Irish Nat. Journ. 1, 242).

Roads and road traffic have spread native plants such as *Juncus macer*. Canals have extended widely the range in the Central Plain of plants like *Butomus* and *Sagittaria*, as also of *Potamogeton* spp., *Charophyta*, etc. They have brought *Apium Moorei* and *Potamogeton coloratus*, otherwise unknown in the county, inside the Dublin boundary, and *Lycopus*, *Potamogeton densus*, *Glyceria aquatica*, etc., almost into the heart of the city.

Railways in Ireland furnish a classic example of their power of promoting dispersal, by the rapidity with which in recent years *Diplotaxis muralis*, *Arenaria tenuifolia*, and *Lunaria minor* – none of them native – have extended their range through the country. *Senecio squalid* – us has travelled by rail from Cork to Dublin, and *Tragopogon pratense* from Leinster (presumably) to Belfast.

76. The maximum change of vegetation due to human operations is found in cities, in well-tilled land, and in gardens, where the change amounts to a full 100 per cent. as regards NNN plants, and may be nearly equally high for NN*. Even leaving out of account the fact that much of the present grassland was originally wood, the influence of grazing animals is still profound in the richer soils, tending to produce a uniform and limited flora, of little interest to the botanist. On poorer soils, especially on limestone, the change is less; it is less still on the mountains, and there affects the relative abundance of the constituent plants rather than the question of their presence or absence. The surface of Ireland has about one-fifth under crops and a little over one-half in grass, with about 11 per cent. mountain land and 8 per cent. peat bog and marsh, and 4 per cent. water; so that over at least three-quarters of the surface the indigenous vegetation has been destroyed or greatly altered. The farmland runs up the hills (mostly following the drift deposits) to heights which vary from 200 ft. in the exposed areas of the west to about 1200 ft. in sheltered spots in the east. From these figures, the very small amount of ground which remains in anything like its pristine condition may be judged.

The net result of human operations comprises two categories – (1) extermination or reduction or redistribution of the native plants, and (2) introduction of alien plants.

These changes are difficult to estimate, since they involve comparison with the past, which can only vaguely be reconstructed. They are greatest in those parts of the country which are richest, were earliest settled, and support the largest human population. In the County of Dublin, which comes foremost in these respects, the alien flora is estimated (qualitatively) at 22 per cent. of the total*. In Kerry it is estimated at 14 per cent*. Quantitatively the difference is much greater: in Kerry, with its large areas of almost undisturbed mountain land, there is, relatively to area, probably not one-tenth the amount of introduced plants which exists in the small County of Dublin.

In the light of evidence now available, there can be little doubt that certain plants, set down in former works such as “*Cybele Hibernica*” as introduced or probably introduced, are indigenous in Ireland in at least some of their stations. Such are *Viola odorata*, *Trifolium glomeratum*, *T. subterraneum*, *Prunus Avium*, *Rosa stylosa*, *R. rubiginosa*, *R. micrantha*, *Pyrus Malus (acerba)*, *Lysimachia Nummularia*, *Cuscuta Epithimum*, *C. Trifolii*, *Sisyrinchium angustifolium*, *Leucojum cestivum*, *Allium Babingtonii*, *Juncus mater*, *Brachypodium primatum* – see Journ. Bot., 1934, 68-75.

* COLGAN: Fl. Dublin, xxxvi.

* SCULLY: Fl. Kerry, xxxiii.

THE BOTANICAL SUBDIVISION OF IRELAND.

77. Several plans have been put forward, at different times, to allow the distribution of plants within the country to be shown by numbers or symbols representing subdivisions, large or small, of the whole area – as Watson did for Britain in his “Topographical Botany,” and as indeed it is necessary to do if one attempts to express in detail the range of plants within any but a small area. No such scheme is required or used in the following pages, save in the “Census List of the Irish Flora” at end, on account of the geographical arrangement of the subject-matter; but it may be well to indicate the plans which have been proposed or used.

WORKERS AT THE IRISH FLORA.

78. In this book it is not possible in most cases to give the names of the finders of the rarer plants; and all that can be attempted in the present section is to indicate briefly the principal workers whose investigations have made possible a compilation such as this, and to mention in a few words the scope of their researches. For convenience of reference the names are arranged alphabetically, though a chronological arrangement would be more appropriate. Details of their published communications, often merely indicated below, up to 1900, will be found in the Bibliography of “Irish Topographical Botany.” The more important subsequent papers or notes are indicated, like the earlier ones, in the latter portion of this book, where the plant or area dealt with is mentioned. In the following notes “first finder” means of course first finder of the plant in Ireland. Only those writings are referred to which deal especially with the Irish flora, and only the rarer plants which were found are mentioned.

Apart from the books noticed, the bulk of material relating to Irish plants has appeared in journals as follows :—

For the earlier period, say 1830-50 – “Magazine of Natural History” and its successor the well-known “Annals and Mag.”

1841 – 1863 “The Phytologist.”

1863 to date “Journal of Botany.”

1892 – 1924 “Irish Naturalist.”

1926 to date “Irish Naturalists' Journal.”

Also Proceedings of the Dublin Natural History Society, 1849-71, and of other Irish societies.

A few contractions are used below:— B. & B. signifies Britten and Boulger's “Biographical Index of British and Irish Botanists,” 2nd ed. by A. B. Rendle, 1931; D.N.B., the “Dictionary of National Biography”; Fl. Dublin, Colgan's well-known Flora, 1904; Fl. NE.I., Stewart and Corry's similar work for Down, Antrim, and Derry; Lett, H. W. Lett's “Botanists of the North of Ireland,” in Proc. Belfast Nat. Field Club, 1912-3, 615-628 (reprinted in Irish Nat. 1913, 21-33; the page – references below are to the original paper).

ADAMS (John): “A Student's Illustrated Irish Flora,” 8vo, London, 1931. Proposed a useful scheme for the botanical subdivision of Ireland (77). Papers and notes in Irish Naturalist.

ALLIN (Rev. Thomas): “The Flowering Plants and Ferns of the County Cork,” 8vo, Weston-super-Mare, 1883. And many notes on Cork plants in Journ. Bot. 1871-4.

ALLMAN (Prof. George James): First finder of *Diotis maritime* (1845). Biography – D.N.B. 1 335; B. & B. 5.

ANDREWS (William): Notes and papers especially on ferns, mostly in Proc. Dublin Nat. Hist. Soc. 1841 – 71. Found *Cerastium arvense* var. *Andrewsii*, *Trichomanes radicans* var. *Andrewsii*. Claimed to have found *Saxifraga Andrewsii* (S. ? *Aizoan X spathularis*). Biography D.N.B. 1 4C9; B. & B. 8.

BABINGTON (Prof. Charles Cardale): Many notes and papers, mostly in Ann. & Mag. Nat. Hist., 1836 – 72. First proposer of a scheme for the botanical subdivision of Ireland (77). Biography – “Memorials of Charles Cardale Babington,” 1897 (portrait); Journ. Bot. 1895, 257 – 266 (portrait); etc.

BAILY (Katherine Sophia, afterwards Lady Kane): “The Irish Flora,” 8vo, Dublin, 1833. Biography – Lett 623.

BALFOUR (Prof. John Hutton): Papers (mostly Connemara) in Phytologist and Trans. Bot. Soc. Edinb., 1853 – 76. Biography – D.N.B. 2 56; B. & B. 17.

BALL (John): Finder of *Potamogeton Babingtonii* (1835). Biography – Journ. Bot. 1889, 365 – 370; D.N.B. Suppl. 1, 115 – 8.

BALL (Robert): First finder (with William THOMPSON) of *Astragalus danicus* (1834), and *Allium Babingtonii* (1834). Biography – Nat. Hist. Review 1858, 134; D.N.B. 2 77 – 8.

BARRETT – HAMILTON (Gerald E. H.): Papers (some with Miss L. S. GLASCOTT, or with C. B. MOFFAT) on Wexford plants, in Journ. Bot. and Irish Nat., 1887 – 4908. Biography – Irish Nat. 1914, 83 – 93 (portrait, list of papers).

BARRINGTON (Richard Manliffe): Reports on Tory I., the Blaskets, L. Erne, and (with R. P. Vowm.r) Ben Bulbin and L. Ree, and other papers, mostly in Journ. Bot. and Proc. Roy. Ir. Acad., 1872 – 1915. First finder of *Caltha radicans* and (with R. P. VOWELL) of *Epilobium alsinefolium* (1884), and (with H. and J. GROVES) of *Nitella gracilis* (1892). Biography (with portrait and list of papers) Irish Nat. 1915, 193 – 206; Journ. Bot. 1915, 364 – 7 (portrait); B. & B. 22.

BENNETT (Arthur): Papers and notes, in Journ. Bot. and Irish Nat., 1881 – 1919. Biography – Journ. Bot. 1929, 217 – 221 (portrait).

BLASHFORD (J.): First finder of *Microcala filiformis* (before 1804), and *Colchicum autumnale* (1799).

BRENAN (Rev. Samuel Arthur): Ulster notes, in Journ. Bot. and Irish Nat., 1884 – 1901. Biography – Irish Nat. 1908, 43; Lett 625.

BRITTEN (James): Papers and notes in Journ. Bot., 1872 1919. Portrait – Journ. Bot. 1912, frontispiece. Biography (with portrait) – Journ. Bot. 1924, 327 – 343.

BRUNKER (James Ponsonby): Papers and notes on the Wicklow flora, 1918 .

BULLOCK – WEBSTER (Rev. George Russell); Papers (some with J. GROVES) on Charophyta, in Irish Nat. and Journ. Bot., 1917 – 20. First finder of *Nitella mucronata* (1901), *N. spanioctema* n.sp. (1916), *C. muscosa* n.sp. (1917).

CARROLL (Isaac): A few short papers in Phytol., Journ. Bot., etc., 1854 – 75. Biography – Journ. Bot. 1881, 128.

COLGAN (Nathaniel): “Flora of the County Dublin,” 8vo, Dublin, 1904. Editor (with R. W. SCULLY) of “Contributions towards a Cybele Hibernica,” ed. 2, 1898. Many papers and notes in Irish Nat. (mainly) and Journ. Bot., 1885 – 1918. First finder of *Scrophularia alata* (1894), 35 and (with F. W. BURBIDGE) of *Senecio X albescens* (1902). Biography (with portrait and list of papers) – Irish Nat. 1919, 121 – 6; B. & B. 69.

CORRY (Thomas Hughes): Joint author with S. A. STEWART of “Flora of the North – east of Ireland,” 8vo, Belfast, 1888. Papers and notes, mainly in Journ. Bot., 1880 84. First finder of *Hieracium hypocharoides* (1879). Biography – Fl. NE.I. v–vi; Journ. Bot. 1883, 313 – 4. Isaac Carroll collected it at an earlier date, but did not recognise it. See 334.

D'ARCY (Elinor): First finder of *Carex magetlanica* (1901).

DAVIES (John Henry): Many papers and notes (Antrim and Down) in Irish Nat., 1892 – 1907.

Biography – Irish Nat. 1909, 235 – 6; Lett 625 – 6; B. & B. 86.

DICKIE (Prof. George): “A Flora of Ulster and Botanist's Guide to the North of Ireland,” 8vo, Belfast, 1864. A few other contributions. Biography – Fl. NE.I., xx–xxi; D.N.B. 15 32; B. & B. 90.

DEUCE (George Claridge): Papers and notes, mostly in Journ. Bot., Bot. Exchange Club Reports, and Irish Nat., 1890 – 1929. First finder of *Utricularia ochroleuca* (1875), *U. Bremii* (1875), and many critical plants. Biography – Journ. Bot. 1932, 141 – 4.

DRUMMOND (James): First finder of *Pinguicula grandiflora* (1809) and *Spiranthes gemmipara* (1810). Papers in Munster Farmer's Mag., 1818 – 20. Biography – D.N.B. 16 33; B. & B. 95.

FOOT (Frederick James): Papers and notes, chiefly on ferns, mostly in Proc. Dublin. Nat. Hist. Soc., 1860 – 71. Biography – Geol. Mag. 1867, 95.

GROVES (Henry) and James GROVES: Papers, mostly on Charophyta, in Journ. Bot. (mainly) and Irish Nat., 1880 – 98. First finders of *Nitella tenuissima* (1892), and *N. gracilis* (with R. M. BARRINGTON, 1892).

GROVES (James) and Rev. G. R. BULLOCK – WEBSTER: Papers on Charophyta, in Journ. Bot. and Irish Nat., 1917 – 24.

HART (Henry Chichester): “Flora of the County Donegal,” 8vo, Dublin, 1898. “Flora of Howth,” 8vo, Dublin, 1887. Many reports and papers on flora of Irish mountains, rivers, islands, in Journ. Bot. (mainly), Proc. R. Irish Acad., etc., 1873 – 1908. First finder of *Cochlearia greenlandica* (before 1896), *Helianthemum Chalcidius* (1893), *Hieracium hibernicum* (1883), *Carex Bcenningtlauseniana* (1883 – 4). Biography – Irish Nat. 1908, 249 – 254 (portrait, list of papers); Journ. Bot. 1911, 121 – 2 (portrait); B. & B. 141 – 2.

HEATON (Rev. Richard): First finder of *Dryas octopetala*, *Gentiana verna*, *Scilla verna*, and very possibly *Saxifraga spathularis* (*umbrosa* auct.) and *Euphorbia hiberna*, published as Irish in How's “Phytologia,” 1650. Biography – Colgan Fl. Dublin xix; B. & B. 143.

HIND (Rev. William Marsden): Papers, mostly in Phytologist, 1851 – 71. Biography – Lett 619.

K'EOGH (John): “Botanica Universalis Hibernica,” 4to, Cork, 1735. Biography – D.N.B. 31 33; B. & B. 172.

KINAHAN (George Henry): Papers on ferns (western), mostly in Proc. Dublin Nat. Hist. Soc., 1860 – 71. Biography (with portrait) – Irish Nat. 1909, 29 – 31.

KINAHAN (Prof. John Robert): Papers on ferns, mostly in Proc. Dublin Nat. Hist. Soc., 1854 – 63. Biography – B. & B. 173.

KIRK (Thomas): First finder of *Potamogeton sparganiiifolius* (before 1856).

KNOWLES (Matilda Cullen): Papers and notes (Tyrone, Limerick, etc.) in Irish Nat., Irish Nat. Journ., Proc. R. Irish Acad., 1897 – 1932.

LEEBODY (Mary Isabella): Notes (northern) in Journ. Bot. and Irish Nat., 1893 – 1911. First finder of *Teesdalia nudicaulis* (1896). Biography – Irish Nat. 1911, 218.

LETT (Rev. Henry William): Notes (NE area) in Journ. Bot. and Irish Nat., 1884 – 1914. First finder of *Rubus Leitii* (1901), *Hypochoeris glabra* (with C. H. WADDELL, 1900), *Carex pauciflora* (1889). Biography – Irish Nat. 1921, 41 – 3; Journ. Bot. 1921, 75 – 6; B. & B. 186.

LEVINGE (Harry Corbyn): Papers (mostly on Westmeath plants) in Journ. Bot. and Irish Nat., 1891 – 6. First finder of *Chara denudata* (1892), and (with H. and J. GROVES) of *Nitella tenuissima* (1892). Biography – Irish Nat. 1906, 107; B. & B. 186 – 7.

LHWYD (Edward): First finder of *Arenaria ciliata* (1699), *Saxifraga Geum* (1699), *Potentilla fruticosa* (1699), *Dabeocia polifolia* (about 1699), *Adiantum*, *CapillusVeneris* (before 1700). Paper in Phil. Trans., 1712. Biography – B. & B. 187.

LINTON (Rev. Edward Francis): Notes and papers in Journ. Bot. and Irish Nat., 1886 – 1909. Finder of *Carex trinervis* (1885).

LYNAM (John): First finder of *Sisyrinchium angustifolium* (1845). Biography – B. & B. 186.

MACALLA (William), phycologist: First finder of *Erica Mackaii* (before 1835). Biography – B. & B. 197.

MACKAY (James Townsend): “Flora. Hibernica,” 8vo, Dublin, 1836. Catalogues of Irish plants, and notes, 1806 – 60. First finder of *Erica mediterranea* (1830), *Arabis Brownii* (1805), *Bartsia viscosa* (before 1806), *Sibthorpia europaea* (1805), *Helianthemum canum* (before 1806), *Poa alpina* (1804), and other plants. Biography – Fl. Dublin xxvi–xxviii; B. & B. 199.

MARSHALL (Rev. Edward Shearburn): Papers (one with W. A. SHOOLBRED) and notes (Wexford, Mayo), in *Journ. Bot.* (mostly) and *Irish Nat.*, 1892 – 1912. First finder of *Ranunculus scoticus* (1899), *Leucjum cestivum* (1897), *Sisyrinchium californicum* (1896), *Tolypella nidifica* (1896), *Chara connivens* (1896). Biography *Journ. Bot.* 1920, 1 – 11 (portrait).

MOFFAT (Charles Bethune): “Life and letters of Alexander Goodman More,” 8vo, Dublin, 1898. Papers and notes (mostly Wexford) in *Irish Nat.* (chiefly) and *Journ. Bot.*, 1889 – •

MOORE (David): Joint author with A. G. MORE of “Contributions towards a *Cybele Hibernica*,” 8vo, Dublin, 1866. Many papers and notes in *Phytol.*, *Journ. Bot.*, etc., 1843 – 78. First finder of *Trifolium glomeratum* (1869), *Rosa Moorei* (c. 1835), *Apium, Moorei* (before 1866), *Inula salicina* (1843), *Pyrola secunda* (1835) *P. rotundifolia* (1870), *Ajaga•pyramidalis* (1854), *Carex fusca* (1835), *C. divisa* (1866), *C. elongata* (1837), *C. paradoxa*, *Calamagrostis neglecta* var. *Hookeri* (1836), *Glyceria Borreri* (before 1866), *Equisetum Moorei* (with J. MELVILLE, 1851), *Chara tomentosa* (1841), *Tolypella prolifera* and *T. intricata* (before 1860), and other plants. Biography – *Gard. Chron.* 1879, 739 (portrait); *Fl. NE.I.* xviii–xx; B. & B. 219; *Fl. Dublin* xxvii–xxix.

MORE (Alexander Goodman): Joint author with David MOORE of “Contributions towards a *Cybele Hibernica*,” 1866. Many papers and notes in *Journ. Bot.*, *Trans. Bot. Soc. Edinb.*, etc., 1855 – 93. First finder of *Viola stagnina* (1851), *Trifolium subterranea* (1867), *Scirpus nanus* (1868), *Deschampsia alpina* (before 1872), *D. setacea* (1869). Biography – “Life and Letters” by C. B. MOFFAT, 1898 (portrait); *Irish Nat.* 1895, 109 – 116 (portrait, list of papers); *Journ. Bot.* 1895, 225 – 7 (portrait); *Fl. Dublin* xxvii–xxx; B. & B. 220.

MORE (Frances M.): First finder of *Neotinea intacta*, 1864. Biography – *Irish Nat.* 1909, 132; *Fl. Dublin* /LXVii – XXiX.

MURPHY (Prof. Edmund): Paper in *Mag. Nat. Hist.* 1829, etc. First finder of *Trollius europaeus* (before 1829), *Rubus Chamaemorus* (1826), *Polystichum Lonchitis* (1826). Biography – B. & B. 224.

NEWMAN (Edward): Papers and notes, chiefly on ferns, in *Phytol.* (mainly), 1839 – 54. Biography – *Journ. Bot.* 1876, 223 – 4; *Memoir*, by his son (portrait), 1876.

O'BRIEN (Robert Donough): First finder of *Scirpus triqueter* (1900). Biography – *Irish Nat.* 1917, 113.

O'KELLY (Patrick B.): First finder of *Potamogeton perpygmaeus* (1891), *Limosella aquatica* (1893).

OLIVER (Daniel), jun.: Papers in *Phytologist*, 1851 – 3. First finder of *Naias flexilis* (1850) and *Euphrasia salisburgensis* (1852). Biography – *Journ. Bot.* 1917, 89 – 95 (portrait); B. & B. 233.

O'MAHONY (Rev. Thaddeus): Paper in *Proc. Dublin Nat. Hist. Soc.*, 1860. First finder of *Simethis planifolia* (1848) and *Epipactis atropurpurea* (1851). Biography – B. & B. 233.

PETHYBRIDGE (George Herbert): Joint author (with R. LI. PRAEGER) of “Vegetation of the District lying south of Dublin,” *Proc. Roy. Irish Acad.* 25 B 124 – 180, 5 plates, coloured map, 1905.

PHILLIPS (Robert Albert): Notes and papers (S and SE Ireland) in *Irish Nat.* 1893 – . First finder of *Ranunculus lutarius* (1894), *R. tripartitus* (1896), *Sorbus latifolia* (1924), *Enanthe pimpinelloides* (1896), *Serratula tinctoria* (1925), *Brachypodium pinnatum* (1898).

POWER (Thomas): “The Botanist's Guide for the County of Cork” (in “Contributions towards a

Fauna and Flora of the County of Cork,” by J. R. HARVEY, J. D. HUMPHREYS, and T. POWER), 8vo, London, Cork, 1845.

PRAEGER (Robert Lloyd): “Irish Topographical Botany” (1901), and Supplements for 1901 – 5, 1906 – 28, and 1929 – 34, all in Proc. R. Irish Acad. “A Tourist's Flora of the West of Ireland,” 8vo, Dublin, 1909, etc. Also many papers and notes in Journ. Bot., Irish Nat (mainly), etc., 1890 – . First finder of *Medicago sylvestris* (1894), *Sorbus anglica* (1933), *Arctium majus* (1893), *Polygonum laxiflorum* (1896), *Spiranthes stricta* (1892), *Poa palustris* (1896), *Glyceria Foucaudii* (1903), *Lastrea remota* (1898), *Phegopteris Robertiana* (1932), *Equisetum litorale* (1917).

ROGERS (Rev. William Moyle): “Handbook of British Rubi,” 8vo, London, 1900. Papers and notes on Rubi in Journ. Bot. and Irish Nat., 1894 – 1918. Described several Irish Rubi and determined very many. Biography – Journ. Bot. 1920, 161 – 4 (portrait).

SCULLY (Reginald William): “Flora of County Kerry,” 8vo, Dublin, 1916. Joint editor with N. COLGAN of “Contributions towards a Cybele Hibernica,” 2nd ed., 8vo, Dublin, 1898. Papers and notes, mainly on Kerry plants, Journ. Bot. and Irish Nat., 1888. First finder of *Hieracium Seallyi* (1894), *Polygonum sagittatum* (1889), *Juncus macer* (1889), *Carex hibernica* (1889), *Nitella batrachosperma* (1889), *Chara canescens* (1894).

SHERARD (William): First finder of *Mertensia maritima* (c. 1691). Biography – Journ. Bot. 1874, 129 – 138; B. & B. 274.

STELFOX (Arthur Wilson): First finder of *Carex Pairai* (1920). Papers and notes in “Irish Naturalist,” etc., 1914 – .

STEWART (Samuel Alexander): Joint author with Thomas Hughes CORRY of “A Flora of the North – east of Ireland,” 8vo, Belfast, 1888; and (with R. LI. PRAEGER) of “A Supplement to the Flora of the North – east of Ireland,” 1895. (See also under WEAR, S.) Reports, papers, and notes (NE (mostly), Fermanagh, L. Allen, Lower Shannon) in Proc. R. Irish Acad., Journ. Bot., and Irish Nat., 1865 – 1904. First finder of *Ranunculus fluitans* (1865), *Hieracium Stewartii* (1891), *Carex aquatilis* (1884). Biography – Irish Nat. 1910, 201 – 9 (with portrait and list of papers); Journ. Bot. 1911, 122 – 3 (portrait); Lett 623 – 4; B. & B. 289.

STOKES (Whitley): First finder of *Trichomanes radicans* (before 1804). Biography – B. & B. 290.

TATE (Prof. Ralph): “Flora Belfastiensis,” 16mo, Belfast, 1863. A few notes in Journ. Bot., etc. Biography – Fl. NE.I. xx – xxi; Irish Nat. 1902, 36 – 9; B. & B. 296.

TEMPLETON (John): MS. “Flora Hibernica” and other MSS. in Library R. I. Academy. Letter (on *Rosa hibernica*) in Trans. R. Dublin Soc. 3 162, 1802. First finder of *Rosa hibernica* (1795), *Sisymbrium Ligusticum seoticum* (1793), *Adoxa Moschatellina* (with J. L. DRUMMOND, 1820), *Orobanche rubra* (before 1793). and many other plants, Biography – Fl. NE.I. xvi – xviii; B. & B. 298; Fl. Dublin xxiv – xxv; Lett 616 – 7.

THOMPSON (William), author of “The Natural History of Ireland,” 4 vols. Notes in Ann. Nat. Hist. and Phytologist, 1842 – 3. First finder of *Elatine Hydro – piper* (1836), *Astragalus danicus* (with R. BALL, 1834), *Allium Babingtonii* (with R. BALL, 1834). Biography – Memoir, by R. Patterson, in Thompson: Nat. Hist. of I., 4 (portrait).

THRELKELD (Caleb): “Synopsis Stirpium Hibernicarum,” 12mo, Dublin, 1726. Biography – Fl. Dublin xix – xx; B. & B. 301.

TOMLINSON (W. J. C.): Paper and notes in Irish Nat., 1903 – 16. Biography – Irish Nat., 1921, 108.

TOWNSEND (Miss H.): Finder of *Helianthemum guttatunt* (before 1843).

TRENCH (Miss): Finder of *Euphorbia Peplis* (1839). Biography – Lett 620 – 1.

VOWELL (Richard Prendergast): Joint author with R. M. BARRINGTON (vide) of reports in Proc. R. Irish Acad., 1885 – 8. First finder (with R. M. BARRINGTON) of *Epilobium alsinefolium* (1884). Biography – Irish Nat. 1911, 218.

WADDELL (Rev. Cosslett Herbert): Notes (mostly NE area) in *Irish Nat.*, 1892 – 1917. First finder of *Hieracium senescens* (1900), *Hypochceris glabra* (with H. W. LETT, 1900), *Erythraea litoralis* (with J. E. SAUL, 1913), *Rhinanthus major* (1908), and some critical plants. *Biography – Irish Nat.* 1919, 108; *Journ. Bot.* 1919, 358 – 9; *B. & B.* 311.

WADE (Walter): “*Catalogus systematicus plantarum indigenarum in comitatu Dublinensi inventarum*,” Pars prima. 8vo, Dublin, 1794. Papers in *Trans. R. Dublin Soc.*, 1802 – 4. First finder of *Matthiola sintucta* (1804), *Eriocaulon septangulare* (1801). *Biography – Fl. Dublin*, xxiii – xxiv; *B. & B.* 312.

WEAR (Sylvanus): “A Second Supplement and Summary of Stewart and Corry's Flora of the North – east of Ireland,” *Belfast Nat. Field Club*, 1923. *Biography – Irish Nat.* 1921, 23.

WHITE (J.): “An Essay on the indigenous Grasses of Ireland.” Dublin, 1808. Contributor to “The Irish Flora,” 1833. *Biography – Fl. Dublin*, xxvii; *B. & B.* 180.

WHITLA (William): First finder of *Equisetum trachyodon* (1830). *Biography – B. & B.* 325.

WYNNE (Rt. Hon. John): First finder of *Arabis petraea* and *Saxifraga sitvalis* (1837). *Biography – B. & B.* 336.

1. Division of Ireland into 12 DISTRICTS (based mostly on county boundaries) and numbered XIX to XXX from S to N, corresponding to and continuing the 18 PROVINCES used by H. C. Watson in his “*Cybele Britannica*” (3, 1852). Proposed by Prof. C. C. Babington* in 1859 (and used, re-numbered 1-12, by Moore and More in “*Cybele Hibernica*,” 1866, and by Colgan and Scully (who preferred Roman numerals) in the second edition of the same work (1898)); also division into 37 subordinate VICE-COUNTIES (a few of the larger of the 32 counties being bisected), corresponding to the 112 VICE-COUNTIES used by Watson in his “*Topographical Botany*” (1873-4). * BABINGTON (C. C.): “Hints towards a *Cybele Hibernica*.” *Proc. Dublin University Zool. and Bot. Assoc.* 1 246-250, 1859, and *Nat. Hist. Review* 6 (Proc.) 633-637, 1859.
2. Partition into 40 DIVISIONS, numbered 1-40 from S to N (derived from the 32 counties of Ireland by partition of the larger ones), corresponding to the 112 VICE-COUNTIES used by H. C. Watson in his “*Topographical Botany*” (1873-4). Proposed by R. Ll. Praeger in 1896*, and used in “*Irish Topographical Botany*” (1901) and in a number of subsequent papers by various authors dealing with other groups of the flora and fauna. See fig. 29.* R. LL. PRAEGER: “On the Botanical Subdivision of Ireland.” *Journ. Bot.* 1896, 57-66, and *Irish Nat.* 1896, 28-38, map.
3. Partition of Ireland into 12 SUB-PROVINCES, derived by dividing each of the four Provinces of Ireland into three (and designating them U1, U2, U3, etc., U = Ulster); each of these contains two to five of Praeger's VICE-COUNTIES. Proposed by J. Adams in 1908*. This suggestion has distinct advantages over the corresponding scheme of Babington, inasmuch as the coast-line and the mountain areas are somewhat evenly distributed among the 12 areas, which tends to emphasize differences of biological distribution not dependent on habitat only.* J. ADAMS: “On the Division of Ireland into Biological Sub-Provinces.” *Irish Nat.* 1908, 145-151, map.
4. Proposal by R. Ll. Praeger* to employ his subdivision or that of Babington graphically, when desired, by printing, in two kinds of type (representing presence or absence) the Division-numbers in positions approximating to those which the Divisions occupy on a map.
* R. LL. PRAEGER: “A Simple Method of representing Geographical. Distribution.” *Irish*

Nat. 1906, 88-94, and Journ. Bot. 1906, 128130.

Amended by A. W. Stelfox*, to allow the use, instead of numbers, of two-letter symbols to represent the DIVISIONS, these symbols being obtained by contracting the names of the Divisions. Used in several subsequent botanical and zoological papers.

The forty divisions into which Ireland is partitioned in "Irish Topographical Botany" (fig. 29) have an average area of 813 square miles (maximum 1336 (W Mayo), minimum 316 (Louth)) – which approximates closely to the average of Watson's 112 vice-counties, which is 804 sq. miles. This allows comparisons to be instituted between the two, which show clearly the reduction in the flora on the western side of the Irish Sea. The actual figures vary according to the standard adopted for that flexible term species. If we use it in a conservative sense (e.g. that adopted in "Irish Topographical Botany," and shown there by heavy type), a standard which approximates to that of Babington's "Manual" (excluding suppl. 2 of the 10th edition), the maximum for any Irish division stands at present at 800 (Antrim), the minimum at 520 (Monagh'an), the average at 640. If we include the plants treated as sub-species in "Irish Topographical Botany" (still a conservative estimate), the maximum for any Irish division is 942 (Down) and the minimum 554 (Longford). (The increase in the difference between the extremes is largely due to the unequal working out of segregates: for instance, only one fruticose *Rubus* is on record from Longford.) If estimated on the standard of the "London Catalogue," the numbers would be larger. These figures may be compared with such English county totals as have been published. The latter are greater by some 50 per cent.* A. W. STELFOX: "A List of the Land and Freshwater Mollusks of Ireland." Proc. Roy. Irish Acad. 29 B 65-164, P1. VII. 1911.

SOME RARE OR INTERESTING PLANTS.

79. For convenience of reference it may be well to list the more interesting members of the Irish flora in systematic order, with brief notes as to their distribution, etc. This list deals mostly with such well-marked and well-known species (Linneons) as are of rare occurrence in Ireland or Britain or both, but some interesting critical plants and hybrids have been included. A fair amount of work has been done at the more critical plants in Ireland, but a great deal remains. Many of the finer splits, such as those of *Capsella*, *Viola*, *Taraxacum*, *Thymus*, *Salicornia*., have hardly been touched as yet. In so far as segregates have been awarded specific rank in the eleventh edition of the "London Catalogue," their Irish range is shown in brief in the "Census List" which appears at the end of this volume. For further information, the obvious Irish works of reference should be consulted, as well as papers by E. S. Marshall, G. C. Druce, C. H. Waddell, etc., referred to in the Bibliography in "Irish Topographical Botany"; also my own papers, "Gleanings in Irish Topographical Botany," in Proc. Roy. Irish Acad., 24, B, 1902, and "A Contribution to the Flora of Ireland" (including 3rd Suppl. to "Irish Topographical Botany") in Proc. Roy. Irish Acad., 42, B, 1934. Druce's "Comital Flora of the British Isles" contains some additional records (*Viola*, *Alchemilla*, *Thymus*, *Rhinanthus*, etc. – see 492). As regards hybrids, work is required in *Epilobium*, *Euphrasia*, *Rumex*, *Salix*, and some other genera. The few hybrids mentioned below are ones in which interesting species take part, or which are known to be of very infrequent occurrence.

80. *Ranunculus fluitans* Lamk.—Known only from the Sixmilewater in Antrim, where it grows abundantly for some miles (461). First found by S. A. Stewart in 1.865. Widespread in England and southern Scotland, and in Europe generally.

81. *Ranunculus tripartitus* DC. – Found by R. A. Phillips in 1896 growing plentifully in a small lake S of Baltimore in W Cork (see Journ. Bot., 1896, 277, and Irish Nat., 1896, 166), and the

closely allied *R. lutarius* in a pool near Adrigole, 20 miles to the NW in 1894. Only Irish stations. In Britain *R. tripartitus* is exceedingly rare, and in England in SW only. In Europe western. See also 297, 306.

82. *Ranunculus scoticus* E. S. Marshall (*R. petiolaris* E. S. Marshall, 1892, non H. B. & K., 1821. *R. Flammula* var. *petiolaris* Lange). – Only recently separated from *R. Flammula*, and distribution imperfectly known. First found in Ireland by Marshall on Achill I. in 1899; since by many lakes in W Mayo, and by Loughs Corrib, Mask, Conn, Achree, Gill, Key, Macnean, Erne, Neagh (Londonderry), and Dan (Wicklow). Also by L. Bofin in Leitrim, whence there was a doubtful old record (*Journ. Bot.*, 1892, 377). From 50 ft. (L. Corrib) to 1000 ft. (lakelets S of Lower L. Erne). It occurs both on and off the limestone. Figured in *Journ. Bot.*, 1892, tab. 328. Known from 14 vice-counties in Scotland.

82a. *Caltha radicans* Forst. – Long known only from Devenish Island near Enniskillen, it proves to be widespread in Ireland, though not in such an extreme form. It is lowland, favouring lake-shores especially in the Central Plain and elsewhere, and becomes rare only in the E and SE. See *Irish Nat. Journ.*, 5, 98-102, 1934, for particulars of its distribution.

83. *Meconopsis cambrica* Vig. – Isolated stations on the hills in many counties, 50-1500 ft., but absent from some likely ground, such as Kerry, Mayo, Donegal. First found by John Templeton at Fair Head in Antrim before 1804. Southern in Britain, being not native in Scotland. Southwestern in Europe (Ireland to Spain and the Jura).

84. *Matthiola sinuata* Br. – A rare and decreasing species in Ireland, but still grows on the Wexford coast (see *Irish Nat. Journ.*, 1, 96), and in Clare (*Irish Nat.*, 1912, 153, and *Irish Nat. Journ.*, 5, 33); apparently extinct in Kerry (*Fl. Kerry*, 16). In Britain confined to SW England and Wales. Elsewhere on the shores of W Europe and the Mediterranean.

85. *Arabis Brownii* Jordan *Diagn.* 123, 1864. (*A. ciliata* auct. angl., non R. Br. *A. hibernica* Willmott, *Journ. Bot.*, 1924, 26). A critical plant, which has been involved in much confusion, on account of its proximity to forms of *A. hirsuta*. As now segregated, it appears to be endemic in Ireland (see Salmon in *Journ. Bot.*, 1924, 2368). First found by Lhwyd in 1699. In sandy places along the west coast in S Kerry, W Cork, Clare, W Galway, and W Donegal.

86. *Cochlearia anglica* Linn. – Till lately considered a southern plant in Ireland (Wexford to the Shannon), with an outlying station on the Foyle, but now known to occur in muddy places and by muddy waters all round the Irish coast. It crosses everywhere with the ubiquitous *C. officinalis*, the hybrids being usually much more abundant than pure *anglica*, and including “var.” *Hortii* (Praeger in *Proc. R. Irish Acad.*, 41, B, 96-100, 1932). In Britain southern, but extends to the W coast of Scotland. In Europe along the NW coasts.

87. *C. groenlandica* Linn. (see Marshall in *Journ. Bot.*, 1892, 225-6, tab. 326. *C. scotica* Druce). – West and north coasts, in Cork, Kerry, Clare, Galway, Mayo, Sligo, Donegal, Derry, Antrim, frequent on exposed sea-rocks. See Praeger in *Proc. R. I. Acad.*, 41, B, 101-2, 1932. Frequent in similar situations in Scotland; apparently absent further S in Britain. NW Europe to the Arctic. First found by H. C. Hart before 1896. Crosses in Kerry, Donegal, and Derry with *C. officinalis*.

88. *Sisymbrium Irio* Linn. – A characteristic Dublin alien, unknown elsewhere in Ireland. Formerly abundant; much rarer now, owing mainly, according to Colgan (*Fl. Dublin*, 21), to the substitution of concrete for gravel on suburban foot-ways. Occasionally found from Swords to Dun Laoghaire (Kingstown), but mostly near the city, where it was first noted by John Templeton at the

beginning of the 19th century. In Britain it is equally rare and local. Widespread in Europe, extending to N Africa, etc.

89. *Helianthemum guttatum* Mill. – The type and var. *breweri* grow plentifully at Three Castle Head in W Cork, and on Inishbofin (405) and (var. *Breweri* only). the neighbouring Inishark in W Galway; the type also sparingly on Inishturk (406), a few miles N. First found by Miss Townsend before 1843. The variety grows on Anglesea, but the nearest station for the type is the Channel Islands. The plant has a wide foreign range – Europe, N Africa, W Asia.

90. *Helianthemum canum* Baumg. – Locally abundant in Burren, Co. Clare, with outliers on Inishmore and the Cliffs of Moher to the W, and Salthill in W Galway to the N. First found by J. T. Mackay before 1806. W England, rare. More widely spread abroad, in Europe, W Asia, N Africa.

90a. *Helianthemum Chamaecistus* Mill. – Found by H. C. Hart in 1893 on bare limestone south of Ballintra in SW Donegal (Journ. Bot., 1893, 218); disallowed subsequently as a casual escape or introduction. Refound on the same ground in 1933, amid a native flora, and undoubtedly indigenous. (Irish Nat. Journ., 5, 76-77.) The only Irish station for a plant very widespread in Britain.

91. *Viola stagnina* Kitaibel. – Very local, in damp places on the western limestones in Clare, SE Galway, E Mayo and Fermanagh, and on the banks of the Shannon near Roosky in Longford. It is essentially a plant of the “turloughs” – deep grassy hollows in the limestone which are flooded, often for long periods, especially in winter (360). The neighbourhood of Gort seems to be its headquarters. Hybridizes freely with *V. canina*. First found in Ireland by A. G. More in 1851 at Garryland near Gort. In England very rare, mostly on bogs and fenlands in the E. Also in NW and central. Europe.

92. *Viola lutea* Huds. – In only three areas – one in W Cork, one in Clare, and a third about the upper Liffey in Kildare, Wicklow and Dublin, where it is very abundant, in places. From sea-level to 1000 ft. In hilly districts almost throughout Britain. Europe.

93. *Polygala vulgaris* var. *Ballii* (Nyman). (Var. *grandiflora* Bab. *P. grandiflora* Druce. *P. Babingtonii* Druce). – This fine variety has been long known from the Ben Bulbin range (422, 429) in Sligo and Leitrim (to 1700 ft.) and from Benevenagh (456) in Derry. G. C. Druce has recorded it also from Ardahan in SE Galway and Inchnadamph in Sutherland (Irish Nat., 1912, 240) and Ostenfeld from the Faeroes (Bot. of the Faeroes, 71, 1901), but the identity of these plants with the Irish one appears somewhat doubtful. See A. Bennett, Journ. Bot., 1912, 228-9, and G. C. Druce, *ibid.*, 1913, 60-61.

94. *Silene acaulis* Linn. – Common on the Ben Bulbin range, with outlying single stations in Mayo, Donegal, and Derry, 400-1600 ft. – a NW distribution characteristic of alpine and “Scottish” species in Ireland. Alpine in Britain. Circumpolar, in Arctic and northern regions.

95. *Arenaria ciliata* Linn. subsp. *hibernica* Ostenfeld and Dahl (plate 3). In *Nyt Magazin for Naturvidenskaberne*, 1917, 215-225, these authors distinguish the Ben Bulbin plant under the name *hibernica* from subsp. *pseudofrigida* occurring in Arctic Europe, and subsp. *norvegica* (*A. norvegica* Gunnerus and auct. britt.) of Shetland and Arctic Europe and America, the three forming “Kollektivart” *A. ciliata*. The plant is of frequent occurrence on the W part of the Ben Bulbin range in Sligo, on limestone rocks, 1200-1950 ft. (423). Found by E. Lhwyd in 1699 (Druce Com. Fl. Brit., 54); first recorded by J. T. Mackay in 1806.

96. *Elatine Hydropiper* Linn. – Was apparently confined to Lough Briclan and Lough Shark, Co. Down, and L. Neagh (465) until the making of the canals late in the 18th century, when it spread from L. Neagh along the Lagan Canal as far as Belfast, and (presumably from L. Shark) down the Newry Canal to Newry. Not seen recently in most of its old stations, but occupies 15 miles of the canal from Newry northward (see Irish Nat. Journ., 5, 102-4). First found in Ireland by William Thompson at Newry in 1836. Equally rare in England and Wales, though not quite so local. Widespread in Europe, but local; Siberia, N America.

97. *Lavatera arborea* Linn. – An aboriginal inhabitant of sea-rocks, with a present range much extended by introduction into cottage gardens. Indigenous in the S (Waterford to Clare), and in Wicklow, Dublin, Antrim, on cliffs and sea-stacks. Of doubtful standing elsewhere. Britain as far N as the Clyde. W and S coasts of Europe; N Africa, Canaries.

98. *Erodium moschatum* L 'llêrit. – A plant of uncertain standing, chiefly about roadsides and towns by the sea. Of 20 divisions (out of 40) in which it grows, only one (Offaly) is wholly inland. More frequent in Cork than elsewhere. Widespread in England and Wales. Widespread in Europe, N Africa, W Asia, America, N. Zealand.

99. *Ulex europaeus f. strictus* (Mackay). (*Ulex strictus* Mackay in Trans. Roy. Irish Acad., 14, 166, 1824 – 5 (nomen solum). *U. europaeus* var. *strictus* Mackay Fl. Hib.. 1, 74, 1836. *U. hibernicus* G. Don, Loudon's General System, 2, 148, 1832). – This curious juvenile form of *U. europaeus*, soft, erect, with short branchlets and spines, and few flowers, was found at Mountstewart, Co. Down, by a Mr. Murray of Comber; he brought it into his nursery, where it was seen by John White, gardener at Glasnevin and author of the “The Grasses of Ireland” (1808), by whom it was introduced into cultivation (see Fl. NE Ireland, 34).

100. *Medicago sylvestris* Fr. (? *M. falcata* X *sativa*). Co. Dublin only – a large patch on dunes at Malahide, and a smaller patch at Portmarnock, 34 miles S (228). First recognised by Praeger in 1896 (Irish Nat., 1896, 249-251), but has grown at Portmarnock for at least 80 years (specimens in Herb. Nat. Mus., Dublin). See also Colgan Fl. Dublin, 55-6.

In Britain a very rare plant of the E counties of England. On the Continent local and rather western. Often set down as *M. falcata* X *sativa*. In Ireland, in the area where the plant occurs the former is a rare casual, the second a naturalized alien; *M. sylvestris* is there a very persistent perennial.

101. *Astragalus danicus* Retz. (*A. hypoglottis* Linn.). – Known only in Ireland from the Aran Islands in Galway Bay, where it was first found by R. Ball and Wm. Thompson in 1834. It appears to be limited there to Inishmore and Inishmaan, where it is a member of the peculiar calcicole flora of the bare limestones (352), spreading to sandy pastures. In Britain local, on gravelly and chalky soils from N Scotland to S England. Arctic – alpine in Europe; also in N Asia.

Clearly a relict species in Ireland from Glacial or early Postglacial times.

102. *Trifolium glomeratum* Linn. – SE coast only, in Wexford (Rosslare and Arthurstown) and Wicklow (riverside at Wicklow, where it was found for the first time in Ireland by D. Moore in 1869). S and SE England. SW and S parts of the Continent, from W France along the Mediterranean; W Asia, N Africa, Canaries.

103. *Lathyrus palustris* Linn. – Drainage has greatly reduced this plant on Lough Neagh, where it was formerly frequent. Elsewhere it has a number of stations confined to the Shannon and Erne

basins, also outposts in Wicklow. (Compare the similar range of *Sium latifolium*). Middle England mostly. A northern circumpolar plant.

104. *Lathyrus maritimus* Bigel. – Another northern plant, clearly relict, known only from sand-dunes at Rossbeigh on the S side of the head of Dingle Bay. Recorded as long ago as 1756 (Smith: “History of Kerry,” 380) from the sands of Inch on the N shore close by, and seen at intervals, apparently in both stations, until 1845. Rediscovered at Rossbeigh in 1918 (Irish Nat., 1918, 113115). It grows there in fair quantity over a limited area. (See 318, also Scully Fl. Kerry, 72-4, and Irish Nat., l.c.) In Britain down the E and SE coast from Shetland to Dorset. Elsewhere a northern and Arctic circumpolar plant.

105. *Rubus*. – Though much collecting has been done in this group, as by S. A. Stewart, H. W. Lett, C. H. Waddell, R. A. Phillips, R. W. Scully, E. S. Marshall, W. M. Rogers, and the writer, Irish brambles are still incompletely known. Their range and abundance seem to differ materially from what obtains in England, and Moyle Rogers has remarked on the fact that few species in Ireland tally exactly with their British analogues. A few noteworthy plants may be mentioned here:–

R. hesperius Rogers. – Chiefly in the W, apparently frequent. Very rare in Britain.

R. iricus Rogers. – In nine S and W divisions, from Cork to Mayo, and also Antrim. Type apparently endemic, but var. *minor* is found in Britain.

R. Lettii Rogers. – In Cavan, Armagh, Down, and half a dozen English counties.

R. adenanthus Boul. and Gill. – S and N Kerry and five British vice-counties.

R. mucronatoides Ley. – W Mayo and three English vice-counties only.

R. regillus Ley. – In N and S Kerry, also Down; and three vice-counties in Britain.

R. morganwgensis Barton and Riddelsdell. – In Down and some eight British vice-counties.

R. ochrodermis Ley. – In SE Galway and eight British vice-counties.

Among other Rubi rare in both Ireland and Britain are *R. altiarcuatus*, *nemoralis*, *Questieri*, *Salteri*, *Wedgwoodia*, *thysiger*, *longithysiger*, *serpens*, etc.

106. *Dryas octopetala* Linn. (plates 2, 20). – He who has viewed the thousands of acres of this Arctic-alpine plant in full flower on the limestones of the Burren region of Clare, from hill-top down to sea-level, has seen one of the loveliest sights that Ireland has to offer to the botanist. It has a second less continuous headquarters about Ben Bulbin and northward, and single stations in Donegal, Derry, and Antrim. It is not certain that in its limited stations off the limestone in W Galway (391) and Donegal (445) the plant is actually in a non-calcareous soil, for the metamorphic rocks among which it occurs may well yield a sufficiency of calcium by the decay of primitive limestone or of serpentine. In this connection see also 193. In outlying stations on limestone drift at Gentian Hill and Barna Head, west of Galway, as in Burren, it descends to sea-level. Its highest station in Ireland is only 1300 ft. (Slieve League in Donegal). First found by Rev. Richard Heaton before 1650 (How's “Phytologia”). In Britain from Wales to Orkney, mostly on mountains, and essentially a limestone plant. An Arctic-alpine circumpolar species: also in the Caucasus.

107. *Potentilla fruticosa* Linn. (plate 21). – On limestone rocks along the western edge of the Central Plain for about 40 miles from N Clare to E Mayo, locally abundant. N England on limestone, very local. A northern and alpine plant with a wide but local circumpolar range, S to the Himalayas and Caucasus.

108. *Rosa*. – Knowledge of Irish roses has not kept pace with recent work in England. Some existing records stand in need of revision, and further work is required. The only species which is known to have a definite local range in the country is *R. micrantha*, which is confined to Kerry and

Cork. *R. stylosa* (var. *systyla*) (apparently southern and native – see *Journ. Bot.*, 1934, 69). *R. Afzeliana* (= *glauca*), *R. dumetorum*, *R. coriifolia*, *R. Sherardi* (omissa), and *R. tomentella* occur, but their range is not worked out yet. *R. spinosissima*, *canina*, *tomentosa*, *arvensis* are common, *rubiginosa* and *mollis* rather rarer. Among the hybrid forms, *R. gracilescens* and *R. Moorei* (*rubiginosa* X *spinosissima*), two very rare plants, are old north-eastern finds, and *R. mayoensis* (*mollis* X *spinosissima*) has been recently described (Wolley-Dod in *Journ. Bot.*, 1924, 202) from Mayo and Sutherland. *R. pilosa* is Irish only, but the station is unknown. Two other hybrids are mentioned separately below, the first because of its essentially Irish history, the second because it is unknown elsewhere.

109. *Rosa hibernica* Templeton (*R. dumetorum* X *spinosissima*). – This rose was first found between Belfast and Holywood in Down (474) in 1795 by John Templeton, who described it as a new species in 1802. Long looked on as *R. canina* X *spinosissima*, that combination is now attributed to the plant known as *R. hibernica* var. *glabra* Baker (X *R. glabra* Wolley-Dod). The “type” has been found about Tillysburn and Stranmillis near Belfast and (?) Magilligan in Derry, *R. glabra* about Glenarm and Carnlough in Antrim, and Magilligan: also in Co. Limerick (*Irish Nat.*, 1903, 250). Rare in Britain and on the Continent. See Templeton in *Trans. Dublin Soc.*, 3, 162-4; J. Britten in *Journ. Bot.*, 1907, 304-5, and *Irish Nat.*, 1907, 309-10; H. W. Lett in *Journ. Bot.*, 1907, 346-7; Wolley-Dod in *Journ. Bot.*, 1931, Suppl., 14.

110. *Rosa Praegeri* Wolley-Dod (*R. canina* X *rugosa*). – A natural cross between the native *R. canina* and the Japanese *R. rugosa*, recently found at Cushendun in Antrim (*Journ. Bot.*, 1928, 87-88). Not known elsewhere.

111. *Sorbus Aria* group. – The complicated group of forms formerly included in *S. Aria* have recently been found to be well represented in Ireland. *S. anglica* (*S. Mougeotii* var. *anglica* Hedlund), rare in W England, is Native at Killarney. *S. rupicola* is apparently quite rare, but ranges from Kerry to Antrim. Unexpectedly, *S. porrigens* (= *S. hibernica*), which like *anglica* is confined in Britain to the region of the Severn, proves to be the prevailing Irish plant, ranging from Kerry to Dublin and Sligo. *S. Aria*, very widespread in Britain, is so far in Ireland determined only from the neighbourhood of Galway. (See *Irish Nat. Journ.*, 5, 50-52, also Salmon in *Journ. Bot.*, 1930, 172-7.) More distinct is *S. latifolia*, first found by R. A. Phillips in 1908, occupying an area along the rivers Barrow and Nore above and below New Ross, and I believe native there (see *Irish Nat.*, 1924, 129; *Irish Nat. Journ.*, 4, 194), as the others undoubtedly are in the regions indicated.

112. *Saxifraga nivalis* Linn. – Among *Arenaria*, *ciliata* and other alpines on the cliffs of Annacoona in the Ben Bulbin range (422), 1200-1950 ft. Only Irish station, where it was first found by John Wynne in 1837. In Britain in Wales, the Lake District, and the Highlands, in alpine situations. A northern circumpolar plant.

113. *Saxifraga Geum* Linn. – Confined in Ireland in its typical (pure) form to the SW (Kerry (except the north) and W. Cork (300)). Elsewhere in the Pyrenees, N Spain, Portugal; also reported from the Alps and Carpathians, but there is no reason to consider it native there. Observation points to the truth of Scully's suggestion that this is a decreasing species in Ireland, now tending to hybridize itself out of existence by crossing with the stronger *S. spathularis* (*umbrosa* auct.). This view is endorsed by its more recent discovery on Clare Island, Co. Mayo (the only station outside the district named), where it occurs sparingly not in its pure form, but in a hybrid state well known in the SW and representing a plant about two-thirds *S. Geum* and one third *S. spathularis*: and along with this on Clare Island (amid abundance of typical *spathularis*), are other plants about half-way between the two species. *S. Geum sensu stricto* is a plant “*foliis reniformibus dentatis*” (Linn. *Sp.*

Pl. (ed. 2), 575). This is a well-marked form, varying little except in size and in the dentition of the leaves, which may be crenate or apiculate-crenate or truncate-crenate or quite sharply serrate with teeth about equilateral (i.e., with the base of the teeth equalling the sides). Authors subsequent to Linnaeus have often included under *S. Geum* forms in which the leaves are not reniform, only orbicular, the leaf-margins entering the petiole at about a right-angle. Forms of this facies (to which the Clare Island plant belongs) have several times been awarded separate names – *S. polita* Haworth, *S. dentata* Haworth, *S. gracilis* Mackay, *S. elegans* Mackay, but they must be looked on as of hybrid origin – the first step from *Geum* towards *spathularis*. *S. hirsuta* represents a further stage towards *spathularis* among the complicated hybrid progeny, being fairly intermediate between the parents. Thence other forms lead on to pure *spathularis* (see under that species). (See Scully Fl. Kerry, 125-6, also Praeger in Irish Nat., 1912, 205-6.)

First found by E. Lhwyd, in Kerry, in 1699.

114. *Saxifraga spathularis* Brotero. (*S. umbrosa* auct. non Linn.) (plates 4, 34).—An abundant and characteristic plant at all elevations in the Kerry-Cork (300) and Galway-Mayo (384) mountain areas; more local in Donegal. Eastward it dies out before Cork city is reached, but reappears in the mountains of Waterford and S Tipperary (Galtees (250), Knockmealdown (284), Comeraghs (285)), with very interesting outlying stations on Luignaquilla and Conavalla in Wicklow (263). On the Continent it grows in the Pyrenees, N Spain, and Portugal. It is stated to occur (under the name *umbrosa*) in Corsica and the Alps, but Hegi and others look on it, as an escape in those places, and the plant intended is no doubt the strong-growing true *S. umbrosa* L., which is a hybrid *Geum* x *spathularis* form, a common plant of gardens.

In the absence of *S. Geum*, with which it crosses very freely, producing a multitude of puzzling forms, *S. spathularis* is in Ireland a plant of uniform facies. The most widespread form, which Dr. Scully takes as the Irish type, is “a compact fleshy plant with a rosette of spreading obovate leaves and short but broad footstalks”; his description cannot be improved upon.

The only distinguishable variant which appears to belong to pure *spathularis* is var. *serratifolia* (Mackay) (*S. serrate* Sternberg) with “long and rather narrow erect leaves and deep serrations”; in Kerry it is rarer than the other. Some extreme forms of it are found in gardens under several names.

Var. *punctata* (*S. punctata* Haworth) which is equally common, at least in Kerry, and has “roundish or slightly oblong leaves, more or less erect, with almost flat tapering footstalks” is considered by Dr. Scully, I think rightly, to represent the first stage showing the influence of crossing with *S. Geum*. Thence we pass through forms showing more *Geum* influence, to *S. hirsuta* Linn., which is fairly half-way between the two species. The forms nearer *S. Geum* have been referred to under that species (113).

Where *S. Geum* and *S. spathularis* grow together in the SW, each generally shows every conceivable gradation towards the other (plate 4); where *spathularis* alone occurs, as in Waterford, S Tipperary, W Galway, Donegal, it shows no variation in the direction of *Geum*; on the contrary, variation, when it occurs, tends to be away from *Geum* leaves more sharply toothed, blade smaller or narrower or more cuneate; observations converse to the above cannot be made, as there is no Irish area where *Geum* grows unaccompanied by *spathularis*.

While absolutely hardy on the highest mountain-summits in Ireland, the plant rejoices in a maximum of shade and moisture. In the Killarney woods, growing among *Hymenophyllum*, rosettes may be seen a foot across, bearing flowering stems a foot and a half in height.

A full and excellent account of these two species as found in Ireland, their varieties and hybrids, with plates, including an account of breeding experiments confirming views long expressed by botanists regarding hybridity in the group, is given by Dr. Scully in his "Flora of Kerry," 96-106. This convincing exposition is not so widely known as it ought to be : it is not referred to, for instance, in ENGLER and IRISCRER'S Monograph of Saxifraga in the "Pflanzenreich" series, though published two years after Dr. Scully's volume. The authors of the monograph describe many varieties and forms of both species which are without question merely hybrids.

115. According to the foregoing remarks, the Irish Robertsonian Saxifrages may be arranged as under, following closely Scully's interpretation: the series of 86 native leaf-forms which he figures should be studied in this connection:-

1. *S. Geum* L. Leaves reniform.
 forma a. Margin crenate (? *Robertsonia crenata* Haworth). (Scully, pl. I, 1-4.)
 forma β. Margin serrate (var. *serrates* Syme. ? *R. dentata* Haworth). (Scully, pl. I, 5-13.)
2. *S. spathularis* Brot. Leaves obovate.
 forma a (typica). Leaves spreading, rather broadly obovate, moderately deeply serrate. (Scully, pl. VI, 14-16.)
 forma β. *serratifolia* (Mackay). Leaves erect, long and narrower, deeply serrate. (Scully, pl. VI, 19-23.)
3. *Geum* x *spathularis*. Leaves of many intermediate shapes. (Scully, pl. II, 1-34, III, 1-23, VI, 1-6.)
 Here belong:-
S. elegans Mackay (*S. spathularis* var. *punctata* x *Geum* var. *serrata* (E. S. Marshall)).
S. gracilis Mackay.
S. polita Haworth.
S. hirsuta L. (Scully, pl. III, 1-8.)
S. punctata Haworth. (Scully, pl. VI, 10-12.)

116. Saxifraga Hirculus Linn. – Rare, in lowland peat-bogs in four midland counties, also in W Mayo, and at 1000 ft. in Antrim. In Britain equally rare, and mostly in Scotland. Elsewhere alpine-arctic and circumpolar.

117. Saxifraga hypnoides aggr. – Ireland is remarkably rich in hypnoid Saxifrages. Several are as yet unknown elsewhere, namely: *S. Drucei* E. S. Marshall (Brandon in Kerry, Arranmore in W Donegal). *S. Sternbergii* Willd. (plate 22) (Brandon in Kerry, Ballyvaughan, Black Head, and Aran in Clare, mostly as var. *gracilis*: a plant with a puzzling range – Ireland, Norway (one station), Harz, Bavaria). *S. hirta* Sm. (Kerry, frequent; Galtees and Clare (Aran)). *S. affinis* A. Don (Brandon in Kerry (Mackay, 1805) – not seen since). *S. incurvifolia* D. Don (Kerry (several stations), W Galway (Muckanaght)). *S. hypnoides* var. *robusta* E. S. Marshall (Black Head in Clare). In addition, *S. rosacea* Mcench (*decipiens* Ehrh.), which has only one British locality, occurs in several stations in Kerry, on the Twelve Bens in W. Galway, and on Clare I. in W Mayo. *S. sponhemica* and *S. hypnoides* are frequent, the former ranging over the Kerry and Waterford mountains and re-appearing in Antrim and Derry, the latter ranging from Clare round the west and north to Antrim and Wicklow. For further particulars see papers by E. S. Marshall in Journ. Bot., 1917 – 18.

118. Apium inundatum x nodiflorum (*A. inundatum* var. *Moorei* Syme Engl. Bot., 4,102, 1865, and Suppl., 187. *A. Moorei* Druce in Bot. Exch. Club Rep., 1911, 20-21). – This rather controversial plant is essentially an Irish form, occurring as at present known in 24 of the 40 divisions, from Limerick and Kildare to S Donegal and Antrim. Seems very rare in Britain, being on record from

only four English vice-counties. According to Druce (Com. Fl. Brit.) it occurs in W Germany. This seems a strange distribution for a hybrid of which the parents have both a wide range, but Riddelsdell (Irish Nat., 1914, 1 – 11) in a full discussion makes out a very good case for hybridity. The plant varies towards *nodiflorum* (f. *subnodiflorum*), and towards the other parent (f. *subinundatum*). First found by David Moore near Portmore in Antrim about 1835.

119. *Carum verticillatum* Koch. – An essentially “Atlantic” species, on the Continent ranging down the W coast from Belgium southward, in Britain found along the W coast in England, Wales, and Scotland; in Ireland confined to the SW, where it is locally abundant, and to a few stations in W Donegal, Londonderry and Antrim.

120. *Oenanthe pimpinelloides* Linn Known only from pasture at Trabolgan in E Cork (293), presumably native. First found by R. A. Phillips in 1896. S England. Middle and S Europe, N Africa, Asia Minor.

121. *Rubia peregrina* Linn. – Up the W coast as far as Mweelrea, and the E coast as far as Meath. Never far from the sea, though not maritime. Flourishes equally on or off the limestone. Wales and S England. S Europe and NW Africa.

122. *Inula salicina* Linn. (plate 25). – A noteworthy plant, being one of the few, other than the Lusitanian and American groups, which are Irish but not British. It is confined to the limestone shores of Lough Derg (353 – 4), the largest of the expansions of the Shannon, in N Tipperary and SE Galway, where it was first found by David Moore in 1843 (Journ. Bot., 1865, 333 – 5, and *ibid.*, 1866, 33 – 36, tab. 43). Rather widespread on the shores and islets, at a little above flood-level, from the head of the lough a Portumna as far S as the vicinity of the Carrikeen Islands, near Dromineer. Not yet recorded from the S portion of the lake. Its habitat is the rough grassy, stony, or boulder – strewn ground that intervenes between flood – level and the arboreal zone (plate 26). There it runs about by stolons, forming small colonies, and flowering rather sparingly in July. In the garden it spreads rapidly, and soon forms a large patch, with a network of slender white underground stems. It is not yet fully known what effect the Shannon Electricity Works, by which the water of the lake is raised to about winter level, may have on the plant, but there is little reason to fear for it. Widespread on the Continent, from Greece to Norway and W France to central Russia and on into Asia; and in view of its presence in Ireland its absence from Britain is difficult to explain.

123. *Diotis maritima* Cass. (*D. candidissima* Desf.) (plate 7). – SE coast – Waterford (not seen recently) and Wexford (278), where it still exists in some quantity, First found by J. G. Allman in 1845. In Britain southern, on coasts from Suffolk to Anglesea, discontinuous and now very nearly extinct. A plant of the Mediterranean, extending to Portugal and the Canaries. For a full account of the plant in Britain and Ireland, with good photographs taken in its Wexford habitat (one of them reproduced here), see C. P. Hurst in “Manchester Memoirs,” 1901 – 2, 1 – 8, pl. 1 – 2.

124. *Artemisia Stelleriana* Bess. – This ornamental Siberian plant, thrown out from the gardens of St. Anne's at Clontarf, Co. Dublin, before 1891, drifted across to the adjoining sand-spit of the North Bull (228), and is naturalized there now over a distance of at least a couple of miles (though apparently rare of late), See Moffat in Journ. Bot., 1894, 22 and 104 – 106; Areschoug, *ibid.*, 70 – 75; Colgan Fl. Dublin, 110 – 111; and Journ. Bot., 1900, 317 – 8. Naturalized in Cornwall, New York, Kamtschatka (Druce).

125. *Senecio squalidus* x *vulgaris*. – The S European *Senecio squalidus*, naturalized and abundant about Cork (291), where it appeared about a century ago (and has since spread to many Cork towns, and recently to Dublin). hybridizes freely at Cork and sparingly at Dublin with *S. vulgaris*, giving rise by continued crossing to a progeny stretching from the one species to the other, complicated at Cork by the frequent presence of *S. vulgaris* var. *radiates*. Its nomenclature is involved – see Burbidge in *Irish Nat.*, 1897, 300, and Phillips, *ibid.*, 1898, 22. At Maryborough a small colony of *S. squalidus* has produced crosses with *S. Jacobcea*.

126. *Senecio cineraria* x *jacobaea* (*S. albescens* Burbidge and Colgan). – The Mediterranean *S. Cineraria*, escaped from a garden at Dalkey, Co. Dublin, has colonized the rocky shore in abundance for nearly a mile. Here it crosses freely with *S. Jacobaea*, the hybrids showing every gradation from one species to the other – see 233. Similar crossing has been recorded where the plant has run wild in SW England.

127. *Cnicus palustris* X *pratensis* (*C. Forsteri* Smith). – Not uncommon where the parents grow together: recorded from Clare, Carlow, Leix, Dublin, SE Galway, Westmeath, E Mayo, Londonderry. See *Proc. Roy. Irish Acad.*, 24, B, 72 (1902).

128. *Hieracium* – Irish *Hieracia* have been tolerably well worked, and the older names revised according to modern knowledge. The Hawkweed flora is fairly rich. Three “species” – *H. Scullyi* Linton (S Kerry), *H. Stewartii* F. J. Hanb. (Down), and *H. sttbintegrum* Stenstr. (N. Kerry) are, so far as at present known, in the British Isles confined to Ireland. Among other rare Irish forms are:– *H. flocculosum* Backh. (Down, Antrim), *proximum* F. J. Hanb. (Kildare, Wicklow, E Donegal), *scoticum* F. J. Hanb. (W. Donegal), *Leyi* F. J. Hanb. (Derry), *repandum* Ley (Sligo), *orimeles* W. R. Linton (S and N Kerry, E and W Donegal), *hypochoeroides* Gibson (W. Cork, Clare, W Mayo, Sligo, Louth), *hibernicum* F. J. Hanb. (Down and E Donegal), *lepistoides* Johanss. var. *sublepistoides* Zahn (N. Kerry, Limerick, Down), *grandidens* Dahlst. (Down), *cinderella* Ley (Down), *pachyphyllaides* Zahn (Antrim, Derry), *killinense* Zahn (Antrim), *sagittatum* Lindeb. (Down), *maculosum* Dahlst. (Dublin), *crebridens* Dahlst. (Clare), *cymbifolium* Purchas (Clare, Sligo), *cordigerum* Norrl. (Derry), *farrense* F. J. Hanb. (Wicklow, Antrim), *orarium* Lindeb. (W. Mayo, Antrim), *senescens* Backh. (Down), *sparsifolium* Lindeb. (S. Kerry), *strictum* Fr. (Wicklow, Antrim, Derry), *dunuosum* Jord. (Wicklow). The most widespread forms in Ireland are *anglicum* (in 20 divisions), *iricum* (16), *triviale* (17), *umbellatum* (18).

129. *Arbutus unedo* Linn. (plate 13). – The most striking and handsome of the Hiberno-Lusitanian group, forming in the Killarney woods (322) and at Lough Gill (420) not a bush, as usual along the Mediterranean, but a tree up to 30 or 35 ft. in height when growing among other trees, or with a rounded form and a height of up to 20 ft. in the open. Scully mentions boles 12-14 ft. in circumference, but the tree mostly branches widely from near the base, and trunks of any length are rare. The *Arbutus* is essentially lowland, the highest station on record being 525 ft. in Kerry. It shows no preference as to soil (provided the soil is dry) growing equally on bare limestone and on bare sandstone or metamorphic rocks, or in woodland humus, or peat. While in the woods and on the islands of the Lakes of Killarney it is still abundant, it has generally been greatly reduced in quantity and in range in the south-west by being cut for iron-smelting in the 18th century and earlier; it still extends sparingly and discontinuously as far as Lough Currane to the SW, and Adrigole and Glengarriff to the S. By place-names which embody the Irish name of the *Arbutus* (*caithne* and *cuinche*) we are enabled to trace its former extension as far N as Mayo, and recently (*Proc. R. Irish Acad.*, 41, B, 105-113, 1932) I have endeavoured to show that it is undoubtedly indigenous on Lough Gill in Sligo, where many very old trees occupy chinks in limestone rocks and

elsewhere in wild situations among a native tree-flora (see 420). A gap of 160 miles separates the Kerry and Sligo stations. An attempt to find intermediate habitats on the Galway – Mayo lakes was unsuccessful. The islets in L. Mask and L. Corrib, mostly drift-covered, have a different aspect and a different vegetation. The S end of L. Conn seemed much more likely. There the pointer plants *Taxus* and *Sorbus rupicola*, which are its companions at Killarney and L. Gill, grow on the rocky lake-margin, backed by dense oak-wood, with a vegetation closely recalling that of its Kerry and Sligo habitats; but *Arbutus* does not appear to be there now. The earliest mention of *Arbutus* in human records dates back to the eighth century. In the Brehon Laws (IV, 147) it is included among the classified lists of trees interference with which constitutes trespass:– “The Shrub trees are; black thorn, elder, spindle tree, white hazel, aspen, arbutus, test-tree.” *Caithne* is the word there used for *Arbutus*. The first printed record is in Parkinson's “*Theatrum Botanicum*,” 1489-90 (1640).

South of its Irish stations, its next appearance is on the Brittany coast-cliffs of Trieux near Paimpol in Cotes du Nord; it re-appears on the coasts of SW France, and extends across the Pyrenees and along the whole length of the Mediterranean.

An excellent and very full notice of *Arbutus* is given in Scully's “*Flora of Kerry*,” 179-183.

130. *Erica Mackaii*. Hooker. (*E. Mackaiana* Bab.) (plate 29). – The most limited in range of the Hiberno-Imsitanian plants. It occurs in W Galway over a couple of square miles from Urrisbeg to Craigga-more Lough 4 miles W of N of Roundstone, and in a slightly different form over an undetermined area on the E side of Carna, 6½” miles SE of Roundstone. At Craigga-more (389), where it was discovered by William M` Alla prior to 1835 (see *Companion to Bot. Mag.*, 1835, 158), it is quite abundant. A double form, with the stamens converted into petals, giving the flowers a very obese appearance, was collected at Craigga-more by A. G. More in 1869 (fine specimens in *Herb. Nat. Mus.*, Dublin), and again by F. C. Crawford of Edinburgh in 1901, after whom it has been called *E. Crawfordii*.

At that place, and southward towards Urrisbeg, it hybridizes rather freely with *Tetralix*, forming *E. Praegeri* Ostenfeld in *New Phytol.*, 1912, 120.

E. Stuartii Linton in *Ann. Scott. Nat. Hist.*, 1902, 176-177 and *Irish Nat.*, 1902, 177 – 178 is diagnosed as *E. Mackaii* x *mediterranea* – I have no doubt correctly. It was found (one clump) at Craigga-more (389) by Charles Stuart of Chirnside, Edinburgh, in 1901, 41 growing with *Mackaii*: *E. mediterranea* has its nearest station on Urrisbeg 3 miles to the south. The plant is, like *Crawfordii* and *Praegeri*, in cultivation.

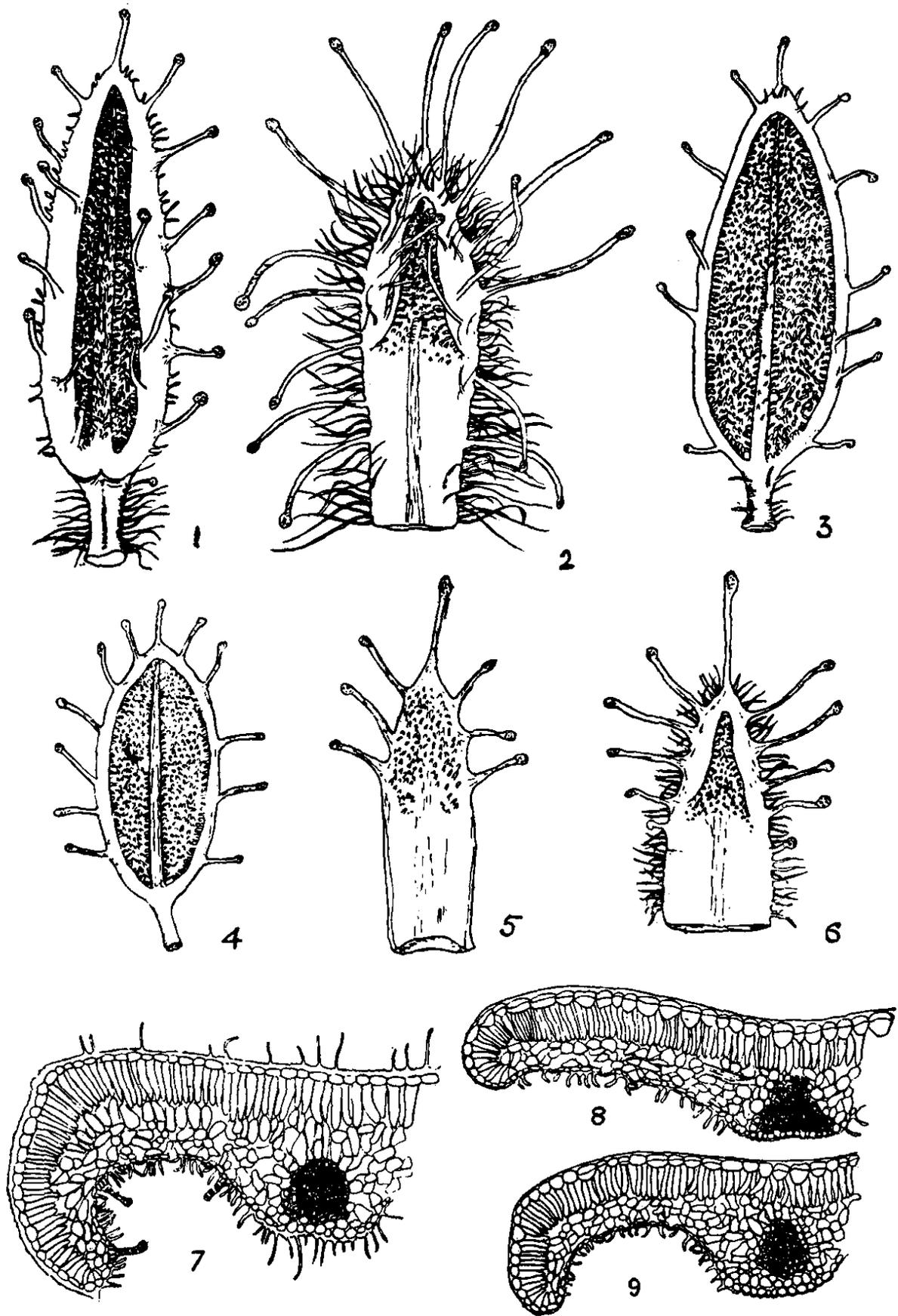


FIG. 11.

1, 3, 4, leaves ($\times 10$), 2, 4, 5, sepals ($\times 13$), 7, 8, 9, transverse sections of leaves ($\times 56$), of *Erica Tetralix* (1, 2, 7), *E. Mackaii* (4, 5, 8), and *E. Praegeri = Mackaii \times Tetralix* (3, 6, 9). By permission of Miss Margaret H. Smith.

E. Mackaii has been very variously placed by botanists, most often as a variety of *E. Tetralix*, but it is undoubtedly entitled to rank as a distinct species. This is to my mind finally proved by the study of the leaf-anatomy of this group of *Erica* by Miss Margaret Smith, published (in part) in *Trans. Bot. Soc. Edinb.*, 30, 198-205 (1930). In *Mackaii*, alone of the Irish Heaths, the upper epidermal cells have a transverse septum, dividing each into two approximately equal parts. In *E. mediterranea* and *E. Tetralix* this remarkable character is absent. In *E. Crawfordii* it is present, showing that this curious plant has been correctly interpreted as *E. Mackaii* *flore pleno*. In *E. Praegeri* and *E. Stuartii* it is present in half of the epidermal cells, the other half being undivided, pointing along with other characters to crossing between *Mackaii* and other species, which others are undoubtedly *Tetralix* and *mediterranea* respectively. By the kindness of Miss Smith I am able to reproduce here (fig. 11) some of the drawings which illustrate her paper. First found by Wm. M'Ala before 1835. Outside Ireland *E. Mackaii* is confined to the Pyrenean region. A useful discussion of it is to be found in Duriteus' "Iter Asturicum Botanicum" (see Lacaita in *Journ. Bot.*, 1929, 256-258).

131. *E. mediterranea* Linn. (*E. hibernica* Syme. *E. mediterranea* var. *hibernica* Hooker) (plate 35). – Has a fairly wide range in the great Galway – Mayo bog area (384), extending from Urrisbeg near Roundstone northward at intervals to the Mullet and Lough Conn, growing best where the peat is well drained – at Mallaranny over six ft. in height.

A plant of wet boggy ground, generally sloping but of no great elevation. Particularly fond of the edges of streamlets and lakes. Usually forms scrubby rounded bushes about 2 ft. in height, easily picked out from among the other heaths by the erect twigs and spreading leaves. Often commences to flower in January. At its best in April; frequently flowers sparingly in autumn. The flower-buds of the following season are already well developed in September. The plant sometimes suffers severely from winter sea-winds in its maritime stations. In 1931 it was much blasted about Mallaranny, so that there was practically no blossom in that spring. In Erris and Achill a dark-flowered dwarf form occurs; but when grown in the garden alongside the typical plant for a few years, very little difference is perceptible. First found by J. T. Mackay in 1830 on Urrisbeg.

Not in Great Britain. Elsewhere confined to Portugal, NW Spain, and SW France. Its hybrid with *E. Mackaii* is referred to in the preceding paragraph (130).

132. *Dabeocia cantabrica* K. Koch. (*D. polifolia* D. Don. *Menziesia polifolia* Juss.) (plate 27). – Confined to the Galway – Mayo metamorphic mass (384). Widely spread in W Galway; local in Mayo, from near Cong to Killery and Curraun Achill. To 1900 ft. on Maamtrasna and 1800 ft. on the Twelve Bens; on very exposed heaths in W Connemara it grows down to the edge of the Atlantic. Absent from Britain, but occurs in SW France, Spain (where in the Pyrenees it flourishes on ground under snow for five months of the year (see *Irish Nat.*, 1909, 3)) and the Azores.

Commences to flower in May, and blooms all through the summer into late autumn. In nature a rather straggling plant, growing best when trailing through other shrubby species, such as *Erica*, *Rubus* or *Ulex Galii* (as in plate 27). Its limit of altitude in Ireland and Spain (*supra*) shows that, like *Saxifraga spathularis*, it is not a tender species, despite its southern range. The sepals are very variable in the Irish plant, being broad-based or narrow-based, entire or with several acuminate teeth near the apex ending in gland-tipped hairs.

A white-flowered form is long in cultivation, as well as a purple and white form known as bicolor; the former is figured in Sweet "British Flower Garden," 6, t. 276.

133. *Limonium humile* Mill. – In almost every maritime division in Ireland, often abundant. Rather southern in Britain, being in Scotland confined to the S. The segregate *transwallianum* has been found in Clare (350) and *L. paradoxum* in Donegal (452).

134. *Microcala filiformis* Hoffingg. and Link. – SW only, locally abundant from Skibbereen to Dingle Bay, 0-800 ft. First found by W. H. Harvey in 1845. In England south-western likewise, along the coast from Pembroke to Sussex, with a station in Norfolk. Europe, rather western; Azores. Scully (Fl. Kerry, 194-5) gives a good account of it.

135. *Gentiana verna* Linn. (plate 24). – A plant of the western limestones, sometimes very abundant, from Clare (Ennis) up to Mayo (Lough Carra), W to the Aran Islands, and E to beyond Athenry. Ranges from 0 to 1000 ft., but mostly quite lowland. First found in Ireland by Richard Heaton, and recorded in How's "Phytologia," 1650. Sub-alpine in England, on limestone in the N. Rather widespread on the mountains of Europe and nearer Asia.

Very rare off the limestone, but grows on peaty road-side banks on the shales, 700-800 ft. elevation, between Ballyvaughan and Lisdoonvarna. Its occurrence in profusion on sea-sands near Ballyvaughan (plate 23) cannot rank as an exception to its calcicole proclivities.

Increases vegetatively by slender underground shoots proceeding from a central rootstock, thus making in open ground patches a foot across with 50 to 100 flowering stems, representing a single individual.

136. *Linaria repens x vulgaris* (L. sepium Allman). – An interesting hybrid, originally claimed as a new species, which grows plentifully by the river at Bandon (295), Co. Cork, accompanied by the parents. First found by G. J. Allman before 1843 (Watson in Hooker's Lond. Journ. Bot., 1842, 76-86; Allman in Proc. Roy. Irish Acad., 2, 404-406 (1843); Babington in Trans. Bot. Soc. Edinb., 5, 20-22, 64 (1858) and Ann. and Mag. Nat. list. (2), 14, 408-411 (1854), 16, 449-450 (1855)). Occurs also at Killowen in Down with the parents.

137. *Sibthorpia europea* Linn. – South-western: confined to the Dingle Peninsula (324) in Kerry, 0-1700 ft. First found by J. T. Mackay in 1805. In Britain also south-western (Sussex to S Wales). South-western in Europe (W France, Spain, Portugal).

138. *Veronica peregrina* Linn. – Thoroughly naturalized in Donegal, Derry, and Tyrone. Rare and seemingly only sporadic elsewhere, in various counties in the N half of Ireland. An American species which has colonized widely on the Continent, but so far has had little success in Britain.

139. *Euphrasia brevipila x salisburgensis*. – By Lough Coura in Offaly (246). Definitely so named by F. Townsend as a new hybrid (Proc. Roy. Irish Acad., 24, B, 78, 1902). As *E. salisburgensis* is not known so far E in Ireland (its nearest station lying some 45 miles to the W) further investigation is desirable.

140. *E. frigida* Pugsley. – Summit of Croaghaun (2192 ft.) in Achill Island (408); several other northern forms (*Cochlearia greenlandica*, *Hypericum pulchrum* var. *procumbens* Rostrup) grow on the same hill. Collected in 1904-5 by R. Ll. Praeger and named *foulaensis* by F. Townsend (Irish

Nat., 1904, 285; 1906, 43). A subarctic plant known in Britain from Yorkshire and Scotland (see Pugsley: "Revision of the British Euphrasiae," Journ. Linn. Soc. (Bet.), 48, 490, 1930).

141. E. salisburgensis Funk (plate 28). – A characteristic plant of the low western limestones, extending continuously from Askeaton in Limerick to Lough Mask in Mayo, including the Aran Islands, and reappearing on the limestone hills of Sligo, Leitrim, and Fermanagh, and on low-lying limestones south of Donegal town (fig. 12). Mostly on bare limestone rocks or cliffs, but sometimes on walls, sand-dunes or non-calcareous rocks (as on the Ca1p at Inchicronan L. in Clare, with such calcifuge species as *Digitalis* and *Athyrium*). First found by Daniel Oliver on Inishmore in 1852 (F. Townsend in Journ. Bot., 1896, 441-4, tab. 363; *ibid.*, 1897, 471-3, tab. 376, 380. N. Colgan in Irish Nat., 1897, 105-8, and Journ. Bot., 1897, 196-9. H. W. Pugsley in Journ. Linn. Soc. (Bot.), 48, 532-4, pl. 37).



FIG. 12.—RANGE OF *Euphrasia salisburgensis*.

FIG. 12. – RANGE OF *Euphrasia salisburgensis*.

This plant is easily recognised in the field by its dwarf bushy growth, characteristic colour, and jagged upper leaves. In vigorous plants the lowest branches are themselves much branched, and almost as long as the main stem, so that a dense roundish bush is produced. The leaves in exposed places assume a beautiful coppery brown. The plant has a habit of growing in dense clumps, composed of many individuals, on little bare dry patches of ground. The flowers are of medium size, mainly white, and stand out conspicuously against the dark foliage.

Especially luxuriant bushy plants 2½" high and 12" in circumference sometimes grow among *Thymus* on small ant-hills of a minute yellow ant – which one might expect to be a distinctly acid habitat – the “earthing up” done by the ants apparently stimulating growth (Irish Nat., 1906, 259-60). In Aran, *Sedum anglicum* is characteristic of the same habitat – see 352. I cannot separate var. *hibernica* Pugsley, l.c., – see Proc. Roy. Irish Acad., 42, B, 75.

Hitherto unknown in Britain, *E. salisburgensis* has recently been found in Yorkshire (Pugsley, l.c.). Druce's Devon record (Com. Fl. Brit. I.) is erroneous (Pugsley in Journ. Bot., 1933, 90). On the Continent widespread, usually alpine, not confined to calcareous rocks.

142. *Bartsia viscosa* Linn. – With a rather wide though local foreign range – W and S Europe, N Africa, W Asia, Canaries – this plant is in Great Britain markedly southern and western (Sussex to Argyll). In Ireland it is also conspicuously southern and western – through Waterford, Cork, Kerry continuously, and then disconnected stations in Galway, Donegal, and Derry. But only in the SW does it become common.

143. *Orobanche rubra* Smith. – Marginal and mainly northern, though it occurs in Kerry and Cork. More frequent in Burren and on the basaltic area of the NE than elsewhere, but is found on all kinds of rock, 0 – 1000 ft. First found in the British Isles by John Templeton on the Cave Hill, Belfast, before 1793. In Britain chiefly on the W coast from N Scotland to S England. Middle and S Europe, W Asia. Parasitic on *Thymus* only apparently.

144. *Utricularia intermedia* Hayne. – A plant which, like its ally *Pinguicula lusitanica*, is much more abundant in Ireland than in Britain, occurring in 23 of the 40 divisions, mostly in the centre and W. First found in the British Isles by Dr. Robert Scott in Fermanagh about 1804. Very seldom flowers. Generally in bog – pools with a soft muddy bottom, in which the colourless bladder – bearing branches burrow deeply. In Britain widely spread, but very rare. Of northern range in Europe., Asia, and America.

145. *Pinguicula grandiflora* Lam. (plate 9 and fig. 13). – The most attractive of the Hiberno – Lusitanian species, and most botanists who have seen it in its glory in Kerry and Cork will endorse the opinion of Dr. Scully that it is the most beautiful member of the Irish flora. The plant grows in extraordinary profusion over wide areas on bog, wet rocks, and damp pastures, with rosettes of yellow leaves up to 2½" long by 1½" broad, and numerous great flowers of imperial purple an inch or more across (up to 1.3 inch !) on stems 6" to 9" high.

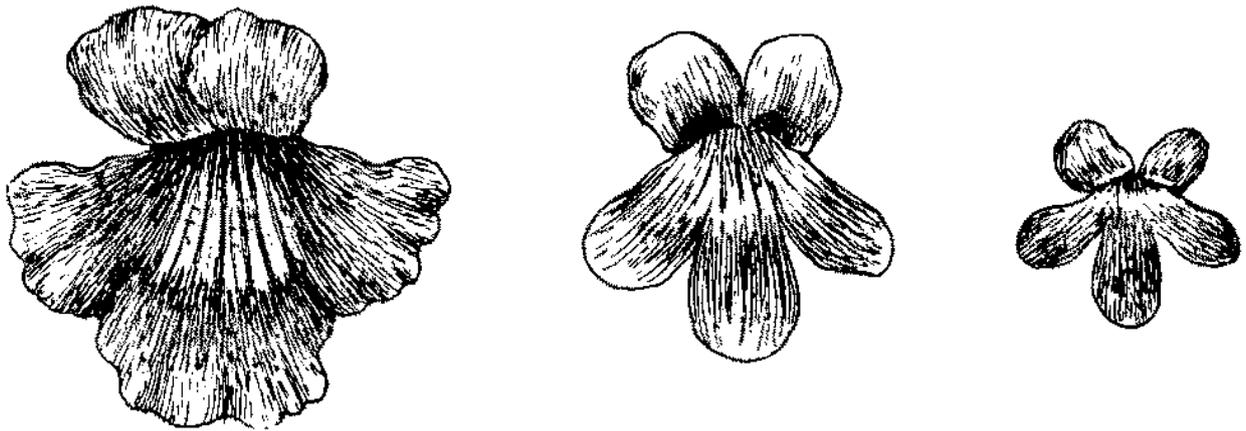


FIG 13.

1. *Pinguicula grandiflora*. 2. *P. grandiflora* × *vulgaris*.
3. *P. vulgaris*. All $\frac{1}{4}$. From near Kenmare, Co. Kerry.

With a tolerably wide SW Continental range – W France, N Spain, Portugal, Swiss and French Alps – *P. grandiflora* is abundant throughout W Cork and Kerry, thinning out northward to the Shannon, and eastward as far as Mallow. Extends from sea – level to 2250 ft. First definitely found by James Drummond in 1809. “Butterwort” is mentioned in Smith’s “History of Kerry,” p. 85 (1756), as abundant on islands at the head of Kenmare River, and no doubt this species is intended.

The insectivorous features of the plant are not confined to the leaves. The flowering stem, the calyx, and the outside of the lower corolla – lobe bear glandular hairs among which insects may be found entangled, and are no doubt digested.

Plants with white and with pale lilac flowers have been recorded, and I have thrice found a few plants bearing purplish – pink blossoms.

P. grandiflora appears to be an enterprising species, quite ready to colonize new ground. There is no evidence of any recent extension of its natural range. but half a dozen roots introduced in 1879 to boggy ground at Killanne near the foot of Blackstairs in Wexford had increased in 1913 to 95 plants (Irish Nat., 1896, 212), but it has since disappeared (see 271). It grows on a dripping cliff at Lisdoonvarna in Clare (345), where at first I thought it native (Irish Nat., 1903, 269; 1907, 242); but there is reason to think it has come from a garden just above; it is still increasing. H. C. Hart records (Fl. Don., 214, 1898) that the plant “has established itself thoroughly in peat – bogs at Carrablagh” on Lough Swilly in Donegal, but it has not been seen there recently. In Cornwall it was planted on Tremethick moor by Ralfs, and when it was in danger of extermination by collectors, in spite of very rapid increase, plants were transferred to Trungle moor and the Land’s End district, where they are reported to have “multiplied with marvellous speed” (Davey Fl. Cornwall, 345 – 6 (1909)). These “forgeries of nature’s signature” are much to be regretted.

In Kerry *P. grandiflora* hybridizes readily with *P. vulgaris* (fig. 13). The cross is not common on account of the remarkable rarity in that area of the latter species. One sees ten thousand *P. grandiflora* for one *P. vulgaris*. But wherever *P. vulgaris* occurs among its ally, and only there, hybrid forms may be found – corolla about $\frac{3}{4}$ ” across (intermediate between the $\frac{1}{2}$ ” of *vulgaris* and the 1” or more of *grandiflora*), corolla – lobes much larger and edges less divergent than in *vulgaris*, but not with overlapping undulate margins as in *grandiflora*, and the white patch on the corolla –

throat intermediate in shape between the long cuneate form found in *grandiflora*, and the broad short form of *vulgaris*. With these there may often be found forms nearer one or the other parent, presumably arising from secondary crossing. (Praeger in Journ. Bot., 1930, 249.) Druce (Com. Fl. Brit. I., 229) has called the hybrid *P. Scullyi*.

146. *Pinguicula lusitanica* Linn. – One of the! plants, which, while occurring in both Ireland and Britain, is much more widespread in the former. Recorded from 33 of the 40 Irish divisions, from sea – level to 1000 ft., being an apparent absentee only from some lowland inland counties. In Britain in SW England, Isle of Man, and W Scotland alone. On the Continent south – western, in W France, Spain, Portugal.

147. *Galeopsis intermedia* Vill. – Has been found in Leix (Emo) and Meath (Bective) but appears very rare. Very rare also in Britain.

148. *Teucrium Scordium* Linn. – Along the Shannon from Roosky in Leitrim to Doonass above Limerick, often abundant, particularly on L. Ree (379) and L. Derg (253). Also in outlying stations at Ballyspillane L. in N Tipperary and Glanquin in Clare (361). Always on limestone. England – very rare, chiefly in the E. Widespread in Europe; Siberia.

149. *Ajuga pyramidalis* Linn. (plate 3). – Around Galway Bay only: on limestone in Burren (346) and the Aran Islands (352) on basalt at Bunowen in Connemara (388), from about 50 to 200 ft. Crosses in Burren with *A. reptans* (Journ. Bot., 1926, 31). First found by D. Moore, 1854. In Britain from Westmorland northward. Widespread in Europe, mostly northern and sub – alpine; Caucasus.

150. *Oxyria digyna* Hill. – On the S and W mountains – the Galtees and those of Cork – Kerry, Galway – Mayo, Ben Bulbin, and W Donegal, 550 – 3150 ft. In Britain on mountains from Wales northward, not common. An arctic – alpine plant elsewhere.

151. *Euphorbia Peplis* Linn. – Once found at Garraris Cove, near Tramore, Waterford (273), by Miss Trench in 1839 (Mackay in Proc. Dublin Univ. Zool. and Bot. Assoc., 1, 1859). Not seen since, though several times searched for (see Cyb. Hib., ed. 2, 520). Very rare in England, on sandy shores from S Wales to Hants; a decreasing species. From France southward and along the Mediterranean, reappearing on Asiatic salt-tracts.

152. *Euphorbia Paralias* Linn. – Whole E coast, but very rare on the W (N Kerry, Clare, W Galway). In Britain rare and southern on the E side, commoner on the W, absent from Scotland. SW and S coasts of Europe.

153. *Euphorbia portlandica* Linn. – In Ireland distributed like the last. W and S coasts of Britain, from S Scotland southward. Has a “Lusitanian” range on the Continent – W France and the Peninsula.

154. *Euphorbia hiberna* Linn. (plate 10). – An Atlantic. Mediterranean plant, its Irish habitats linked with its Continental ones (France and Spain to Switzerland and Italy) by stations in Cornwall, Devon, and Somerset. In Ireland it has an extended S and W range – Waterford, Cork, Kerry, and Limerick continuously, and isolated stations in Galway, Mayo, Donegal. In the SW it grows in profusion in rough pastures, hedgerows and woods, mostly lowland, but rising to 1800 ft. in Kerry. Adare in Limerick (not recently confirmed, but well vouched for) is the only station on the limestone. *E. hiberna* has long been used in Ireland by poachers to kill fish by placing bundles of crushed stems in streams. A good example of its poisonous properties is given in a letter from

Francis Vaughan to John Ray dated April 24, 1697 (Corresp. of John Ray (Ray Soc., 1848)), and the results of a full experimental enquiry into its effects on salmonoid fishes, by H. M. Kyle, are published in Proc. Roy. Soc., 70 (1902), 48-66.

The appearance of the plant in summer is often marred by a profusion of *Uromyces tuberculatus*, which results in spindly growth and gives a golden colour to the leaves and stems.

155. *Spiranthes gemmipara* Lindley. – It is over 120 years now since James Drummond, Curator of the Cork Botanic Garden, added to the European flora one of its most interesting members. Long known as *S. Ramanzoffiana*, it has recently been replaced under its older name of *gemmipara*, while its companion plant, found much later in Armagh and other northern counties, and at first identified as the same, is now separated as *S. stricta*. Drummond's station was at Berehaven in W Cork (296), where the plant has been seen frequently since. Dunmanway and Desert, further to the E, were subsequently added as additional stations; and recently (1921 and after) it has been found by several observers about West Cove in the Derrynane area (314) of S Kerry, 12 miles NW of Berehaven. Its general distribution is at present uncertain pending the working out of the North American segregates.

It has been erroneously recorded from Devon (Journ. Bot., 1909, 385), and its being in fact *gemmiparous* has been questioned – without reason so far as the Irish plant is concerned.

156. *Spiranthes stricta* Nelson (plate 41). – The northern form of the Irish “*S. Romanzoffiana*” has been determined (see under *S. gemmipara*) as *S. stricta* Nelson. It occupies the basin of the Bann, from above Portadown, all round Lough Neagh (462, 465), and down to Coleraine (462), growing in cut-away bog, damp meadows and on wet stony lake-shores. See (e.g.) Tomlinson in Irish Nat., 1907. 311-4

The plant is like some other orchids (e.g., *Ophrys apifera*) a very uncertain flowerer. On Brackagh Bog near Portadown (its original Irish station) in 1931 over 200 blooms were counted. In 1932 three persons searching for an hour saw only three. It is affirmed that in 1930 blossom was much more abundant than in 1931, and that the bog was “white with them.”

First found by Praeger above Portadown in 1892 (Journ. Bot., 1892, 272-4). In Britain known only from Colonsay, where it was recently discovered (Journ. Bot., 1930, 346). Unknown in Continental Europe. Widespread in northern N America.

Papers on these two *Spiranthes*, by Col. Godfery, with figures of the northern and southern plants will be found in “Orchid Review,” 1922, 261-3, and 1930, 291-5.

157. *Epipactis atropurpurea* Raf. (*E. atropurpurea* Schultz). – On the western limestones from S Clare to Cong, growing in crevices of the bare rock, 0-1000 ft. Similar habitats in Britain, from Devon to N Scotland, very local. Europe, Caucasus, Persia.

158. *Neotinea intacta* Reichb. f. (*Habenaria intacta* Benth.) (plate 2). – Essentially a plant of the bare limestone “pavements,” but occurs also on calcareous sea-sands and occasionally on non-calcareous rocks (Coal-measure shales 6 to 8 miles off the limestone near Lehinch in Clare (Irish Nat., 1901, 143), and on Silurian or metamorphic rocks at Mount Gable near Cong). The plant is abundant in the Burren region in Clare and SE Galway, and extends along the limestone shores of L. Corrib and L. Mask to L. Carra. There are interesting outliers in SW Connemara, on limy sands or light moory soil overlying the acid rocks (Irish Nat., 1906, 260; 1907, 243) (fig. 14); it is strange

that it does not occur on the Aran Islands. First found by Miss F. M. More at Castle Taylor, Galway, in 1864 (D. Moore in Journ. Bot., 1864, 228, and A. G. More in Trans. Bot. Soc. Edinb., 8, 265 (1865). See also H. G. Reichenbach, Journ. Bot., 1865, 1-5, tab. 25). Unknown in Britain. On the Continent from W France around the Mediterranean to Asia Minor and the Canaries.

Neotinea appears above ground in October, sending up first one and then another short, broad, acute glaucous leaf, which can withstand hard frost. Flowers in the middle of May. In summer easily recognised by the short fruit with close-ranked capsules, which is dead and dry by the end of June, but persists till autumn if not trampled.

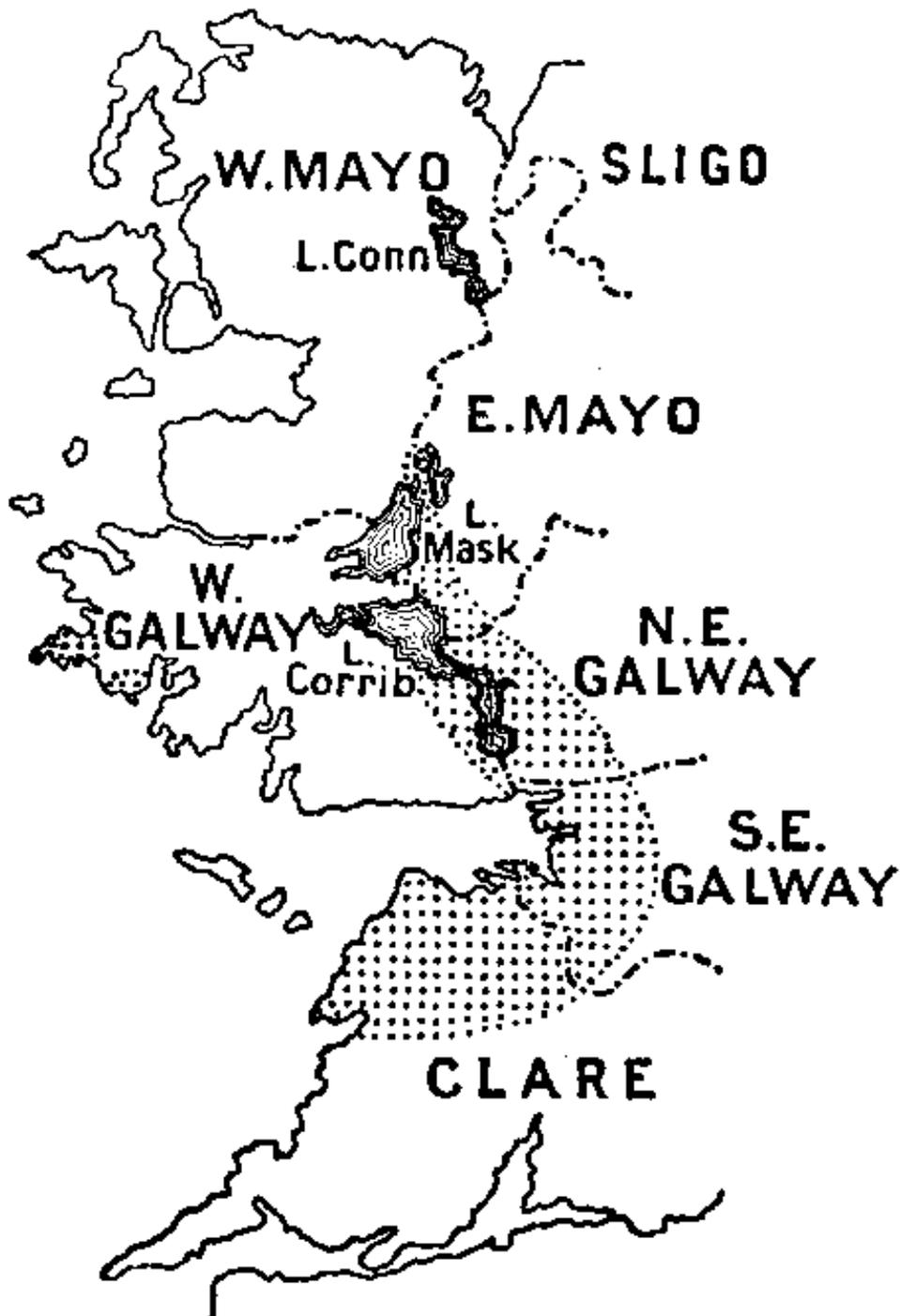


FIG. 14.—RANGE OF *Neotina intacta*.

FIG. 14. – Range of *Neotina intacta*.

The commoner Irish form, which H. W. Pugsley has recently named var. *straminea*, has unspotted leaves and wholly greenish-white flowers. What must rank as the type is rarer: it is a more robust plant with glaucescent darker green leaves faintly spotted with purple and flowers of which the sepals are veined or shortly striped with dull purple and the lip marked towards the base with purplish pink in dots, blotches or short stripes. As the records are founded in many cases on fruiting plants or on dried specimens, the separate range of the two forms cannot be given accurately. The

spotted plant is not uncommon in Burren and SE Galway along with var. *straminea*; it was the second which I collected in SW Connemara. In no case does the Irish plant bear flowers of a uniform pink colour, as shown in several well-known figures (e.g., "English Botany," ed. 3; Reichenbach in *Journ. Bot.*, 1865). R. A. Phillips has noted both forms near Menlo in NE Galway. Pugsley's recent paper on the Irish plant (*Journ. Bot.*, 72, 54-5) should be consulted.

158a. *Orchis O'Kellyi* Druce. – There is confusion about this plant. The *Orchis* first observed by P. B. O'Kelly in Clare, and pointed out by him to many botanists, which he called *O. maculata* var. *immaculata*, is a handsome white variety of *O. elodes*. This is the plant which Druce was shown, and which he proposed to name after the finder: but by inadvertence white *Fuchsii* was sent to him. by O'Kelly, and his description refers to this. The other is a handsome and distinct plant, characterized by its slightly glaucous unspotted leaves and its very fragrant flowers with buff anthers. *O. O'Kellyi* of Druce does not appear to be worth a separate name; the other is more distinct, and might have a varietal name under *O. elodes*, but it needs further observation. It is abundant in Burren. See *Irish Nat.*, 1933, 143 (where, however, it is called O'Kellyi).

159. *Sisyrinchium angustifolium* Mill. (*S. anceps* Cay.) (plate 11). – The status of this plant in Ireland has often been impugned on account of its known rapid increase following introduction in places as far apart as Germany, Norway, and Queensland. But in Ireland its habitats and distribution afford no suggestion of this kind. It never occurs about houses, gardens, or places of traffic, but affects old marshy meadows and hill-sides where the flora is strictly native, many of its stations being remote from all human influence. First found by James Lynam in 1845 near Woodford in SE Galway (*Phytol.*, 1846, 500) and later in S Kerry (*Journ. Bot.*, 1882, 8), it has since been shown to be widespread in Kerry and to occur also in W Cork, Clare, Tipperary, Sligo, Leitrim, Fermanagh, W Donegal, with a suspicious station in Antrim (*Irish Nat.*, 1916, 187) – a wide western range in wild ground, very unlikely for an introduced species. Dr. Scully, who has studied the plant for a long period in its Kerry head-quarters, considers it native there, and points out that in 20 years it has not increased in stations which have been under observation (*Fl. Kerry*, 283-4). My own view coincides with his. Another objection is based on the alleged ease with which it spreads from gardens. In Ireland evidence of this is absent. Indeed, R. M. Barrington records (*Irish Nat.*, 1904, 208) that seeds scattered during three different years in suitable moist coarse meadow by the Enniskerry River in Wicklow failed to produce plants. The suspicious station by L. Neagh in Antrim seems an exception, but need not disturb us; the same thing occurs in the ease of *Saxifraga Geum*, *Pinguicula grandiflora*, *Leucojum aestivum* and other rare indigenous plants which are also occasionally grown in gardens. Outside Ireland the plant as a native is confined to temperate N America. It has escaped in a number of places in S England.

160. *Sisyrinchium californicum* Ait. – The case of this species is different from that of the last. Also an American plant (and unknown elsewhere in Europe), it grows in some abundance over an area of flat marshy rushy meadow-land, one mile N of Rosslare station in Wexford (278). First found here by E. S. Marshall, who in spite of all difficulties considered it indigenous – or if not, then deliberately planted, which appears equally improbable (see *Journ. Bot.*, 1896, 366); his later view was that it is a case of survival, not introduction (*ibid.*, 1898, 49). See also A. B. Rendle, *ibid.*, 1896, 494-5, tab. 364. A native of California and Oregon. Its presence in Ireland is difficult to account for, but it is almost certainly an introduction.

161. *Leucojum aestivum* Linn. (plate 17). – A plant whose standing has been often questioned because it is grown in gardens, but E. S. Marshall, who first found it in Ireland in the marshes of the Slaney, thought it undoubtedly native there, a view also held by M. C. Knowles and R. A. Phillips,

who studied its distribution in the Shannon marshes about Limerick and generally, in an exhaustive paper. I think there can be little doubt that it is indigenous in the stations above-mentioned, and probably also by the Little Brosna river in Tipperary and Offaly, and in Waterford, Leix, Tyrone, and Antrim. The authors of the paper referred to pertinently point out that *L. pulchellum*, a near ally, which is also much cultivated, has never been found “wild” in Ireland; they draw the conclusion that *L. aestivum*, instead of being an escape, has been brought into gardens from native stations. Southern England, Europe, Caucasus, Asia Minor.

162. *Asparagus maritimus* Mill. – A very rare plant of the Wicklow, Wexford, and Waterford coasts (272), with only four recent stations; it was evidently more abundant on the SE coast in former times. First recorded by C. Smith (“History of Waterford”) from Tramore (where it still grows) in 1746. Some other records refer to escaped plants of the large cultivated form. In Britain south western, from Dorset to Wales. Rather widely spread along the coasts of Europe, in Russia and the Canaries.

163. *Simethis planifolia* Gren. and Godr. (*S. bicolor* Kunth). – One of the most restricted in range of the Hiberno-Mediterranean plants, occupying a single area of ground in S Kerry and another much smaller one in Hampshire. It grew formerly in Dorset also, and has been replanted there. The Irish station consists of some. 10 to 12 sq. miles of wild rocky and furzy heath with a peaty subsoil, extending from Derrynane eastward; it is fairly abundant there (314). First found by Rev. T. O'Mahony (Lond. Journ. Bot., 1848, 571). On the Continent from Normandy to Spain and on to Sardinia, Corsica, and Italy.

164. *Allium Babingtonii* Borrer. – Along the W and NW coast from Galway Bay to Lough Swilly, favouring the islands – Aran (especially), Inishbofin, and probably the Donegal Arranmore. On the three Aran Islands it looks thoroughly native, in rock-chinks and sandy places. There and elsewhere it is often near houses, but it is no doubt an indigenous plant brought into cultivation (see Journ. Bot., 1934, 74). Elsewhere in Cornwall only.

165. *Juncus macer* S. F. Gray (*J. tennis* auct. britt. non Willd.). – This American plant has been under suspicion of introduction into Ireland, since it is undoubtedly alien on the European continent and elsewhere, where it has now spread very widely. In N America its usual habitat is the edges of paths or roads, which tends to easy dispersal by moving traffic. But while in continental Europe its rapid spread is notorious, twenty years' observation by Dr. Scully of the plant in Kerry reveals no such tendency (Fl. Kerry, 292); and as in the case of *Sisyrinchium*, its habitats lie mostly in wild remote areas, far from all obvious sources of introduction such as ports or railways. Outside of Kerry (where it is locally abundant) and W Cork the plant is in Ireland known from roadsides in Wicklow, salt marshes on Inishmore in Galway Bay, and one suspicious station in Down, now destroyed, in Victoria Park close to the Belfast docks. While it will be difficult to find proof, it seems probable that research will tend to establish the position of this plant as indigenous.

M. L. Fernald, to whom we are indebted for the correction of the name of this plant (Journ. Bot., 1930, 364-7), considers that *Juncus macer* may be a native of the Scottish mountains (Clova, G. Don, 1795 circa), but a recent introduction in England. Ireland he does not refer to.

The plant has been known as an alien spreading on roadsides in England (since 1883 – see Ridley in Journ. Bot., 1885, 1) and elsewhere.

166. *Juncus acutus* Linn. – This fine rush occurs along the S and E coasts from Cape Clear to Wicklow town, especially in Wexford. In Britain southern, absent from Scotland. Southern on the Continent, from France eastward. Asia, Canaries, America.

167. *Potamogeton perpygmus* Hagstr. (*P. coloratus* X *pusillus*, *P. lanceolatus* auct. quoad pl. *hibernicam*). – There has been much discussion concerning *P. lanceolatus*. This has centred round the English plant (Cambridgeshire and Wales), which has been variously interpreted as *alpinus* X *pusillus*, *coloratus* X *pusillus*, and *gramineus* X *pusillus*. We are here concerned only with the Irish plant. Examination of this in its original Clare station (Cahir River S of Black Head) will I think confirm the view that it is *coloratus* X *pusillus*. The plant grows with both its reputed parents, the only other Pondweed in the stream being *P. natans*. It has moreover precisely the peculiar red tint of the local *P. coloratus*. A large form (Irish Nat., 1896, 243) grows in shallow rippling streams at Clonbrock (369) and Barbersfort (368) in NE Galway. The name *lanceolatus* being applicable to the English plant (which, on the evidence, would appear to be *alpinus* X *pusillus*), the Irish hybrid has been named by Hagstr. *P. perpygmceus* (Bot. Exch. Club Report, 1922, 630). This plant, which appears to be endemic in Ireland, was first found (in the Cahir River) by P. B. O'Kelly (Journ. Bot., 1.891, 344; 1892, 195).

168. *P. sparganiifolius* Last. (*P. Kirkii* Syme. *P. gramineus* X *natans*). – Long known as growing in the Maam River (394) in W Galway, where it was first found by T. Kirk in 1853 (Babington Manual, ed. 4, 351, 1856). The station is near the bridge at Maam. It has been gathered also in Lough Corrib by M. Norman in 1858 (Bot. Exch. Club Report, 1930, 394), and there is a doubtful record from Lough Neagh (see Irish Nat., 1909, 83-5). England and the Continent, very rare.

169. *P. Babingtonii* Ar. Benn. (*P. longifolius* Bab. non Gay. *P. lucens* X *prcelongus*). – A single floating stem picked up by J. Ball in Lough Corrib (367) in 1835 is all that is known of this plant, which is figured in Engl. Bot. Suppl., 2847. Its rediscovery is very desirable. See A. Bennett in Journ. Bot., 1894, 204-5.

170. *Potamogeton filiformis* Nolte. – N half of Ireland, in lakes mostly on the limestone, rare. Scotland and Anglesea, local. Northern in Europe, and spread as far as America and Australia.

171. *Ruppia maritima* Linn. (*R. spiralis* Hartm.). – From Kerry up the S and E coasts to Donegal, discontinuous, more frequent in Down than elsewhere. Throughout Britain, but local and rare. World-wide in range.

172. *Naias flexilis* Rosk. and Schmidt. – This little water-plant, very wide-spread in N America, has in Europe a marked “Atlantic” distribution – Kerry, W Galway, and W Donegal in Ireland, Perth and Skye in Scotland, Esthwaite Water in Lancashire, and a few stations in NW Europe. Being small and inconspicuous in its submerged habitat, it is probably more widespread along the western Irish coast than would appear. First found by Daniel Oliver at Cregduff Lough, Roundstone, in 1850 (Bot. Gazette, 2, 278, 1850).

173. *Eriocaulon septangulare* With. (plate 12). – The most wide-ranging of the Hiberno-American plants, found from Adrigole in W Cork to the Rosses, N of Dungloe, in W Donegal. Locally abundant in S Kerry, W Galway, W Mayo. Avoids the limestone tracts, the only station being Killower Lough in NE Galway, which is also unusually far inland, 18 miles from the head of Galway Bay. Often very abundant where it occurs, covering the peaty bottom in shallow water. It is extremely buoyant, and in rough weather breaks away from its anchorage, sometimes in large mats, and is often washed up in quantity, when its curious soft white jointed worm-like roots form a

conspicuous feature. The flower-stem (July–Sept.) varies in length from a couple of inches, when growing on bare wet ground, to over three ft. when the plant grows in deep water.

Differences in water-level during summer are shown by the flower or fruit heads being submerged, or so much raised above the water that the stems slope: the normal height of the flower above water being 4 inches. In July, the previous year's stems are often still undecayed, lying criss-cross across the green rosettes on the bottom, looking like pale straws.

To 1000 ft. in Cork, but usually lowland. First found by Walter Wade in Connemara in 1801. In Britain confined to the Scottish islands of Skye and Coll. Not on the European continent. In N America has a very wide range.

174. *Scirpus nanus* Spreng. (*S. parvulus* Rcem. & Schult.). – Very rare in Ireland, confined to two stations – the tidal portion of the Cashen River in N Kerry (330), where it is abundant for some 3 miles (Scully in *Journ. Bot.*, 1890, 110) and the river-mouth at Arklow (276) in Wicklow (A. G. More in *Journ. Bot.*, 1868, 254 and 321 – 3, tab. 85). In Britain almost equally rare, in Wales and S England. On the Continent rather widely spread; Asia, Africa, America.

175. *Scirpus filiformis* Savi (*S. Savii* Seb. and Maur.). – Round almost the whole Irish coast. Rare beyond tidal influence, as in Kerry (850 ft.), Wicklow (700 ft.), E Donegal (300-550 ft.). N to S of Britain, but local. Continental distribution “Mediterranean,” from W France eastward. Has a nearly world-wide range.

176. *S. triqueter* Linn. (plate 16). – As at present known, confined to the foreshore on both sides of the Shannon, from above Limerick to Tervoe lower light about 5 miles below the city, and sparingly in Cratloe Creek a mile further down on the Clare side (334). In the tidal river below the town it grows in great profusion on the muddy foreshore. Above the town, it occurs sparingly above the “head of the tide” as far as the old canal entrance 1 mile ENE of Limerick, growing small and starved in running fresh water.

In Britain only on the tidal reaches of rivers in S (especially SE) England. On the Continent widespread, both along the coast and by rivers in central Europe. Asia, Africa, America.

177. *Rhynchospora fusca* Ait. – On peat-bogs, widespread in the W and centre, often very abundant, its area including half of Ireland. Its E boundary runs roughly from W Cork to Westmeath and on to Donegal Bay. First found by J. T. Mackay near Killarney in 1805. In Britain much rarer, from S England to mid Scotland. A plant widespread in Europe.

178. *Carex pauciflora* Lightf. – Widespread and often abundant over an area of some 10 sq. miles of bog, on the Garron Plateau, at about 1000 ft. elevation from Parkmore station to the Trosks above earnlough in Antrim (468), often accompanied by *C. magellanica*, also here in its only Irish station (H. W. Lett, *Journ. Bot.*, 1895, 216-7; R. Ll. Praeger, *Irish Nat.*, 1920, 97). Alpine and northern in Britain, and arctic-alpine on the Continent and N America.

179. *Carex paradoxa* Willd. – Very rare, in S Clare (342) and central Westmeath (487) only. Very rare also in England, though occurring from N to SE. A plant of N Europe and Siberia.

180. *Carex fusca* All. (*C. Buxbaumii* Wahl.). – Found by David Moore on Harbour I. in Lough Neagh (464) in 1835 (*Companion to Bot. Mag.*, 1835, 307), and seen there occasionally till 1886; apparently extinct now (see Stewart & Corry *Fl. NE Ireland* 161, and *Irish Nat.*, 1920, 104). For 60

years this remained the only station in the British Isles, but in 1895 it was found by a loch in Arisaig, West Inverness (A. Bennett in Ann. Scott. Nat. Hist., 1895, 247-9). The plant has a very wide range through Europe, Asia, N and S Africa.

181. *Carex aquatilis* Wahl. – Rather frequent in Ireland, being native in 13 divisions, mostly in the typical form (var. *elatio* Bab.), and chiefly towards the N in low stations near the hills, but extends to the extreme south. A recent arrival in Dublin (Irish Nat., 1901, 49). First found by S. A. Stewart at Lough Allen (Journ. Bot., 1885, 49). In Britain northern. Elsewhere in Arctic Europe. See also A. Bennett in Irish Nat., 1892, 48-50.

182. *Carex hibernica* Ar. Benn. (*C. aquatilis* X ? *Goodenowii*. *C. aquatilis* X *Hudsonii*? Ar. Bunn.). – This plant has its only known station by the river half a mile above Galway's Bridge on the old Killarney-Kenmare road in S Kerry, where it was found by R. W. Scully in 1889 – see A. Bennett in Journ. Bot., 1897, 250, and Scully Fl. Kerry, 329; also 323. Not known elsewhere. It looks more like a *Goodenowii* than a *Hudsonii* cross, and the former species is present, the latter absent.

183. *Carex magellanica* Lam. (*C. irrigua* Smith). – Frequent on the high moorland of the Garron Plateau in Antrim (468) at about 1000 ft., with *C. wucillora*, which also has here its only Irish station. From mid-Scotland to N Wales, rare. A N European plant.

184. *Carex punctata* Gaud. – Kerry and Cork only, by the sea, from Kerry Head to Ballycottin. SW and W coasts of Britain as far as S Scotland, rare and discontinuous. W Europe (not always maritime), Asia Minor, N Africa.

185. *Calamagrostis neglecta* P. Beauv. var. *Hookeri* Syme. – This variety was long known only from Lough Neagh (464), where it was first found by David Moore in 1836, and has since proved to be of frequent occurrence around that lake and the adjoining L. Beg, though now extinct in some of its former stations. See Fl. NE Ireland and Cyb. Hib. (2), 417. Recently found in a fen at Stow Bedon in Norfolk (A. Bennett in Journ. Bot., 1915, 281, and Irish Nat., 1915, 170), which is its only known station in Britain. The type is absent from Ireland.

186. *Sesleria caerulea* Arduin. – The most abundant and characteristic grass of the western limestones, occurring wherever bare limestone appears, save in Limerick; it apparently does not cross the Shannon in the S. Confined in Ireland to the district W of the Shannon save where it colonizes the E bank in Tipperary and Westmeath, and the shores of the Shannon lakes. It follows the western limestones to their limit in S Donegal (444). From the limestone rocks it extends to esker-ridges, dry pastures, and sand-dunes; and in SW Connemara (388) to rocky heaths where no trace of limy soil is evident. In Fermanagh, also, it grows on ledges of Yoredale sandstone (438). Occurs abundantly at sea-level, and thence up to 1000 ft. in Clare and 1100 ft. on the Ben Bulbin range.

Rarer and much scattered in Britain, chiefly on limestone hills, from N Scotland to N England and Wales. Rather southern on the continent, widespread. Iceland.

187. *Poa alpina* Linn. – On Brandon (325) in S Kerry, and Ben Bulbin and Annacoona in Sligo (423), 1500-3100 ft. In Britain from N Wales to N Scotland, 3000-4000 ft. Of alpine-arctic circumpolar range; Himalayas, N Africa.

188. *Glyceria Foucaudii* Hackel (*G. festumformis* auct. britt. non Heynhold, *G. maritima* var. *hibernica* Druee) (plate 18). Locally plentiful in the Shannon estuary (331, 342) (River Fergus, also

Foyne 3) and in Down (especially Strangford Lough (475), mostly on islets with a gravelly shore underlaid by clay). It forms a fringe at or slightly below highwater mark, and lower down than the plants (*Aster Tripolium*, *Atriplex* spp., etc.) which accompany it. It is very distinct when growing, and recognised at a distance by its large, erect tufts, two ft. or more in height. Two plants of different appearance are included in the Shannon records for this species – the one erect, growing on open shores: the other on mud, with prostrate shoots – see the papers quoted in footnotes 52 and 53; further work on these forms is desirable.

In Britain southern, confined to the S English coast. On the Continent a Mediterranean species.

189. *Glyceria Borreri* Bab. – Dungarvan Harbour (286) in Waterford (Irish Nat. Jl., 1, 96 (1926)), Wexford Harbour (277), and Dublin Bay (236) only, on muddy ground by the sea. Southern in Britain (Bristol Channel to the Wash, with an outlying station in Forfar). Elsewhere by the North Sea in Holland and Germany.

190. *Juniperus*. – In Ireland both the Junipers are found chiefly along the W coast. *J. communis* is mainly lowland and calcicole, spread over the low-lying limestones from Killarney to Ballina and on by Sligo and Fermanagh to colonize the metamorphic rocks of Mayo and Donegal. *J. sibirica* (= raw) on the other hand is spread over the non-calcareous rocks of the W from Kerry to Donegal (on limestone ('1 or peat) in Sligo), and on across the Antrim basalts to the Mourne granites from sea-level (such as sand-dunes in Kerry) to 2000 ft. (in Down), being mostly upland. *J. communis* is rarer and *J. sibirica* commoner than in Britain. See Irish Nat. Journ., 5, 58-61 (1934).

191. *Taxus baccata* Linn. f. *fastigiata* (Lindl.). – The Irish or Florencecourt Yew, *T. fastigiata* Lindl., now so common in cultivation, had its origin in two seedlings found wild by Mr. George Willis about 1767 on a limestone rock at Carrick-na-Madadh above Florencecourt (430), Co. Fermanagh; one of the original specimens still grows in Florencecourt demesne. These plants were females, and consequently most of the specimens in cultivation (which have been produced by cuttings) are females also. Recently, however, male plants have been found to be in cultivation in England, and these have been traced to the Barnham Nurseries near Bognor, where they have been grown for at least 45 years. How they originated there is not known. Possibly a seedling of the usual *typica* X *fastigiata* cross came true to *fastigiata* (which has apparently happened once before) and was a male: possibly it was a case of sex reversal in *fastigiata*, a phenomenon not unknown among other plants.

Fruit is usually borne in abundance by natural crossing with the Common Yew, but almost invariably the seeds reproduce the typical form, not the variety. It would be interesting to learn whether *fastigiata* 8 crossed with *fastigiata* 9 produces *fastigiata*. Dr. Maxwell Masters considered the Florencecourt Yew to be a juvenile form of the species, in which the characters of the seedling (the radial disposition of the leaves and the upright habit) are preserved throughout the life of the plant.

192. *Trichomanes radicans* Sw. – A characteristic Irish plant, demonstrating the “Atlantic” conditions which prevail everywhere over the island by its occurrence in N, S, E, and W; but it is much more wide-spread in the S, and now extinct in its most easterly stations (Wicklow), where it was found for the first time in Ireland [at Powerscourt] (268) by Whitley Stokes before 1804. The raids of collectors have greatly diminished its quantity everywhere. Occurs from sea-level to 1000 ft. See excellent account by Scully in Fl. Kerry, 359-61.

In Britain extremely rare, in Wales, N England, W Scotland. Elsewhere almost world-wide, warm-temperate or tropical.

193. *Adiantum Capillus-veneris* Linn. (plate 23). – Along the W coast from Clare to Donegal, but very rare except in the Aran Islands (246) and Burren (252), where it is often abundant in fissures of the limestone, ascending to 800 ft. Some very limited stations are far from the Carboniferous limestone, and have been quoted as examples of the plant's occurrence in lime-free habitats – such as

guum C. & G.). – A remarkable dwarf gregarious form grows on the Great Blasket, Brandon Point, and Three Sisters Head in S Kerry, and Slieve League and Horn Head in W Donegal, in all cases in places of great exposure. It has at different times been referred to *O. lusitanicum* of the Channel Islands, or to the var. *polyphyllum* of Orkney and Scilly, but is not the first and more likely the second. As seen on the Great Blasket, it forms a carpet one inch high, with at least 100 plants to the sq. foot (Irish Nat., 1912, 161).

201. *Equisetum litorale*. Kiihlew. (*E. arvense* X *iimosum*). – Since its discovery in Down (Irish Nat., 1917, 141-7, pl. VI-VII) in 1917, this interesting hybrid has been found in no less than 19 of the 40 county-divisions. Its apparent greater abundance in Ireland than in Britain (where it is recorded from very few stations in England and Scotland) probably signifies want of recognition in Britain rather than actual rarity there. Elsewhere it has been recorded from many places in both Europe and N America. The Irish plant in most cases belongs to the var. *elatus* Milde.

203. *Equisetum Moorei* Newman. – This Horsetail has a quite definite range along the E coast from Ardmore Point in Wicklow to Wexford Harbour (272), on sand-dunes and rocky or clayey banks by the sea, in dry or wet ground. Its appearance is that of a slender *hyemale*, and it has been sometimes assigned varietal rank under that species, sometimes specific rank. One character held to favour the latter view was its alleged deciduous habit, which was later denied. Having collected it in several stations, and grown the plants alongside *hyemale* from different places, I find the stems to be much less persistent than in the other. In a normal winter all the stems except a few produced in autumn die back to within a short distance of the base, while *hyemale* usually remains green throughout, losing at most a few of its ultimate joints. No intermediate forms occur in the *E. Moorei* area, and the plant appears to be strictly maritime, in contrast to *hyemale*. I think it deserves specific rank, in the modern use of that term. First found by D. Moore and J. Melville at Rockfield in 1851 (Phytol., 1854, 17-18). Unknown in Britain.

Schaffner, whose full discussion of the plant should be noted (American Fern Journal, 21, 95-98, 1931), from a study of herbarium material, identifies it with *E. hyemale* var. *Schleicheri* Milde and *E. occidentale* Hy. He maintains it as a distinct species.

204. *Equisetum trachyodon* Braun (*E. Mackaii* Newman). – The frequency of this northern plant in Ireland is noteworthy, in view of its extreme rarity in Britain (Kincardine only, doubtful). It grows in no less than 15 divisions, from Kerry to Antrim and from Mayo to Dublin, being rather northern and western. First found by F. Whitla in Colin Glen near Belfast before 1830. A rare northern species on the Continent and in America.

205. *Equisetum variegatum* Schleich. There are several forms of this in Ireland. What ranks as the type (var. *majus* Syme) is not infrequent, especially along sandy river-banks – a plant of medium

size, with spreading or suberect stems of a lightish green colour. Var. *arenarium*, a smaller (often minute) prostrate very slender form growing in damp places in sand-dunes, looks very distinct from the last, but when grown side by side it becomes only slightly smaller and more prostrate, and has just the same colour. More distinct is a form characteristic of canal banks in the Central Plain, but found in other places also – strong, with very erect very numerous stems 2 to 3 feet high, of a very dark green colour. This plant, as seen in Glen Cahir, Clare, was noted by G. C. Druce as intermediate between *variegatum* and *trachyodon*, but the sheath characters are all those of *variegatum*. Lastly there is *E. Wilsoni* of Newman, as tall as the last, but much stouter and of a lighter green, known only from Kerry – the Lower Lake of Killarney (Muckross Bay and Ross Bay) and Caragh Lake. Although I have searched for this plant, I know it only from dried specimens, and cannot express an opinion as to its distinctness: but it does not seem sufficiently removed from *variegatum* to rank as a species.

206. *Isoetes lacustris* Linn. f. *maxima* Blytt (var. *Morei* Syme., *I. Morei* Moore). – A remarkable long-leaved form of *I. lacustris* known from Upper Lough Bray in Wicklow (268), where it was first found by A. G. More (see D. MOORE: “On a new species of *Isoetes* from Ireland.” *Journ. Bot.*, 1878, 353-5, tab. 199). The leaves may attain a length of over 2 ft. A form approaching this has been found by E. S. Marshall in Lough Camelaun in the Dingle Peninsula, S Kerry; and leaves 18-20 inches were collected by Scully at Lough Slat in the same neighbourhood (*Fl. Kerry*, 383).

207. Charophyta. – The general range of the Charophyta is often extraordinarily wide, resembling that of many of the minute-spored terrestrial cryptogams rather than the comparatively heavy-seeded phanerogams. The Irish Charophyte flora is fully dealt with in the recent monograph by GROVES and BULLOCK-WEBSTER (*Ray Society*, 1917, 1924). The following, so far as at present known, appear to be the Irish species which are rarest in Ireland and Britain :–

Tolypella nidifica Leonh. – Wexford Harbour; two Scottish stations; N and W Europe; Kerguelen.

Nitella batrachosperma Braun (*N. Nordstedtiana* H. and J. Groves. *N. confervacea* Braun). – Killarney and Caragh L., Achill Island, Kindrum in W Donegal. In Britain in the Outer Hebrides only. Wide-spread over the world.

Nitella tenuissima Kuetz. – Ballinooly in NE Galway, Scraw Bog and L. Owel in Westmeath. Britain – Norfolk, Cambridge, Anglesea. World-wide.

Nitella spanioclema Groves and Bullock-Webster. – Described from L. Shannagh and L. Kindrum in W Donegal; also in Perth.

Chara muscosa Groves and Bullock-Webster. – Described from L. Mullaghderg in W Donegal; also in Orkney.

Chara denudata Braun. – Brittas L. in Westmeath. Unknown in Britain. Switzerland, Italy, Cape Colony.

Chara tomentosa Linn. – Abundant in the Shannon lakes of Ree and Derg, and in the Westmeath lakes. Unknown in Britain. Widespread in Europe; also known front Asia and N. Africa.

UNVERIFIED RECORDS AND MISSING PLANTS.

208. As in most countries, the list of species recorded on mistaken determination or careless localization is in Ireland a long one (see *Cyb. Hib.* (2) 471-520). But there are some interesting records which may still prove to be correct, as has been the case with *Limosella*, recorded from Connemara in 1804, set down as 'not' Irish by subsequent botanists, and refound in Clare in 1893; *Helianthemum chamaecistus*, reported from S Donegal. in 1893, set down subsequently as planted or escaped, and refound undoubtedly native in the same locality in 1933; and *Lathyrus maritimus*, known in Kerry from 1756 to 1845, given up as extinct, and refound in its old station in 1918. A

few of the more interesting of these are mentioned in order to draw to them the attention of visiting botanists.

209. *Thalictrum alpinum* Linn. – At about 2000 ft. on Brandon, S Kerry – A. Ley in Journ. Bot. 1887, 374. Never refound on this well-worked mountain, but a mistake seems unlikely. Unknown elsewhere in the S half of Ireland.

Matthiola sinuata R.Br. – Old records from Beal Castle, 1756, and Banna, 1878 (both in N Kerry, 330), and Straw Island on Aran, 1835 (352). Some of the strand plants are notoriously irregular in their appearance, and *Matthiola* may still re-appear.

210. *Saxifraga Geum* Linn. – Reported from Clifden in Connemara; – see 390.

spathularis Brot. (*umbrosa* auct.). – Reported from Malin Head in Donegal – see 452.

Erica ciliaris Linn. – Stated by Mackay (Nat. Hist. Rev. 1859, 537) to have been found by Bergin at Craiggamore (389), W Galway (the station for E. Mackaii), in 1846; and recorded by J. B. Balfour (Phytol. 1853, 1007) as found in the same place in 1852. The Bergin record is backed by a specimen (*E. ciliaris*!) in Herb. Trin. Coll. Dublin, certified by Bergin as portion of the original finding (see Cyb. Hib. (1) 183 and (2) 498). Searched for by many botanists since without success. Quite likely to occur, as this Pyrenean heath extends as far north as SW England (35), and others of the same geographical group grow at Craiggamore.

211. *Erica vagans* Linn. – Cliffs in Islandieane town-land, W of Tramore, Waterford (383); found by Dr. Burkitt (before 1866) and named by Dr. Robert Ball (Cyb. Hib. ed. I, 184). Searched for in vain since. General range similar to the last, so its occurrence in Ireland is quite possible, but it is certainly not now in the station named. See Proc. R.I.A., 42, B, 72.

212. *Erica stricta* Donn. North of Ireland, 1834 (Dr. Lloyd), spec. in Herb. Hooker (see Cyb. Hib. (2) 499, and Journ. Bot. 1872, 25). Reported from Sallagh Braes, Co. Antrim, and Downhill (or rather Magilligan 456), Co. Derry (Irish Nat. 1923, 32). The Magilligan plant has been refound, and was an escape (see Proc. R. Irish Acad. 41 B 114-5, 1932). The other two records are not definitely localized, and are unsatisfactory. A S European plant, to be expected (if anywhere in Ireland) in the SW rather than in the NE. But the Mediterranean *Glyceria Faucaudii* is abundant on Strangford Lough close by.

213. *Arctostaphylos alpina* Spreng. – Included without comment in the Irish flora by Druce (Com. Fl. Brit. I) on the strength of a specimen in his herbarium labelled as collected by Bishop Mitchison near Kilmacrenan, W Donegal, in 1865. The area has been searched by Druce and by myself. The station is quite unsuitable, and no alpine plant is found in the vicinity (see Proc. R. Irish Acad. 41 B 113-4, 1932). I have no doubt that a mistake in labelling occurred.

Scrophularia, alata Gilib. – Near Limerick, 1846 (Isaac Carroll); spec. in Herb. Brit. Mus.! Known to grow by the Liffey (236), where it is abundant, and also sparingly by the Bann in Londonderry (362), so quite likely to occur also by the Shannon, but cannot be found. See Britten, also Praeger, in Irish Nat. 1909, 222.

214. *Limosella aquatica* Linn. – “Frequently occurring where the water has stood during the winter, county Galway, near Ballynahinch, Connemara” Wade *Plantae Rariores*, 1804. Now known to occur locally in the adjoining county of Clare, to which as at present known it is confined. With a

wide range in Britain, it is very possibly not so restricted in Ireland as would appear. The habitat of the species is quite correctly described by Wade.

Euphrasia salisburgensis Funk. – Reported from Lough Neagh – see 466. Also from a rock-ledge at 1100 ft. on Benevenagh, Co. Derry – B.E.C. Report, 1924, 588. Doubtful.

215. *Euphorbia Peplis* Linn. (151). – Once found in Ireland – at Garraris Cove near Tramore (283), Waterford, 1839 (see *Cyb. Hib.* (1), 258). In Britain a rare and decreasing species of S England and Wales. Probably extinct, but should be watched for along the Irish E and S coasts.

216. *Elisma natans* Buchenau. – Druce recorded this as Irish (from Killarney and Clare) in *Irish Nat.* 1910, 237, on the authority of *Gluck*. But *Gluck* informed me subsequently (see *Irish Nat.* 1913, 105) that he considered the evidence for the inclusion of this plant in the Irish flora was insufficient. In the “Comital Flora of the British Isles” Druce sets it down without comment as an Irish plant.

217. *Potamogeton Babingtonii* Ar. Benn. (*lucens* X *pralongus*). – One fragment found by J. Ball in 1835 floating in Lough Corrib; see *Cyb. Hib.* (2), 378. An extremely rare hybrid, the refinding of which would be desirable.

P. sparganiifolius Last. – Reported from Lough. Neagh – see 466.

218. *Carex fusca* All. (*C. Buxbaumii*). – Known from 1835, when it was found by D. Moore (Companion to *Bot. Mag.* 1835, 307), till 1886 (S. A. Stewart) on Harbour Island, in Lough Neagh, 3 miles S by E of Toome: apparently now extinct through grazing. This is the only Irish station, and it is equally rare in Britain, having a single station in Scotland – by a small loch in Arisaig, W Inverness (A. Bennett in *Ann. Scott. Nat. Hist.* 1895, 247-9). Still quite likely to occur at other places on the extensive and incompletely worked shores of L. Neagh. The original station, which had been reduced to a bare pasturage (*Fl. NE.I.* 161), is now again covered with scrub (*Irish Nat.* 1920, 103). The L. Neagh flora suffered from the lowering of the level of the lake in 1855, and since that date a number of plants very rare in the north have not been seen there – see 465. The plant has a very wide range through Europe, Asia, N. and S. Africa.

Carex elongata Linn. – Also not seen on L. Neagh since Dr. Moore's time, is a case similar to that of *C. fusca*; but it has a second Irish station on L. Erne.

219. *Phegopteris Dryopteris* Fee. – This fern is remarkably rare in Ireland, most of the records are old, and the refinding of it in its recorded stations is very desirable. These lie in Clare (“roadside between Broadford village and the Cliffs of Moher,” T. H. Wright – *Cyb. Hib.* 2); Wicklow (“at Sheenabeg near Aughrim, very sparingly, 1879,” G. H. Kinahan, *ibid.*, and “in good quantity on a hillside overlooking Glendalough,” 1879 [but reported from memory after twenty years], E. S. Marshall in *Journ. Bot.* 1899, 269); Leitrim (Benbo Mountain, 800 ft., J. Wynne – *Cyb. Hib.* (1) 368); Sligo (Lough Talt, Ox Mountains, R. Warren – see *Irish Nat.* 1897, 27); and Antrim (north side of Knocklayd, sparingly, D. Moore, *Cyb. Hib.* (1) 368 – see *Irish Nat. Journ.*, 5, 36, 1934).

Athyrium alpestre Milde. – Glenveigh, W Donegal – F. R. Browning in B.E.C. Report 1927, 426. Not reported from Ireland before or since, and the record needs confirmation.

Tolypella prolifera Leonh. – Not refound at Glasnevin – see 236.

