

**A REPORT ON THE GRASSLANDS AND CLOSELY RELATED VEGETATION**

**TYPES OF THE BURREN REGION**

**OF**

**WESTERN IRELAND**

**BY**

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**1984**

## I SUMMARY

Samples were taken of grassland/heathland vegetation from the Burren area of Western Ireland. Overall 110 samples were taken, concentrating on areas not previously investigated in earlier studies. An attempt is made to describe and tentatively classify the range of communities that are typically encompassed by the term "Burren Grasslands". The continuous nature of this vegetation is stressed and the consequent difficulties in classification outlined.

Individual sites of scientific interest are outlined and form part of an overall region of scientific interest. The distribution and status of the vegetation types described is also discussed. Finally, the present and possible future threats to "Burren Grasslands" are discussed with particular emphasis on the increasing impact of piecemeal reclamation and addition of fertilizers on the character of "Burren Grasslands".

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## 1 INTRODUCTION

The present study concentrates on the vegetation of shallow soils overlying carboniferous limestone in Co. Clare and South East Co. Galway in Western Ireland. An attempt is made to describe the range of communities that are usually encompassed by the term "Burren Grasslands". During the course of the study a small number of deeper soiled meadows over limestone and shale were also sampled.

Studies in Britain (Ratcliffe, 1977) have shown that the soils on which calcareous grasslands occur are relatively similar chemically to each other and this common factor gives the characteristic composition, both in terms of floristics and structure to calcareous grasslands. These soils are characterised by a high pH, usually in the range 6.5-8.5, a high available calcium content, usually in the range 300-1000 mg calcium/100 g, a high, free calcium carbonate content (30-75%) and often a notable organic matter content (7-20%), the latter being associated with the permanent nature of these grasslands.

The presence of variable superficial deposits, the degree to which the soil has been leached, varying aspect, precipitation and steepness of slope can all contribute to variations in soil features. Soil leaching due to the high level of precipitation (1200-1400 mm/annum) is a major influence on the vegetation of the area under study. Leaching creates conditions which enables calcifuge species to compete in an otherwise calcicolous community. Increased levels of leaching lead to increasing dominance of calcifuge species.

Open pavement habitats - which are frequent in the area under study - often have extremely immature soils and on cliffs, screes and pavements they consist largely of pockets containing mixtures of humus and downwashed or windblown mineral particles. These vestigial soils have rendzina or brown earth affinities and are usually developed on bedrock. The importance of irregular broken pavement is that it provides favourable habitats for species which are suppressed by grazing or those which cannot tolerate competition in a closed community, especially one composed of more competitive species.

The calcareous grasslands are characterized by great floristic diversity and therein lies their special botanical interest. Included within this diversity are the more striking members of the Burren flora such as Dryas octopetala, Neotinea maculata, Helianthemum canum, Epipactis atrorubens and Geranium sanguineum. These occur relatively frequently within the "Burren grasslands" and their presence emphasizes the botanical interest and scientific importance of this vegetation. There is, however, growing evidence that the floristic richness of such vegetation is often associated with a poverty of major soil nutrients other than calcium, i.e. nitrogen, potassium and phosphorus, which limits the growth performances and competitive power of certain species (notably grasses). Addition of manure and artificial fertilizers can upset this competitive balance and lead to sward impoverishment as some species increase in cover and stature, resulting in a dramatic decrease in scientific importance.

Previous studies on calcareous grasslands and limestone heathlands in Ireland are few and detailed information concerning the "Burren grasslands" can only be found in Ivimey-Cook and Proctor (1966) and Shimwell (1968, 1971). However, the major part of the latter author's work on the Burren remains unpublished. The present study therefore relies heavily on the work of Ivimey-Cook and Proctor (op. cit) in an overall interpretation of the character, status and distribution of "Burren grasslands". The present study does not attempt to resolve the intricacies of the phytosociological classification of "Burren grasslands" rather it sets out to achieve the following aims:

- i) to describe and tentatively map the range of calcareous grassland and related vegetation in the area under study,
- ii) to tentatively correlate the types outlined with previous sociological classifications,
- iii) to assess the scientific status and conservation value of the types outlined,
- iv) to outline suitable areas for conservation,
- v) to outline the present and possible future threats to the vegetation types described.

## 2 THE STUDY AREA

The present study concentrates on grassland and grass-heath vegetation in that area of South-West Ireland known as the Burren (Figure 1). This area is larger than the original barony whose boundary does not include all the karstic limestones of North Clare and the adjacent areas of South-East Galway but which were included in the present study. The Aran Islands are included within this area. During the course of this survey additional samples were obtained from outside the survey area, in East Donegal and West and North-East Galway. A limited number of samples were also obtained from drift overlying the Namurian shales in the area surrounding Lisdoonvarna.

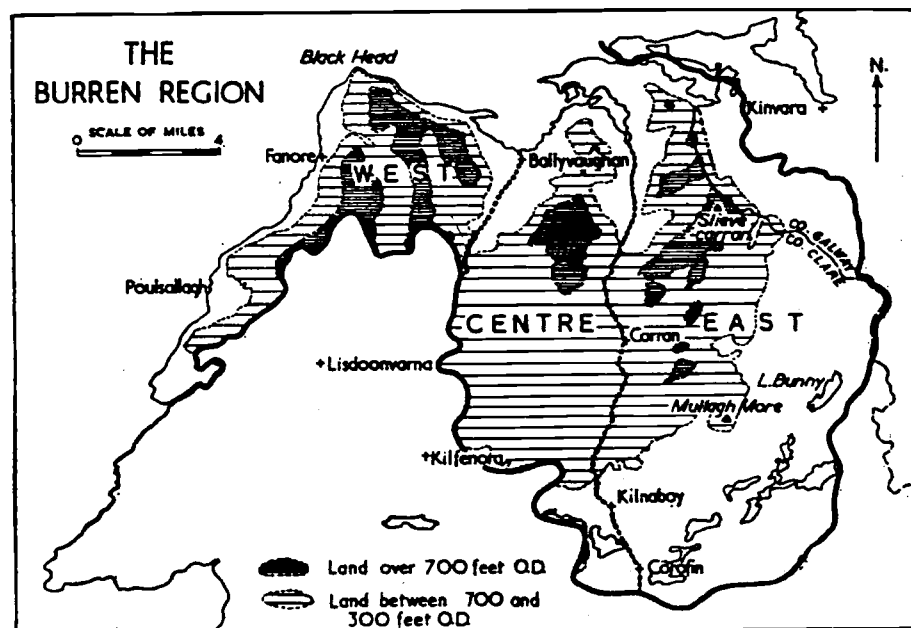


Figure 1: A map of South West Ireland showing the area on which the present survey concentrated.

### 3 METHODS

Within the study area the survey concentrated on areas from which no prior data were available. For this reason, where possible, samples were collected from areas in which Ivimey-Cook and Proctor (op. cit.) had not previously sampled (Fig. 2). Vegetation samples were taken using the Braun-Blanquet method of cover estimation. An effort was made to sample the full range of grassland and related vegetation occurring on shallow soil over limestone in the areas visited. With each relevé, additional notes were taken on vegetation structure, microtopography, surface soil type, phenology, management, surrounding vegetation and landscape. In all 110 such samples were collected (Fig. 2).

Throughout this report, names of vascular plants follow Webb (1977), those of mosses Smith (1980) and those of lichens Hawksworth et al. (1980).

The species lists were tabulated and the tables manipulated by hand. This labourious process severely limited the scope of the vegetation analysis. Computer aided manipulation and analysis would have provided a more extensive and detailed classification of over 100 relevés.

The species Festuca rubra and F. ovina could not always be distinguished from each other in the field with certainty. Following Wells (1975) and Willems (1978) these taxa are listed together in the tables where they could not be reliably distinguished. Additional species to those included in Tables 1, 2 and 3 are presented in Appendix 1.



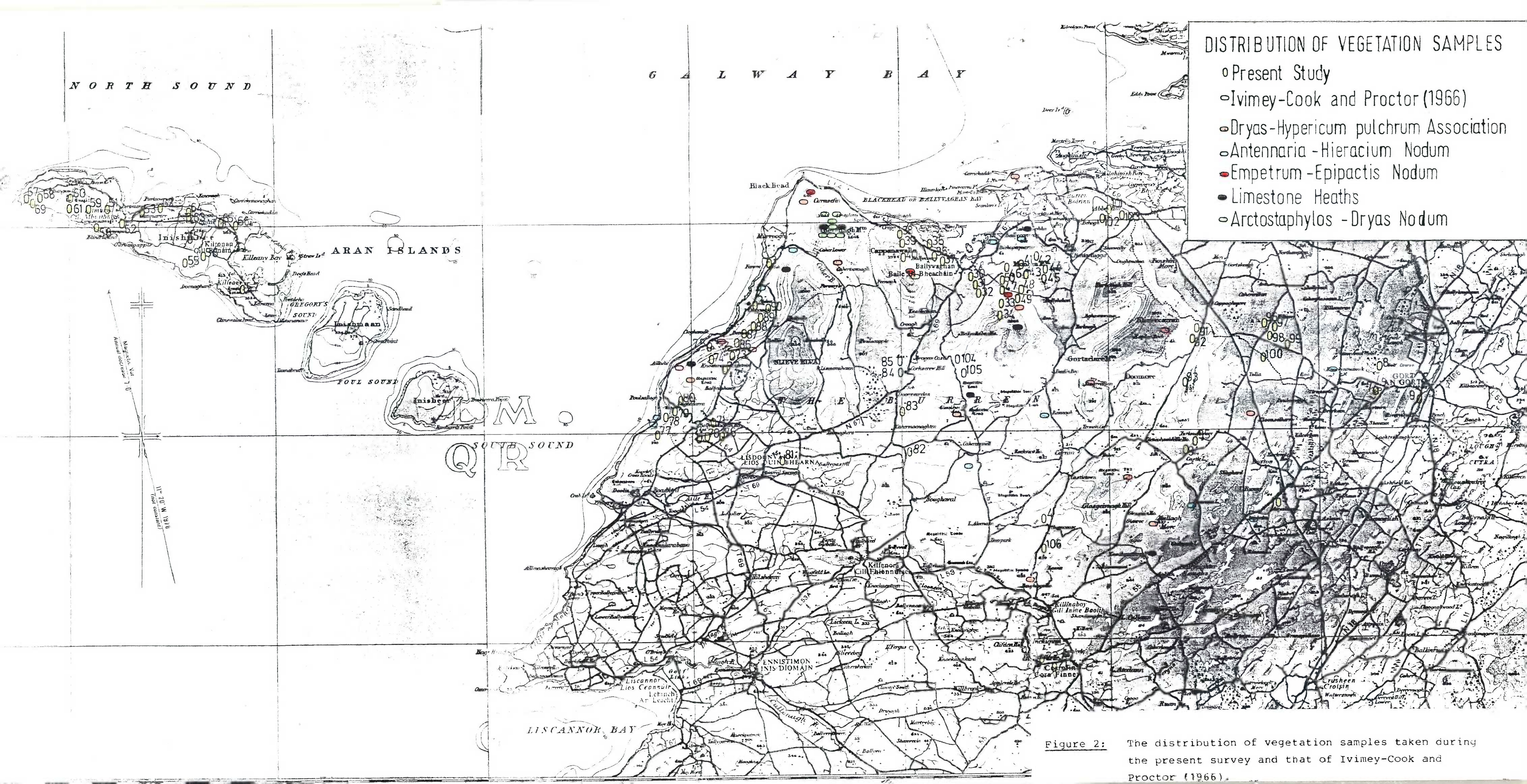


Figure 2: The distribution of vegetation samples taken during the present survey and that of Ivimey-Cook and Proctor (1966).



#### 4 DESCRIPTION AND CLASSIFICATION OF VEGETATION TYPES

In this section the range of grasslands and closely related vegetation types encountered are described and tentatively correlated with previous sociological classifications.

##### 4.1 Leucanthemum-Rhinanthus meadows

These meadows are characterised by having a low (15-35 cm), open sward dominated by poor-yield grasses (Table 1, Fig. 3). Typical graminoid dominants include Festuca rubra, Holcus lanatus, Cynosurus cristatus and Anthoxanthum odoratum. Festuca rubra is the usual dominant with other grass species forming scattered taller stands. Their topography is flat and their soils well drained, although some damp pockets may occur.

Legumes are frequent with Trifolium repens, T. pratense and Lotus corniculatus typically forming a ground carpet flora. Less frequently Trifolium dubium and Medicago lupulina are also present. The most notable character of these meadows is their striking phenology. Visual amenity is a criterion used by Haffey (1984) in his evaluation of traditional hay meadows in the Northumberland National Park. The attractiveness of a traditional hay meadow is influenced by the quality and variety of colourful meadow flowers. The best examples seen in the present study had an extremely attractive aspect of Leucanthemum vulgare with the frequent presence of root parasites in the form of Rhinanthus minor, Euphrasia species and more rarely Orobanche minor (Plate 1). The presence of the more seldom occurring Centaurea scabiosa and Knautia arvensis to accompany the frequent Centaurea nigra complete a striking phenology.

These meadows are frequently "alternate" meadows; that is fields which are occasionally meadowed but mainly used for grazing (O'Sullivan pers. comm.). However, when such fields are not fertilised regularly they can be extremely species-rich and may have extensive stands of the root parasites outlined above.

**TABLE 1: Leucanthemum - Rhinanthus meadows**

Column No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Size of sample (m <sup>2</sup> )	4	9	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Total cover	86	100	100	75	96	95	70	100	100	100	95	100	90	100	100	100	100	100	100
Herb cover	80	80	100	75	90	80	70	10	100	95	80	100	80	100	100	98	100	100	100
Moss cover	86	100	60	45	80	95	30	25	85	95	50	0	90	90	95	30	10	40	70
No. of species	25	25	32	21	29	33	18	21	27	26	18	14	32	33	32	26	32	31	35
Relevé number	52	66	96	18	14	13	3	12	27	19	6	9	10	29	28	17	1	71	70
<i>Trifolium pratense</i>		+	1	+	2	2	2	3	1	3	+	+	2	2	1	1	2	2	2
<i>Trifolium repens</i>	+	1	3	+		1	3	1	1	1	3		1	2	1	1	2	2	3
<i>Festuca rubra</i>	4	3	3	2	3	2	2	2	2		2	3	1	2	3		4	3	2
<i>Plantago lanceolata</i>	1	+	1	4	+	1	3	2		3	1		1	1	1	1	2	2	2
<i>Cerastium fontanum</i>		+		+	+		+	1	+	1	+	+	1	+	+	+	+	1	1
<i>Dactylis glomerata</i>	+	+	+		+	+	1	+	1			1	+	+	+	1	+	1	1
<i>Holcus lanatus</i>		2	+	+		+	+	+	2	+		2	1	1	2	3	1	1	1
<i>Cynosurus cristatus</i>			+		1	1		1	2	2	2		1	1	2	1		3	2
<i>Leucanthemum vulgare</i>	+	1	1		+	+			+		+		2	2	2	+	+	2	2
<i>Rhinanthus minor</i>	2	2	2	1	+		3	3	+	1			+		+		1	+	
<i>Anthoxanthum odoratum</i>			+	1	+	+			1	2	+	1	+			+	3	1	2
<i>Hypochoeris radicata</i>		1	1	2			+			2				3	1		+	2	1
<i>Lotus corniculatus</i>	+	1			2	2			1					2	3		2	2	1
<i>Rumex acetosa</i>				+				+		+		+	+			2	+	+	+
<i>Achillea millefolium</i>	+		2		+	1			1			2		1				2	1
<i>Bellis perennis</i>					+		3		+	+	2		3	1	1		2		
<i>Briza media</i>			+		2	2			2					2	1		+	1	2
<i>Centaurea nigra</i>			+		+	1			1					1	+		+	3	2
<i>Lolium perenne</i>							+	1	1	+	2		1		1	1	1		
<i>Prunella vulgaris</i>			1			+			+	+			+	1	1			+	2
<i>Carex flacca</i>	2		+		+	2			1				1	+				1	
<i>Heracleum sphondylium</i>	+						+	+		+						+	1	1	1
<i>Ranunculus acris</i>			+	+					1				+			+	2	2	2
<i>Ranunculus bulbosus</i>					1	1		2			2	1	+		1		1		
<i>Taraxacum officinale</i>	+						+				1		+		+	+	+		1
<i>Luzula campestris</i>					+	+	+		+				+		+		1		
<i>Medicago lupulina</i>	1	+	2			+			3				1	2					
<i>Primula veris</i>					+	+	+					+	1				+		+
<i>Centaurea scabiosa</i>	+	+	3		2	1													
<i>Galium verum</i>	2	3				+								+	1				
<i>Succisa pratensis</i>			+			1								2				2	2
<i>Trifolium dubium</i>							+	+		2	+				1				
<i>Trisetum flavesens</i>						+		1	+					1	2				
<i>Vicia cracca</i>			2	+									1			+	1		
<i>Agrostis capillaris</i>				+									+		+				2
<i>Dactylorhiza fuchsii</i>			+		+										+			+	
<i>Daucus carota</i>	1	1	1			+													
<i>Linum catharticum</i>			+		+									1	+				
<i>Poa trivialis</i>								+	+		+					2			
<i>Anacamptis pyramidalis</i>	1	+													+				
<i>Bromus hordeaceus</i>								1			+					1			
<i>Campanula rotundifolia</i>	2	2	+																
<i>Euphrasia rostkoviana</i>															+			1	+
<i>Hieracium pilosella</i>					+	+								+					
<i>Leontodon taraxacoides</i>			+						+					2					
<i>Orobanche minor</i>		+											1	1					
<i>Polygala vulgaris</i>					+	+								1					
<i>Ranunculus repens</i>									+							1			1
<i>Conopodium major</i>																	1	1	1
<i>Poa pratensis</i>							2				+						+		
<i>Pseudosleropodium purum</i>	3				3	1								1					2
<i>Brachytecium</i> sp.							2	3				3							
<i>Calliergon cuspidatum</i>			4						4										2
<i>Rhytidiadelphus triquetrus</i>	3			3						5									
<i>Rhytidiadelphus squarrosus</i>		4				4												2	3









Plate 1: A low sward "alternate" meadow near Fanore, rich in root parasites particularly Rhinanthus minor.



Plate 2: A species rich meadow on drift overlying shale near Ballynalackan Castle.



The best examples found of these meadows were small and fragmentary relics of old management practices. The more species-poor examples have increased dominance of grass species. Obviously addition of fertilizers has played a role in decreasing the species diversity and hence the interest of these areas.

Sociologically, the more species-rich types on the driest soils are of great interest. These seem to be intermediate between the Centaureo-Cynosuretum sub-association galietosum and the Arrhenatheretum elatoris association (O'Sullivan, 1982; White and Doyle, 1982). The latter association of dry meadows is found on the continent and little is known of its distribution and status in Ireland.

#### 4.2 Dryas - Sesleria - Hypericum pulchrum community

This grouping correlates with Ivimey-Cook and Proctor's (1966) Dryas octopetala - Hypericum pulchrum association (Table 2, Figure 3). These authors described it as the commonest limestone grassland community and the most characteristic of the Burren grassland types, occurring on dark organic soils over bare limestone.

Dryas octopetala, frequently Calluna vulgaris, and a group of large calcicolous mosses, including Breutelia chrysocoma, Hylocomium brevirostre and Neckera crispa dominate the physiognomy of the community. The following 4 ecological groupings of species within this association were described by Ivimey-Cook and Proctor (op. cit.):

- a) Common calcicole species of limestone grassland e.g. Asperula cynanchica, Linum catharticum and Thymus praecox.
- b) A group of large pleurocarpous mosses some of which have been mentioned above.

- c) various, saxicolous bryophytes on exposed rocks and fragments of limestone e.g. Ctenidium molluscum, Scapania aspera and Tortella tortuosa.
- d) A group of species of leached soils, almost always represented at least by Calluna vulgaris and Hypericum pulchrum and becoming more prominent with progressive leaching.

Several of the more notable rare species of the Burren grow in this community including Euphrasia salisburgensis and Gentiana verna though none are confined to it. This community is usually grazed.

The greatest variation in the association is due to the accumulation of organic material followed by leaching and acidification. In the earliest stages of colonisation, scattered plants of Dryas octopetala, Sesleria albicans, Thymus praecox and Tortella tortuosa together with other calcicoles, become established in the small crevices of the bare limestone; the resulting turf is very open but differs floristically from the mature Dryas-Hypericum association, chiefly in the general paucity of species. This open turf may remain as a plagioclimax on exposed outcrops. Normally, however, a black, organic soil accumulates rapidly under the vigorous mat produced by Dryas and the mosses, and at the same time leaching at the surface begins. The end product of this process is probably a heath, on a peaty soil a few centimetres deep, such as can be seen on the summit plateaux of Gleninagh Mountain, Moneen Mountain and just north of the Glen of Clab. All the intermediate stages can be found and the mosaic structure of the community over the blocks and fissures of the underlying limestone is certainly responsible for these intermediates being widespread in space and long-persistent in time. Calluna vulgaris is almost always present from an early stage and many of the common calcifuges of the heaths may be present in the typical association. The principal change is the gradual elimination of calcicole species and a consequent progressive shortening of the species list.

Column No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Size of sample (m <sup>2</sup> )	4	4	4	4	4	4	9	4	4	4	4	4	4	4	4	4	4	1	1	4	1	4	4	4	1	1	4	1	4	4
Total cover	95	95	95	98	80	90	60	100	95	98	90	100	100	90	60	96	70	80	100	100	95	80	100	100	100	100	95	100	100	92
Herb cover	95	95	95	98	80	90	30	100	95	98	82	95	100	65	50	96	70	80	95	100	90	80	100	100	92	90	95	96	100	92
Moss cover	90	90	95	50	50	90	50	70	95	40	85	60	50	40	30	96	35	30	70	60	60	80	100	100	100	100	20	85	80	60
No. of species	35	20	21	25	22	25	23	25	26	23	26	29	21	28	23	31	27	25	24	30	28	29	28	27	20	25	34	20	31	40
Relevé number	39	33	34	74	42	49	40	104	43	45	38	103	93	92	91	90	89	88	87	75	48	47	44	105	84	86	80	85	99	79

Dryas octopetala	3	2	2	4	2	3	3	3	3	4	2	4	3	1	2	3	2	3	3	4	2	2	3	4	4	3	4	2	3	
Sesleria albicans	3	3	3	2		4	2	3	3	3	3	2	4	3	4	3	3	2	3	3	2	3	3	2	2	2	2	2	3	
Carex flacca	1	2	2	1	2	2	1	2	2	2	1	1	2	1		2	2	2	2	2	1	2	2	1	2	2	1	2	2	
Thymus praecox	2	1	2	2	1	2	1	1	1	1	2	1	2	2	2	2	2	1	1	2	1	1	1	1	1	2	1	1	1	
Succisa pratensis		1	2	1	1	1	+	2	2	2	1	1	2	2	+	2	2	1	2	3	1	1	1	1	2	2	3	2	1	2
Potentilla erecta	2	1	+	+	1	1		1	1	1	+	1		1		1	1	1	2	2		+	1	1	1	1	1	1	1	
Campanula rotundifolia	+	+	1	1	+		+	+	+	+	+	+	+			1	1	+	1		+	+	1	1	1		1		1	
Linum catharticum	+	+	+		+	+	+		+	+	+	+	+	+	+	+	+		+	+		+	+			+		+	+	
Lotus corniculatus	1	+		1		1		1			2	+	+	+	1	2	1		2	1		1	1	1	1	1		1	1	
Calluna vulgaris	1	1		+		+	1		+	1	1	+	1			2	1		1	1		1	1	1	1	1	2	2		
Hypericum pulchrum	+				+	+		1	+		+	1		+			+	+	+	+	+	+	1		+	1	+	1		
Asperula cynanchica		1	1		+	1		1			1	+	+	1	1	1	1	1	2	1	+	+	+	+			+	+	+	
Carex pulicaris	1	2	2	1	1	2			2	2	1		1			+	1	1	1	1	1	2	1							
Viola riviniana	+	1				+		+	+	+	+	1				1	+	+	1	1		+		1		+	+	+		
Geranium sanguineum	1			1		+			+	+		1	+	1	1	1	1	1	2	+			1		1	2			1	
Solidago virgaurea	+						1	+	+		+			1	+		+	+	+	1	+	+	+		1				+	
Festuca rubra/ovina	2	2	2	1	1		1								2					1				2	2	3	2	2		
Carlina vulgaris					+		+	+			1			1	+							+	+		+	1		+	+	
Carex caryophyllea				1	2					1		1					1				+		2		+	1		1	1	
Antennaria dioica										2		1		2		2	2	3				1	+			1		2	+	
Koeleria macrantha	1						1				1	+		+				+		+					+	+		+	+	
Polygala vulgaris	+			+			+		+	+	+	+									+			+		+		+	+	
Teucrium scorodonia				+	+			1		1										+	+	1	1		1					
Briza media	2								+		2	+		2			1				+	+					2			
Plantago lanceolata	1										+						1			1					1		+	+	+	
Festuca rubra										2	2					3	2	2	3	1					2				2	
Hieracium pilosella				+								1		1	1							+	1				+	+	+	
Hypochoeris radicata	+								+		+							+	2		+					1		1		
Plantago maritima										+					+		1		1	1	1					2		2		
Rosa pimpinellifolia				+						1				1						+	+		+			1				
Epipactis atrorubens	+				1	+	+	+																			1			
Hieracium anglicum					2			+	1				+			1				+										
Trifolium pratense	+			+							+								+						+		+		+	
Empetrum nigrum	1	2	2	1			+																							
Euphrasia salisburgensis														1	1		+	+						+						
Festuca ovina								2				2	2	3														3		
Galium verum							1													1				2	1		2			
Achillea millefolium				+															1						+	1			1	
Dicranum scoparium	1	2	2	3	1	2	2	3	1		2	2	+	3	2	3	1	1	1	2	2	2	1		1			3	1	
Pseudoscleropodium purum			2					1	2	2	3		1	1	1	1	1		1	2	1	2	2	2	3	2	2		2	
Breutelia chrysocoma	4	2	2	2		4	2	1		2	2		2	1		1			1	3	1	3	1		3		3		1	
Tortella tortuosa	1	1	1	1	2	+	2								1	1	1	1		2		2		1		1			1	
Ctenidium molluscum	1				1	2	2	1		2	2				+	1					1	1		1						
Hylocomium brevirostre	1			2				1				1	1						1	2		2	3	3			4			
Neckera crispa		2	2		2	2						3	+					2	2		1	2				2				
Hypnum cupressiforme			1	1						2		1												1		3	1			
Rhytidiadelphus squarrosus	1								2		2	1					3													
Cladonia rangiformis					1		2											1	1		+	+	1							
Thuidium tamariscinum				2						3							1								3		1		2	
Ditrichum flexicaule										1				+	+	1					1								+	
Scapania aspera	1		1		1			+	1																					
Rhytidiadelphus triquetrus																											+	1	2	

The above description of the Dryas octopetala - Hypericum pulchrum association is reproduced directly from Ivimey-Cook and Proctor (op. cit.). It is obvious from their description that this association encompasses a very large range of variation. Indeed if each of these sub-groupings were easily distinguished as entities in their own right, each could be granted association status. However, they cannot as each sub-grouping contains strong elements of the other three. It is impossible to define exact units in this vegetation due to its continuous nature. It seems best to consider this association as a continuum between grassland and heathland. Each of Ivimey-Cook and Proctor's sub-groupings then represent phases in that continuum.

An examination of Table 2 and indeed Ivimey-Cook and Proctor's (op. cit.) samples illustrate the continuous nature of this vegetation. White and Doyle (1982) have included Ivimey-Cook and Proctor's (op. cit.) Dryas octopetala - Hypericum pulchrum association in the order Vaccinio - Genistetalia. These are heathlands of uplands and of more continental areas. These authors reclassified the association from the dry grassland class to the heathland class on the basis of the constancy and often dominance of Calluna vulgaris and the overall frequency of calcifuge species such as Calluna, Potentilla erecta, Empetrum nigrum, Hypericum pulchrum, Danthonia decumbens, Hylocomium splendens and Thuidium tamariscinum. However, such a reclassification ignores the strong grassland and calcicole elements which are indicated by dominance of Sesleria albicans and the presence of such species as Breutelia chrysocoma, Asperula cynanchica, Carex flacca and Carlina vulgaris (Ivimey-Cook and Proctor op cit; Etherington, 1981). It seems best to treat this vegetation as a continuum between calcareous grassland and limestone heathland.

The problems of the classification of "Burren grasslands" continues to give rise to problems. Willems (1982) outlines the Asperulo-Dryadetum association as representing the dry chalk grassland "of the Upper Carboniferous limestone of Western Ireland mainly in the Burren region". This study of Mesobromion



communities in Western Europe is based on 800 relevés. However, an examination of the synoptic tables provided in the paper reveals that the analysis of the Asperulo-Dryadetum in Western Ireland is based on only six samples.

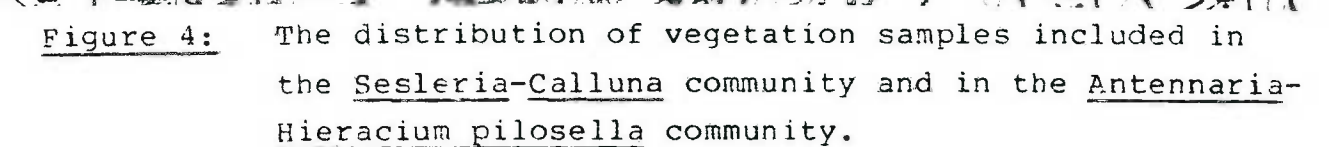
Columns 1-8 in Table 2 may be correlated with the Empetrum nigrum - Epipactis atrorubens Nodum of the Dryas octopetala-Hypericum association of Ivimey-Cook and Proctor (op. cit.). This vegetation occurs on exposed slopes and crests at rather high altitudes near the west coast. In its most marked form Dryas octopetala, Empetrum nigrum and Sesleria albicans form an open cover, a few cm high over the bare shattered limestone. Column 7 illustrates vegetation which has a strong element of IVP's Arctostaphylos uva-ursi-Dryas octopetala Nodum which occurs on upper mountain pavements. It forms a low growing mat of Juniperus communis and Arctostaphylos uva-ursi.

#### 4.3 Sesleria albicans - Calluna vulgaris community

Table 3, section 1, (columns 1-18) displays examples of what can be termed a Sesleria-Calluna community. (Figure 4). Calluna vulgaris plays a major role in the physiognomy of this community but is never fully dominant. Sesleria albicans is constant and typically co-dominant with Calluna and Festuca spp. (Plate 4). Typically this vegetation is an open, species-rich grazed grassland-like sward with frequent digitate Calluna. Grassland species occur throughout this sward. The heather may also form small clumps on average 25 cm tall. Erica cinerea may also occur but is not constant. Soils range from being drift to being a more typical dark organic type. The soil is shallow, rarely exceeding 5 cm in depth. Calcicole mosses are frequent but common calcifuge species such as Hylocomium splendens and Rhytidiadelphus spp. are also present.



- Antennaria-Hieracium Nodum (IVCP)
- Sesleria-Calluna Community
- Antennaria-Hieracium Community
- Antennaria-Hieracium Community (Helianthemum variant)
- Antennaria-Hieracium Community (exposed pavement variant)





This community appears to represent a stage in progressive leaching to a more species-poor limestone heath in which Calluna and Erica are increasingly dominant. . This Sesleria-Calluna community is in turn derived from a more grassland-like community. Columns 1-9 in Table 3 contain samples which are close to the Dryas-Hypericum pulchrum association previously described. Indeed the continuous nature of the vegetation on the shallow soils over limestone in the Burren is illustrated again in Table 3.

The samples in Table 3, columns 1-18, are again difficult to classify conventionally, once again due to the continuous nature of the vegetation. It contains a major element of the Calluno-Ulicetea (shrub heathland class) and in particular the Genisto-Callunion alliance. There is also a major element of the Festuco-Brometea (Dry chalk grassland class) evidenced by the presence of such species as Anthyllis vulneraria, Carlina vulgaris, Filipendula vulgaris, Koeleria macrantha and Sanguisorba minor. Also present are elements of the class Molinio-Arrhenatheretea (lowland grassland class) in particular the Centaureo-Cynosuretum subassociation Galietosum seen in the prevalence of Galium verum and the occurrence of such species as Achillea millefolium, Hypochoeris radicata, Lotus corniculatus, Briza media and Rhytidiadelphus squarrosus. An interesting variant is seen in those samples which contain Filipendula vulgaris. R100 also has Trifolium medium and Solidago virgaurea suggesting an element of the class Trifolio-Geranietea (Marjoram class-vegetation of warm, dry, open habitats), (O'Sullivan, 1982; White and Doyle, 1982).

It seems best to consider this vegetation as a later stage in succession to a more species poor limestone heath as more detailed attempts at classification can only be speculative.

#### 4.4 Antennaria dioica-Hieracium pilosella community

The samples outlined in Table 3, Sections 2 and 3 (Columns 19-39) may tentatively be correlated with Ivimey-Cook and Proctor's (op. cit) Antennaria dioica-Hieracium pilosella nodum. IVP

differentiated this nodum from the Dryas octopetala-Hypericum pulchrum association by the presence of a group of five species, Anthyllis vulneraria, Bellis perennis, Centaureum erythraea, Leucanthemum vulgare and Hieracium pilosella with Helianthemum canum occurring most frequently in this nodum. This vegetation generally occurred on soils containing a high percentage of drift.

Classification of samples collected in the present study using the five "differential" species outlined above did not prove entirely satisfactory. Of the 110 vegetation samples taken during the course of the present study, none contain the full five "differential" species. However, a tentative correlation is possible using less than the full complement of species. In the present study the soil on which this community occurred, in general had some elements of drift and all were shallow.

This vegetation was typically a short sward, relatively species rich community. Sesleria albicans is usually the dominant grass species. The vegetation in Section 2 (Columns 19-29) is characterised by a Thymus praecox mat and frequent Asperula cynanchica. Antennaria dioica and Hieracium pilosella are frequent with the former species often contributing significantly to the vegetation cover.

The samples in Section 3 (Columns 30-39) display an interesting variation in that they contain the rare and protected Helianthemum canum. The distribution of this species in Ireland is restricted to the Burren region, Galway city and to Inishmore on the Aran Islands (Webb and Scannell, 1983). These samples are more species-poor and generally contain areas of broken ground over which the rockrose forms a loose mat. This vegetation is often very close cropped, the presence of Hypochoeris radicata is probably an indication of grazing pressure.

All these samples can be included in the class Festuco-Brometea and in Ivimey-Cook and Proctors Antennaria-Hieracium pilosella nodum senso lato.



Table 3, Section 4 (Columns 40-48) include a group from exposed areas on limestone escarpments and terraces. The soil on which this vegetation occurs is generally shallow and dark organic in nature. This vegetation typically forms small pockets in large expanses of open pavement, often where the limestone is shattered. The level of grazing varies greatly depending on accessibility. Sesleria is normally dominant with Festuca spp, Thymus praecox, Hieracium pilosella and Carex flacca contributing notably to the cover. Carex pulicaris may also contribute significantly in some samples.

These samples (Table 3; Section 4) are probably best attributed to the Antennaria-Hieracium pilosella nodum. However, there may be some affinities with the Seslerio-Caricetum pulicariae association (Shimwell, 1968; Dixon, 1982). This is the typical association of the limestone uplands of the Yorkshire and Lancashire Dales; where stands occur principally on steep south and west-facing slopes where the influence of glacial drift is minimal. Characteristic species are Carex pulicaris, C. capillaris (local), C. hostiana, Molinia caerulea, Primula farinosa and P. vulgaris.

## 5 AREAS OF SCIENTIFIC INTEREST - DISTRIBUTION AND STATUS OF VEGETATION

### 5.1 Areas of Scientific Interest

The boundary shown in Figure 5 outlines the overall area of scientific interest in the Karstic limestone region of North Clare and South-East Galway, including the Aran Islands.

#### 5.1.2 Sites of Scientific Interest

The individual sites of scientific interest are outlined in Figure 6. The ratings for these sites are presented in Tables 4 and 5. Table 4 presents and rates the sites selected during the present study. These were rated using the site evaluation criteria outlined by Curtis (Appendix 2). Table 5 presents those areas of scientific interest rated either by the Forest and Wildlife Service as a result of previous surveys or by An Foras Forbartha (1981).

### 5.2 Distribution and Status of Vegetation

In this section the distribution of the range of grassland/heathland communities which have already been described in Section 4 is outlined. The number of these communities present in the areas recommended for conservation is displayed in Table 6.

#### 5.2.1 Leucanthemum-Rhinanthus meadows

Distribution: The distribution of these meadows is extremely fragmentary. Permanently enclosed dry meadows are very rare in Ireland as evidenced by the very small number of dry meadows encountered on the present study. Examples of alternate meadows used to be frequent in the Clare and East Galway area but are now extremely restricted. Neglected graveyards may contain the best examples of dry meadows, for example the graveyard at Kilmurvy on Inishmore in the Aran Islands.

TABLE 3: *Sesleria albicans* - *Calluna vulgaris* community and *Antennaria dioica* - *Hieracium pilosella* community

Column No.	SECTION 1																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Size of sample (m <sup>2</sup> )	4	3	4	1	4	4	9	1	4	2	4	9	4	4	1	4	4	4
Total cover	60	80	100	80	95	100	100	100	98	95	95	60	100	100	100	85	85	90
Herb cover	60	75	90	80	65	100	80	100	80	95	95	55	100	100	95	75	75	80
Moss cover	50	70	100	80	55	80	70	80	70	60	70	55	80	60	100	40	40	85
No. of species	24	25	30	32	35	30	22	31	35	32	32	31	26	28	33	30	24	31
Relevé number	72	55	37	97	4	98	100	94	5	95	54	58	59	68	31	8	7	61
<i>Sesleria albicans</i>	3	2	2	1	1	2	1	1	1	1	2	3	2	2	1	1	2	3
<i>Thymus praecox</i>	1	+	1	1	+	1	+	1	+	2	+	+	+	1	2	1	2	
<i>Carex flacca</i>	1	2	1		+	2		2			2	1	2	2	1	+	3	1
<i>Lotus corniculatus</i>	+	+	3	2		+	1	1	+	1	1	+	1	1		2	1	1
<i>Campanula rotundifolia</i>	1	1	+		+	+	+	+	+	+	1	1	1	1		+	+	1
<i>Festuca rubra</i>	2	3		3		2	3		4		4	3		3		3	2	
<i>Geranium sanguineum</i>	2	1	1	+	+	+	+	2	1	+	2	+	1	1	3	+		2
<i>Potentilla erecta</i>	1	+		1		2	1	1	1	+	+	+	+	1		+	1	1
<i>Carex caryophylla</i>	+		1	2	1			2	1	2	1		2	1		+	1	1
<i>Hieracium pilosella</i>		+	1	+	+	1		1		1	+		2	1		+	1	
<i>Galium verum</i>	2	+	2	+	+		+	3	+	+	2	1	1		2	1	+	2
<i>Plantago lanceolata</i>			1	2			+		+	1	1	+		1	2	+	+	1
<i>Succisa pratensis</i>	+	2	2	1	1		+	+	1		1	1	1	+		+	2	1
<i>Asperula cynanchica</i>	+	+	1		+						1	+			1	+		1
<i>Hyphocheris radicata</i>				+	1					+	1	2	1	1	+			+
<i>Koeleria macrantha</i>			1		+				+	+	1				2		+	
<i>Achillea millefolium</i>				2					1	+	1	1	1	1	+			+
<i>Antennaria dioica</i>			1	3	1		1	3	+	2	2		+	3	2	+	2	2
<i>Briza media</i>			1	+									+			+	1	
<i>Carlina vulgaris</i>				+		2	3	2	+	+	2	+	3	2	1	+	+	2
<i>Calluna vulgaris</i>				+														
<i>Sanguisorba minor</i>		1	1					+	+	2	+	3	2	1	+	+	+	2
<i>Plantago maritima</i>	1	+								1		1	+	+	2	+		2
<i>Linum catharticum</i>				+				+	+		+	1	+	+	+	3		1
<i>Teucrium scorodonia</i>	1		+		+	1							1		+			
<i>Danthonia decumbens</i>			1	1		+		1		1	+							
<i>Rosa pimpinellifolia</i>		+		+		1			+	+	1	2	+			+		
<i>Festuca rubra/ovina</i>			3		3			3		4		3			3			3
<i>Anthyllis vulneraria</i>				+					+						+			+
<i>Viola riviniana</i>	1		1		+	+		1				+		+				
<i>Carex pulicaris</i>	1	1				1								+				
<i>Trifolium repens</i>					+							+	+					
<i>Helianthemum canum</i>											+	+			+			
<i>Ranunculus bulbosus</i>			+							1					1			
<i>Anthoxanthum odoratum</i>			2		+						+				+	1		+
<i>Centaurea erythraea</i>				+								+						+
<i>Hypericum pulchrum</i>	1	+	+	1	+	1	+	+	+									+
<i>Polygala vulgaris</i>	+							+	+									
<i>Taraxacum officinale</i>	+		+			+				+						+		
<i>Cynosurus cristatus</i>										+	1				1	+		
<i>Solidago virgaurea</i>			1				+											
<i>Agrostis capillaris</i>				1		1	2	1		1					1			1
<i>Centaurea nigra</i>									+	+								
<i>Filipendula vulgaris</i>			3		1	1	2	2	2							1		
<i>Galium sternerii</i>		+										+						
<i>Erica cinerea</i>			+		3	3	1	+	+		3							
<i>Prunus spinosa</i>		+																
<i>Pteridium aquilinum</i>			+		+						+		+					
<i>Prunella vulgaris</i>				+				2	+								+	
<i>Leucanthemum vulgare</i>																		
<i>Euphrasia salisburgensis</i>															+			
<i>Molinia caerulea</i>					+	+		+										
<i>Pseudoscleropodium purum</i>			4	3		1	2	1	2	1		3		3	3		+	3
<i>Tortella tortuosa</i>	1	1										1		+				1
<i>Neckera crispa</i>	2	2										2	2		2		+	
<i>Dicranum scoparium</i>				1		2	2	1	1	1	2			1	2	1		1
<i>Ctenidium molluscum</i>	1											2		1	1			1
<i>Hylocomium splendens</i>	3		1	2	3	3	4	3				2	4	1	2			3
<i>Rhytidiadelphus squarrosus</i>		2					1	3	+		1				1			
<i>Frullania tamnifolia</i>																		
<i>Cladonia rangiferina</i>					2					1	2	2		1				1
<i>Alectoria chrysocoma</i>	3																	
<i>Myurocladia cupressiformis</i>																		
<i>Hylocomium brevirostre</i>												+						
<i>Eurynchium praelongum</i>										3	3							
<i>Thuidium tamariscinum</i>										1						1		
<i>Rhytidiadelphus triquetrus</i>			2	4														3
<i>Peltigera canina</i>																		
<i>Fissidens adianthifolius</i>									+									
<i>Scapania aspera</i>									+						1			

SECTION 2											SECTION 3										SECTION 4									
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
4	1	4	4	2	4	2	4	4	4	4	4	4	4	4	2	3	4	1	1	1	1	4	4	4	1	1	4	9	4	2
100	85	88	80	75	85	90	60	95	85	95	100	85	90	100	95	100	95	60	80	80	100	100	85	100	80	100	60	95	80	
95	83	88	80	70	85	90	60	80	85	85	90	75	99	90	75	50	85	50	80	78	80	80	85	85	80	85	55	95	80	
60	60	86	80	75	15	90	20	95	20	85	100	80	99	99	60	100	90	60	70	70	100	100	85	100	40	100	60	60	80	
42	28	34	31	22	28	29	31	21	17	28	22	27	22	31	26	26	23	18	14	25	19	16	30	19	19	27	30	21	27	
11	24	30	32	56	77	57	50	36	26	106	65	62	53	51	2	64	67	78	63	69	101	102	46	41	25	83	60	35	23	
	1		4	2	3	2	2	3	3	3	2	2	3	2	1	2	3	2	3	3	3	3	2	3	2	3	2	4	2	
2	2	2	2	1	2	2	+	2	1	1	+	1	+	2	2	1	1	2	3	1	2	1	3	1	2	1	1	1	2	
3	+	1	+	1	2	1	2	2	1	2	1	+	1	1	1	2	1	2	1	1	2	1	2	2	+	1	1	2	+	
	2	1	+	1	1	1	+	2	2	1	4	1	1	1	2	+	1	1	1	+	+	+	+	1	+	1			1	
		2	2	3	3	4	1	2	2			3	3	4	1	3	4	3	3	3			3	2	3			2	3	
		3	+	+	1	+		+				+	+	2	1		1	+		1							2	+	3	
+	1	1	1	+	1	+	1	1	1	1	1			1	2	1	2		1	2	1	1	1		+	1	+	+	+	
+	1	1	1	+	2	1	+	1	+	1	2	+	2	2		+				2			2	+	1	1	1	1	1	
1	1	1	1	1	1	1	+	1	+	1	+	1	1	1	+	1	1	1	+							1	1	1	1	
2	3	2	1	1	2		+	2	2	2	3			+	+	+	1			+	2		+			2	1	+	+	
	1	+	+	+	+		+	1	+	1	+	+		1	1	+	+	+	+	+	1	+	+	+	+	2	1	+	+	
		1	1	1	1	1	2				+	+	2	1	1	+	+	+	+	+	1	+	+	+	+	2	1	+	+	
+	+	+			1	2		+			+	+		1		+	+	+	+	+	1	+	+	+		2	2	+	+	
+	+	+	+		+	+		+			+	+	+	+	+	+	+	+	+	+	1	+	+	+		2	2	1	+	
1	+	+	+	+	1	+	1				+	1		3		+				+	2	3			2	2				
+		+	+	+	+		+				+	+			1					+	1				1	1				
1	1	+			+	+	1			1	2	3	2	1	1	2	3	2	3	2	1	2	2		+				+	
+	2	+	+	+	+		+	+					+	+									+	1					+	
+	+	+			+	+		1						+									+	1					+	
1	+				+	+	+							+												1			+	
1		1			+	+	+	+			2	3	2	1	1	2	3	2	3	2			+		+		1			
		+			2	2								+	+					+					+					
							1							+	+				1											
1	+				+																			+						
		+																												



TABLE 4: Evaluation and rating of sites of scientific interest encountered during present survey

Site	Evaluation Criteria Rating	Representativeness (3)	Habitat Diversity (2)	Community Diversity (2)	Species Diversity (2)	Species Rarity (2)	Land-scape (2)	Sensitivity to disturbance (2)	History (2)	Access (2)	Boundaries (2)	Ownership (2)	Security of Tenure (2)	Man-Power (2)	Costs (2)	Liabilities (2)	Special Features (2)	Potential Educational Use (2)	Potential Amenity Use (2)	Subjective Assessment (5)	Action (2)	Total (44)	Rating	Criteria Score	Rating
Coastline and Pavement from Poulsallagh to Blackhead		3	2	2	2	2	1-2	1	1-2	2	1	0	0	2	2	2	2	2	1	5	2	35-37	International	0-10	None
Inishmore		3	2	2	2	2	1-2	1	2	1	2	0	0	1	0-1	2	2	2	1	5	1-2	32-35	National/International	0-20	Local
Gleninagh and Cappanawalla mountains		2-3	1-2	2	1-2	2	1-2	1	1	0-1	1	0	0	2	2	2	1	1-2	1	5	2	28-34	National	20-25	Regional
Clooncoose		0-1	1	1-2	1-2	1	1-2	1	1	1	1	0	0	1	2	2	1	1	1	5	2	24-38	Regional/National	25-35	National
Area East of Glensleade Castle		0-1	1	1	1-2	1	1-2	1	1	1	1	0	0	1	1-2	2	1	1	1	5	2	21-27	Regional/National	35-44	International
Moneen and Mountains South		0	1	2	1-2	2	1-2	1	1	0-1	1	0	0	1	1	0	1	2	1	3	2	21-24	Regional		
Roo		2-3	1	1	1	1	1-2	1	0	0	1	0	0	1	1	2	1	1	1	3	1	20-22	Regional		
Gort Race Course		3	3	2	1	1	1	1	1	1	0	0	0	2	2	1	1	2	1	3	1	27	National		

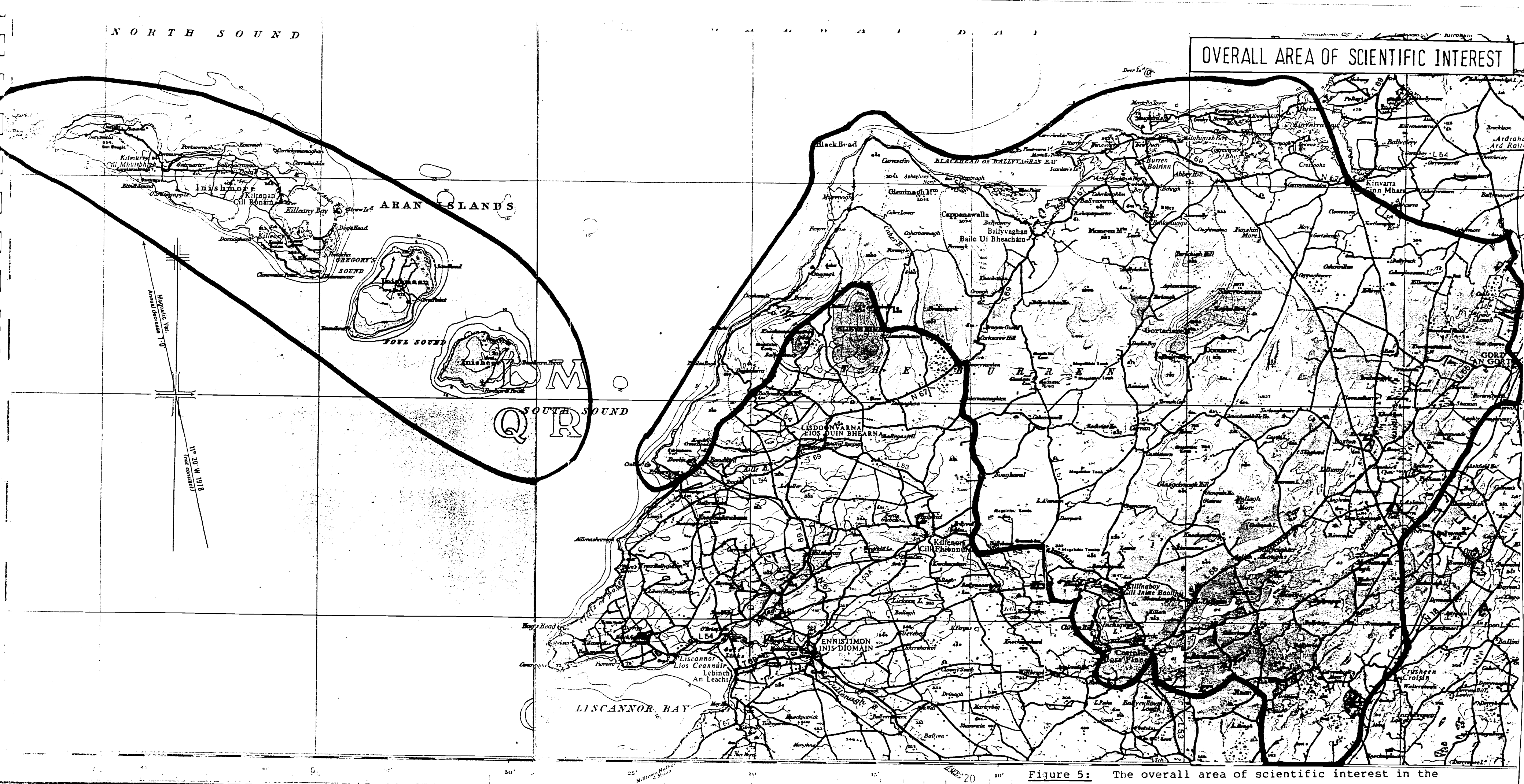


Figure 5: The overall area of scientific interest in the Karstic limestone region of North Clare and South-East Galway, including the Aran Islands.

Good examples of dry meadows were also found adjacent to the coast road between Kilmurvy and Kilronan on Inishmore. On the mainland the type is well expressed on the coast near Fanore and south of Kinvara near Kilinny. Outside the Burren good examples of alternate meadows were found on the banks of the river Corrib at Menlo in Galway. A species poor variant was noted near Laghy in Donegal.

A group of species-rich meadows occurring on the shales in the Ballynalackan Castle region near Lisdoonvarna were included in this group for convenience (Plate 2). These occur on deeper, poorer draining soils and contain a small number of wet meadow species. True wet meadows in which rush species are frequent and often dominant and which include a large number of species indicative of impeded drainage were not sampled in the course of the present study.

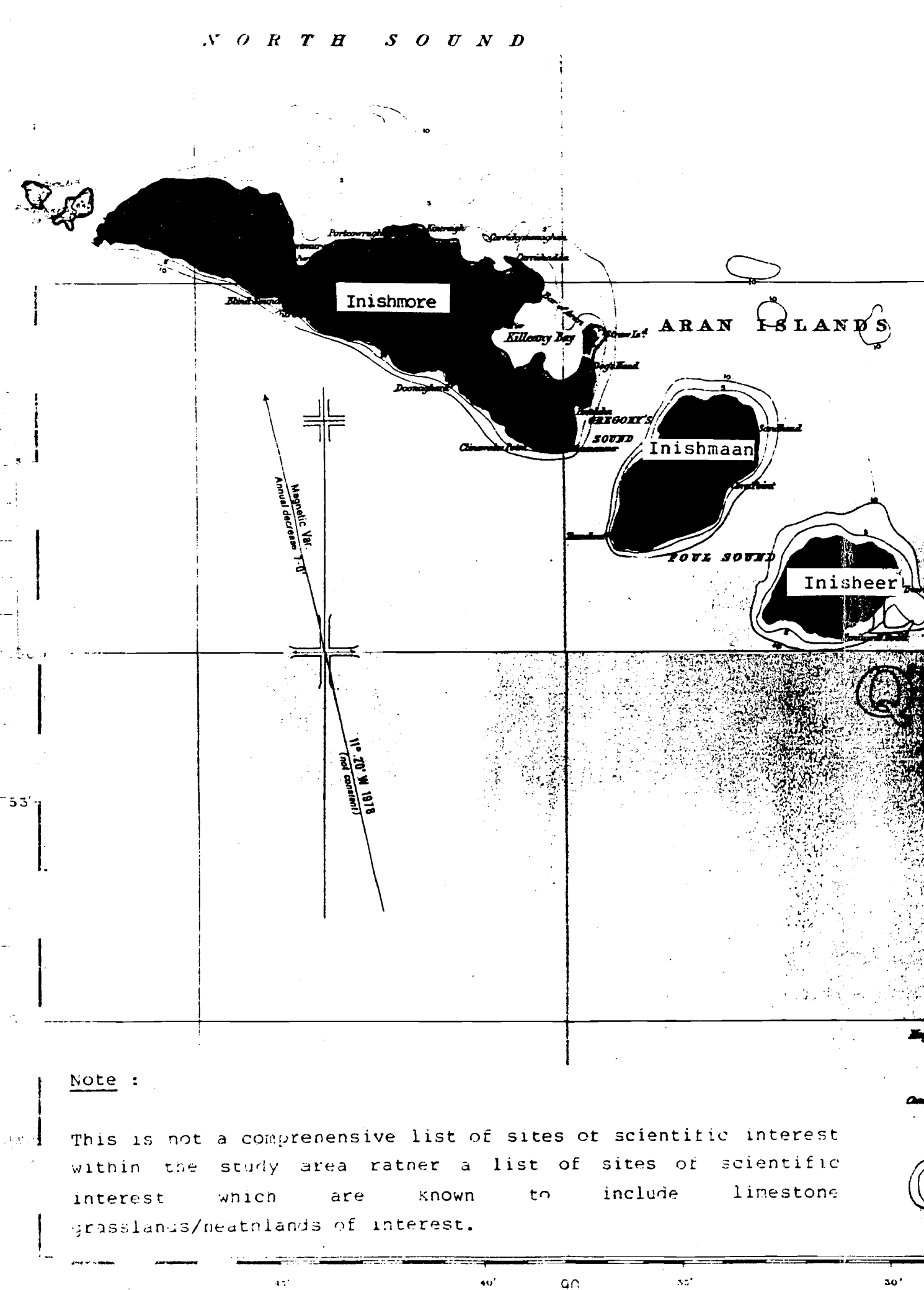
Known Distribution outside Study Area: Little is known of the status and distribution of Irish dry meadows. Any available data points to a very fragmentary and decreasing distribution.

The shale meadows included in the table are the "driest" type occurring on the shales, both these and wetter meadows including such Atlantic herbs as the bog thistle (Cirsium dissectum) are rapidly decreasing. Species rich wet meadows over shale are best developed in west Limerick and south-west Clare.

Scientific Status: "Alternate" dry meadows contain elements of the Arrhenatheretea elatioris association: a continental association whose status is unknown in this country mainly due to its rarity. They are therefore of high scientific interest.

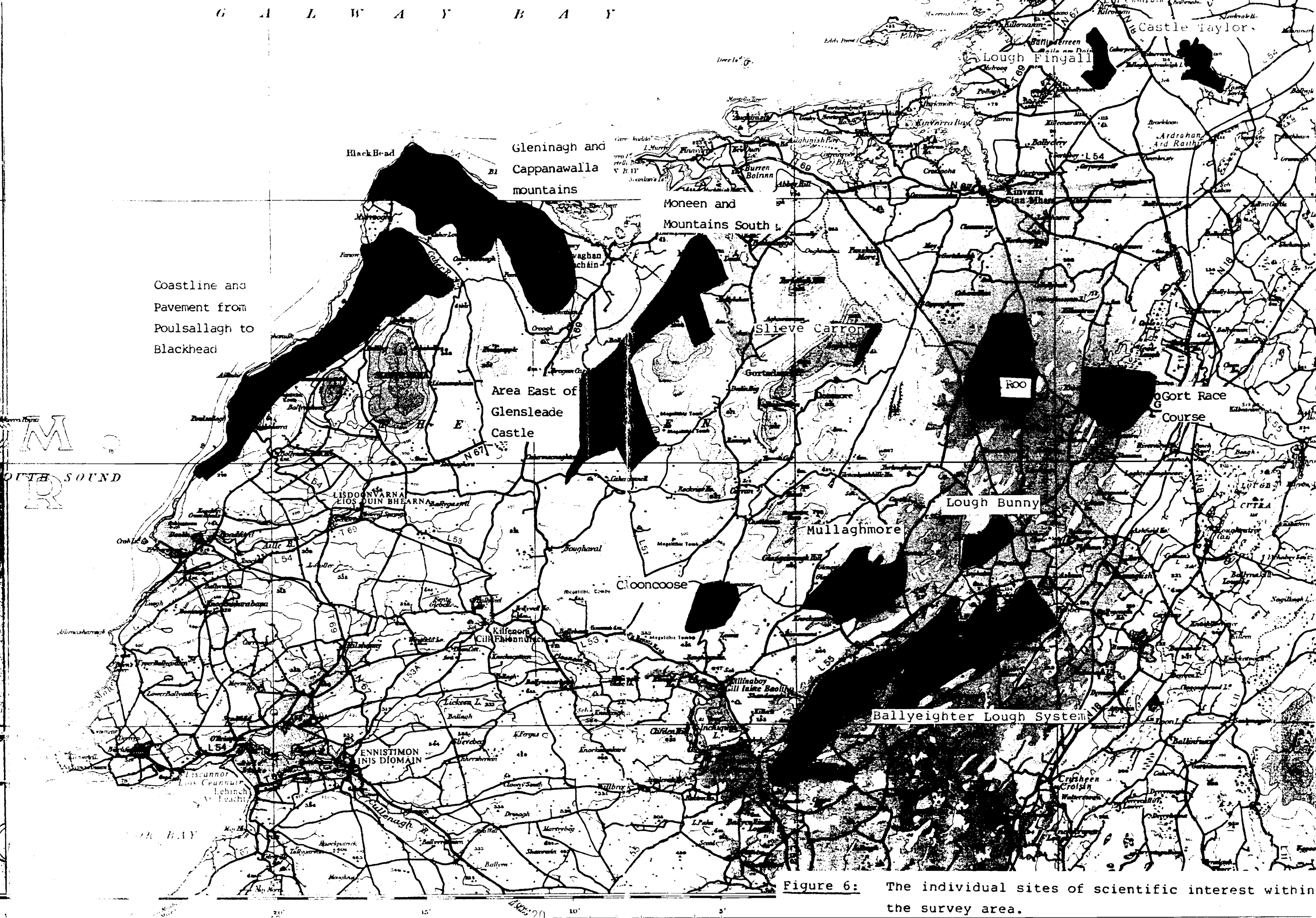
Conservation Status: Good examples of this vegetation need to be conserved urgently as due to rapidly changing land management practices these meadows are likely to disappear completely over the next ten years.

# INDIVIDUAL SITES OF SCIENTIFIC INTEREST



Note :

This is not a comprehensive list of sites of scientific interest within the study area rather a list of sites of scientific interest which are known to include limestone grasslands/heathlands of interest.



**Figure 6:** The individual sites of scientific interest within the survey area.

TABLE 5: RATING OF SITES NOT VISITED DURING THE PRESENT SURVEY

SITE	RATING AN FORAS FORBARTHA/ FOREST & WILDLIFE SERVICE
Mullaghmore	International
Ballyeighter Lough System	National
Inishmaan (Aran Islands)	National
Lough Bunny	National
Castle Taylor	Regional
Slieve Carron	Regional
Lough Fingall	Local
Inisheer (Aran Islands)	Local

Note :

This is not a comprehensive list of sites of scientific interest within the study area rather a list of sites of scientific interest which are known to include limestone grasslands/heathlands of interest.



TABLE 6: Grassland/Heathland communities known to be present  
at the sites of scientific interest selected as a result  
of the present survey

SITE	GRASSLAND / HEATHLAND COMMUNITIES PRESENT						
	Leucanthemum- Rhinanthus Meadows	Dryas- Hypericum Community	Empetrum Epipactis Nodum	Arctosta- phylos Dryas Nodum	Sesleria- Calluna community	Antennaria- Hieracium community	Antennaria- Hieracium Helianthe- mum variant
Coastline and pavement from Poulsallagh to Blackhead	/	/			/	/	/
Inishmore	/				/	/	/
Gleninagh and Cappanawalla Mts.		/	/	/	/	/	
Clooncoose						/	
Area east of Glensleade Castle		/	/				
Moneen and mountains south		/	/		/	/	
Roo					/		
Gort Race Course							

Sites of Scientific Interest: The best example of dry alternate meadows found during the present survey were on Inishmore (L825103, L880100) on the Aran Islands, and on the mainland at Fanore (M136802) and near Killinny (M372505).

#### 5.2.2 Dryas-Sesleria - Hypericum pulchrum community

Distribution: This community is equivalent to Ivimey-Cook and Proctors (1966) Dryas octopetala-Hypericum pulchrum association which those authors describe as the commonest limestone "grassland" community and the most characteristic of the Burren "grassland" types. Figure 2 illustrates the spread of samples of this vegetation from the present study and that of Ivimey-Cook and Proctor. Although it is the most characteristic of Burren "grasslands" due most notably to the role in which Dryas octopetala plays in it, the results of the present study does not indicate that it is the commonest. Figure 2 gives a good indication of its distribution.

The best examples of this vegetation found during the present study occurred near the coast at Poulsallagh and in the area east of Glensleade Castle. The Empetrum nigrum - Epipactis atrorubens nodum replaces the Dryas - Hypericum community on exposed slopes and crests at rather high altitudes near the west coast and intergrades completely with it. This nodum occurs on the plateau pavements from Cappanawalla to Blackhead and in similar habitats on Moneen mountain and Peak 1008 O.D. south of it.

Known Distribution Outside Study Area: Not presently known outside the study area.

Scientific Status: Of high status due to the following:

- i) Species rich
- ii) Contains a large number of very local/rare species including several with Mediterranean or arctic/alpine distributional affinities
- iii) Contains an admixture of calcicole and calcifuge species
- iv) Community is not known outside study area.

Conservation Status: This community is prone to degradation due to overgrazing and addition of fertilisers. Some form of protection is necessary to ensure that examples of this community survive in their present form. The impact of grazing and fertiliser application on the scientific status of this and similar communities is outlined in Section 6.

Sites of Scientific Interest: The best sites encountered in the present study include the coastline and pavement from Poulsallagh to Blackhead; Gleninagh and Cappenwalla Mountains; the area east of Glensleade castle; Moneen and Mountains south.

#### 5.2.3 Sesleria albicans - Calluna vulgaris community

Distribution: This community represents a later stage in succession to a more species-poor limestone heath. As such, this community is widespread throughout the Burren area. The distribution outlined in Figure 3 is to be interpreted therefore as the distribution of sample sites and not the community.

Known Distribution outside Study Area: No comparable community described from outside the study area.

Scientific Status: As a stage in a continuum from limestone grassland to limestone heathland, the status of this community is equivalent to the other stages outlined.

Conservation Status: With the exception of Leucanthemum-Rhinanthus meadows all the communities outlined in this report represent stages in a continuum from limestone grassland to limestone heathland. This continuous nature characterises Burren limestone grasslands/heathlands. In any attempt to conserve Burren grasslands/heathlands it is therefore necessary to ensure that examples of prominent stages in that continuum are conserved. This is such a stage.

Sites of Scientific Interest: Good examples of this community occur on the pavement between Poulsallagh and Blackhead, on Inishmore in the Aran Islands, on Gleninagh and Cappenawalla mountains, on Moneen Mountains and Mountains south, at Roo (M395025) and at Lough Bunny.

#### 5.2.4 Antennaria dioica-Hieracium pilosella community

##### 5.2.4.1 Typical Community

Known Distribution Outside Study Area: Similar communities occur elsewhere but none are exactly comparable.

Scientific Status: At its best developed this community is the most species-rich of the Burren's limestone grasslands/heathlands. Ivimey Cook and Proctor (1966) recorded 59 species from one 4 square metre sample. Good examples also contain a number of very local/rare species including several of Mediterranean or Arctic/alpine distributional status. This community is of a high scientific status.

Conservation Status: This community is prone to overgrazing and sward impoverishment due to addition of fertilizer. Conservation is therefore necessary to preserve the best examples.

Sites of Scientific Interest: This community is well developed on the pavement from Poulsallagh to Blackhead; at Clooncoose (R265095); and at Lough Bunny.

##### 5.2.4.2 Antennaria dioica - Hieracium pilosella community Helianthemum variant

Distribution: On the Clare part of the mainland this variant is restricted to a narrow band from Blackhead southwards to beyond Poulsallagh. This variant may also occur at Mullaghmore where the rockrose also occurs (Webb and Scannell, 1983), although it is not confined to this community (Ivimey-Cook and Proctor, 1966). This variant is widespread on Inishmore in the Aran Islands where its distribution is well illustrated by the spread of the relevés (Figure 3, sample numbers 67, 69, 51, 53, 62, 63, 64, 65).

Known Distribution outside Study Area: Not known outside study area.

Scientific Status: Of high interest due to the presence of the rare and protected Helianthemum canum.

Conservation Status: This community is prone to overgrazing and this is especially evident on Inishmore in the Aran Islands. A certain level of grazing maintains the open sward in which Helianthemum thrives but sustained, heavy grazing may lead to degradation of the community. The vegetation on the mainland is subject to lower grazing levels and is more species rich. Some measures need to be taken to control the grazing levels on Inishmore in the Aran Islands in order to preserve the integrity of this community.

Sites of Scientific Interest: The coastal band of pavement between Poulsallagh and Blackhead; Inishmore in the Aran Islands.

5.2.4.3 Antennaria dioica - Hieracium pilosella community exposed pavement variant

Distribution: More frequent than sample distribution suggest. Common on exposed limestone terraces and escarpments.

Known Distribution outside Study Area: Similar communities probably occur in other karst areas.

Scientific Status: This variant is of low interest.

Conservation Status: Of low priority.

Sites of Scientific Interest: None.

## 6      PRESENT AND POSSIBLE FUTURE THREATS TO BURREN GRASSLANDS/HEATHLANDS

The major threats to the vegetation outlined in the previous sections are overgrazing, piecemeal addition of fertiliser and reclamation. Overgrazing results in a degraded form of the original plant community. Controlled grazing levels are necessary to maintain a species-rich sward. Lack of grazing - abandoning - also results in a decrease in species number and a dominance of few species only (Willems, 1983).

A good example of overgrazing is seen in the pavement south-east of Corkscrew hill in the Burren. Here overgrazing and probable addition of fertiliser has resulted in the replacement of the poor-yield grasses and species-rich sward by high-yield grasses with an overall sward impoverishment. Elements of what must have been the dominant species-rich community are present in the least accessible areas. A number of species associated with grazing become dominant in the degraded sward including Cerastium fontanum, Hypochoeris radicata, Luzula campestris and Trifolium repens (Dixon, 1982).

Recovery from extensive overgrazing is often only partially successful. Generally the extent of recovery depends greatly on the time over which the community has been allowed to recover (Ratcliffe, 1977). Readjustment of such a community, through invasion and competition, is slow and may take several centuries for anything approaching the original communities to develop (Ratcliffe, 1977). A great deal depends on the ability of former species to spread back and re-colonise the lost ground. It has been found in re-invasion of old fields that many species which are later dominant in the community invade early (Pickett, 1982). Studies of former agricultural chalk grasslands in the Netherlands has shown that in sample plots which have received no fertiliser but have undergone controlled grazing or recovery, the species number has increased from 28 in year-one to 35 in year-ten (Willems, 1983). Over the full course of the ten years four species disappeared (includes fleeting appearances) and 6 appeared. No rare species invaded.



A longer timescale for re-establishment of a species rich sward in a seriously degraded community must be envisaged (Ratcliffe, op cit). In general, species which were originally local or rare will not reappear, or will take longest, for their powers of spread under the prevailing conditions are very limited (Ratcliffe, op. cit). It is the common and vigorous species which will re-appear first and assume the most prominent place in the changing community (Ratcliffe, op. cit). Recently reverted grasslands of this type are usually recognisable because they contain only the common species and lack those which are rare or local (Ratcliffe, op. cit). It is reasonable to suppose that calcareous grasslands with a large number of rare and local species are of considerable age, and have remained under a particular band of grazing management, without other disturbances over a long period (Ratcliffe, op. cit).

The impact of addition of fertilizers to species-rich swards is well documented. Most notably the application of nitrogen causes a drastic decline in species richness and species diversity. Particularly, the herbs are reduced and finally eliminated (Thurston, 1969; Van Hecke et al, 1981; Vermeer and Berendse, 1983). The indiscriminate aerial application of nitrogen-rich fertilizers as well as the more traditional piecemeal application can eventually have no other effect than major decreases in species richness and species diversity in those grass and grass heathland communities of International Scientific Importance, which give the unique floristic diversity to the Burren region. It is therefore critically important that the long term effect of such procedures should be held in mind at all times.

#### ACKNOWLEDGEMENTS

I would like to thank Dr. T.G.F. Curtis and Miss A. Bassett for their assistance and advice throughout the course of the survey. Dr. Austin O'Sullivan is also gratefully acknowledged for his helpful correspondence concerning Irish grasslands. Special thanks are due to Ms. Theresa O'Brien for careful typing of a difficult manuscript.

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## APPENDIX I

### Additional Species in Vegetation Tables

#### Additional species in Table No. 1

Relevé 52: Anthyllis vulneraria 2; Crepis capillaris 1; Senecio jacobea +; Veronica chaemedrys +; Hypnum cupressiforme 1; Ctenidium molluscum 3.

Relevé 66: Agrostis stolonifera 1; Anthyllis vulneraria +; Euphrasia tetraquetra +; Odontites verna 2; Pimpinella major 1; Hylocomium brevirostre 3.

Relevé 96: Euphrasia nemorosa 1; Knautia arvensis 1; Pimpinella saxifraga 2; Lathyrus pratensis 1; Hypericum perforatum +.

Relevé 18: Thuidium tamariscinum +.

Relevé 14: Antennaria dioica 1; Carlina vulgaris +; Poa annua +; Thymus praecox 2.

Relevé 13: Blackstonia perfoliata +; Knautia arvensis +; Leontodon hispidus +; Dicranum scorparium 1; Poa annua +.

Relevé 12: Poa subcaerulea +.

Relevé 27: Plantago maritima +.

Relevé 19: Veronica chaemedrys +; Festuca pratensis +; Luzula multiflorus +; Dactylorhiza maculata +; Myosotis arvensis +; Filipendula ulmaria +.

Relevé 6: Crepis vesicaria (+).

Relevé 9: Poa subcaerulea 1; Tragopogon pratense +.

Relevé 10: Blackstonia perfoliata +; Crepis vesicaria +; Cirsium arvense +; Hypericum pulchrum +; Lathyrus pratensis +.

Relevé 29: Carex caryophyllea +; Carex pulicaris +; Centaureum erythraea 1; Koeleria cristata 1; Thymus praecox (+).

Relevé 28: Convolvulus arvensis +; Cirsium palustre +.

Relevé 17: Alopecurus pratensis +; Festuca pratensis 2; Veronica chamaedrys +; Prunus spinosa +.

Relevé 1: Lathyrus pratensis 1; Myosotis discolor +; Cardamine pratensis +.

Relevé 71: Centaureum erythraea +; Leontodon autumnalis 2; Potentilla erecta 1.

Additional species in Table No. 2

Relevé 39: Anthoxanthum odoratum 1; Luzula multiflora +; Primula vulgaris 1; Ranunculus bulbosus +.

Relevé 33: Danthonia decumbens +.

Relevé 34: Fissidens cristatus 1.

Relevé 42: Frullania tamarisci 1.

Relevé 49: Orchis mascula +; Frullania tamarisci 1; Fissidens adianthoides 1; Cladonia pyxidata +.

Relevé 40: Arctostaphylos uva-ursi 1; Juniperus communis 1.

Relevé 45: Gentiana verna +; Orchis mascula +.

Relevé 38: Orchis mascula +; Primula vulgaris +; Ranunculus bulbosus.

- Relevé 93: Molinia caerulea 1.
- Relevé 92: Galium saxatile +; Prunus spinosa +.
- Relevé 91: Camptothecium lutescens 1; Fistsdens adianthoides +.
- Relevé 90: Gymnadenia conopsea +; Hylocomium splendens 2.
- Relevé 89: Rhinanthus minor +.
- Relevé 88: Gentiana verna +; Rhinanthus minor +.
- Relevé 87: Gentiana verna +; Carex panicea 2; Primula veris +.
- Relevé 75: Prunella vulgaris 1; Trifolium repens 1.
- Relevé 47: Orchis mascula +; Molinia caerulea +.
- Relevé 44: Ranunculus bulbosus +; Senecio jacobea +; Trifolium repens 1.
- Relevé 84: Trifolium repens 2; Lathyrus pratensis 1; Hedera helix +.
- Relevé 86: Lathyrus montanus +; Camptothecium lutescens 1; Hylocomium splendens 3.
- Relevé 80: Molinia caerulea 2; Carex panicea 1; Danthonia decumbens +; Erica cinerea 1; Helianthemum canum 1; Prunella vulgaris +.
- Relevé 85: Lathyrus pratensis 1.
- Relevé 99: Carex pilulifera 1; Gymnadenia conopsea +; Veronica officinalis; Agrostis capillaris 3; Filipendula vulgaris 2.
- Relevé 79: Agrostis stolonifera +; Anthyllis vulneraria 1; Blackstonia perfoliata 1; Centaurium erythraea +; Danthonia decumbens +; Leucanthemum vulgare 1; Prunella vulgaris 1.



Additional species in Table No. 3

Relevé 55: Leontodon taraxacoides 1.

Relevé 37: Trifolium pratense +.

Relevé 97: Dactylorhiza maculata.

Relevé 4: Bellis perennis 1; Dactylorhiza fuchsii +; Lolium perenne +; Senecio jacobea +; Conopodium majus +; Dactylis glomerata +.

Relevé 94: Trifolium pratense 1; Galium saxatile +.

Relevé 98: Lathyrus montanus 1; Hedera helix +.

Relevé 100: Trifolium medium 1; Lathyrus montanus +.

Relevé 5: Carex hostiana 1; Gymnadenia conopsea +; Poa subcaerulea +; Galium boreale +; Platanthera bifolia +; Vicia cracca +; Schoenus nigricans +.

Relevé 54: Gymnadenia conopsea +.

Relevé 58: Senecio jacobea +.

Relevé 95: Spiranthes spiralis +.

Relevé 59: Cladonia pyxidata 1.

Relevé 68: Rhinanthus minor +; Gymnadenia conopsea.

Relevé 31: Dactylis glomerata 1; Minuartia verna +; Trifolium pratense 1; Ditrichum flexicaule +.

Relevé 8: Luzula campestris +; Juniperus communis +.

Relevé 7: Bellis perennis +; Juniperus communis +; Rhytidiadelphus loreus 1.

Relevé 11: Blackstonia perfoliata +; Dactylorhiza fuchsii +; Trifolium pratense 1; Avenula pubescens; Conopodium majus 1; Dactylis glomerata +; Holcus lanatus 1; Lathyrus pratensis 1; Leontodon autumnalis +; Listera ovata +; Luzula campestris +; Vicia cracca 1; Euphrasia sp +; Rubus fruticosus +.

Relevé 24: Bellis perennis +; Daucus carota +; Trifolium dubium +.

Relevé 30: Dactylorhiza fuchsii +; Plagiochaila asplenioides +.

Relevé 32: Gentiana verna +; Orchis mascula +; Lophocholea bidentata 1; Cladonia pyxidata 1; Fissidens cristatus 1.

Relevé 56: Medicago lupulina 1; Crepis vesicaria +.

Relevé 57: Leontodon taraxacoides 1.

Relevé 50: Trifolium pratense +; Listera ovata +; Hieracium anglicum +.

Relevé 36: Gentiana verna 1.

Relevé 106: Gentianella amarella +.

Relevé 62: Hieracium anglicum +.

Relevé 53: Poa pratensis.

Relevé 51: Bromus hordaceus +; Trifolium pratense +.

Relevé 2: Rhinanthus minor 1; Avenula pubescens +.

Relevé 64: Aira caryophyllea +.

Relevé 102: Carex pilulifera 1.

Relevé 46: Ditrichium flexicaule 2; Hieracium anglicum +.

Relevé 83: Ditrichium flexicaule +; Lathyrus pratensis +; Luzula campestris 1.

Relevé 60: Trifolium pratense +; Daucus carota +.

Relevé 23: Trisetum flavescens (+).

## APPENDIX 2

### SITE EVALUATION CARD

#### 1) REPRESENTATIVENESS OF ECOSYSTEM

##### RATING

- 0 - other sites of its type in county
- 1 - only site of its type in county
- 2 - only site of its type in province
- 3 - only site of its type in country

#### 2) HABITAT DIVERSITY (see notes)

- 0 - 1-3 habitats on site
- 1 - 4-6 habitats on site
- 2 - 7 or more habitats on site

#### 3) COMMUNITY DIVERSITY

- 0 - 1-3 communities present
- 1 - 4-6 communities present
- 2 - 7 or more communities present

#### 4) PLANT SPECIES DIVERSITY

- 0 - 40 species or less
- 1 - 41-120 species present
- 2 - 120 species present

#### 5) SPECIES RARITY (see notes)

- 0 - number very local, rare or very rare species on site
- 1 - 1-5 very local, rare or very rare species on site
- 2 - 6 or more very local, rare or very rare species on site



6) LANDSCAPE CATEGORY

- 0 - agricultural or artificial landscapes human interference high
- 1 - semi-natural landscape with moderate human interference
- 2 - near-natural landscape with very little human disturbance

7) SENSITIVITY TO DISTURBANCE

- 0 - some disturbance will effect site little if at all
- 1 - some disturbance will modify site but not alter value
- 2 - some disturbance will totally alter or destroy site

8) RECORDED HISTORY

- 0 - information unavailable but unexplored
- 1 - limited information available
- 2 - well documented

9) ACCESS TO SITE

- 0 - site in remote area or vehicular access difficult
- 1 - public transport some distance from site, vehicular access possible
- 2 - public transport near site, vehiculara access easy

10) BOUNDARIES

- 0 - insecure, long and possibly expensive to maintain
- 1 - fairly secure but some maintenance required
- 2 - good security with minimal maintenance needed

11) OWNERSHIP

- 0 - private
- 1 - private and state bodies
- 2 - public ownership

12) SECURITY OF TENURE

- 0 - management agreement possible
- 1 - lease agreement possible
- 2 - ownership possible

13) MANPOWER

- 0 - regular maintenance likely with heavy demand
- 1 - regular maintenance likely with low demand
- 2 - little maintenance necessary with little or no labour

14) COSTS

- 0 - high cost of machinery, manpower and purchase
- 1 - moderate cost of machinery, manpower and purchase
- 2 - low costs of machinery, manpower and purchase

15) LIABILITIES

- 0 - possible future development or disturbance on site
- 1 - possible long term development. No immediate threats
- 2 - no known liabilities

16) SPECIAL FEATURES

- 0 - feature which may lower conservation interest
- 1 - special feature of some interest
- 2 - special feature of overriding interest

17) POTENTIAL EDUCATIONAL USE

- 0 - very limited, use suitable for small groups only
- 1 - good use though some restrictions may be necessary
- 2 - outstanding use at all levels of education

18) POTENTIAL AMENITY USE

- 0 - very limited amenity use
- 1 - can withstand limited access
- 2 - can withstand heavy pressures

19) SUBJECTIVE ASSESSMENT

- 0 - low priority site. Low scientific value. Major management problems
- 3 - medium priority site. Good scientific value. Few management problems
- 5 - top priority site. High scientific value. No management problems.

20) ACTION

- 0 - no action needed
- 1 - some action may be necessary at a later time
- 2 - immediate action required

MAJOR CATEGORY	SECONDARY CATEGORY	THIRD CATEGORY
Woodland	Deciduous* Coniferous* Mixed* * name dominants	High forest Coppice Coppice with standard plantation
Scrub Dwarf Shrub Tall Herb 0.75 m Grassland and short herb 0.75 m Reed bed (phragmites) Moss dominated communities	<u>Soil Types</u> Peats Alluvium Mineral Marl	<u>Water Regime</u> Well drained Impeded or high water Subject to flooding Aquatic transitional including emergent vegetation and marshes Ombrogenous peats Soligenous peats
Open habitats (Vegetation cover 25%)	Soil reaction Acid Neutral Basic	Shingle Sand Mud, silt, clay Horizontal rock Cliff 45 m Cave
Agricultural habitats	<u>Soil Types</u> Peats Alluvium Mineral Marl	Cereal Roots Grassland Other crops
Marginal habitats	<u>Soil Types</u> Peats Alluvium Mineral Marl	Hedgerow Roadside verge Embankment Walls
Aquatic: Flowing water	Springs or very small streams, slow or fast (0.75 m wide). Ditches and larger streams, slow moving (0.75 m - 3.5 m wide). Fast streams and rivers (0.75 m) Canals and lowland rivers (3.5 m)	Wooded Not wooded, exposed Shingle bottom Sandy bottom Mud or silt bottom Rock bottom
Aquatic, Still water	Puddle - very small water bodies Pond - small ponds Up to 5 m <sup>2</sup> Mere - large ponds (2.5 ha) Lakes 72.5 ha	