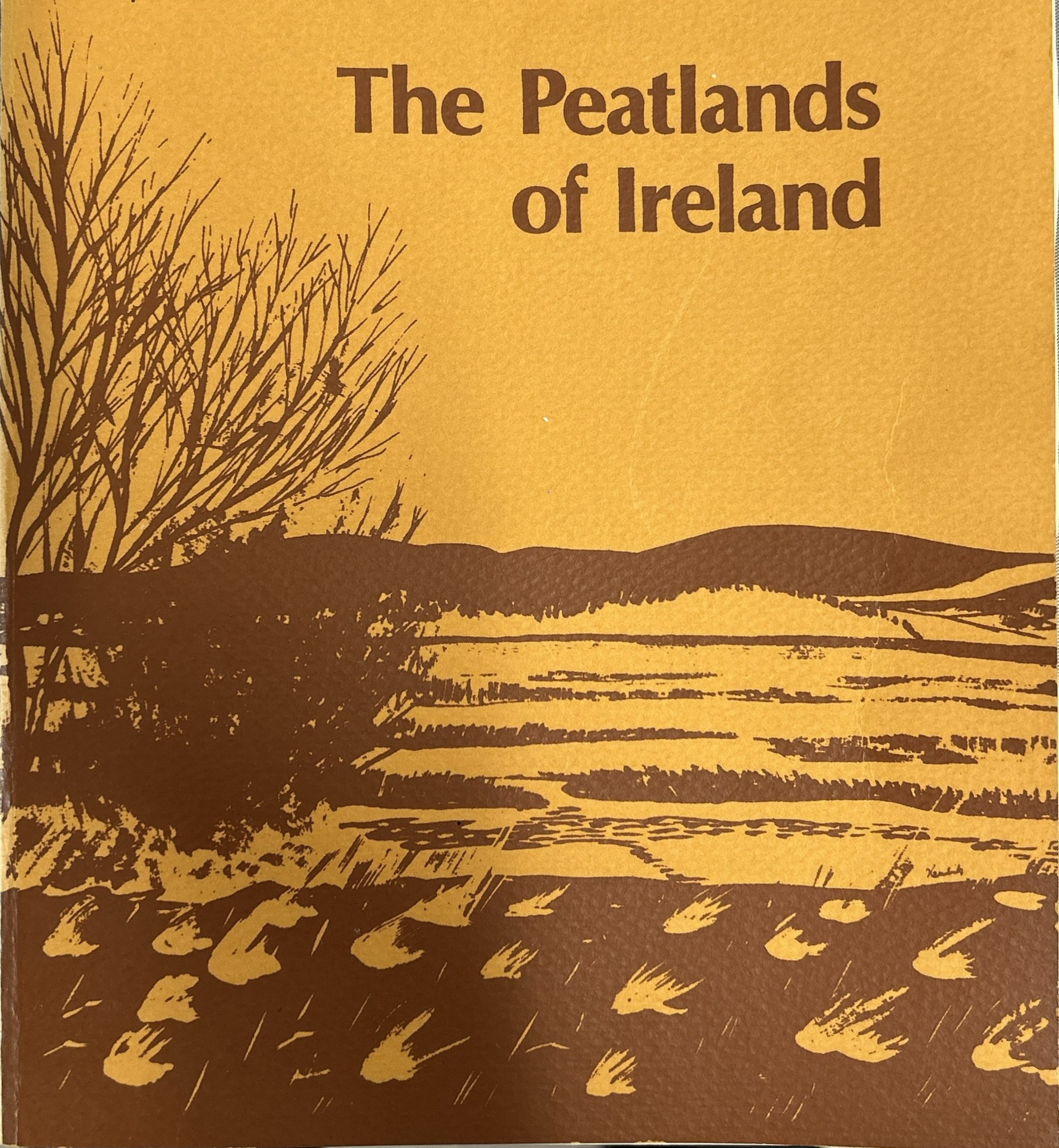
an foras talúntais

The Peatlands of Ireland



Soil Survey Bulletin No. 35 2nd edition

The Peatlands of Ireland

To accompany Peatland Map of Ireland, 1978

by

R. F. HAMMOND

Published by An Foras Talúntais, 19 Sandymount Avenue, Dublin 4 1981

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Preface to Second Edition

The second edition of Soil Survey Bulletin No. 35 incorporates amendments and improvements to the text. Acknowledgement is made to all those who offered advice and suggestions and especially to Dr. A. M. O'Sullivan, An Foras Taluntais, and Dr. E. Farrell and Mr. G. Doyle, University College, Dublin.

M. J. Gardiner,
Head, National Soil Survey of Ireland, 1981.

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Introduction

Peatland covers 16.2 per cent i.e. 1.34 million hectares of Ireland. Within the Republic peatlands cover 17.2 per cent of the land surface. Development of these peatlands has given rise to a major industry producing about 4 million tonnes of peat fuels per annum. Most of this goes to produce 25 per cent of the electricity generated in the country, the remainder is sold as fuel; some 1.13 million cu. m. of moss peat are also produced each year for horticultural use. In Northern Ireland 12.4 per cent of the land surface is covered by peatlands but no wide-scale industrial exploitation has taken place.

There is increasing interest in the future role of peatlands in the agricultural, horticultural and sylvicultural industries, either as private or state run enterprises. Their significance for conservation and amenity is also extremely important in long term national planning. Raised bogs, once typical of the lowland Midlands landscape, have virtually disappeared.

In 1920 the Geological Survey published a map of peat-bogs and coal-fields in Ireland which reflected the practical requirement for that time. This was included in the 1921 Report on Peat produced by a Government Commission appointed to examine the resources of the country. (This report formed the basis for the development of the peat fuel industry of to-day). Area figures quoted then and to-day are still based on the survey of 1810–1814 carried out by the Bog Commissioners. In the meantime much peat has been removed and attention is now focussing more on the ultimate land use potential of peatlands.

Research by An Foras Talúntais has shown their potential for agricultural production. However, a knowledge of the distribution, composition and characteristics of the various types of peat is a pre-requisite in planning the future development of our peat resources.

The 1920 Geological Survey peat map is now of little use since it does not separate the different peat types in the country. Since its publication and that of the General Soil Map of Ireland, (1969) a large amount of new data has become available from a broad spectrum of sources and disciplines. This new map classifies the extent of the various peat types in the country based on the current state of knowledge of peat composition and development.

Data Sources and Map Compilation

To procure, assess and compile the data necessary to produce a new peat map of

Ireland was complicated because of the many sources and various forms in which it was available. Data for the map came from published and unpublished material, in map and written form, aerial photographic interpretation, personal communication with interested parties and original research into those aspects not previously covered.

Since 1968 the National Soil Survey programme of An Foras Taluntais has been operating in counties containing a significant amount of peatland (Table 1). These detailed studies have greatly expanded our knowledge of the extent and character of the different peatland categories.

Table 1: Area of peat soils in counties surveyed under the National Soil Survey

County	Area ha	Peat soil area ha	% of County
Carlow	89,691	1,047	1.2
Clare	345,050	61,483	17.8
Kildare	168,672	24,317	14.4
Laois	169,562	20,859	12.3
Leitrim	158,937	57,420	36.1
Limerick	267,910	20,795	7.8
Meath	233,372	10,289	4.4
Offaly	199,109	64,146	32.2
Westmeath	175,236	37,728	21.5
West Donegal	106,477	66,326	62.3
Wexford	236,648	728	0.3
West Mayo	558,643	155,961	27.9

Ground observations and depth measurements give the most accurate data for preparing the map. However, with a good base level of reference knowledge, the use of aerial photographs is an invaluable tool.

Aerial photographs taken 1973/1974, which cover most counties with the exception of Donegal, parts of Sligo, Cork, Waterford and Louth, were used with the permission of the Geological Survey of Ireland. The scale of 1 : 30,000 compared very favourably with the map scale 1 : 25,000 used by the National Soil Survey (base maps only).

Peatland distribution for Northern Ireland was derived from the Peat Bog Survey of Northern Ireland (1956), Land Use Survey Maps (1939), the 1920 Peat Map, and from personal contact with interested parties in Northern Ireland e.g., Botany Dept., Queen's University, and the Forestry and Soil Science sections of the Department of Agriculture.

Map Scales and Procedures

A major difficulty with the map and photographic material used was the many different scales and ages of material. To facilitate cartographic procedures and at the same time make an accurate calculation of the different categories of peatland in the Republic all material was reduced to 1 : 126,720 scale. Area calculations for Northern Ireland were computed at 1 : 575,000 scale. The reduction and scale variations are shown schematically in Table 2. A reliability map showing the sources of data is shown in Fig. 1.

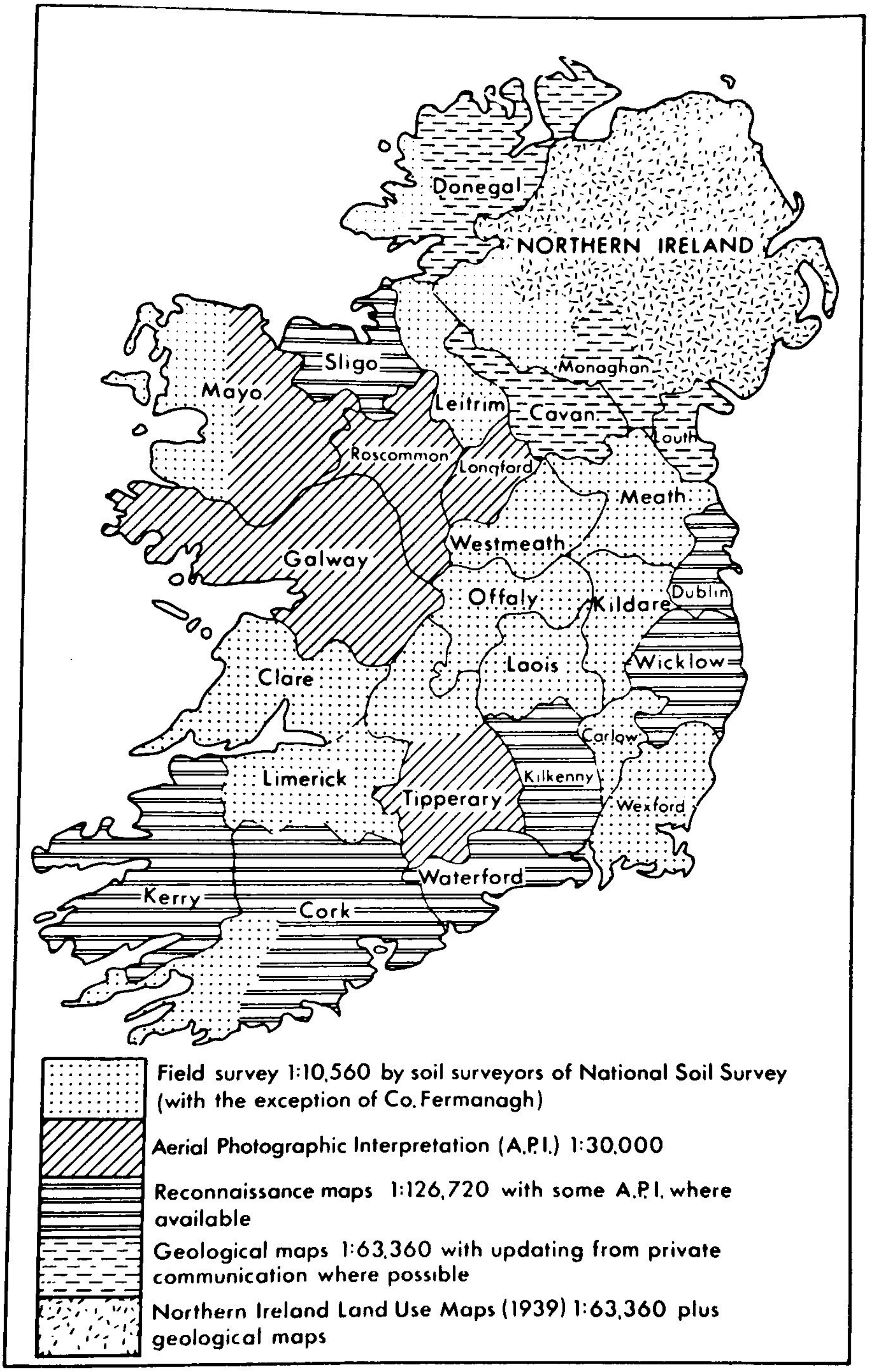
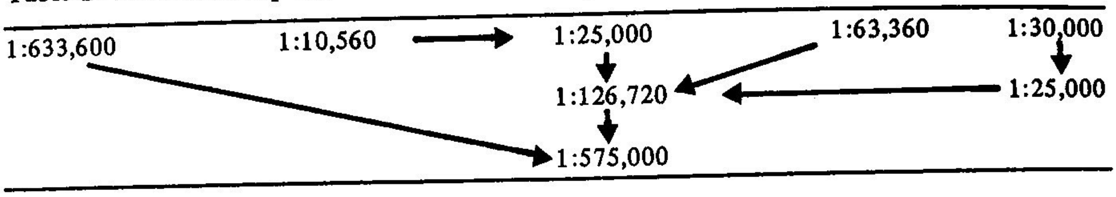


Fig. 1: Reliability map showing sources of data

Table 2: Different map scales and reduction steps used during the compilation.



Areas of north-west Sligo, Donegal, Cork and Waterford were not covered by detailed reconnaissance field sheets or aerial photographs. Compilation data were restricted to field excursions and the use of the geological sheets from which the 1920 peat map was prepared.

The accuracy and reliability of the data from the geological sheets were checked in the three following ways: The 1 : 633,600, 1920 peat map was enlarged photographically, black outline on transparent base, to the publication scale of the new peatland map 1 : 575,000. Peat areas from the published soil map of Co. Clare (Finch 1971) were reduced to 1 : 575,000 and a comparison fit made between the two. It was found that the fit was tolerable. (Fig. 2). A further check was carried out using the 1 : 25,000 topographical maps. On these maps the peat areas were delineated with the knowledge of map symbol, topography, altitude, climate and field experience. The reduction of these areas to 1 : 63,360 and comparison to the Geological map sheets also gave a tolerable fit. Thirdly, the aerial photographic interpretation data, when reduced to publication scale and checked back to the enlarged original map of 1920, also gave good correlation (Fig. 3).

The evidence, as presented in Figs. 2 and 3, shows that there is a tendency for the 1920 peat map to over represent peatlands in the country. This trend is more pronounced when using aerial photographs without ground control (Fig. 3) than when using orthodox field survey methods. However, the accuracy of these three checks carried out during compilation was sufficient to put a degree of trust in the 1 : 63,360 maps for these regions not covered by aerial photographs.

Improvements over the original 1920 peat map are as follows: the scale at 1 : 575,000 is larger than the previous map at 1 : 633,600; also, whereas the latter map was only a single category monochrome map there are now thirteen separations for peatland types and land utilisation facets of peatlands.

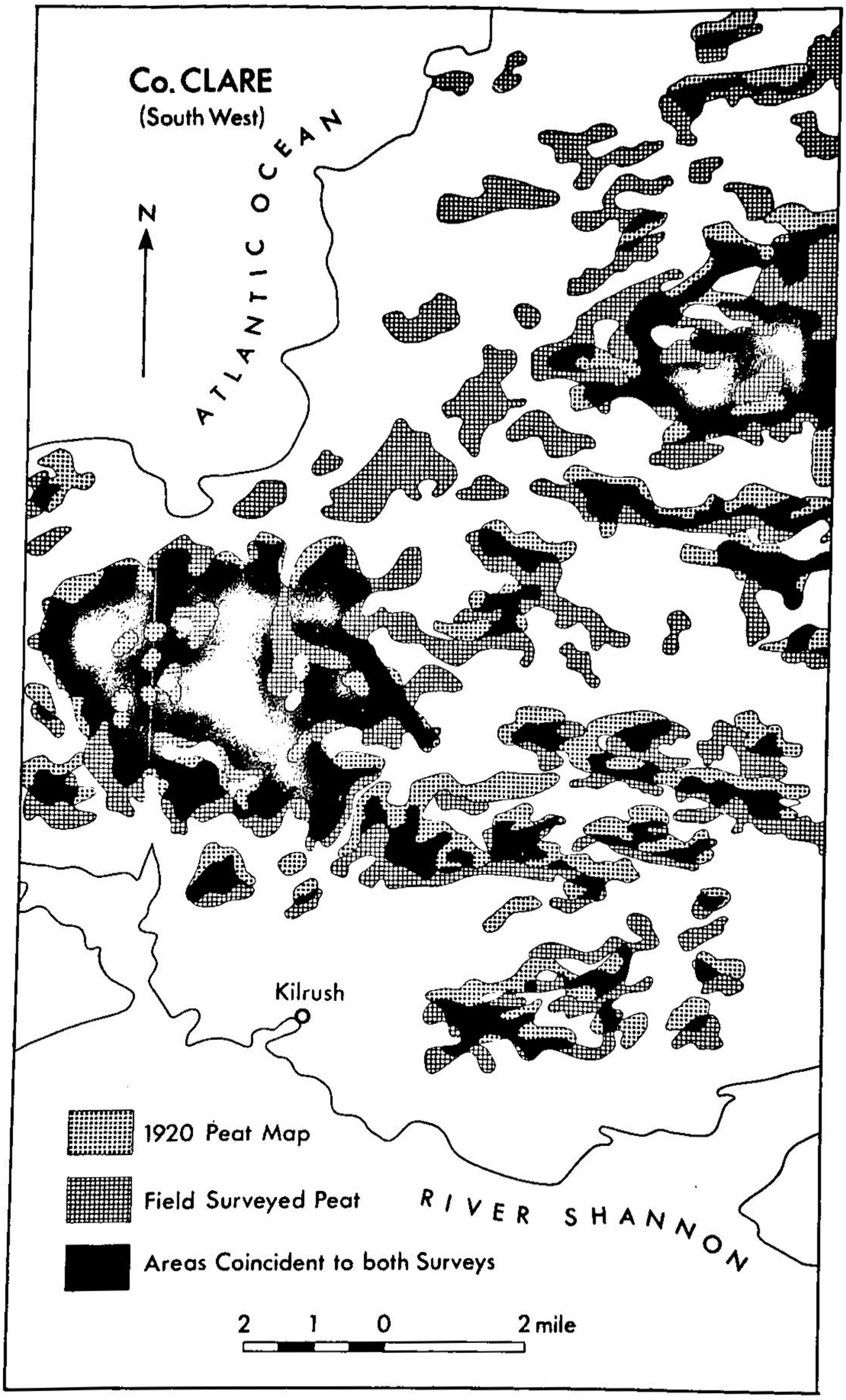


Fig. 2: Comparison of field surveyed peat areas to peat map of 1920

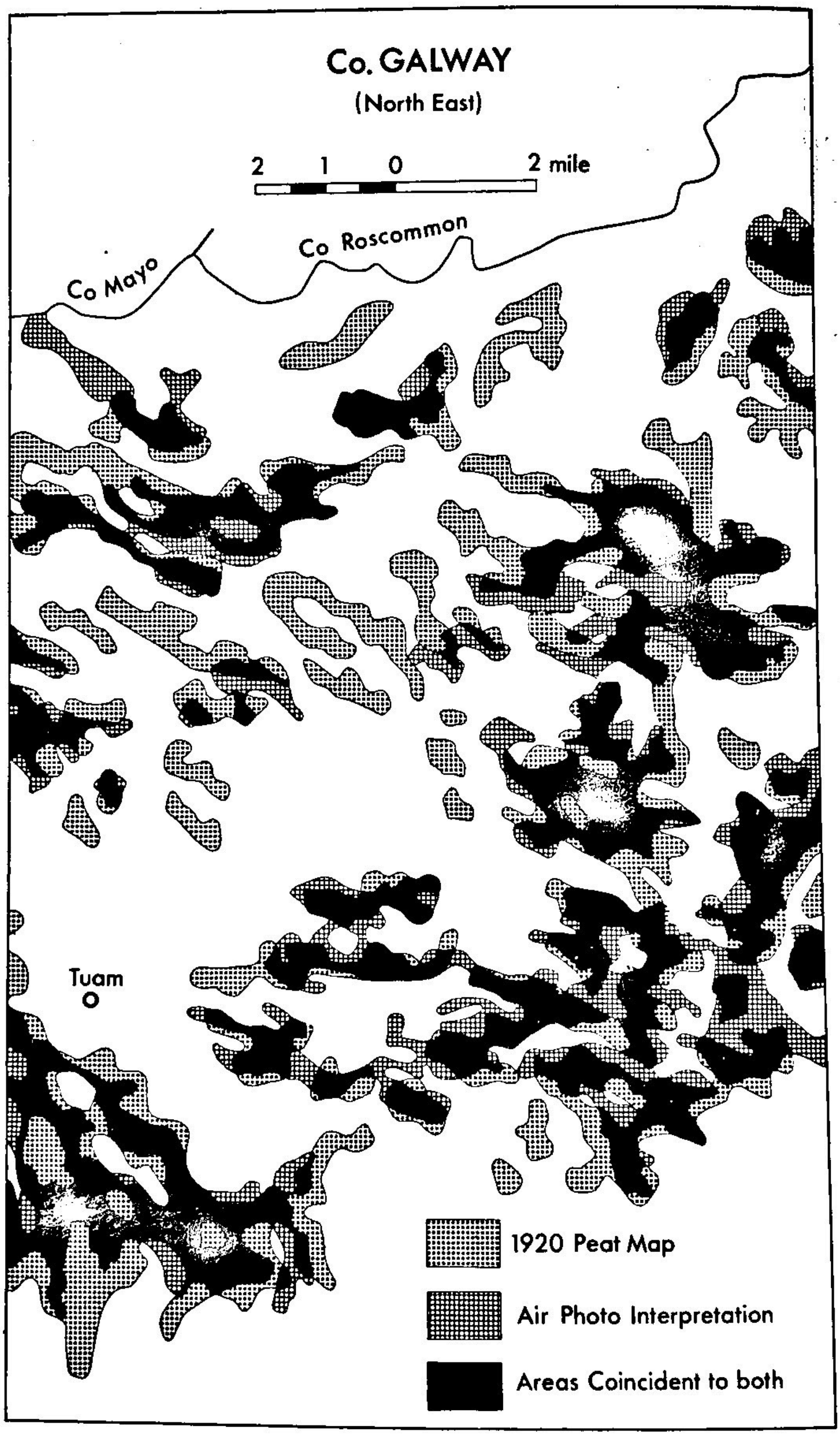


Fig. 3: Comparison of peat distribution from aerial photographic interpretation data to the same peat area on the 1920 map

2

Peat Formation

Peat is a biogenic deposit which developed in the post-glacial (Holocene) period i.e., within the past 10,000 years. Three basic peat formations are recognised in Ireland: (1) raised bogs of the Central Plain; (2) blanket bogs of the Western seaboard and the upland regions, and (3) fen peats. Their genesis has been influenced by drainage, climate, hydrology, geomorphology, nutrient status and glacial geology, but over the centuries these deposits have been drastically altered by man's activities.

Geomorphology

The basic landscape patterns of the country have been determined by the bedrock geology. This pattern was subsequently modified by the glaciations of the Pleistocene period. The combination of bedrock geology and glaciation has determined peatland distribution patterns. Factors common to all peat formations are that they form in areas of impeded drainage and/or high rainfall. The Central Plain of Ireland is low-lying, flat and underlain by Carboniferous limestones. Much of Ireland, especially the Central Plain, is covered by glacial drift deposited during the Midlandian glaciation. This has given rise to a random pattern of gently undulating topography and a local relief generally less than 6.0 metres in amplitude. On this type of physiography drainage gradients are small and peat formations common. The lithology of the glacial drift is strongly influenced by the type of underlying bedrock and ice sheet provenance. The dominance of limestone in the drift cover of the Midlands has controlled the nutrient status of the ground waters and influenced the eco-systems that contributed to the initial stages of peat formation in raised bogs.

Blanket bog has developed in the western part of Ireland under conditions of extreme oceanity over topographical situations varying from flat lowland at sea level to hill and mountain. In parts of counties Cork, Clare, Donegal, Kerry and Sligo the distribution pattern is sharply demarcated along lines of past orogenies e.g., Ox and Derryveagh mountains. In the drier central and eastern half of the country blanket bog is restricted to the wetter higher mountain masses.

Climate and Chronology

Peat began to form in Ireland early in the post-glacial period, i.e., shortly after 10,000

B. P. (Hammond, 1968). Climate during this period varied and peat deposits reflect these changes either by change in the peat sediment type or by the fossil pollen assemblages preserved within the peat. Studies of peat deposits have enabled research workers to reconstruct post-glacial climatic events and to establish a chronology for their formation. Radio carbon (^{14}C) dating has enabled changes in climate and rate of peat formation to be dated accurately. These relationships between climatic changes and peat type with time are outlined in Table 3. Generally the rate of peat accumulation was slow in warm and dry periods and relatively quicker during moist periods.

Table 3: Chronology, post-glacial climate and sediment type for Ireland

Years before present (1950)	Climate	Period	Sediment type
12,000	Cold Mild Cool	Late-glacial	Clay Limnic/telmatic (aquatic/semi-aquatic) Clay
10,000	Temperature rising	Pre-boreal	Limnic (aquatic)
9,600	Warm-dry	Early boreal	Limnic/telmatic (aquatic/semi-aquatic)
8,000	Climatic optimum	Late boreal	Terrestrial
7,500	Warm-wet	Atlantic	Mainly ombrogenous terrestrial
5,100	Warm but rather dry	Sub-boreal	Mainly ombrogenous terrestrial
2,500	Increasing wetness and falling temperature	Sub-Atlantic	Mainly ombrogenous terrestrial

Mire Types and Their Origins

The mire or peat types which occur in Ireland can be classified into two broad groupings (a) ombrogenous mires (raised and blanket bogs) where continued growth is due to the influence of atmospheric precipitation and (b) topogenous mires (fen peat types) where development is controlled by topography and the ground water table (Table 4).

Table 4: Fundamental mire (bog) types

Ombrogenous		Topogenous	
Mire type	Nutrient supply	Mire type	Nutrient supply
Raised bog[a]	Precipitation	Paludification bog[b] (von Post 1937)	Ground water
Blanket bog	Precipitation	Fen (lowmoor)	Ground water

[a]*Growth at present controlled by rainfall but originally by ground water*

[b]*Peat forming environment where water table levels are high without forming open water*

The origins of topogenous mires and the subsequent development of raised mires vary from one location to another. Variables which influence these formations are related to local hydrology e.g., continuity of supply, nutrient content, depth, rate of flow and the climatic factors of sunshine, temperature and evapo-transpiration. These affect the productivity of the eco-system(s) by influencing the phytosociology and biomass production in a given location.

Growth of ombrogenous mires

Raised Mire: Raised bogs are complex structures of organic debris attaining thicknesses of 9 to 12 metres in the undrained state, depending on the underlying topography. The stratigraphy of the sediments which comprise a raised bog fall into three categories: a basal tier of peat types formed under the influence of minerotrophic ground water, and sub-surface and upper tiers comprised of humified and poorly humified *Sphagnum* peats, respectively, formed under nutrient conditions of base-poor atmospheric precipitation.

The broad stratigraphical arrangement of peat types shown in a schematic diagram (Fig. 4) is drawn from an actual raised bog site.

The process of peat development from topogenous to ombrogenous (Fig. 5) is as follows: initial peat formation can be identified by the occurrence of post-glacial lakes (Godwin, 1956) or locally wet hollows if plaudification was the cause (von Post, 1937).

Local hydrology is an important element in peat formation. Bellamy (1972) defines such situations as templates of peat formation. He expresses the conditions instrumental in development in the form of an equation:

$$\text{Inflow} + \text{precipitation} = \text{Outflow} + \text{evaporation} + \text{retention}$$

In basins, the surrounding catchment area influences the water supply and its nutrient content. In the Central Plain, immediately succeeding the Midlandian Cold Stage, ground waters from unleached calcareous glacial drift contained substantial concentrations of calcium and magnesium, with lesser amounts of potassium and sodium. That river and lake waters were highly basic is seen by the presence of shell marls and *Chara* chalk muds beneath the bogs (Hammond, 1965; Carey, 1970).

In a lake or water-filled basin, aquatics, either floating or rooted, were the major peat formers (limnic). Near the shore line, in shallower water, semi-aquatics established as the major peat formers (telmatic). On senescence of the aerial and sub-aerial plant parts the debris accumulating in the water decreased water depth. This resulted in encroachment of plants into the lake and displacement and diversion of water. A net result of this was the establishment of higher water tables close to the environs of the lake and subsequent paludification i.e., (von Post, 1937). In turn, this created a suitable environment for the development of terrestrial eutrophic and/or mesotrophic peats, the secondary mire type of Bellamy and Moore (1973). The factors relating origin to nutrition and hydrology are summarised in Table 5. Simultaneous with the lateral spread vertical accumulation took place which influenced the ground water effect and the resultant stratigraphy.

The vertical accumulation of plant debris however, diminished the ground water effect and plants had an increasing dependence on rainfall to supply nutrients. With this change in the hydrosere a transitional zone developed where plant communities of one seral stage

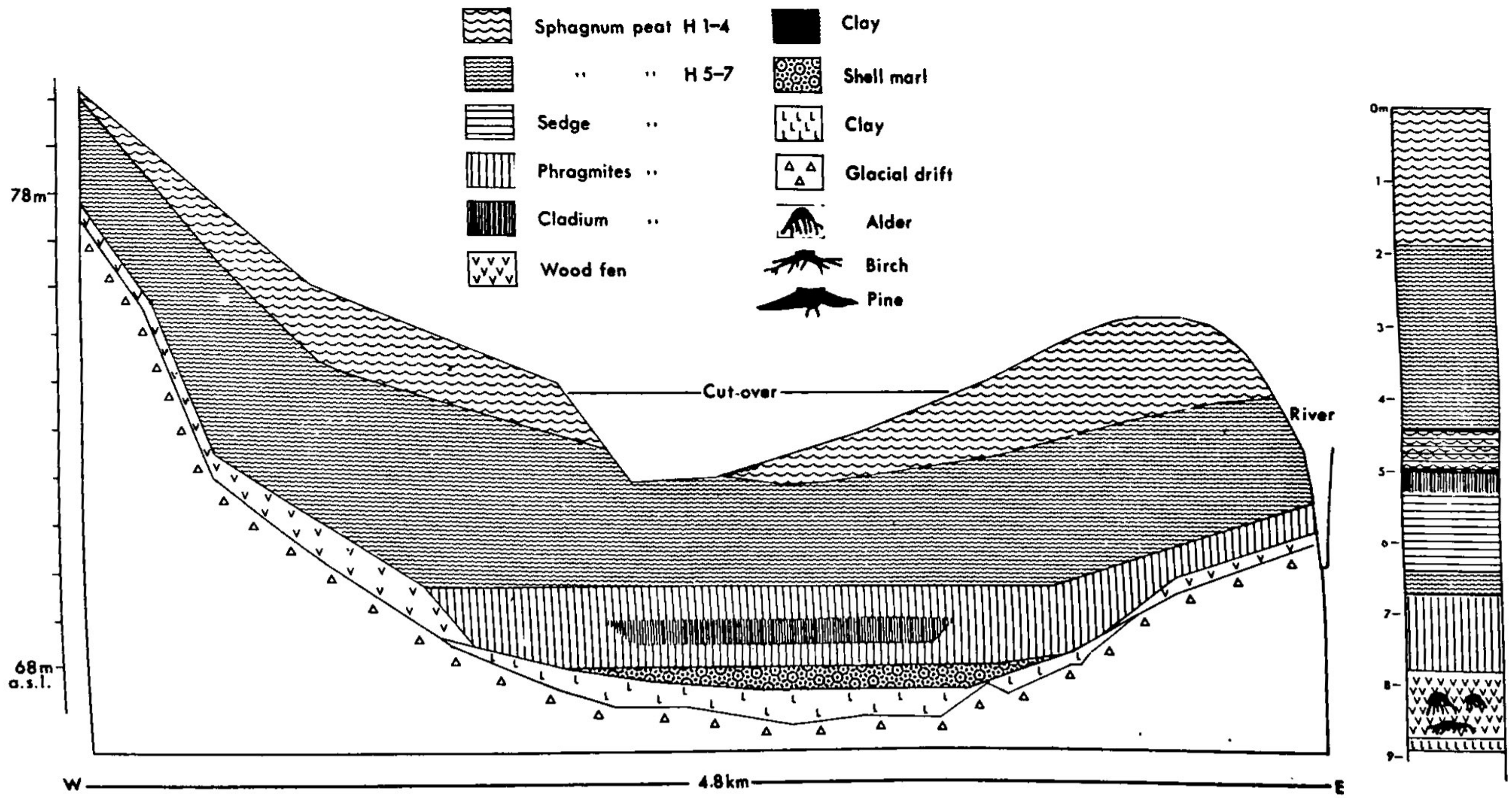


Figure 4: Schematic diagram showing cross section (Hammond, 1968) and detailed profile (Tansley, 1939) of raised bog in the Central Plain of Ireland

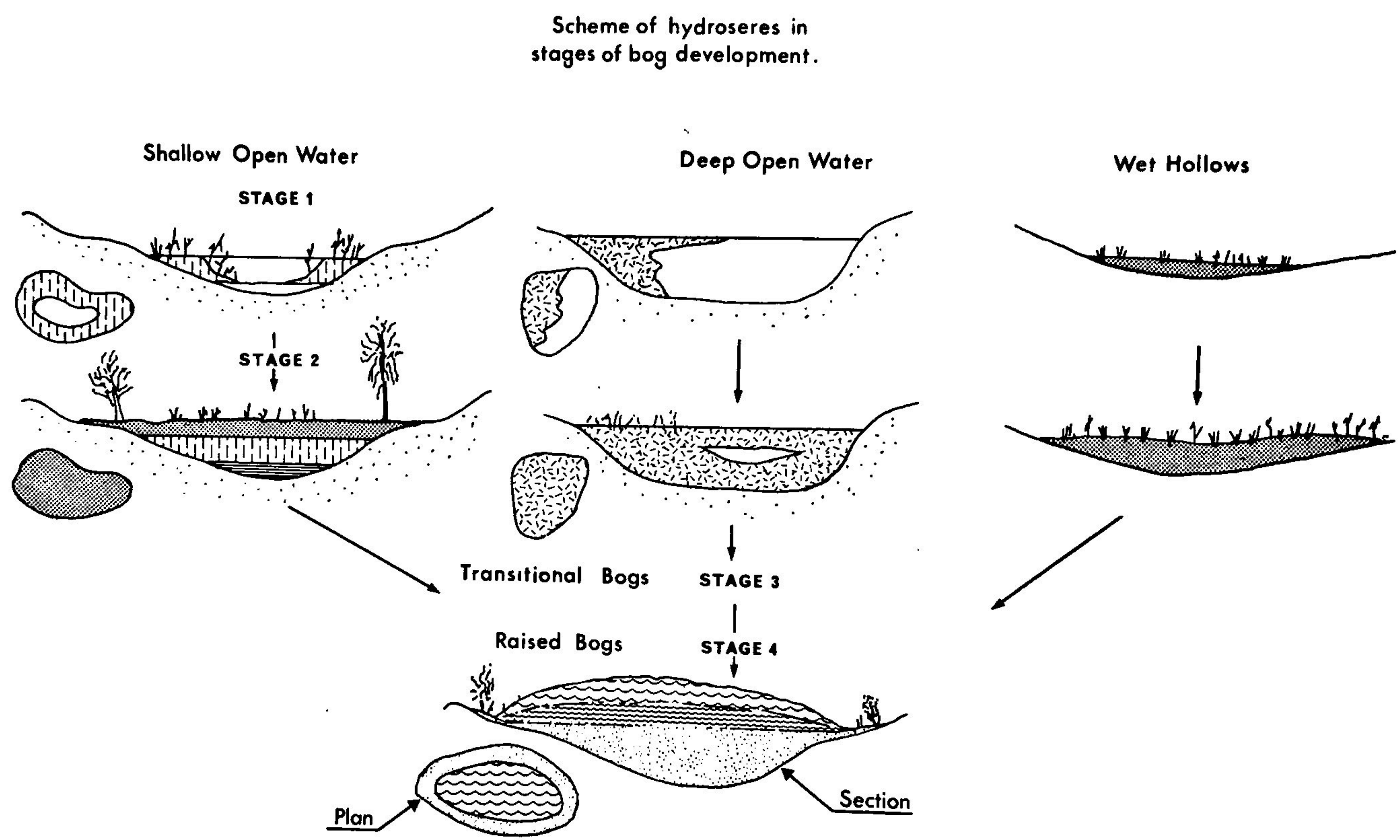


Figure 5: Scheme of hydroseres in stages of bog development

Plate 1:
A raised bog profile from Timahoe Bog, Co. Kildare, showing fen peat at the base, overlain by humified *Sphagnum* peat and the characteristic upper layer of poorly humified *Sphagnum* moss peat. The lighter colour towards the surface is due to drying out of the peat.
(photo R. F. Hammond)

were phasing out and the succeeding terrestrial ombrotrophic peats were attaining dominance. The ombrotrophic peats constitute the bulk of raised bog formations. Such vegetational sequences can be seen in peat cuttings throughout the Central Plain of Ireland. The upper layers of a raised bog present a complex appearance, the sequence of the sediments depending on the past phytosociology.

Blanket Mire: Blanket bog is a characteristic feature of many areas along the western seaboard and the higher hill and mountain masses. The onset of formation of this mire type is closely correlated with climatic deterioration within the post-glacial period. Development in upland areas had started before 4,000 B.P. (Mitchell, 1976). Pine stumps, now peat covered, testify to the better growing conditions at elevations of 600 m+ at periods earlier than 4,000 B.P. Blanket bog initiation has been dated to 4,150 – 2,150 B.P. (Smith *et al.* 1971). This shows that blanket bog formation took place in discrete locations over long periods of time, later coalescing into the widespread peat landscape we see today.

The term blanket bog was first used by A. G. Tansley (1939) to describe this type of peat terrain, which conforms to the underlying topography, except on very steep slopes.

Table 5: Sediment and peat types classified according to the environmental factors instrumental in their formation

Origin	Sedimentary (Allochthonous)		Sedentary (Autochthonous)	
Nutrition	Eutrophic	Oligotrophic	Minerotrophic	Ombrotrophic
Hydrology				
Terrestrial			Woody fen peat	*Calluna* peat *Sphagnum imbricatum* peat *Molinia* peat *Trichophorum* peat
Telmatic (semi-aquatic)			*Carex* sedge fen peat Reed peat	*Eriophorum vaginatum* peat
Limnic (Aquatic)	Sapropel Gyttja Shell marl Diatomite	Dy		*Sphagnum cuspidatum* peat

Development of this mire type is controlled by climatic factors i.e. cool summers, high rainfall (> 1,250 mm) with more than 225 rain days per annum and very high atmospheric humidity. In the undrained state, depending on the underlying topography, peat depths vary between one and six metres.

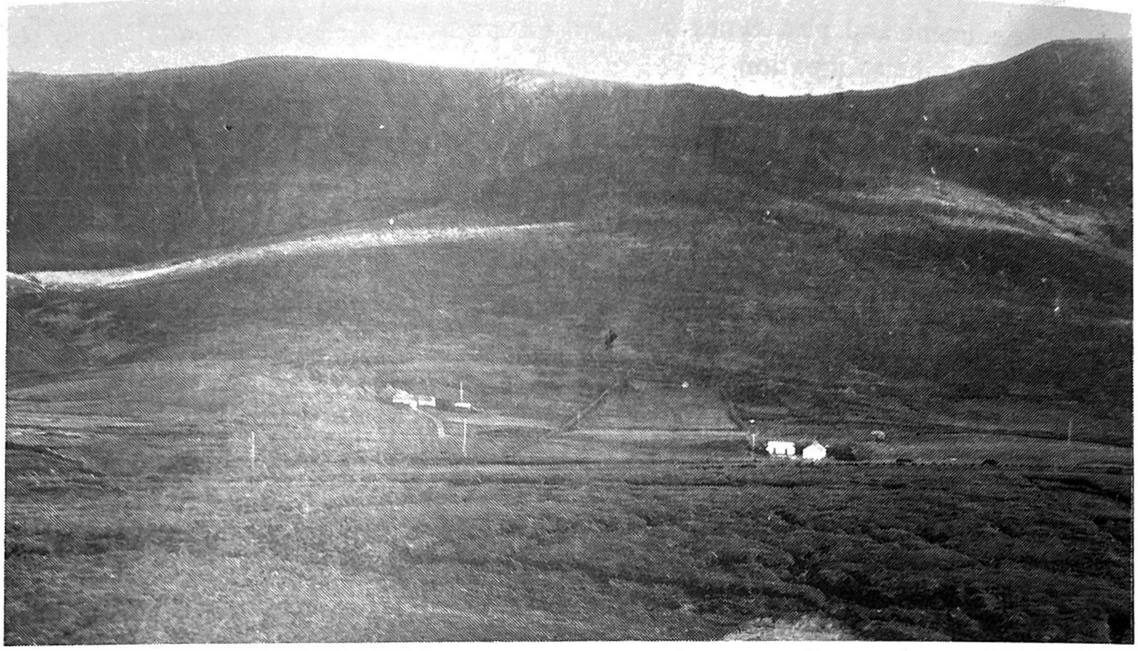
The morphology and physical characteristics of the peat profile differ markedly from that of raised bog. In the upper layers of a raised bog profile *Sphagnum* species predominate, with varied and complex changes in decomposition, colour and morphology. In blanket bog *Sphagnum* species are components of the surface vegetation but are never found within the peat profile in the same abundance as in Midland bogs.

Neither is there widespread occurrence of peat types of fen origin in the lowest layers of blanket bog. Plant remains more characteristic of eutrophic to mesotrophic plant environments are found in contained basins where local enrichment of nutrients took place. These are usually of limited extent relative to the overall area of blanket bog.

Blanket bog profiles are more homogenous in their morphology, although three basic layers are discernible. These are (1) an upper fibrous layer dominated by recent and sub-fossil roots of cyperaceous plants; (2) a sub-surface layer of pseudo-fibrous peat and (3) a basal layer of well-humified greasy peat with variable amounts of timber remains. With the exception of the basal layer where recognisable macro-fossils are few, the remainder of the profile is dominated by plants of grass (*Molinia*) and cyperaceous origin (*Eriophorum spp*) with the local occurrence of *Calluna vulgaris* and *Myrica gale* fragments embedded in the humified matrix.

Growth of Topogenous Mires

Fen Mire: This peat category is ubiquitous and comprises limnic, telmatic and terrestrial peat types. These occur at the base of raised bogs in the Central Plain, in river valleys,



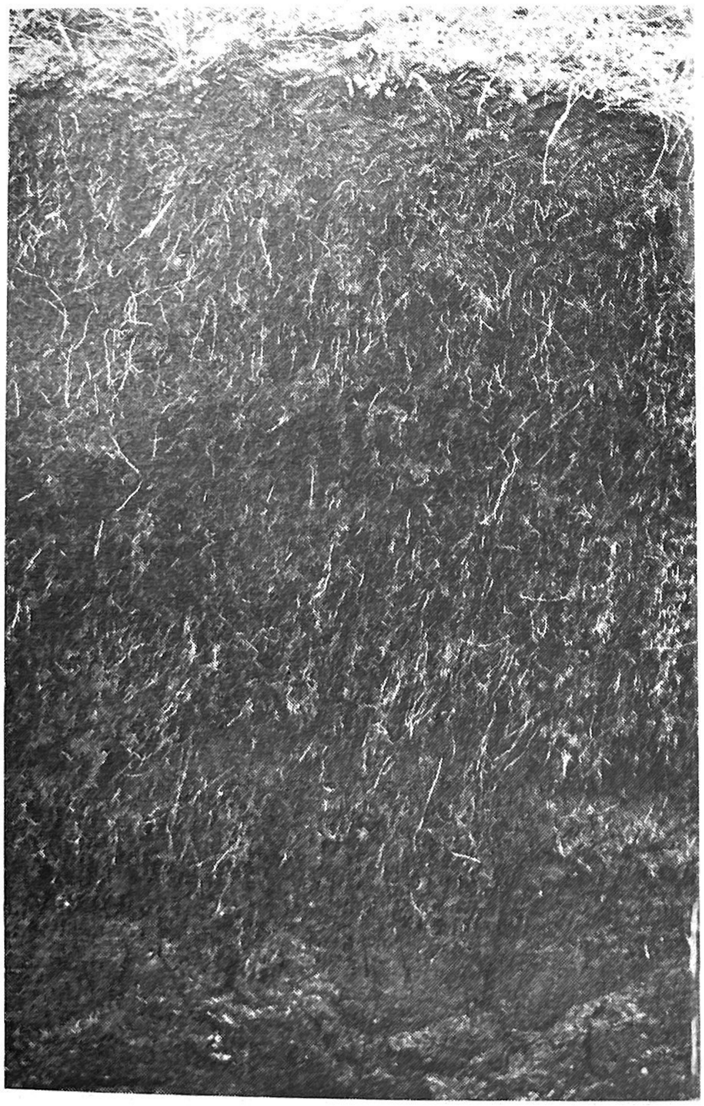


Plate 2 above:
Peat soils on the northern slopes of Slieve League, Co. Donegal, with deep blanket peat in foreground and cultivated peat soils in the middle distance. In the background shallower peat soils extend up into the mountain
(photo C. Godson)

Plate 3 left:
The top 110 cm of a deep blanket bog profile showing the upper fibrous layer dominated by recent and fossil roots of cyperaceous plants and the sub-surface layer of pseudo-fibrous peat
(photo R. F. Hammond)

poorly drained hollows and adjacent to raised bogs. Extensive development of ombrogenous *Sphagnum* peat has never taken place in these locations because of continued flushing by base-rich ground waters preventing the development of oxyphilous plant species. Within Table 5 the major peat types which occur in fen mires are classified according to the environmental factors instrumental in their formation.

Undisturbed fens are very rare in Ireland, especially in the Midlands and those still in existence are being severely threatened by agricultural development. Most fens have been drained and cultivated in the past but have reverted to poor pasture. In some areas where drainage is blocked they now exhibit species which are more characteristic of undrained fen.

3

Classification of Peat Soils

Classification of peatlands at the highest level is based on phytosociology and genetical concepts. The system of classification, at this level, can only be applied to undisturbed peatlands. It is limited in its application when applied to man-modified peatlands which are being used or are potential areas for agriculture, horticulture and forestry. Such peatland requires a classification scheme which defines the specific soil characteristics essential for evaluating their ultimate land use.

The National Soil Survey is compiling an inventory of the nation's soil resources, of which a major segment is the organic or peat soils. A knowledge of the different peat types, their related internal soil factors and fabric arrangement are important in considering the production and the adaptability of these soils to various crops, and productivity under defined sets of management conditions can only be quantified when soil properties are known.

There have been numerous attempts to devise an internationally acceptable peatland classification, so far without success. Therefore, for Irish peatlands a synthesis of classification criteria used both in Ireland and abroad has been used.

Classification systems are based on orderly concepts and arrangements so that groups of objects and materials can be placed in well defined classes. The purpose of a classification system is to group different types into uniform classes according to those properties which are of the greatest importance for a particular object. It is therefore understandable that different classifications have been developed for different purposes.

Botanists have used variations in botanical composition as a criterion for their peat classification, later complementing it with certain other criteria, for example, the trophic level. Geologists, in contrast have based their classification on such criteria as the morphology of the bog, and the ground water level. In agriculture and forestry the acidity and nutrient content of the peat have been used as criteria in classification. Lately, particularly for peat in horticultural use, the structure of the peat, its water and air capacity (fibrous, amorphous, granular) have been used as the main criteria.

Classification of Peats

The classification of Irish peatlands (blanket bog, raised bog and fen) is derived from their surface vegetation and genesis (Tansley, 1939; Osvald, 1949; Moore, 1962). These classification separations were used by Barry (1954) and are the basis of the legend for the present map at a scale of 1:575,000. However, Barry's classification scheme applied only to those peatlands which are *in situ* and which have not been man-modified by past and present usage of peat bogs for fuel production (hand and industrial) and increased utilisation for agriculture and forestry.

The degree of decomposition of the peat material and its botanical composition form the basis for peat classification. These two factors are the easiest properties to identify in the field and they influence all the important physical characteristics of peat such as permeability, water holding capacity (W.H.C.), bulk density (D_b) and fibrosity. But these soil factors are altered by human activity, e.g. drainage of organic soils will accelerate the degree and rate of decomposition, increase bulk density and decrease fibrosity. The rates of alteration, especially in surface horizons, will be increased by the addition of mineral materials ("marling") and fertilisers.

The degree of decomposition or humification which is used as a criterion for peat classification is based on the method developed by the Swedish peat scientist Lennert von Post in the 1920s. The scale is based on values 1–10 (>number >decomposition). Three separations are made in this scale giving the following categories:

Class	Degree of decomposition or humification (von Post)
Light	H 1 – 3
Dark	H 4 – 6
Black	H 7 – 10

The validity of a classification based on botantical composition depends on how well the plants forming the peat can be classified into a few large homogenous groups so that the residues of a few plant groups are similar.

The degree to which peat forming plants were preserved depends on past climatic and edaphic conditions. Identification of plant species from more or less decomposed residues can be difficult. The more easily recognisable species are the mosses and lignaceous plants whereas herbaceous plants tend to decompose quickly. In several classification systems the following grouping is used.

1. *Sphagnum* peat mosses
2. *Hypnum* peat mosses
3. Sedge and some other plants, whose remains have similar properties
4. Woody plants

In the Central Plain *Sphagnum* mosses are the typical peat formers. In respect to the nutrient supply and moisture content of the substrate the *Sphagnum* moss forms a very heterogenous group. The sedge peat category of the classification grouping includes a broad spectrum of sub-fossil plant remains. The term sedge identifies with those plants which are found in the families *Cyperaceae, Carex* spp. in particular and *Gramineae*. The plant materials confer similar physical, chemical and morphological properties on this peat type. It is commonly found in the sub-fossil state and forms the parent materials for many peat soils on drained fen areas.

> Organic soil materials that are saturated with water for prolonged periods, or are artificially drained, and have 30% or more organic matter if the mineral fraction is 50% or more clay, or 20% or more organic matter if the mineral fraction has no clay, or proportional intermediate organic matter contents if the clay fraction is intermediate. (Soil Survey Staff 1975).

From the early days of soil survey in Ireland a depth of 30 cm was taken as the minimum for a peat soil. This has then in part conditioned the acceptance of a definition based on this depth. The following is taken as the depth for organic material to constitute a soil in its own right:

> For land to be classed as peatland the depth of organic soil material, excluding the thickness of plant layer, must be at least 45 cm on undrained land and 30 cm on drained land.

These two definitions then define the exact nature of the peat material and its minimum depth as an organic soil. The American system (Soil Survey Staff, 1974) has established for practical purposes a control section of 160 cm for describing peat soils of moss origin and 130 cm for others.

Materials which fail to meet the above definitions are usually classified as peaty or humic sub-divisions of mineral soils e.g., peaty podzol, peaty gley, in The General Soil Map, Second Edition (1980). These criteria are the basis on which the organic soils have been mapped by the National Soil Survey of An Foras Taluntais.

In the county Soil Survey Bulletins published by An Foras Taluntais organic soils are mapped and described at the series level which is a basic category in soil classification. The soil series contains soils with a similar type and arrangement of horizons developed on similar parent materials. However, because of scale limitations it was not possible to show individual soil series on the present peatland map.

In the succeeding chapter the characteristic features of the peat soils are described. Profile descriptions for peat soils classified at series level are given in the appendices.

4

The Peat Soils of Ireland

Knowledge of the composition and characteristics of various types of peatland soils is a pre-requisite in planning their future development. To meet these requirements definitive information on the extent of the different categories of peat soils and their suitability for different enterprises was required. The map legend to accompany this new peatland map of Ireland includes all peat soils, whether undisturbed or man modified.

The terminology used to describe large formations of organic debris is numerous e.g. bog (red bog, black bog), bogland, peatland, peat, turf, moss, moor, peat deposit, moory soils, mire, organic soil, histosols, hochmoor, fen, swamp, marsh, raised bog, blanket bog. Most of these terms have, at one time or another, been applied to accumulations of what is generally understood to be raw peat. This is a largely organic material produced by the incomplete decomposition of vegetable debris by micro-organisms under wet conditions where oxygen is limited or excluded.

For the map legend and bulletin, the terms used were chosen on the basis of (a) common usage in Ireland and (b) frequent use in English internationally. The terms bog and mire were selected as representing terms of national and international usage respectively. Bog is derived from the Gaelic *bogach* meaning a quagmire bog, whereas mire, used in recent years internationally, derives from myrr (Old Norse) meaning bog. The terms raised bog, blanket bog and fen are in common usage both at national and international level.

Table 6 shows the mire types, related sub-types, and areas for each in the country.

Unmodified Mires

Raised Mire Soils

Raised bogs are natural organic formations characteristic of the Central Plain, i.e. 'the Bog of Allen'. They have formed in depressed topography on calcareous glacial drift (Hammond, 1968). Their mode of formation has resulted in a characteristic 'raised' appearance, hence the term 'raised bog'.

Two sub-types are recognised, a True Midland sub-type and a Transitional sub-type (Moore, 1962). This division is based on the relationship between the botanical composition and the increasingly wet climate as one moves from east to west across the country (Fig. 7).

True Midland Sub-type: In the drier Midlands, the plant species indicative of the sub-type are *Andromeda polifolia* (Bog Rosemary) and *Vaccinium oxycoccus* (Cranberry). In

Table 6: Classification of unmodified and modified mire types in Ireland

Non-industrial							Industrial	
Mire Types	Mire Sub – types	Area (ha)	Rainfall (mm)	Altitude (m)	Average depth (m)	Nutrient Supply	Category	Area (ha)
Raised Bog	True Midland	39,810[a] 1,980[b]	< 1,000	< 152	7.0	Ombrotrophic	Machine Peat	15,580
	Transitional	25,270 2,830	1,000 to 1,250				Milled Peat	24,690
							Moss Peat	5,050
	Man-Modified	172,110 21,830	< 1,250		2.5		Potential Industrial Areas	28,790
Fen	Man-Modified	92,510 9,300			1.2	Minerotrophic		
Blanket Bog	Low Level Atlantic	243,610 1,130	> 1,250	< 152	3.0	Ombrotrophic (in small flush areas minerotrophic)	Machine Peat	810
	Man-Modified Atl.	85,590 530					Milled Peat	7,160
	High Level Montane	321,060 100,120		> 152	1.2			
	Man-Modified Mon.	115,630 29,140						

(a) Total area in Republic (b) Total area in Northern Ireland.

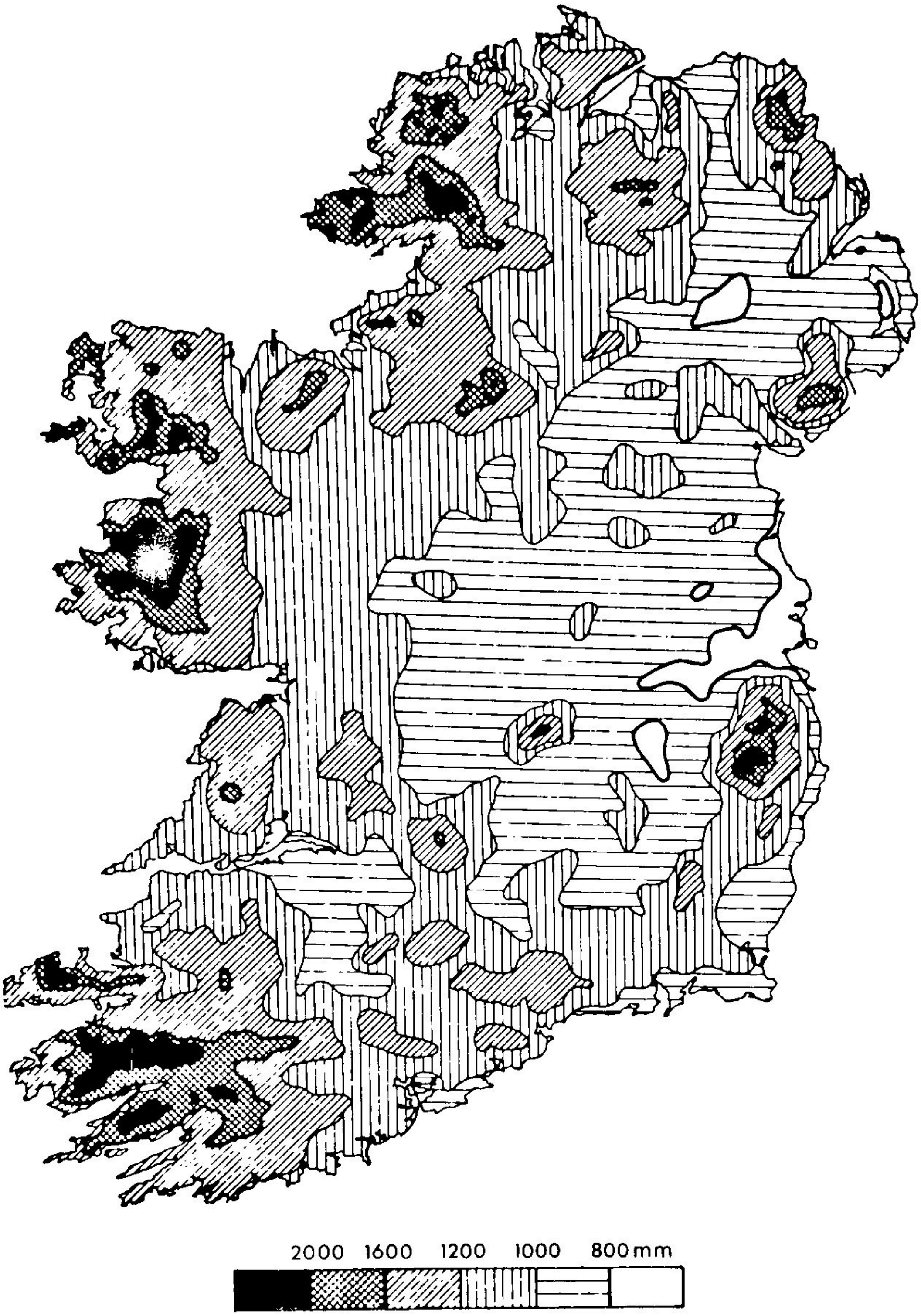


Fig. 7: Mean annual rainfall (mm) 1931–1969

Reproduced from "The Climate of Ireland" by P. K. Rohan, 1975, with the permission of the Controller, Stationery Office, Dublin.

Northern Ireland, the relatively few unmodified raised bog areas which occur in counties Tyrone and Antrim are included in this category on the basis of similar rainfall and topography. However, these two species do not occur in the vegetation lists published for Northern Ireland (Anon., 1956).

Transitional Sub-type: The climatic division between the two sub-types is based on the 1,000 mm isohyet. With increasing oceanity of the climate westward the indicator species of the Transitional sub-types are *Pleurozia purpurea* and *Campylopus atrovirens* (Table 7). The occurrence of *Pleurozia purpurea* for the transitional type raised bog category mapped in Northern Ireland is recorded in the published vegetation lists (Anon., 1956).

As noted above these landscape units can be separated on the presence/or absence of certain plant species and shown on the map accordingly. In the soils context, however, the following considerations have to be taken into account. The depths of organic materials within these formations can vary from 3–8 m. Using the definitions for peat soils outlined in Chapter 3 only the uppermost 1.0–1.5 m are examined, described and analysed to determine the soil series.

Irrespective of botanical separation these landscape units are always associated with excessively wet surface conditions. In general they have an upper layer of poorly humified *Sphagnum* peat over variable depths of humified *Sphagnum* peat, with *Calluna* remains and *Eriophorum* fibres which in turn overlie a basal layer of woody and fen plant remains (Fig. 4).

From the data available to date for the peat type parent materials of these landscape units no marked differences can be seen between the soils of these botanically different sub-types. Therefore only one soil series is recognised, namely the Allen Series (Conry, *et al* 1970). This series is so called because of its strong association with the Bog of Allen, historically this name links all the raised bogs across the Midlands. A profile description, physical and chemical data and macrofossil content are given in Appendix I.

Fen Mire Soils

No sub-divisions are made in the fen peats, since (a) many of the fens are contiguous to raised bogs, and (b) in most cases they have been drained and are now under permanent pasture.

Undisturbed fens are rare and can only be found in a few counties in Ireland. Owing to their small size their representation on the map is not possible, even their continued existence as natural entities is under threat from agricultural and urban pressures.

The characteristic dominant species associated with this peatland category in its natural state are *Schoenus nigricans* (Black Bog Rush), *Cladium mariscus* (Sword Sedge) and *Phragmites australis* (Common Reed).

Blanket Mire Soils

Blanket bog has been divided into two sub-groups, an Atlantic sub-type and a Montane sub-type. Along the western seaboard where blanket bog is extensive, the division is made at the 150 m contour, since Moore (1962) found that up to the 150 m contour *Schoenus* *nigricans* is a major contributor to the botanical composition, thus establishing a line of demarcation between sub-types (Table 7). It is noteworthy that in the eastern and central parts of the country blanket bog has not formed below 150 metres.

Low Level Atlantic Sub-type: Large expanses of this peat type occur in counties Galway and Mayo, and to a lesser extent in counties Cork, Donegal and Kerry on flat to very gently undulating topography below 150 metres O.D. At present they show relatively little man-modification. However, with increasing forest planting this situation is changing. West of Galway city this sub-type is shown with an R symbol on the map to denote the widespread occurrence of large granite boulders in that area.

Table 7: Plant species specific to the ombrotrophic peat types (Moore, 1962)

	Blanket Bog		
	Western	Mountain	Raised Bog
Molinia caerulea	V		
Schoenus nigricans	V		
Pleurozia purpurea	IV		
Campylopus atrovirens	II		
Potentilla erecta	III		
Polygala serpyllifolia	III		
Pedicularis sylvatica	II		
Drosera intermedia	II		
Vaccinium myrtillus		IV	
Empetrum nigrum		IV	
Diplophyllum albicans		III	
Andromeda polifolia			V
Oxycoccus quadripetalus			III
Sphagnum imbricatum			II
S. *fuscum*			II
S. *magellanicum*	II		IV

Roman numerals represent constancy classes for each species.

V	species occurring	81 – 100% of the releves.
IV		61 – 80%
III		41 – 60%
II		21 – 40%

Plant names according to D. A. Webb, 1977, An Irish Flora, 6th rev. ed., Dundalgen Press, Dundalk.

Organic soils of this type are extremely wet and acid and have very low permeabilities, < 1.0 mm per day (Galvin, 1972). Peat depths vary according to the underlying topography from less than 1.0 m to greater than 6.0 m. The Glenamoy Series (Kiely, 1974) represents the Atlantic sub-type, a profile description and analytical data are given in Appendix 1.

High Level Montane Type: This peat type occurs extensively above 150 m along the western seaboard. and at much higher levels on the major mountain masses throughout the country. Recent field surveys in Wicklow and the Knockmealdown Mountains (see General Soil Map, 2nd Ed., 1980), carried out since the preparation of the data for the Peatland Map in 1977 show that the peatland in these areas is not as extensive as originally interpreted. In the Slieve Blooms the high level sub-type occurs at altitudes greater than 210 m whereas in the Wicklow Mountains bog formation occurs at 330 m. Cruickshank (1970) has shown that in Northern Ireland the occurrence of blanket bogs can be correlated with the 300 m contour. These soils in the natural state are acid, extremely wet and poorly drained. With increased reliance on such areas to provide soils for forest trees, the areas of untouched bog are decreasing annually. The profile chosen to represent the montane type is from Co. Leitrim (Walsh, 1975). Peat depths are variable depending on slope. At breaks in slope or on very gentle slopes, depths can be 2–3 m but as a general rule the average is 1.2 m. A profile description and analytical data are given in Appendix I.

Modified Mires

Man-modified peatlands are defined as those areas where the bogland surface has been physically disturbed and the natural vegetation altered. In such cases peatlands have been drained (for agriculture, forestry, fuel production), grazed, marled and cut for peat fuels.

The vegetation growing on man modified unreclaimed peatland can indicate the soil condition and therefore its economic potential for land development. Peat depth, peat type, nutrient supply and micro topography created during modification all influence the plant species present, their extent, vigour etc. Table 8 lists some of the more common plant species associated with man-modified areas.

The occurrence of a particular species depends largely on the drainage condition and soil reaction. Mainly birch scrub may dominate on the older drier sites of cut-over areas in raised bogs: willow scrub may be dominant in wetter depressions. Drier sites of younger age will be colonised by heather (*Calluna vulgaris*). Wetter acid areas are colonised by plant species which also occur on the undrained raised bog, e.g. *Sphagnum* spp. and *Eriophorum* spp. Whilst all the species mentioned will grow in acid soil situations they do differentiate the drainage condition. This is a major consideration in the assessment of land development potential. Where the new surface is sufficiently close to the minerotrophic ground water and consists of weakly acid to alkaline peat, re-colonisation is by plant species typical of the same eutrophic peat environment (Table 8).

Those species listed under strongly acid soils (Table 8) also occur on colonised cutover blanket bog. With increased nutrient supply *Juncus* spp. and *Molinia caerulea* constitute major components.

The practice of hand-cutting turf for fuel has been and still is widespread throughout Ireland. The techniques and management of turf cutting employed over the years has had a strong influence on the organic soils which occur on modified peatlands. These areas have become an increasingly important land resource to the farming community for reclamation and improvement. There are four main reasons for this (1) the advent of higher farm gate prices on gaining entry to the EEC; (2) farmer desire to increase farm size and obtain higher output; (3) inflated price of mineral soils; (4) increased awareness of reclamation techniques (drainage, fertiliser usage).

Soils of Man-Modified Raised Mires: Hand-cutting turf for fuel gives an uneven microtopography consisting of deep bog holes which may be separated by variable extents of flat areas used for hand spreading the cut peat. This category is mapped as a complex due

Table 8: Plant species which can occur in unreclaimed man-modified peatland areas as indicators of drainage and nutrient status

Strongly acid soils		Weakly acid to alkaline soils
Betula (spp) (Birch)	*Calluna vulgaris* (Heather)	*Filipendula ulmaria* (Meadow Sweet)
Pinus sylvestris (Scots Pine)	*Erica tetralix* (Cross-leaved Heath)	*Lychnis flos-cuculi* (Ragged Robin)
Sorbus aucuparia (Mountain Ash)	*Myrica gale* (Bog Myrtle)	*Phragmites australis* (Common Reed)
Ulex europaeus (Gorse, Furze)	*Pteridium aquilinum* (Bracken)	*Typha latifolia* (Reed Mace)
Salix (spp) (Willow)	*Molinia caerulea* (Purple Moor Grass)	*Juncus (spp)* (Rush)
	Eriophorum angustifolium (Bog Cotton)	*Potentilla erecta* (Tormentil)
	Scirpus caespitosus (Deer Grass)	*Molinia caerulea* (Purple Moor Grass)
	Carex panicea (Carnation Grass)	*Bryophytes* (Fen Mosses) *Drepanocladus (spp)*
	Narthecium ossifragum (Bog Asphodel)	
	Drosera (spp) (Sundew)	
	Bryophytes (Bog Mosses) *Sphagnum (spp)*	

to the intricate distribution pattern of the soil components which defy clearcut delination on the maps used in field survey. No profile description or analytical data are included for this complex but the overall physical and chemical properties can be correlated with the Allen Series. The name Turbary Complex given to this man-modified land type is derived from the definition of turbary 'a place where peat is dug' (Chambers Dictionary Revised Ed., 1966).

In some areas the peat remaining after handcutting has been reclaimed for agriculture. This soil type, common throughout the Midlands, was reclaimed in the 18th and early 19th centuries in most instances. In recent years there has been a renewal of activity in reclaiming the more level areas of the Turbary Complex and also in renovating derelict land which had previously been reclaimed.

The combination of research work and farmer practice has shown that this soil type is capable of producing grass growth and beef production comparable to that obtained from mineral upland soils. In particular cases where there is a thick well-developed surface soil horizon, it is possible to grow a range of vegetable crops. The profile description and analytical data for this peat type, known as Gortnamona Series (Finch, 1978) are given in Appendix II.

In small areas throughout the Midlands the original surface of the raised bog has been reclaimed for agriculture. This reclamation was carried out in most cases more than 100 years ago, and often dates to pre-Famine times when population pressures on land were at their greatest. The series name Garrymona (Hammond unpubl.) given to this peat type is taken from two Gaelic words meaning literally 'small field of turf'. The individual fields are no larger than a kitchen garden and have usually reverted to very poor pasture. In a few areas these 'bog gardens' are still used to grow potatoes and a limited range of vegetables.

Reclamation of *in situ* raised bog involved drainage and the application of 'marling' material (calcareous glacial tills and gravels) to the bog surface. This technique is well documented in the Bog Commissioners Reports of 1810–1814. The analyses show the alteration in the surface horizon characteristics when compared to those of the Allen Series.

Soils of Man-modified Fen Mires: This soil, called Banagher Series (Conry *et al*, 1970) has developed from organic parent materials, widespread in the Midlands, which grew and accumulated in a minerotrophic environment. Because of this it is potentially one of the better organic soils in the country. It occurs in flat river flood plains, inter-drumlin depressions, kame and kettle topography and in the immediate environs of raised bogs. In such topographical positions it was never covered by an ombrotrophic peat layer. In certain situations, where second-cut hand turf was produced, the overburden of ombrotrophic peat has been removed entirely, exposing the underlying fen peat to soil forming processes.

The development processes which have given rise to this soil type were contingent on drainage initially and in the majority of cases the addition of marling materials. Two phases, shallow and deep, can be recognised within the series. In the former (< 100 cm but >40 cm) pH levels are higher than in the deep phase.

The major proportion of this series is under permanent pasture but small areas throughout the country are used to produce vegetable crops e.g. carrots, celery, brassicas (cauliflower, sprouting broccoli).

A profile description and analytical data for a representative profile are given in Appendix II.

Soils of Man-modified Blanket Mires: *Atlantic Type:* As in the raised bogs of the Midlands, areas of the low level sub-type have been cut for fuel. Large areas of north west Mayo and Donegal have been reclaimed for agriculture in the past, after hand cutting had ceased. In more recent times, the same flat peatlands in west Mayo have been reclaimed for grassland, both for experimental and commercial purposes e.g. the Agricultural Institute Experimental Centre at Glenamoy, and the Gweesalia Grass Drying Co., respectively. Increasingly, areas are also being ploughed and drained for State Forestry.

Since the inception of Bord na Mona in 1946, 7,165 hectares of this peat type have also been developed for milled peat production. No representative profiles of hand cut-over or milled peat areas were sampled, as the composition and distribution pattern were too complex to allow a modal profile to be distinguished.

In historical times population pressures on available land resources along the western seaboard have been quite severe at one time or another. The reclamation of cut-over peatland for cultivation has been a practice of long standing. Land improvement involving the use of sea sand has been well documented (Conry, 1972). The profile chosen to represent this peat type (Gweesalia Series, Kiely, 1974) illustrates this fact as the surface horizon exhibits a well developed granular structure, with abundant rooting and high ash content. The high level of mineral matter is a direct result of sea sand additions. The good permeability and rooting in the surface decrease quickly with depth. A profile description and analytical data are given in Appendix II.

Montane Sub-type: Production of hand won turf was never restricted to lowland areas, many thousand hectares of peatlands in the mountain and hill areas have also been cut-over. By the very nature of the peat cutting operations these areas are very complex in their micro-topography and the soils thereon. No profile description or analytical data are included for this complex situation but the overall physical and chemical properties can be correlated with those of the untouched montane type in Appendix I.

Industrial Peat Soils

Machine peat, milled peat and moss peat are extracted industrially from the bogs in Ireland (Flood, 1970; Power, 1970; Rice, 1970). Although the three production methods differ markedly in their extraction techniques the net result of industrial utilisation will be to expose the various basal peat types. After machine turf production has ceased the deeper peat areas remaining will be milled, similarly in moss peat bogs where an economic depth of peat remains, milling will also take place.

Because peat extraction will not cease for many years the areas shown on the map do not represent soils but rather the areas where the different extraction techniques are being employed. Hence the peat types remaining after extraction will form peat soils in the future.

Plate 4:
Man modification of the peatland landscape by hand cutting

(Photo Cork Examiner)

Plate 5:
Machine modification. The Bord na Mona milled peat bog at Boora, Co. Offaly

(photo Bord na Mona)

5

Land Use of Irish Peat Soils

Utilisation of peatlands for energy, agriculture and other uses e.g. chemicals, waxes has had a chequered history (Cooke, 1970). In the past 160 years several major parliamentary committees (Bog Commissioners 1810–1814; Anon., 1921) have deliberated on its use for various purposes. It was not until the 1940's that major investments were made to develop the peat fuel industry we know to-day. Four million tonnes of peat fuels per annum are now harvested by mechanical methods. In Northern Ireland detailed surveys (Anon., 1956), conducted on the larger peat areas found that they were too small and too shallow to merit economic development at that time.

Research Developments

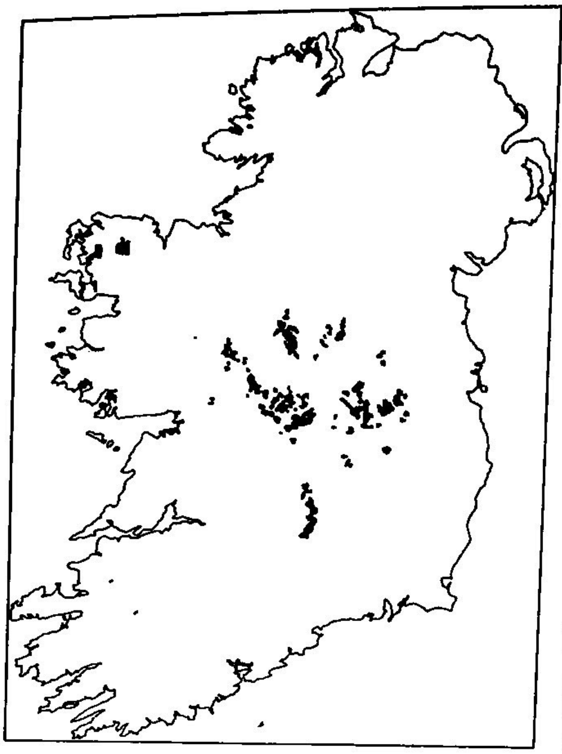
In recent years discussion has centred on the best land use for such (machine cutover) areas when worked out for fuel. Research work started in the 1950s and 1960s covered a broad spectrum of activity. Basic surveys were carried out on sub-soils beneath the peatlands and on peat types themselves (Barry *et al*, 1973; Carey, 1970; Carey and Hammond, 1970). Research on the suitability of crop varieties and their nutrient requirements showed the potential of peat soils for agriculture and horticulture. (An Foras Taluntais – Annual Research Reports). Research findings have now been translated into commercial practice (Bord na Mona Annual Reports 1975–76; 76–77; 77–78).

O'Muirgheasa (1978) discussed the role of forestry as a component for future land use planning on peatland.

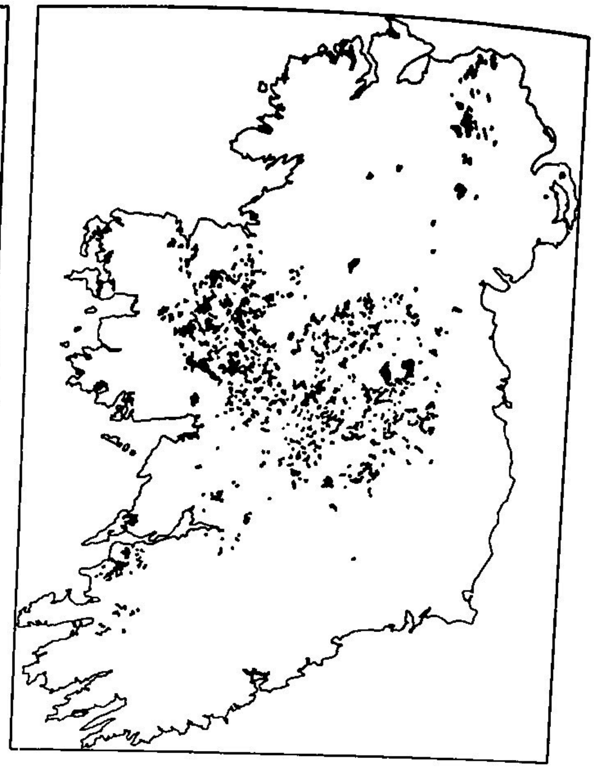
Eventually there will be about 80,000 ha of industrially worked out land available for development. In the past decade a large area of farmer owned peatland has been reclaimed for agriculture as a direct result of escalating prices of upland mineral soils, increased grants-in-aid for land reclamation, and better prices for farm products.

Tables 9–12 show the extent and distribution of the different peatland categories on a county and province basis. Table 13 summarises the land use suitability of the different categories and their limitations for use. Table 13 also lists the soil series mapped by the National Soil Survey, these can be referred to in the Soil Survey bulletins e.g. Finch (1978). Figures 8 and 9 show the distribution patterns of the different categories mapped throughout Ireland.

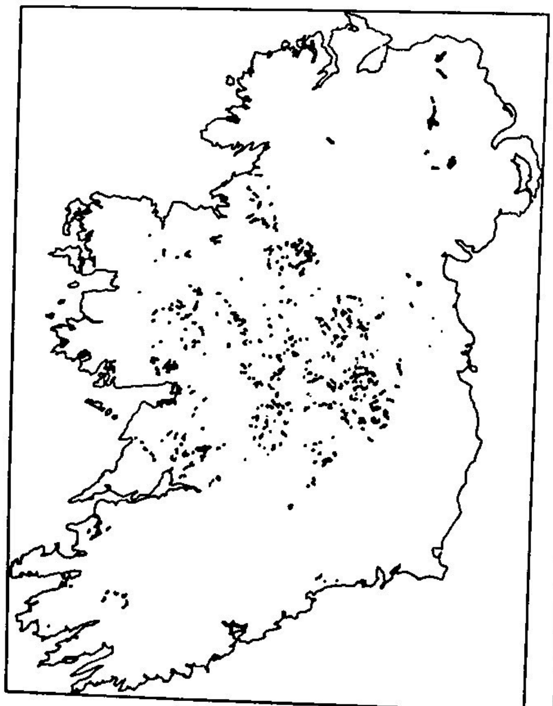
Fig. 8.



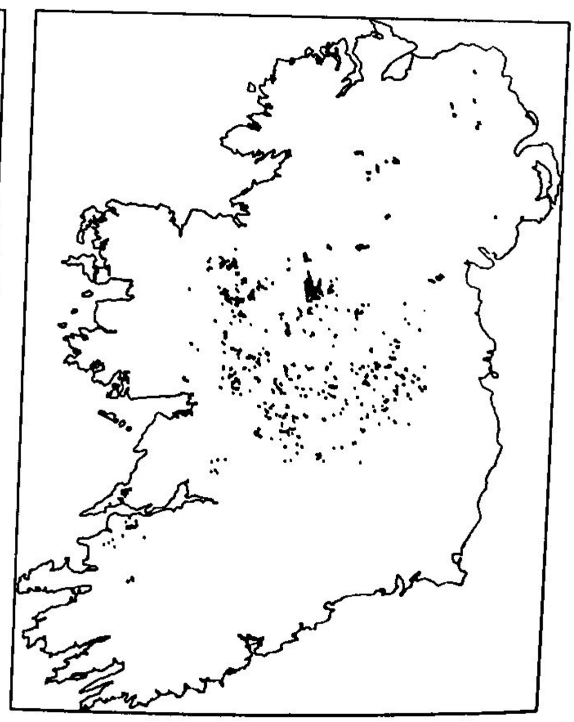
(a) Distribution of industrial peat areas.



(b) Distribution of raised bog–man modified.

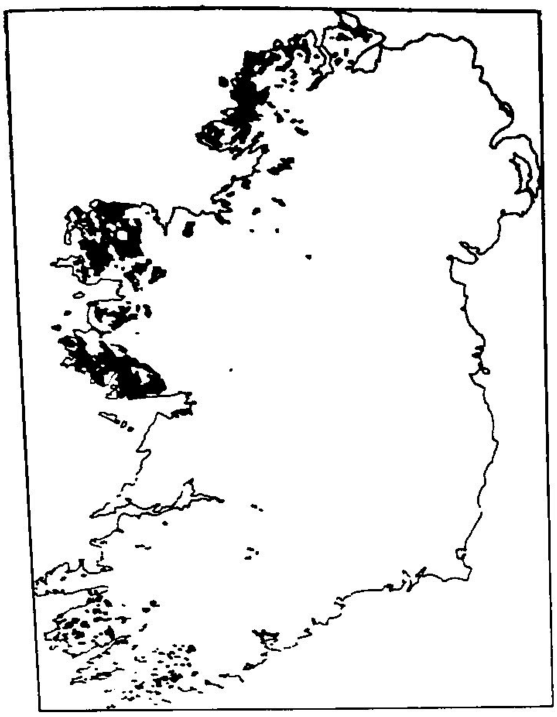


(c) Distribution of fen peat–man modified.

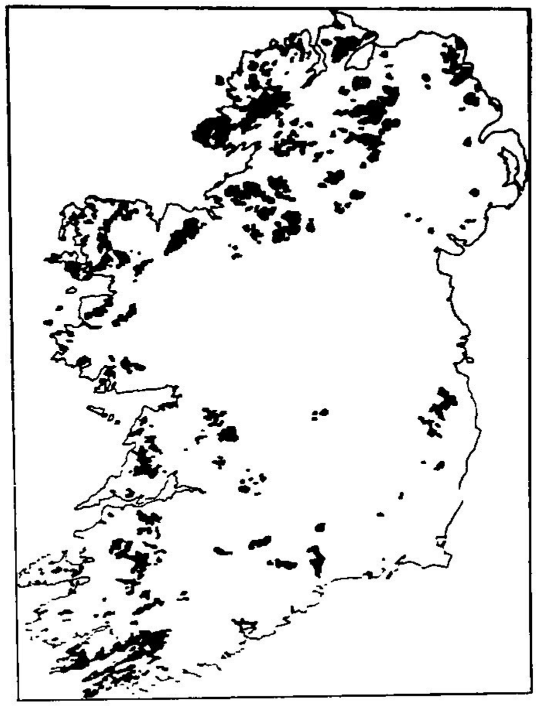


(d) Distribution of raised bog–unmodified.

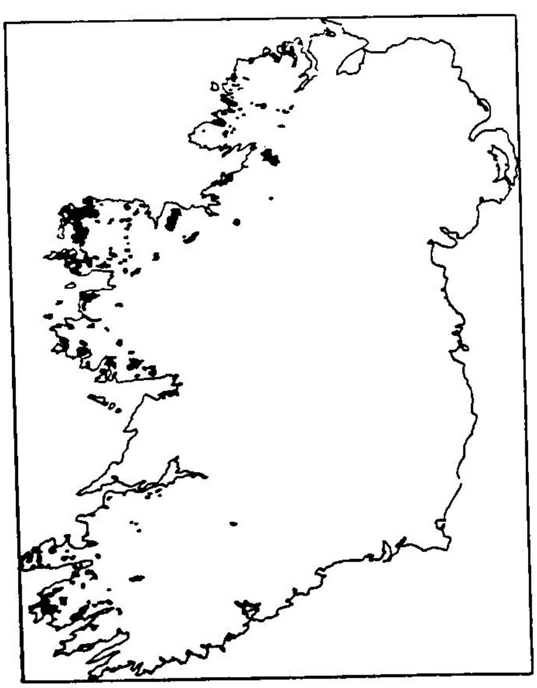
Fig. 9.



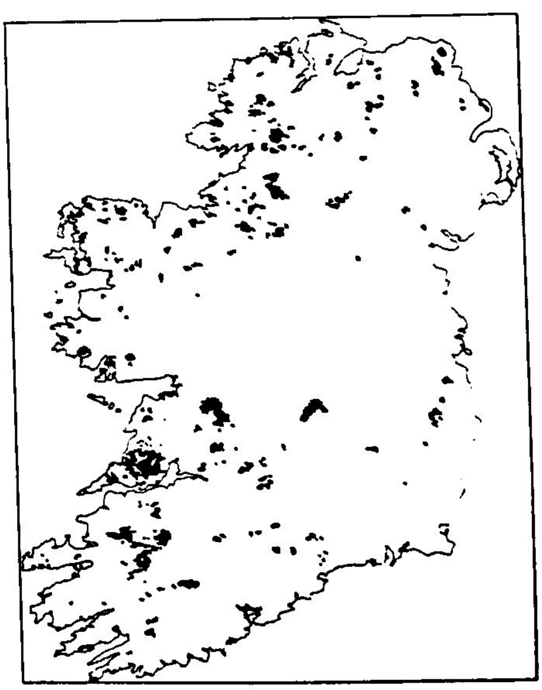
(a) Distribution of blanket bog–Atlantic sub-type.



(b) Distribution of blanket bog–montane sub-type.



(c) Distribution of blanket bog–man-modified Atlantic sub-type.



(d) Distribution of blanket bog–man-modified montane sub-type.

TABLE 9: Areas of the different peatland categories mapped in the counties of Leinster (ha)

	Raised Bog Midland type			Fen	Blanket Bog Montane type		Industrial peat				
	Un-modified	Man modified reclaimed	Man modified un-reclaimed	Man modified	Un-modified	Man-modified	Machine	Milled	Moss	Potential future use	Total
Carlow	–	–	197	–	850	–	–	–	–	–	1,047
Dublin	–	–	–	–	469	–	–	–	–	–	469
Kildare	2,529	364	6,136	5,844	–	–	4,836	1,384	2,205	1,019	24,317
Kilkenny	–	–	101	316	405	–	235	–	–	680	1,737
Laois	2,226	1,012	5,787	5,140	1,214	4,027	202	–	1,012	239	20,859
Longford	4,537	1,345	7,345	1,232	–	–	1,137	2,857	–	3,306	21,759
Louth	526	–	486	81	–	–	–	–	–	–	1,093
Meath	1,319	2,835	1,643	3,901	–	–	255	–	231	105	10,289
Offaly	7,875	1,457	13,520	13,901	413	2,120	5,233	15,981	1,238	2,408	64,146
Westmeath	4,793	7,569	9,012	11,026	–	–	1,424	813	368	2,723	37,728
Wexford	–	–	–	566	–	162	–	–	–	–	728
Wicklow	–	–	971	–	12,719	2,914	–	–	–	–	16,604
Total	23,805	14,582	45,198	42,007	16,070	9,223	13,322	21,035	5,054	10,480	200,776

TABLE 10: Areas of the different peatland categories mapped in the counties of Munster (ha)

	Raised Bog							Blanket Bog						
	Midland type			Transitional type			Fen	Atlantic type		Montane type		Industrial peat		
	Un-modified	Man modified re-claimed	Man modified unre-claimed	Un-modified	Man modified re-claimed	Man modified unre-claimed	Man modified	Un-modified	Man modified	Un-modified	Man modified	Machine	Potential future use	Total
Clare	–	–	–	2,412	–	4,354	7,883	–	–	21,756	25,075		–	61,480
Cork	–	–	–	–	–	–	–	10,683	–	52,180	11,335	–	–	74,198
Kerry	–	–	–	2,165	2,845	5,989	4,654	18,341	20,316	29,462	12,748	344	–	96,864
Limerick	651	1,202	–	–	–	–	352	2,675	514	11,955	3,683	–	–	21,032
Tipperary	2,310	1,165	4,395	–	–	–	4,298	–	–	8,507	6,184	1,048	6,046	33,953
Waterford	–	–	–	–	–	–	615	–	–	9,745	1,598	–	–	11,958
Total	2,961	2,367	4,395	4,577	2,845	10,344	17,802	31,699	20,830	133,604	60,623	1,392	6,046	299,485

TABLE 11: Areas of the different peatland categories mapped in the counties of Connaught (ha)

	Raised Bog							Blanket Bog							
	Midland type			Transitional type			Fen	Atlantic type		Montane type		Industrial peat			
	Un-modified	Man modified re-claimed	Man modified unre-claimed	Un-modified	Man modified re-claimed	Man modified unre-claimed	Man modified	Un-modified	Man modified	Un-modified	Man modified	Machine	Milled	Potential future use	Total
Galway	3,395	279	6,240	7,511	1,857	24,253	10,012	64,447	9,292	12,772	10,320	506	2,580	6,273	159,737
Leitrim	5,018	–	–	858	–	–	16,030	4,512	846	23,842	6,313	–	–	–	57,419
Mayo	–	–	–	2,027	368	26,511	469	82,242	39,324	43,838	10,000	–	7,165	–	211,944
Ros-cm.	4,682	736	9,543	6,600	344	10,979	4,828	–	–	498	692	700	753	5,427	45,782
Sligo	–	–	–	1,445	239	4,978	1,279	3,452	6,944	14,249	4,917	–	–	–	37,503
Total	13,095	1,015	15,783	18,441	2,808	66,721	32,618	154,653	56,406	95,199	32,242	1,206	10,498	11,700	512,385

TABLE 12: Areas of the different peatland categories mapped in Ulster (ha)

	Raised Bog						Blanket Bog				Industrial peat	
	Midland type			Transitional type		Fen	Atlantic type		Montane type			
	Un-modified	Man modified reclaimed	Man modified un-reclaimed	Un-modified	Man modified un-reclaimed	Man modified	Un-modified	Man modified	Un-modified	Man modified	Machine	Total
Cavan	81	–	3,804	1,922	1,882	81	–	–	2,092	1,093	–	10,955
Donegal	–	–	–	–	–	–	57,248	8,361	71,938	11,109	469	149,125
Monaghan	749	–	364	324	–	–	–	–	1,416	–	–	2,853
	830	–	4,168	2,246	1,882	81	57,248	8,361	75,446	12,202	469	162,933
Antrim	1,214	7,284	–	–	–	4,937	–	–	21,570	6.637	–	41,642
Armagh	–	1,943	–	–	–	405	–	–	567	1,214	–	4,129
Derry	728	9,025	–	–	–	3,157	–	–	23,432	5,301	–	41,643
Down	202	1,214	–	–	–	121	–	–	1,983	–	–	3,520
Fermanagh	–	–	40	–	–	–	1,214	728	16,592	10,320	–	28,894
Tyrone	–	3,157	2,995	–	–	1,093	121	–	36,382	7,689	–	51,437
	2,144	22,623	3,035	–	–	9,713	1,335	728	100,526	31,161	–	171,265
Grand total	2,974	22,623	5,281	2,246	1,882	9,794	58,583	9,089	175,972	43,363	469	334,198

TABLE 13: Peatland soils – land use suitability

Mire type	Parent material	Description	Series/Assoc.	Suitability[a]	Use range	Limitation
		Unmodified raised bog	Allen	Unsuitable for cultivation and grazing, poorly suited for forestry, suitable for fuel and moss peat production and amenity.	Very limited	Extremely low nutrient status, strongly acid, very poor drainage.
Raised Bog		Man modified raised bog by hand turf production and drainage	Turbary Complex	Suitable for reclamation depending on limitation. In unreclaimed state suitable for forestry and amenity.	Limited	Turf bank remnants and "bog holes", lack of drainage outfall, acidity, extremely low nutrient status.
			Gortnamona	Suitable for adventitious rooted arable crops, poorly suitable for tap rooted crops, suitable for pasture, meadow and forestry.	Somewhat limited	High water tables Winter and Spring, incidence of late frosts, acid sub-surface layers, high water holding capacity.
	Organic soils with parent materials comprised of acid bog peats developed under the influence of rainfall.	Unmodified Atlantic Type	Glenamoy	Unsuitable for cultivation, grazing and poorly suited for forestry suitable for amenity and wildlife.	Very limited	Extremely low nutrient status, strongly acid, very poor drainage, high rainfall.
		Atlantic Type Man Modified by hand turf cutting	Glenamoy Cutover Series, Gweesalia	Suitable for reclamation depending on limitation.	Limited	Turf bank remnants, poor sub-soil types, rock outcrop, drainage outfall, high rainfall.
Blanket Bog		Unmodified Montane Type		Unsuitable for cultivation, poorly suited for forestry and grazing depending on limitation.	Very limited	Slope, aspect, extremely low nutrient status, strongly acid, high rainfall, altitude.
		Montane Type Man Modified by hand cut turf production	Hill & Mountain Associations	Suitable for reclamation depending on limitation. In unreclaimed state suitable for forestry and amenity.	Limited	Slope, aspect, subsoil type, rock outcrop, peat depth, high rainfall, altitude.
Fen	Organic soils with parent materials comprised of peat developed under the influence of ground water.	Man modified	Banagher	Suitable for wide range of arable and horticultural crops, pasture, meadow and forestry.	Wide	High water tables Winter and Spring, late frosts, high lime areas.

(a) The suitability ratings pre-suppose acceptable standards of management practice at farming level.

Land Use on Midland Peat Soils

Research work at the Peatland Experimental Centre, Lullymore, Co. Kildare on reclamation and amelioration of worked out industrial peat areas has progressed to a stage where commercial application of the results is now being undertaken.

Since the mid fifties the Forest and Wildlife Service have been conducting a research programme to assess the tree species suitability and nutrient requirements when grown on man-modified peat soils. O'Muirgheasa (1978) reports on the performance of Sitka spruce when grown on peat soils developed on cut-over peatland < 2 m deep and that of lodgepole pine growing on deeper peat soils in the Irish Midlands. Sitka spruce has been particularly successful. This resource offers exciting possibilities for future development.

Cole (1976) and MacNaeidhe (1976) spelt out the management factors and capabilities for cut-over Midland peat soils to produce grass and crops. Good drainage, good soil management techniques (prevention of compaction, good ploughing technique), crop nutrition and weed control are essential. On newly reclaimed organic soils high initial applications of the macro elements (NPK) are required and lime must be well mixed into the top 15 to 20 cm. Optimum pH is around 5.5.

Micro-nutrients are essential to crop establishment in newly reclaimed peat soils. Chemical weed control measures on organic soils require 2 to 3 times the rate recommended for mineral soils, also herbicides are rapidly inactivated at normal rates due to the complexing nature of organic soils. Peatlands have some advantages over mineral

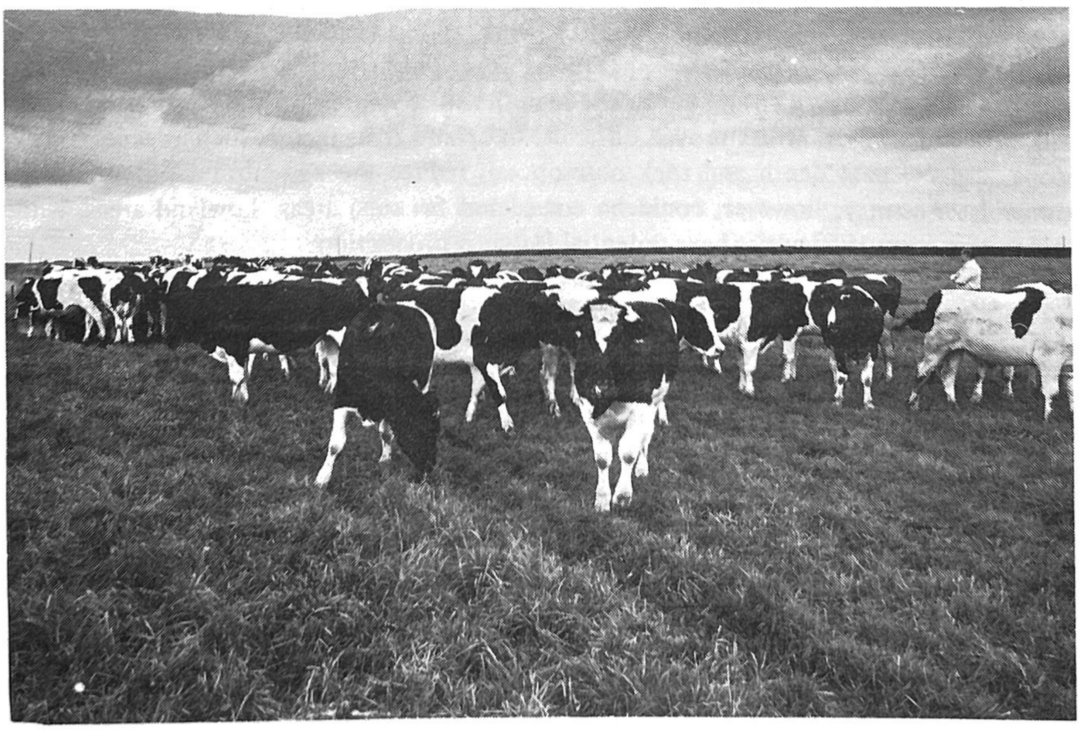


Plate 6:
Friesian steers grazing a ryegrass pasture on a reclaimed industrial peat bog, Clonsast, Co. Offaly. Note the turf bank in the background *(photo Bord na Mona)*

soils e.g. organic soils are friable, stone-free, and easier on farm machinery; good moisture holding capacities lessen the risk of moisture deficit even during periods of prolonged dry weather.

Reclaimed peatlands in the Midlands are mainly devoted to grassland. The same basic management principles apply as for arable crops. Grass production and sward responses to fertiliser are as good as on the better classes of mineral soils. Attention to micro-nutrients is important as they affect grass production and the health of the grazing animal and preventative measures must be taken against deficiencies of magnesium, copper and cobalt. Applications of copper and cobalt sulphates at sowing and the dusting of pastures with magnesite prevent occurrence of such deficiencies in livestock.

In certain areas of the Midlands the occurrence of high soil molybdenum levels can cause induced copper deficiency in the grazing animal. This is easily rectified by injecting the animals. Soil management to prevent poaching is extremely important both at the beginning and end of the grazing season. It is important to have modified farm equipment (tractors with double wheels, large tyres on trailers etc.) so that no damage is caused to the soil structure and hence to internal drainage.

Given proper management over 100,000 ha of organic soils could be brought into production. In many cases this need only entail drain cleaning, outfall maintenance and the application of fertiliser.

Land Use on Blanket Bog Soils

Blanket bogs of the western seaboard and the hills and mountains are also being examined for land use potential. Research work at the Peatland Experimental Centre, Glenamoy, Co. Mayo has shown that good grass production is possible on low level Atlantic Bog (Collins, 1961). Due to the high moisture content of the soil and high rainfall, efficient utilisation has proved difficult. In upland areas factors such as accessibility, slope, aspect, peat depth and rock outcrop can reduce the agricultural potential considerably. Forestry, however, could be considered for such areas. Lowland areas, while still posing many difficulties have potential for grass production.

Future Developments

Considerable progress has been made over the past three or four decades in peatland development. There are, however, legal, social and practical difficulties associated with development, especially those of the man modified peats (Turbary Complex). Reports from the Agricultural Science Association (Anon., 1973) and the Midland Peat Development Committee (Mannion and Callaghan, 1976) discussed these factors at length and offered solutions. Although some progress at local level has been made since, development would be better channelled through a national development plan.

APPENDIX I

Soil profile descriptions and analytical data for organic soils derived from ombrotrophic parent materials of raised and blanket bog origin

Profile 1 – Midland Type

Location:	Clonawiny Td. Co. Westmeath Grid Ref. N: 49.52
Classification:	U.S.D.A. classification Sub-group Typic Sphagnofibrist
Series:	Allen Series
Parent Material:	Ombrotrophic peat of *Sphagnum* origin
Vegetation: Main Species:	*Calluna* and *Sphagnum* spp.
Topography:	On cut edge of bog – slope of 1°
Drainage:	Poor
Permeability:	Poor
Altitude:	99m O.D.
Root Distribution:	Roots to 58 cm

Horizon	**Depth (cm)**	**Description**
Oi1	0-27	Dark reddish brown (5YR3/4); *Sphagnum Calluna* peat; fibric; poorly humified; on washing *Sphagnum* with *Calluna* remains twigs and flower heads etc., clear wavy boundary to:
Oi2	27-58	Dark reddish brown (5YR3/4); *Sphagnum peat;* fibric; poorly humified; on washing dark colour well preserved *Sphagnum;* clear, slightly wavy boundary to:
Oi3	58-87	Dark reddish brown (2.5YR2/4); *Sphagnum-Calluna* peat; fibric; poorly humified; on washing dominantly dark-coloured *Sphagnum* remains; abrupt wavy boundary to:
Oi4	87-118	Black (5YR2/1); *Sphagnum-Calluna* peat; fibric; poorly humified; on washing *Calluna* debris with *Sphagnum imbricatum* dominant and *S. cuspidatum* with *Eriophorum.*

Table 1: Analytical data for Profile 1

Horizon	Depth (cm)	Field Moisture (%)	Saturated Moisture (%)	Ash (%)	Rubbed Fibre (%)	Db (g/cc)	PI index	N (%)	Ex.Ca/Mg Ratio	pH H_2O	pH 0.01M $CaCl_2$
Oil	0-27	68.2	1548	3.0	50.0	0.061	4	1.50	5.00	3.42	2.92
Oi2	27-58	77.4	nd	1.0	41.0	nd	7	1.10	1.28	3.40	2.76
0i3	58-87	87.5	1685	0.6	56.0	0.055	7	0.64	1.05	3.35	2.65
0i4	87-118	90.0	nd	0.6	64.0	nd	7	0.64	0.50	3.50	2.82

Table 2: Macrofossil content of Profile 1

Horizon	Depth (cm.)	*Sphagnum spp.*	*Calluna vulgaris*	*Eriophorum spp.*	Cyperaceous debris (ombro.)	*Non-Sphagnum* mosses	*Phragmites australis*	Fen rootlets	*C. geophilum*	Seeds	Mites	Charcoal	Cyperaceous debris (minero.)	Wood debris	Heterogeneous debris	Amorphous material	Mineral matter	Recent roots
0i1	0–27	+++	+															
0i2	27–58	+++	+	+	++													
0i3	58–87	++	+		++	+			+				+					
0i4	87–118	++++	+		++													

(+) Present; (++) Frequent; (+++) Common; (++++) Abundant

Profile 2 – Blanket bog – low level Atlantic type

Location:	Glenamoy, Co. Mayo Grid Ref. F 89.34
Classification:	U.S.D.A. classification Great Group Medisaprist
Series:	Glenamoy
Parent Material:	Ombrotrophic peat of cyperaceous origin
Vegetation:	Natural Blanket Bog
Topography:	Gently undulating
Drainage:	Poor
Permeability:	Very slow
Elevation:	20 m. O.D.

Horizon	Depth (cm)	Description
Oa1	0-40	Reddish brown (2.5YR2/2); sapric; finely fibrous; somewhat dried out; liberates only turbid water on squeezing; matrix moderately to well humified; greasy; plant residues, rootlets material and fine amorphous debris with charcoal fragments and *Cenococcum geophilum* fruiting bodies; clear smooth boundary to:
Oa2	40-52	Dark reddish brown (5YR2/2); sapric; well humified; greasy; greater than one third of the peat material passes through the fingers on squeezing; plant residues, leaf and rootlet debris and amorphous material; abrupt irregular boundary to:
Oa3	52-120+	Dark reddish brown (5YR3/2 to 2/2) on exposure; hemic to sapric; well humified; greasy; half peat material passes through fingers; some *Carex* residues; plant residues, *Calluna* rootlet material, occasional charcoal and *Sphagnum* leaf.

Table 3: Analytical data for Profile 2

Horizon	Depth (cm)	Field Moisture (%)	Ash (%)	Db (g/cc)	P.I. Index	Rubbed Fibre (%)	N (%)	Ex. Ca/Mg ratio	pH (H_2O)
Oa1	0-40	87.1	3.3	0.100	1	10	1.94	1.58	3.8
Oa2	40-50	84.8	1.8	0.099	6	8	1.93	0.55	3.8
Oa3	52-120+	91.3	2.1	0.093	7	8	1.22	1.39	4.1

Table 4: Macrofossil content of Profile 4

Horizon	Depth (cm.)	*Sphagnum spp.*	*Calluna vulgaris*	*Eriophorum spp.*	Cyperaceous debris (minero.)	*Non-Sphagnum* mosses	*Phragmites australis*	Fen rootlets	*C. geophilum*	Seeds	Mites	Charcoal	Cyperaceous debris (ombro.)	Wood debris	Heterogeneous debris	Amorphous material	Mineral matter	Recent roots
Oa1	0–40															++++		
Oa2	40–52				+++						+	+				++++		
Oa3	52–120+				+++													

(+) Present (++) Frequent (+++) Common (++++) Abundant.

Profile 3 – Blanket bog – Montane type

Location:	Slievenakilla Td.; Co. Leitrim
Classification:	U.S.D.A. classification Sub-Group Terric medisaprist
Soil Series:	Aughty Series
Parent Material:	Ombrotrophic peat of cyperaceous origin
Vegetation: Main Species:	*Calluna vulgaris, Polytrichum spp., Eriophorum spp., Vaccinium oxycoccus, Potentilla spp.*
Topography:	Mountainous.
Slope:	3-4°
Altitude:	280 m. O.D.

Horizon	Depth (cm)	Description
OaI	0-60	Dark reddish brown (5YR3/2); peat; sapric; well humified greasy; humification 7; strong recent and fossil cyperaceous fibres; recent roots to at least 50 cm.; plant residues, mostly cyperaceous root and leaf material; *Sphagnum* and *Calluna* leaves and leaflets, *Calluna* flower heads; *Juncus* seeds; clear, boundary to:
Oa2	60-90	Dark reddish brown (5YR3/2); peat; strong in cypearaceous remains; sapric; well humified; greasy; humification 7/8; increases towards base of layer; plant residues, mainly fine divided rootlet material with amorphous organic matter, charcoal fragments (carbonised *Calluna* leaflets), many remains of *Carabid* beetles; clear boundary to:
Oa3	90-110	Black (5YR2/I); peat; sapric; very well humified; few fine fibres; greasy; plant residues, finely divided leaf and root material, woody remains of birch, much charcoal debris, *Juncus* seeds common, some fine quartz grains; abrupt smooth boundary to:
IC	110+	Glacial till, Namurian shale with yellow sandstone.

Table 5: Analytical data for Profile 3

Horizon	Depth (cm)	Field Moisture (%)	Saturated Moisture (%)	Ash (%)	D_b (g/cc)	Rubbed Fibre (%)	PI index	N (%)	Ex.Ca/Mg ratio	pH (H_2O)
0a1	0-30	85.1	1171	4.2	0.094	1.0	0	2.52	0.6	4.22
0a1	30-60	90.5	1056	1.9	0.091	2.0	1	2.01	0.5	4.00
0a2	60-90	89.7	1077	3.6	0.094	2.0	1	2.01	0.8	4.10
0a3	90-110	86.2	872	5.2	0.102	6.0	1	2.38	1.1	3.70

Table 6: Macrofossil content of Profile 3

Horizon	Depth (cm.)	*Sphagnum spp.*	*Calluna vulgaris*	*Eriophorum spp.*	Cyperaceous debris (minero.)	*Non-Sphagnum* mosses	*Phragmites australis*	Fen rootlets	*C. geophilum*	Seeds	Mites	Charcoal	Cyperaceous debris (ombro.)	Wood debris	Heterogeneous debris	Amorphous material	Mineral matter	Recent roots
0a1	0–30	++							+	Ju		++		++	++	++++		
0a1	30–60	+	+		++				++		+	+		+++	++	+++		
0a2	60–90	+			+++				+		+	+		+	++	++++		
0a3	90–110			+	+++	+			+	Ju	++					+++		

(+) Present (++) Frequent (+++) Common (+++) Abundant. Ju = Juncus spp.

APPENDIX II

Soil profile descriptions and analytical data for man modified peat soils derived from ombrotrophic and minerotrophic parent materials

Profile 4 – Raised bog, man-modified

Location:	Castletown Moor Td. Co. Meath Grid Ref. N: 80.79
Classification:	U.S.D.A. classification Great Group Medihemist
Series:	Gortnamona
Parent Material:	Ombrotrophic peat of *Sphagnum* origin
Vegetation: Main Species:	*Dactylis glomerata* (Cocksfoot), *Filipendula ulmaria* (Meadow Sweet) *Urtica dioica* (Nettle)
Topography:	Flat
Elevation:	97m O.D.
Root distribution:	Good in Oap, moderate in Oel

Horizon	Depth (cm)	Description
Oap	0-33	Black (5YR2/1); sapric; no plant remains visible; fine strong crumb structure; well humified; much marling carried out, egg shells at 30 cm; abrupt smooth boundary to:
Oel	33-59	Black (5YR2/1); hemic; well humified; fine strong sub-angular structure; very few plant remains; abrupt smooth boundary to:
Oe2	59-80	Strong brown (5YR5/8) turning rapidly black on exposure to (5YR2/1); greasy; cyperaceous; peat hemic; very small amount of peat exudes between the fingers on squeezing.

Table 7: Analytical data for Profile 4

Horizon	Depth (cm)	Field Moisture (%)	Saturated Moisture (%)	Ash (%)	Db (g/cc)	Rubbed Fibre (%)	P.I. Index	N (%)	pH	
									H_2O	0.01M $CaCl_2$
0ap	0-33	58.2	260	53.8	0.468	4.0	1	0.64	7.30	7.25
0el	33-59	85.9	835	12.0	0.120	10.0	5	0.88	5.80	5.15
0e2	59-80	85.6	1072	6.0	0.092	12.0	6	0.82	5.30	4.49

Table 8: Macrofossil content of Profile 4

Horizon	Depth (cm.)	*Sphagnum spp.*	*Calluna vulgaris*	*Eriophorum spp.*	Cyperaceous debris (ombro.)	*Non-Sphagnum* mosses	*Phragmites australis*	Fen rootlets	*C. geophilum*	Seeds	Mites	Charcoal	Cyperaceous debris (minero.)	Wood debris	Heterogeneous debris	Amorphous material	Mineral matter	Recent roots
0ap	0–33															++++	++++	
0e1	33–59	+++	++		++											+++		
0e2	59–80	++	++		+++					Cx		++						

(+) Present; (++) Frequent; (+++) Common; (++++) Abundant; Cx *Carex* spp.

Profile 5 – Blanket bog – Atlantic type – man-modified

Location:	Dooagh, Achill Island, Co. Mayo Grid Ref. F 60.05.
Classification:	U.S.D.A. classification Sub-Group Euic Medisaprist
Series:	Gweesalia
Parent Material:	Ombrotrophic peat of cyperaceous origin
Vegetation:	Old Pasture
Topography:	Flat
Elevation:	15 m. O.D.

Horizon	Depth (cm)	Description
Oap	0-25	Black (5YR2/I); sapric; well humified; moderate medium weak crumb structure; no plant remains recognisable; abundant recent roots; abundant sand grains (sea sand additions); clear smooth boundary to:
Oa2	25-45	Black to dark reddish brown (5YR 2/1.5); sapric; moderately well humified; less than one third of peat material passes through fingers on squeezing; few recent roots; plant residues, heterogeneous leaf, rootlet and amorphous material, occasional twig and many fine charcoal fragments; clear smooth boundary to:
Oa3	45-74	As above with more fibres exposed on the profile face.
Oa4	74+	Dark reddish brown (5YR3/3) going to dark reddish brown (5YR2/2) on exposure; sapric; weak fibres; greater than two thirds of peat material passes through fingers on squeezing; strong smell of sulphides; plant residues, very fine twigs, bark and leaf fragments, some rootlet debris, much fine charcoal.

Table 9: Analytical data for Profile 5

Horizon	Depth (cm)	Field Moisture (%)	Ash (%)	D_b (g/cc)	PI index	Rubbed Fibre (%)	N (%)	Ex.Ca/Mg ratio	pH (H_2O)
Oap	0-25	33.2	86.8	nd	1	sand	1.20	32.7	7.5
Oa2	25-45	87.5	4.2	nd	4	10	1.31	16.3	7.0
Oa3	45-74	88.8	6.8	nd	7	6	1.30	13.3	6.2
Oa4	74+	90.0	4.4	nd	7	3	0.90	1.7	4.9

Table 10: Macrofossil content of Profile 5

Horizon	Depth (cm.)	*Sphagnum spp.*	*Calluna vulgaris*	*Eriophorum spp.*	Cyperaceous debris (minero.)	*Non-Sphagnum* mosses	*Phragmites australis*	Fen rootlets	*C. geophilum*	Seeds	Mites	Charcoal	Cyperaceous debris (ombro.)	Wood debris	Heterogeneous debris	Amorphous material	Mineral matter	Recent roots
Oap	0–25															+++	++++	
Oa2	25–45		+						+			+				++++		
Oa3	45–74				+++											++++		
Oa4	74+		++		+++				+							++++		

(+) Present (++) Frequent (+++) Common (++++) Abundant

Profile 6 – Fen – man modified

Location:	Woodtown Td., Co. Westmeath Grid Ref. N: 49.52
Classification:	U.S.D.A. classification Sub-Group Terric Medisaprist
Series:	Banagher
Parent Material:	Minerotrophic peat (Woody-fen)
Vegetation. Main Species:	*Filipendula ulmaria* (Meadow Sweet), *Juncus effusus* (Soft Rush), *Holcus lanatus* (Yorkshire Fog), *Festuca rubra* (Red Fescue)
Topography:	Flat
Drainage:	Good
Permeability:	Moderate
Elevation:	96m O.D.
Root Distribution:	Common in surface horizon, decreasing with depth.

Horizon	Depth (cm)	Description
Oap	0-14	Very dusky red (2.5YR2/2); peat; sapric; fine to medium strong crumb structure; moist friable; very well humified; strong root mat; clear smooth boundary to:
Oa_2	14-29	Black (5YR2/I); peat; sapric; massive structure breaks to sub angular pieces; moist friable; very well humified; on washing, dark reddish brown amorphous lumps with finely fragmented woody debris, strong staining of supernatant water; clear smooth boundary to:
Oa_3	29-52	Black (5YR2/I); peat; sapric; massive structure; well humified; on washing, finely fragmented woody debris with amorphous lumps; clear gradual boundary to:
IAI	52-55	Weak red (2.5YR4/2); peaty loam; massive structure; well humified; wet sticky and slightly plastic; clear smooth boundary to:
IC	55+	Greyish brown (2.5Y5/2); stony loam; pale brown (IOYR6/3); common, coarse, faint mottles; massive coherent structure; wet plastic; vigorous effervescence.

Table 11: Analytical data for Profile 6

Horizon	Depth (cm)	Field Moisture (%)	Saturated Moisture (%)	Ash (%)	Rubbed Fibre (%)	Db (g/cc)	PI index	N %	Ex.Ca/Mg ratio	pH H_2O	pH 0.01M $CaCl_2$
Oap	0-14	68.3	219	40.0	7.0	0.370	0	1.95	28.4	5.70	5.05
Oa2	14-29	78.2	nd	22.5	0.0	nd	1	2.00	47.8	6.38	5.74
Oa3	29-52	80.2	468	18.7	0.0	0.184	1	2.30	42.6	6.32	5.88

Table 12: Macrofossil content of Profile 6

Horizon	Depth (cm.)	*Sphagnum spp.*	*Calluna vulgaris*	*Eriophorum spp.*	Cyperaceous debris (ombro.)	*Non-Sphagnum* mosses	*Phragmites australis*	Fen rootlets	*C. geophilum*	Seeds	Mites	Charcoal	Cyperaceous debris (minero.)	Wood debris	Heterogeneous debris	Amorphous material	Mineral matter	Recent roots
Oap	0–14															+++	+++	++
Oa2	14–29	+														++++		
Oa3	29–52														++++	++	+	

(+) Present; (++) Frequent; (+++) Common; (++++) Abundant

NOTES ON ANALYTICAL DATA TABLES

Saturated Moisture (%)-Moisture content at saturation: Unit weight at saturation expressed as the weight of water per unit weight of oven dry soil on a percentage basis.

Db–bulk density at saturation: Dry weight of peat divided by saturated volume.

P.I.–pyrophosphate index: The solubility of the organic fraction in a solution of sodium pyrophosphate indicates the degree of oxidation or humification (Mackenzie and Dawson, 1962, A study of organic soil horizons using electrophoretic techniques J. Soil Sci. **13** 160–166). Colour index expressed on the Munsell Notation using value-chroma e.g. 10YR6/3 = P.I. 3.

Horizon designators (Soil Survey Staff, 1975).

Oi	Horizon designation for fibric materials which are the least decomposed of all soil organic materials. The root word L. *fibra* – fibre, with the connotative element *i.*
Oe	Horizon designation for hemic materials intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric materials. The root word Gr. *hemi* – half, with the connotative element *e.*
Oa	Horizon designation for sapric materials, the most highly decomposed of organic materials. The root word Gr. *sapros* – with the connotative element *a.*

GLOSSARY OF TERMS

Bog:	A peat-covered or peat-filled area, usually refers to peatland supporting, in its natural condition, oligotrophic vegetation.
Cut-away:	Bogs cut for fuel and where 30 cm or less of peat remains.
Cut-over:	Bogs from which peat has been cut leaving more than 30 cm of peat *in situ*.
Diatomite:	A deposit of the siliceous cell walls of diatoms.
Dy:	Acid substance, rich in colloidal humus with live organisms or evidence of these rare or absent. Also known as humic peat, peat mud.
Eutrophic:	Peat forming environment where water is rich in nutrients.
Fen:	Peatland of high ash content formed under the influence of base-rich groundwater.
Fibrist:	U.S. classification, suborder of Order Histosols. High content of undecomposed plant fibres. Bulk density less than 0.1 g/cc.
Gyttja:	See Sapropel.
Hemist:	U.S. classification, suborder of Order Histosols. Intermediate degree of plant fibre decomposition. Bulk density 0.1 to 0.2 g/cc.
Histosol:	See peat.
Limnic:	Inorganic and organic deposits formed below water level.
Machine peat:	Industrial fuel peat produced by an automatic excavator which cuts from a vertical face, macerates and extrudes the peat on to a drying area with a 60 m-long spreading arm which also segments the spread peat into sods.
Mesotrophic:	See eutrophic. Base status of waters intermediate between eutrophic and oligotrophic.
Minerotrophic:	Refers to peatlands with water percolating through them and carrying nutrients into the peatland from outside sources. These mires typically have waters in which the predominant anion is HCO_3 and the predominant cation is Ca^{++}.
Milled peat:	Peat in a crumb or powder form when air-dried to approx. 50% moisture. The mean particle size will vary with machinery and peat type.
Milling:	Peat winning operation by tractor-powered milling drums with a series of steel pins approximately 30 mm long on the outer surface. The pins scarify the surface, the new layer is harrowed to increase the drying rate and at approx. 50% moisture the crop is ridged and harvested.
Mire:	Wetland ecosystem where peat accumulates.
Mire complex:	Group of mires occurring in a region.
Moss peat: (horticultural)	A peat product containing over 75% Sphagnum mosses.
Oligotrophic:	Peat forming environment where water is lacking nutrients.

Ombrogenous, Ombrotrophic:	Refers to peatlands dependent on precipitation for water and nutrients. These mires typically have waters whose predominant anion is $SO_4^=$ and predominant cation H^+.
Organic soil:	See peat.
Paludification:	Peat forming environment where water-table levels are high without, however, forming open water.
Peat soil:	Organic soil material saturated with water for prolonged periods, or artifically drained, with 30% or more organic matter if the mineral fraction has no clay, or proportional intermediate organic matter contents if the clay fraction is intermediate. For land to be classed as peatland, the depth of the organic soil material, excluding the thickness of the plant layer, must be at least 45 cm on undrained land and 30 cm on drained land.
Peatland:	Generic term to include all classes of peat-covered terrain.
Saprist:	U.S. classification, suborder of Order Histosols. High content of plant materials so decomposed that original plant structures cannot be determined, bulk density more than 0.2 g/cc.
Sapropel:	Freshwater mud laid down in clear water of neutral or alkaline reaction, rich in water-plant, algal and animal remains.
Shell marl:	A calcareous limnic deposit formed in fresh water lakes by *Charophyceae* (Stoneworts) permeated by variable quantities of shells of fresh water molluscs.
Telmatic:	Organic deposits formed between low and high water levels.
Topogenous:	Development controlled by topography.

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