# **OWENMORE RIVER**

 $\Box$ 

 $\Box$ 

L

L

L

J

1

ì

J

1

Proposed Arterial Drainage Environmental Impact Assessment

**Botanical and Ornithological Surveys** 

A Report for National Parks & Wildlife Service Office of Public Works

Roger Goodwillie, Philip Buckley & Caitriona Douglas

## PREFACE

ιi

Ц

L

11

L

L

. .

٦

This report is the outcome of a contract with the Wildlife Service to evaluate the vegetation and birdlife of the Owenmore catchment, County Sligo, and to assess the impacts on them of a proposed arterial drainage scheme.

The study was carried out in 1988-89 under the supervision of Jim Ryan who also gave some assistance in the field. The personnel involved were:

Roger Goodwillie	final report and botanical survey
Philip Buckley	ornithological survey
Caitriona Douglas	botanical survey
Enda Mooney	botanical field assistant 1988

We would like to acknowledge the help of several local naturalists, P.Timpson, D.Cotton, S.Perceval, J.Crichton and B.Jobson and the many pleasant landowners we met in the field. J.Martin and J.Howard of the Arterial Drainage Section, Office of Public Works were also of considerable assistance. CONTENTS

Π

Π

Π

Π

Preface & Acknowledgements SECTION 1 - INTRODUCTION Page 1 1.1 Description of Catchment 1.2 5 The Rivers 6 1.3 The Lakes Arterial Drainage 6 1.4 1.4.1 6 Previous schemes 8 1.4.2 Present proposals SECTION 2 - WILDLIFE SURVEYS 2.1 Botanical Survey 9 14 2.1.1 Results 15 2.1.1.1 Swamp vegetation 2.1.1.2 Tall Grass vegetation 18 Short Grass vegetation 2.1.1.3 20 2.1.1.4 23 Peatland vegetation 2.1.1.5 Woodland vegetation 27 2.1.1.6 28 Tillage 28 2.2 Ornithological Survey 2.2.1 Winter 28 2.2.1.1 Site counts 28 Road transects 2.2.1.2 32 Foot transects 35 2.2.1.3 2.2.1.4 39 Winter bird populations 2.2.2 41 Breeding season 2.2.2.1 Wader survey 41 2.2.2.2 Lough Arrow 43 2.2.2.3 Other habitats 44 2.2.2.4 48 Summer bird populations SECTION 3 - EVALUATION OF WILDLIFE 49 3.1 Vegetation 3.1.1 Species rarity 49 3.1.2 55 Vegetation rarity 3.1.3 Species diversity 55 3.1.4 Habitat diversity 57 3.2 Birdlife 57 59 3.2.1 Winter 59 Wildfowl and waders 3.2.1.1 3.2.1.2 59 Other wintering populations Breeding season 61 3.2.2 3.2.2.1 Waders 61 Lough Arrow 3.2.2.2 64

3.2.2.3 3.2.2.4 3.3 3.3.1 3.3.2 3.3.3 3.3.4 3.3.5 3.3.6 3.3.7 3.3.8 3.3.9 3.3.10 3.3.10 3.3.11 3.3.12 3.3.13 3.3.14 3.3.15 3.3.16 3.3.17 3.3.18	River channels Other habitats Areas of Scientific Interest Unshin River Lough Arrow Ballysadare Bay Flughany Bog Doocastle Turlough Templehouse/Cloonacleigha Lough Cloonakillina Lough Lough Meharth Quarryfield West Turlough Turloughmore Ballygawley Lough Corhawnagh Carrownabunny Knockmullin Feenagh/Bunnamuck L. Lough Dargan Fin/Risheen Loughs Greenan	64 64 70 70 76 79 84 86 89 95 97 100 102 104 106 108 110 112 114 116 118
SECTION 4	- IMPACTS OF PROPOSED DRAINAGE	121
4.1 4.2 4.2.1 4.2.2 4.2.2 4.2.2.1 4.2.2.2 4.2.2.3	Impact on vegetation Vegetation diversity Impacts on species Plants Birds Aquatic species Terrestrial species Significance	122 128 128 132 132 132 134 136
4.3	Impact on Areas of Scientific Interest (ordered as above)	138
SECTION 5	<u>5 - CONCLUSION</u>	147
6. REFERE	INCES	149
7. PLATES	5 1 - 37	152
APPENDIX	1 Vegetation types	160
APPENDIX	2 Sites of high vegetation diversity	200

-----

!

:]

J

 $\Box$ 

 $\Box$ 

J

 $\Box$ 

J

 $\Box$ 

J

J

J

 $\Box$ 

Ŋ

 $\left[ \right]$ 

Ŋ

J

 $\Box$ 

]

ן

#### SECTION 1 INTRODUCTION

# 1.1 DESCRIPTION OF CATCHMENT

The Owenmore catchment covers some 65,500 ha which is predominantly in Co. Sligo but with small extensions into Mayo and Roscommon (Figure 1). It is bounded by the Curlew Mountains (264m) on the south side and the Ox Mountains (514m) on the north and north-west. The eastern edge is marked by the low hills above Lough Arrow and the western by the ridge north of Tobercurry. The catchment is divided into three obvious sections by its three tributaries: the Owenbeg flows east along the foot of the Ox Mountains, the Owenmore northwards through the centre of the catchment and the Unshin north-west from Lough Arrow.

The geology of the area is relatively simple in that all the low land is of limestone (Upper Carboniferous - Visean) which also builds the hills of Keshcorran and Carrowkeel beside Lough Arrow. Older rocks rise through the limestone in two parallel ridges, the Old Red Sandstone of the Curlew Mountains and the precambrian gneiss and quartzite of the Ox Mountains.

Glacial till covers much of the low land (Figure 2) so that the underlying rock is seldom seen. The till is thickest between Ballymote and the Curlew Mountains where it is formed into numerous drumlins, the western end of the main drumlin belt that runs through Cavan, Monaghan and Down. Till is absent from most of the hill areas and from the low-lying ground about Tobercurry. It is thin also near the centre of the catchment, for example, on the hills north of Ballymote and on each side of Riverstown. The basement rock is actually exposed in a low-lying area around Lough Dargan, perhaps as a 'drift-shadow' in the lee of the Ox Mountains.

Peat is widespread in the catchment, and occurs on all the mountains including the limestone Carrowkeel, and in many parts of the lowlands. It is particularly prevalent in the Owenmore sub-catchment where it fills the inter-drumlin hollows, the river valleys and the flat land near the three major lakes - Cloonakillina, Cloonacleigha and Templehouse. There is a significant amount of peat in the Owenbeg valley also, part of which is associated with river sediments, but rather little in the Unshin.

Soil types (Figure 3) are related both to peat content and to the physical quality of the glacial till which is generally fine-grained and rich in clay. There are small areas of brown podsolics/brown earths at the edges of the catchment and on the hill limestones, with patches of well-drained skeletal soils at the foothills of the Ox Mountains. Otherwise gley soils predominate with grey-brown podsolics generally on higher ground and peaty gleys or basin peats in the depressions. The most frequent soil type in the affected land is probably a peaty gley characteristic of the floodplains of





٢.



Figure 2. Surface geology of the Owenmore catchment



Ľ

J

J

J

J

Γ

the larger rivers. (The term 'affected' land is used in this report in preference to 'damaged' or 'benefitting' land. Its counterpart is 'unaffected' land).

Π

Π

Π

# 1.2 THE RIVERS

The catchment is notable for the very different characters of its three major branches. The Owenbeg (23 km) is an acid mountain river subject to spates. Its banks are relatively high and, in the lowlands, often tree-lined. It has a gravel bed and a reasonable gradient and is very seldom polluted. The Owenmore (52 km) is a neutral river, flat, slow-moving except at Annaghmore and partly channelised by previous drainage. It generally is eutrophic receiving both agricultural and creamery effluents. Recent changes at Achonry creamery have led to a decline in nutrient levels (Timpson pers. comm.). The Unshin (23 km) is an alkaline river, rising in the spring-fed Lough Arrow. Its pH remains high throughout its length but it becomes more nutrient-rich as it approaches Collooney. Much of its length is slow-moving but it has two steeper stretches, one with rapids above Lisconny and the other in Markree.

The Owenbeg joins the Owenmore above Collooney where a series of waterfalls occurs behind the town. The Unshin comes in just below and they flow northwest through the Collooney Gap in the Ox Mountains to Ballysadare. Another waterfall takes the river into the muddy Ballysadare Bay where it meanders to the sea. Two minor streams enter the Owenmore between Collooney and Ballysadare taking drainage water from the northern slopes of the Ox Mountains.

The stream and river channels total 312 km in the Owenmore sub-catchment 211 km in the Unshin and 99 km in the Owenbeg. A stream order analysis (Table 1) gives a good impression of the size of channel. First order streams are those flowing from the various sources, springs or bogs. Where two first order streams meet, the flow becomes a second order stream and where two seconds meet, a third order, etc.

TABLE 1 Length (km) of each stream order in the Owenmore system.

Stream Order	Owenmore	Unshin	Owenbeg	Greater Owenmore	Total
1	165	129	60	7	361
2	70	44	17	2	133
3	39	24	4	-	67
4	38	14	18	-	70
5	-	-	_	8	8
Total	312	211	99	17	639

Note: The greater Owenmore is that river plus its tributaries below the confluence of the Unshin at Collooney.

## 1.3 THE LAKES

The catchment contains about 1,470 ha of standing water, made up of 41 lakes. Of the total area, 1,210 ha is in Lough Arrow and 100 ha in Templehouse Lake. The other major lakes are Cloonakillina, Cloonacleigha, and Ballygawley. Three hill lakes occur in the Ox Mountains but otherwise the lakes lie between 27m (Ballygawley) and 94m (Fin Lake). The great majority of lakes are less than 25 ha in extent, indeed almost half the lakes are 0-5 ha in size.

While all lakes fluctuate somewhat over the year, Templehouse Lake experiences the most winter flooding because of its position halfway down the Owenmore catchment. Its shores are inundated once or several times each year, isolating the island at the south end and covering all of the former lake bed around the edge (see below).

A group of turloughs occurs in the south-west corner of the catchment around Tobercurry (Figure 4). This is an area free for the most part of glacial till so that the water table can rise and fall unimpeded by the clay prevalent elsewhere. Many of the turlough basins are small and peat has accumulated in about half of them. A fluctuating lake of turlough type also occurs beside Riverstown while there is a high level example at Greenan on the southern slopes of Keshcorran.

## 1.4 ARTERIAL DRAINAGE

#### **1.4.1 PREVIOUS SCHEMES**

A considerable part of the Owenmore branch was subject to drainage in the past under the 1926 Owenmore Act. Many stretches of the channel were deepened in 1927-36 where these were formed of loose sediments but the intervening rocky ridges were not removed. The bed level of the river retains some of these (over-deepened) profiles today. The overall result was limited in its effect on nearby agricultural land though a lack of maintenance on the field drains probably contributed to this in later years. It did, however, lower some lake levels significantly. Cloonakillina lost half its area which is now covered by a skin of floating sedges, Cloonacleigha and Templehouse were reduced also, the latter by 1.5 m (Perceval, pers. comm.) which exposed a large section of old lake bed, particularly in the SE corner.

Drainage in the other sub-catchments has been sporadic and of extent (Howard, comm.). the Unshin, limited pers. In Toberscanavan was drained westwards into the Owenmore, resulting in the one former lake splitting into two. Clooskirt Lough near Coola was drained into the Douglas River turning it into a floating scraw. A major southern tributary



of the Owenbeg which entered above Billa Bridge was also diverted eastwards at St. Fechin's Bridge to the Owenmore. This may have been part of the work carried out after 1843 when the Coolaney Drainage District was created. More recently some of its headwaters around Killoran have been drained.

## 1.4.2 PRESENT SCHEME

The scheme now proposed will extend to 390 km of the total channel length of 639 km. No drainage is planned on the Owenbeg above Billa. On the Unshin it will end at the eel weir in Lissycoyne, 2.3 km from Lough Arrow. The Owenmore, in contrast, will be deepened almost to its source (Figure 5). The reason for these differences is largely an economic one depending on the amount of affected land that would benefit from drainage. The Owenmore scheme has been designed currently on a figure of 50-60 benefitting acres per mile of channel (14 ha/km) so channels will be included only where they have this amount of wet land near at hand or lead to more substantial areas upstream (Martin, pers. comm.).

average the channel bed will be deepened by 1-1.5m On resulting in a drop in soil water table of 60-100cm. No new channels will be cut except for the straightening of two short meandering sections including a tributary of the Unshin below Riverstown. The smaller lakes (those below 3 ha or so) will generally be treated as part of the river system so that a channel is dug right up to their inflow and outflow. The however will be treated so as to retain larger lakes approximately their summer level either by a sluice or a graduation of bed levels just downstream. Swallow holes and turloughs are not included in the scheme on principle, as it has been found that their drainage give rise to endless problems of water rights.

It is current practice (J. Martin, pers. comm.) for drainage work to be carried out from one side of the river only so that one bank remains intact on any particular stretch. Land holdings and agreement with the landowners will dictate which bank is used at any point. Spoil will generally be piled on the bank but will be removed in the vicinity of major bridges. In the normal course of events it will be used to fill in lowlying land (old meanders etc.) in the flood plain.

The later take-up of field drainage by the local farmers depends on the level of FDS grants that will be available. It is generally taken at a figure of 50-90% of affected land though its extent and location depends on the landowners involved. In this report, it will be regarded as 70% (i.e. that 70% of affected land near a channel that is to be deepened, will eventually be drained and converted to full agricultural use).



## SECTION 2 - WILDLIFE SURVEYS

#### Introduction

J

The purpose of the surveys described in this report was to establish baseline information about the vegetation and birdlife of the affected land in the Owenmore catchment. From this can be derived an idea of its ecological importance relative to other parts of the country and also an assessment of the impacts of the proposed drainage. Since sampling was extensive over the catchment it is likely that the majority of sites with features of particular interest, which can be considered areas of scientific interest, were found.

## 2.1 BOTANICAL SURVEY

The botanical survey described the vegetation of the affected land in terms of its species content and structure. The current state of management was also considered important as the land in question is actual or potential farmland and its vegetation can change very significantly under differing management, even without drainage. If drainage is carried out and later a follow-up ecological study, it will be essential to know how the land was formerly managed in order to record accurately the changes due to drainage.

land sampled affected was survey the During the comprehensively and its vegetation mapped on a field-by-field basis onto the 6" maps. Visually distinct units of vegetation were chosen and a species list in rough order of abundance was assembled for each, while walking through it. The species-abundance lists were later sorted by hand into 30 community types aided by an analysis of 70 releves collected early in the fieldwork and augmented by management and soil details recorded on each site visit. Three observers were involved, spending a total of 155 days in the field in the period June-October 1988. This resulted in the accumulation of data on 214 separate sites usually defined by topography. The vegetation 6187 ha was mapped and 2,024 species-abundance lists of collected: in addition 237 lists of species in drains and rivers were taken. Details of coverage on a subcatchment basis are given in Table 3 and a visual impression by Figure All field cards and field maps have been retained in the 6. National Parks and Wildlife Service where there is also a master set of 6" maps coloured to show the plant communities recorded in each site. An index to the 214 sites on Figure 6 is included as Table 2.



[]

 $\Box$ 

TABLE 3. Index to the sites marked on Figure 6. All maps are Sligo O.S. sheets unless stated.

۲ : اب

].

]

٦

SITE NO.	NAME	6"0.5.	SITE NAME NO.		6"	0.5.
1	CORRAN L.	26	42	SNIGEEN/		
2	RATHDOONY	33		CLOONACALTRY	3	39
3	KILBRATTAN	33	43	CLOONCUNNY/		
4	BALLYDAWLEY	20		KNOCKNAGORE/		
5	TEMPLEHOUSE L	33		KILTYTEIGE	3	39
6	GLEN	26	44	DERNAGRAUG	4	4
7	CARROWREAGH	40	45	TUNNAGH/		
8	CLOONANURE (1)	44		CLOONCUNNY	3	39
9	BEARVAISH, COAGH	39	46	CLOONANURE (2)	4	4
10	CLOONAKILLINA	52 Mayo	47	CLOONEAGH	4	4
11	DOOCASTLE	52 Mayo	48	MOYDOUGH	4	4
12	TURLOUGHMOR	38 -	49	BALLYSADARE W.	2	20
			50	BRICKEEN	3	34
13	BELLANASCARROW		51	LILLYBROOK	4	10
	L.	33	52	BELLARUSH	3	34
14	ARDREA L.	33	53	CLOONYMEENAGHAN		
15	DOOBEG	33		/CLOONGAD	3	34
16	CLETTY	33	54	CLEAVRY L.	3	34
17	DOONGLOON L.	32	55	CLOONYMEENAGHAN		
18	TAWNAVOULTRY	32		LOUGH	3	34
18B	CARROWCLARE	33	56	TANNAGH	3	34
19	LISLEA	32	57	TOBERNAGLASHY/	-	
20	TULLYHUGH	32	• ·	EMLAGH/OGHAM	3	34
21	KILLAWEE L.	32	58	ARDAGH/FIDWOG		34
22	CLOONAGUN	39	59	CARTROWROE	3	33
23	LISANANNY	39	60	CARROWKEEL	3	33
24	GREENAN	40	61	BALLYGAWLEY	2	20
25	TOBERSCANAVAN L	26	62	EMLAGH		
26	DOORLY	26		[KILSHALVY]	3	39
27	KINGSBROOK	34	63	CLOONENA/TUNNAGH	3	39
			64	ARDMINNAN	3	19
28	AGHALENANE	34	65	LISSANANNY/		
29	BALLINAFAD	40		CLOONEEN RIVER/		
				KNOCKANIMMA	3	19
30	HOLLYBROOK	40	65A	KNOCKRAWER	3	9
31	MOVMLOUGH	26	66	LISANANNY	3	19
32	HALFOUARTER	26	67	GORTEEN	4	4
22	KNOXSPARK	20	68	COOPERSHILL	2	27
33	CORHAWNAGH	20	69	LISBANAGHER	2	27
35	TEMPLEVANNY	40	70	CARROWNSPURRAUN	2	27
36	CLOONEEN	33	71	CLOOSKIRT	2	.7
30	RIVERSTOWN 2	7/34	72	TUNNAGH L.	2	.7
38	CARRIGEENROE	33	73	SRAHNANAGH	2	.7
39	CLOONACLETCHA L	32	74	CARTRONDUFFY	2	.7
40	CARROWCRORY	40	75	CLOONENROE	2	6
41	BUNNAMUCK	39	76	FEENAGH L.	3	9
		-				

77	DAVEN L.	39
78	LISCONNY/LACKAGH	26/27
79	TURNALAYDAN	27
80	KNOCKANARROW	27
81	DOWREA	27
82	CARROWNAGARK/	34
	KILMORGAN	
83	DRUMCORMICK/	34
<b>.</b> .	CAPPAGH	_
84	ARDLEE	34
85	BRICKLIEVE	34
0 C O		34
00 97	DOONSHEHEEN	34
07	L. DARGAN	21
80	VITRO22	21
90		40
90 91	CLOONMACDUFF CREVETEID	20
92		44
92	SDACH	44
94	BELLANALACH /	44
54	OGHAM	20
95	KNOCKNAGEEHA	20
96	ARDRAHEEN BEG	20
97	KNOCKNASKFAGH	20
98	KNOCKNASKEAGH BOG	20
99	DOUGLAS R.	27
100	EMLAGH	27
101	KNOCKAUN 27	/34
102	ROSSMORE	27
103	CARRICKCOOLA	27
104	ARDBOY	27
105	RATHDOONY MOR	33
106	RATHDOONY BEG	33
106B	MARKREE	26
107	MEELICK PK/	
	FLOWERHILL	38
108	BALLINAVALLY E.	38
109	DRINAWN	38
110	DOONALLY	27
	KILVARNET N. (1)	25
112	FIN L.	25
111		25
115	DRUMDIVNAGH	25
116	RISHEEN L.	25
117	RATHGRAN 25/	26
110		25
110	KNOCKATOTAWN	25
120	KILLORAN N LOUGH	25
121	CARDOWNEDEN	25
122	CARROWNASKFAGH	20
123	CARROWNABIINNY	25
124	KNOCKADOO	25
125	CARROWNTANY	25
126	FETHERNEEN	26

127 128 129 130	ARDSALLAGH/ARDE TIEVEBOY ARDREE EMLAGH CLOONEEN	Ε	33 33 39 39
132 133 134 135 136 137 138 139 140 141 142 143 144	(DRUMFIN) NEWPARK ARDCREE RANAGHAN MOR CURRAGHANIRON BILLA BRIDGE ANNAGHBEG/GLEN ANNAGHBEG TOBERBRIDE KNOCKBEG EAST KNOCKMULLIN LISANEENY SCHOOI CARRICKBANAGHE LISANEENY DEMESNE	L	336666226 2266226 266226 266226 266226 26
$145 \\ 146 \\ 147 \\ 148 \\ 149 \\ 150 \\ 151 \\ 1554 \\ 1556 \\ 157 \\ 158 \\ 160 \\ 161 \\$	KNOCKNASHAMMER KNOCKNAHOO GORTYGARA MOYRUSH ACHONRY TAWNAVOULTRY TULLYHUGH CLARAGH BLACKWOOD COOLTEEN LISRUNTAGH BALLYNACARROW ROADSTOWN ACHONRY HSE CHAFFPOOL QUARRYFIELD E. QUARRYFIELD W.	26/	44 44 30 322 326 388 388 388 388 388 388 388 388 388 38
162 163 164 165 166 167 168 169 170 171 172 173 174	KNOCKNACRUSHA SHANCARRIGEEN KNOCKNAHOO WOOD-HILL LEECARROW RAGWOOD CLOONSILLA CLOONLAHEEN CLOGHNAKILCOILLA KILFREE CARRICKNAGAT KNOCKNATOBER BALLYSUMAGHAN	38/ 33/ 39/ .GH 27/	39 39 39 38 44 44 44 21 21 27
175	LURGAN	:	27

Π

 176
 CASTLE L.
 27
 196
 MURILLYROE
 34

 177
 GADDANBEG
 27
 197
 CLOGHFIN
 26/27

 178
 BEARVAISH
 39
 198
 GORTALOUGH
 40

 179
 KNOCKANAHER
 39
 199
 MAGHERANORE
 39

 180
 ROOSKY BEG
 39
 200
 LEITRIM SOUTH
 38

 181
 LOUGHANKEDY
 3
 201
 CARROWEELEEN
 40/34

 (Roscommon)
 202
 DRUMRAINE
 34

 182
 DERRLEA
 40
 203
 DAGHLONAGH
 40

 183
 BALLYNARY
 40
 204
 KESH
 39

 184
 UNION WOOD
 20
 205
 CORHAWNAGH (2)
 20

 185
 LAVINSCARTON 21/26/20/25
 206
 ANNAGHCARTHY
 34

 186
 KILVARNET NORTH
 207
 DOONGEELAGH
 34

 (2)
 25/32
 208
 DRUMSHINNAGH
 34

 187
 CLARAGH IRISH
 32
 209
 CARROWCUSHCLY
 33

 188
 KILLORAN S.
 25/

i.

J

J

TABLE 3. Area of affected land sampled in each subcatchment during vegetation survey.

	Owenmore	Unshin	Owenbeg	Greater Owenmore	Total
Total (ha)	5637	2318	427	120	8502
Sampled %	3754 67	1901 82	379 89	84	73

Π

Π

 $\Box$ 

Π

Note: Cutover peat was not generally visited and this accounts for the relatively low Owenmore figure.

The field card data were examined to discover and evaluate sites for their ecological interest (Section 3). Evaluation was based on rarity of species or of semi-natural communities and on diversity within a site. A high vegetation diversity may indicate ecological interest and sites of more than average diversity were examined in more detail (Section 3.1.4). Subsidiary factors of size, human interference, ease of conservation etc. were taken into account and are discussed in the site descriptions (Section 3.3 ) of the areas of scientific interest.

The impact of the proposed drainage scheme (Section 4) was assessed in the light of general ecological knowledge of species and vegetation requirements on the wet/dry gradient. The Moy catchment west of Tobercurry and south to Swinford was also visited as it is a drained river on very similar rock and soil types.

# 2.1.1 RESULTS

The vegetation of the affected land is determined primarily by water content, nutrient levels and agricultural management. It may be divided (Table 4) into five main categories depending on which of these factors is predominant. The code numbers used on maps and field cards are given in brackets after each community.

TABLE 4. Vegetation types recorded in the catchment.

SWAMP	TALL GRASS	SHORT GRASS	PEATLAND	WOODLAND
Reedbed(4A-ii) Emergent Sedge(4A-i) Scraw(4A-iii) Floodsedge(2E) Calcareous Fen(4D)	Reedgrass(1G) Tall Herb(1B) Tall Tussock(1A) Rush-Iris(3K) Rush-Grass(3H) Rush-Sedge(3G)	Floodgrass(1D) Wet Meadow(6A) Damp Meadow(6J) Poor Pasture(3J) Fen Pasture(6F) Lolium Grassland(3A) Dry Grassland(3E)	Raised Bog(2R) Cutover Bog(2P) Molinia Cutover(2C) Enriched Cutaway(2H) Dry Sedge(2I) Acid Grass(3I) Peaty Cutover(3C) Scrub Cutover(2D)	Willow(4H-i) Alder (4H-ii) Deciduous(2N) Conifer(2O)

A short description of the communities is given below where they are dealt with by category - swamp, tall grass etc. Fuller details are contained in Appendix 1, where their phytosociological affinities are also discussed. Their extent is shown in Table 5 and a summary of their characteristics in Table 6.

# 2.1.1.1 <u>Swamp Vegetation</u>

# a) EMERGENT VEGETATION (4A)

 $\Box$ 

The composition of emergent communities varies from site to on the success of the potentially dominant site depending plants such as \*Phragmites, Scirpus lacustris or the larger Carex species. Where one is established it seems to exclude the others. Alternatively, such communities may be based on a floating raft or scraw of such pioneers as *Menyanthes* or *Potentilla palustris*. For these reasons emergent vegetation is divided into <u>Emergent Sedge</u> (4A-i), <u>Reedbed</u> (4A-ii) and <u>Scraw</u> (4A-iii). Emergent Sedge is based on *Carex elata* and *C*. rostrata, sometimes with the addition of C. aquatilis, C. acuta, C. lasiocarpa or C. acutiformis. Reedbed consists of Phragmites or Scirpus lacustris usually with Equisetum fluviatile and C. rostrata. Scraw is often more varied and may involve any of the above Carex species as well as Menyanthes. Cicuta is a frequent broad-leaved plant here (though it grows through other emergent vegetation also), as are Hippuris, Lysimachia vulgaris and Rumex hydrolapathum. Scraw forming species seem to be favoured by sudden changes in water level on both Cloonakillina and Clooskirt they flourished after drainage though are now giving way to sedges.

Emergent vegetation is best developed on the edges of sheltered eutrophic lakes and rivers where it builds up on its own peaty substrate. All in all this vegetation covers 1.6% of affected land, its largest stands being on Cloonakillina and beside Cloonacleigha and Templehouse Loughs. It is occasionally grazed at times of low water.

b) FLOODSEDGE (2E, 4G on a few field cards - these categories were later combined)

This community is an oligotrophic swamp characterised by sedges or Equisetum fluviatile growing in shallow water. There are two distinct types dependant on base status. Carex diandra is common in ponds in cutover bog close to the marl layer and around some lakes, Carex rostrata and Equisetum fluviatile take over when there is more peat present. Whatever the dominant plants the associates usually include Menyanthes,

\* Generic names are used for the plants unless there is cause for confusion.

TABLE 5. Extent (ha) of vegetation types in Owenmore catchment with importance in each sub-catchment.

# % cover in each sub-catchment

Π

Π

Π

Π

Π

Π

Vegetation Type	Area in Catchment	% of total 	Owenmore	Unshin	Owenbeg	Greater Owenmore
Cutover bog (2P) Damp meadow (6J) Fen pasture (6F) Rush-sedge (3G) Rush-Iris (3K) Conifer wood (2O) Molinia cutover (24)	1335 824 603 544 501 468 C) 442	15.7 9.7 7.1 6.4 5.9 5.5 5.2	20.2 9.9 4.6 6.7 4.8 3.8 6.2	6.7 10.6 12.3 5.5 8.9 7.3 2.7	15.7 5.4 7.1 7.2 2.7 0.3 9.4	- 5.9 7.7 4.3 52.5 0.2
Poor pasture (3J) Rush-grass (3H) Wet meadow (6A) Scrub cutover (2D) Tall tussock (1A) Tall herb (1B) Enriched cutaway (1	433 399 340 332 306 280 2H) 238	5.1 4.7 4.0 3.9 3.6 3.3 2.8	5.6 3.7 4.4 2.8 4.4 2.5 2.7	3.7 6.2 3.3 6.3 2.2 5.4 2.2	10.5 9.8 3.3 5.1 0.6 7.4 2.9	- 0.2 - 3.2 3.2 2.7
Lolium grassland ( Dry sedge (2I) Raised bog (2R) Deciduous wood (2N Dry grassland (3E) Emergent marsh (all 4A)	3A) 204 204 187 ) 187 144 136	2.4 2.4 2.2 2.2 1.7 1.6	2.4 2.5 3.4 2.0 1.5 1.0	2.5 1.7 0.2 3.0 1.6 1.4	2.9 4.3 - 0.4 3.5 0.2	2.5 - - 5.4 5.9
Wet woodland (all Flood sedge (2E) Acid grass (3I) Willow wood (4H-i) Reed bed (4A-ii) Emergent sedge (4A- Floodgrass (1D) Calcareous fen (4D)	4H) 85 77 76 68 59 -i) 51 51 9 42	1.0 0.9 0.8 0.7 0.6 0.6 0.5	1.1 0.6 0.8 1.1 0.6 0.9 0.7 0.6	1.0 1.5 1.4 0.5 0.7 0.1 0.5 0.2	- 1.6 - 0.2 - 0.2	0.5 - 0.5 5.9 - 4.7
Scraw (4A-iii) Peaty cutover (3C) Reed grass (1G) Alder wood (4H-ii) Tillage	25 25 17 17 9	0.3 0.3 0.2 0.2 0.1	0.2 0.3 0.1 0.1	0.6 0.2 0.5 0.4	0.4	0.9

TABLE 6. Species richness and other features of vegetation types. In soil O =organic, M =mineral.

					No. sp	ecies	
	Ht(cm)	Soil		Total	Prese >50%	nce > 5%	Rare spp in catchment
a) SWAMP Reed bed (4A-ii Emergent sedge (4a-i) Scraw (4A-iii)	) 200 120	0 0/м	) )	93	1	40	10
Flood sedge	40	0	,	95	2	39	_
<ul> <li>b) TALL GRASS</li> <li>Reed grass (1G)</li> <li>Tall herb (1B)</li> <li>Tall tussock (1.</li> <li>Rush-Iris (3K)</li> <li>Rush-grass (3H)</li> <li>c) SHORT GRASS</li> <li>Flood grass (1D)</li> <li>Wet meadow (6A)</li> <li>Damp meadow (6J)</li> <li>Poor pasture (3)</li> </ul>	200 130 A) 150 140 140 ) 30 ~100 ) ~ 80 J) 50	0 0/M M 0/M 0/M 0/M M		43 122 82 101 48 68 72 88 62	3 2 4 3 4 3 4 4 4	10 42 38 42 34 40 35 36 32	1 3 - - 3 -
Fen pasture (6F Calcareous fen( Lolium grassland	) 60 4D) 40 d ~60	0/M M 0/M		140 123 66	3 6 1	68 75 27	6 11 -
(3A) Dry grassland(3)	E) ~60	0/M		78	2	26	-
d) PEATLAND Raised bog (2R) Cutover bog (2P <i>Molinia</i> cutover Enriched cutaway Dry sedge (2J) Rush-sedge (3G) Acid grass (3J) Peaty cutover (30 Scrub cutover (30)	) (2C) Y(2H) C) 2D)	0 0/M 0 0 0 0		112 136 96 102 48 55	no data no data 2 5 3 6 2 2 no data	33 81 46 52 30 30	3 2
e) WOODLAND Willow wood (4H- Alder wood (4H- Deciduous wood Conifer wood (20	-i) ii) (2H) O)	M O/M M O/M			no data no data no data no data		- 1 4 -

.

Potentilla palustris and Galium palustre. Carex nigra is usually present grading the community into Rush-Sedge, Rush-Grass or Fen Pasture depending on substrate.

Floodsedge occurs in peaty depressions either within a cutover or at the edge of the more oligotrophic lakes. The vegetation also develops where water accumulates on low-lying ground with no easy outfall so may be found in old river meanders and valley bottoms. It covers less than 1% of the total affected land, usually in small patches.

#### 2.1.1.2 <u>Tall grass vegetation</u>

## a) REEDGRASS (1G)

A special development of the tall herb community is often found along riverbanks. In this, *Phalaris* plays the major role with *Urtica dioica* and *Filipendula* frequently present also. The vegetation is tall (1.5 - 2.5m) and dense and is species poor, without bryophytes. *Epilobium hirsutum, Deschampsia cespitosa* and *Juncus effusus* are the only regularly occurring herbs but willows (*Salix cinerea, S. viminalis*) are characteristic if sparse.

Π

Π

Π

Reedgrass grows on nutrient-rich riverbanks where flood debris accumulates. The soil is alluvium, an intimate mixture of peat and silt so the community occurs on valley bottoms where bogs have been cut down to flood level or where rivers are relatively eutrophic. Since it grows in narrow strips, it is not always possible to map and may be slightly more frequent than its 0.2% coverage suggests. It is most widespread beside the Unshin where in one place it contains the rare grass Poa palustris.

b) TALL HERB (1B)

The Tall Herb community is based on broad-leaved species, especially Filipendula ulmaria which out-competes Juncus effusus in eutrophic and ungrazed sites. Other species such as Valeriana, Angelica and sometimes Iris are found also with the tall grasses Festuca arundinacea and Deschampsia cespitosa. This is a layered community with a ground cover of Carex disticha, Agrostis stolonifera and Ranunculus repens.

Tall Herb grows on a silty peat of fairly high nutrient status. It occurs therefore on the floodplain of streams and rivers and sometimes on low-lying cutaways. In modified form it is found in the lower reaches of some turloughs though grazing here and elsewhere leads to its disappearance. Most of its sites are suitable for grazing or mowing (in a dry summer) so its occurrence is haphazard depending on farming patterns. It covers 3.3% of the affected land in the catchment, being most frequent in the Unshin valley and least found in the Owenbeg. Large stands occur near Corran Lake, in Coopershill and Cloonmacduff (lower Unshin).

## c) TALL TUSSOCK (1A)

This community is marked by the constancy of Juncus effusus and Deschampsia cespitosa giving a tall (1.5m) rather uniform vegetation of pronounced tussocks and intervening hollows. Agrostis stolonifera, Filipendula, Carex disticha and Ranunculus repens are frequently present with Glyceria fluitans, R. flammula or Iris in more permanent water tracks.

Tall Tussock is found on low-lying land beside ditches or in the floodplain of fairly oligotrophic rivers. The soil is normally a peaty gley but can be almost pure peat when turf cutting has reduced bank levels and allowed seasonal flooding. The community is subject to grazing though not attractive to animals. It is occasionally mown and even burnt to control rushes. It covers 3.6% of all the affected land and is distinctly more common in the Owenmore catchment when it is found along many valleys between Gorteen and Ballymote. There is also a large stand on the lower Unshin at Cloonmacduff.

## d) RUSH-IRIS (3K)

Iris is the most prominent plant in this community and it shares dominance with Juncus effusus. The rushes never achieve the importance they have in Rush-Grass (3H) perhaps because are nutritionally richer and there the sites are more Agrostis stolonifera, Filipendula competitor species. and while grassland repens are ubiquitous Ranunculus species include Cynosurus and Phleum pratense, Carex disticha (and C. nigra) and Trifolium repens. Juncus inflexus sometimes is present with Deschampsia cespitosa, may indicate which, seasonal flooding.

The community is characteristic of sites with ground water seepage or where surface run-off is concentrated. It occurs, for example, along the base of a drumlin or at the edge of a river flood plain. The soil is gleyed and there is little organic matter in it. Slightly more peat in the substrate seems to produce the classic Tall Herb vegetation. The sites are grazed and tend to become poached in winter.

Rush-Iris covers 5.9% of the catchment and is most frequent in the Unshin valley around Markree.

#### e) RUSH-GRASS (3H)

Rush-Grass appears as an almost pure stand of Juncus effusus but other species are mixed in to give an average level of species richness. Agrostis stolonifera and A. capillaris are frequent in the understorey along with Ranunculus repens and Filipendula. Three noticeable species though they may be widely scattered, are Stellaria graminea, Cirsium palustre and Senecio aquaticus. The latter two become more frequent as grazing intensity increases. The vegetation tends to become

acid with Rumex acetosa, Festuca rubra, Anthoxanthum and Potentilla erecta.

This community is characteristic of permanently damp sites where leaching outweighs the effects of winter flooding and the soil is a peaty gley or gleyed peat. It seems almost a plagioclimax that will develop on any ill-drained soil with permanent light grazing. Occasional mowing has little effect because of the persistence of the *Juncus* clumps but the community can be converted to poor pasture with fertilisers and some drainage.

Rush-Grass covers 4.7% of the affected land and occurs at above average levels in the Unshin and Owenbeg. It is well spread throughout the area.

# 2.1.1.3 <u>Short grass vegetation</u>

#### a) FLOODGRASS (1D)

The Floodgrass community is a simple one consisting of two main grasses (Agrostis stolonifera and Glyceria fluitans) with a variety of wetland herbs. Myosotis scorpioides is the most characteristic but Caltha palustris, Cardamine pratensis, Senecio aquaticus and Iris usually occur, sometimes with Rorippa palustris, Veronica anagallis - aquatica or V. catenata.

The community occurs on good alluvial soils that flood regularly but dry out to be grazed quite heaving. It is found therefore on riverbanks and in field corners close to drains. During floods the grasses float and may even a rm a scraw. A variant of it occurs in turloughs, especially in clayey, closely grazed ones like Doocastle.

b) WET MEADOW (6A)

Ranunculus repens is the most constant member of the Wet Meadow vegetation but more characteristic are Carex disticha, Glyceria fluitans, Agrostis stolonifera, Caltha and Juncus effusus. The number of rushes depends on the frequency of mowing: they occur in scattered non-tussocky form, J. effusus being mixed with J. acutiflorus and Eleocharis palustris. Filipendula and Phalaris survive annual mowing and are frequently common, Rumex acetosa and Senecio aquaticus somewhat less so. This community occurs in the wettest corners of fields and grades into drier meadows with the more frequent occurrence of Poa pratensis, Phleum, Cynosurus and even Lolium perenne.

The watertable is close to the surface for much of the year and mowing machinery sinks into the peaty soil. Flooding is regular in times of high rainfall, both winter and summer. In dry years mowing may occur twice for silage and there is occasionally spreading of manure. The frequent floods maintain

a high nutrient status however. If mowing lapses, Filipendula reasserts itself strongly in the absence of grazing, with cattle the rushes become more frequent and Deschampsia reappears to produce Tall Tussock (1A). Wet Meadow covers 4% of the catchment in stream and river valleys.

# c) DAMP MEADOW (6J)

This community is obviously linked to Wet Meadow (6A) but generally has a greater variety of pasture grasses. Although the dominant species may again be Agrostis stolonifera, there always good amounts of Cynosurus, frequently of Poa are pratensis and Lolium, and usually some Alopecurus pratensis, Phleum and Festuca pratensis also. Filipendula and Ranunculus repens remain common but the lower water content and even slight leaching allows Anthoxanthum, Festuca rubra and much Holcus lanatus. Rosette-forming plants are frequent: Taraxacum Leontodon autumnale and Plantago lanceolata are spp., characteristic and Bellis and Alchemilla spp. occasional. The of docks, especially Rumex obtusifolius, occurrence is probably linked to the use of slurry or manure though R. crispus may be natural close to ditches.

Damp Meadow occurs very widely in the catchment. At 9.7% it is second in importance only to cutover bog. The sites lie somewhat above the valley bottoms in most cases though they may extend right up to the riverbanks if summer water levels drop in the channel, as in the Owenbeg. They are maintained by annual mowing which opens up the vegetation and allows quite a number of species to persist. The community is notably rarer in the Owenbeg catchment than elsewhere.

# d) POOR PASTURE (3J)

Poor Pasture may be characterized as a Cynosurus - Juncus effusus mixture with significant amounts of Agrostis stolonifera, Filipendula and Holcus lanatus. Grass species are much less varied than in wetter grasslands though there is relatively more Agrostis capillaris and Anthoxanthum as well as more Carex panicea. Because the community is grazed and not mown the rushes are clumped: Cirsium palustre and Senecio aquaticus are also more common. The species list of poor pasture is relatively restricted but Prunella and Rhinanthus are more frequent here than elsewhere.

The vegetation type occurs generally on a mineral soil which is seasonally gleyed and sometimes significantly poached. It is the mineral equivalent of Rush-Sedge (3G) but because of its higher nutrient status is grazed more intensively. It may be derived from Rush-Grass (3H) by sustained mowing or spraying coupled with some drainage.

Poor Pasture covers 5.1% of the affected land and occurs in greatest abundance near the Owenbeg/Owenmore confluence on alluvial soils. It seems a relatively stable community representing the level to which reseeded *Lolium* fields

degenerate without intensive management and to which the normal rushy fields can be improved without major investment.

#### e) FEN PASTURE (6F)

This community is the damp herb-rich grassland that is flooded times in the winter and grazed in summer. It is a at characterized by Carex sedge/rush fen nigra, Juncus acutiflorus, Filipendula and Mentha aquatica. It is the most species-rich vegetation type identified and among the prominent species are Carex disticha, Carex panicea, Angelica, Lychnis and Epilobium palustre. Menyanthes and Potentilla palustris are locally important along with Hydrocotyle and Trifolium repens. Bryophytes are common also, especially close lakeshores and where grazing is most intense. Here, to Calliergon cuspidatum, Climacium and Rhytidiadelphus squarrosus are usually found, the latter two often growing on mounds above the lowest level.

Fen Pasture occurs widely in the catchment (7.1%) and is especially frequent near the Unshin. It is characteristic of land regularly flooded by base-rich water from lakes and rivers, occurring behind the tall sedge zones. It holds several of the less common species in the catchment, for example, Stellaria palustris, Achillea ptarmica and Dactylorhiza incarnata.

## f) CALCAREOUS FEN (4D)

Calcareous Fen is a highly distinctive vegetation, of relatively short stature but having a long species list. There is usually some deposition of marl from upwelling ground water. Chara spp grow in any permanent water and mosses are widespread (e.g. Campylium stellatum, Ctenidium molluscum and Drepanocladus sp.). The dominant higher plants include Carex lepidocarpa, Carex panicea, Succisa and Mentha aquatica with almost constant presence of Parnassia. an Grasses are relatively rare but Briza media and Molinia are found. In certain sites other narrow-leaved species play a major role: Eriophorum latifolium, Juncus subnodulosus, Schoenus nigricans and Carex hostiana to name four. The community supports several restricted species, among them Carex dioica, Epipactis palustris, and Selaginella.

Calcareous Fen occurs in the deepest cutaways where the marl layer is exposed but not flooded. More naturally it is found in seepages below drumlins or limestone outcrops, often on valley sides. It is an uncommon community whose largest patches occur on the north sides of the Ox Mountains at Corhawnagh and Knoxpark.

# g) LOLIUM GRASSLAND (3A)

Lolium perenne is the dominant grass in these intensively managed fields with Cynosurus and Trifolium repens subsidiary.

Other species are infrequent: indeed a characteristic of the community is its relative uniformity. There are only 15 species that are anyway frequent (occurring in more than 10% of the lists compiled). These tend to be moisture-loving types like *Filipendula*, *Juncus effusus*, *Ranunculus repens* and *Iris*. Vigorous *Rumex* species are also noticeable, as are nettles in places.

It seems that this community may be produced on any of the catchment soils if sufficient inputs are given. It certainly occurs on peatland and mineral sites, in dry and fairly wet soils. It is perhaps most characteristic of peaty gleys that have been field drained but remain susceptible to winter floods. Such fields can be used for silage, hay or for grazing. They cover 2.4% of affected land spread very evenly over the catchment. This again implies that site conditions are not critical provided there is intensive management.

#### h) DRY GRASSLAND (3E)

Dryish sites on riverbank soils or where field drainage is effective often bear a Cynosurus community with few clumps of rushes but with Senecio jacobaea and Cirsium arvense as a distinct element. There is a significant amount of Lolium, of Plantago lanceolata, Holcus lanatus, Festuca rubra and Trifolium spp. Filipendula, Senecio aquaticus, Rumex acetosa and Carices are absent for the most part. This vegetation is grazed rather than mown and sometimes receives additional fertiliser. If developed on a mineral soil, cattle may be the main animals but if peat is more prevalent, sheep are better suited. In this case, there is less, if any, Senecio jacobaea.

Dry Pasture is limited in the affected land to 1.9% coverage. It occurs as a natural development along some riverbanks, even on spoil banks from previous drainage. Otherwise, it is usually associated with ryegrass swards and other meadowland.

#### 2.1.1.4 <u>Peatland Vegetation</u>

#### a) RAISED BOG (2R)

These are bogs that retain an intact surface although they may have been dried out by marginal cutting. The plant community is the classical *Erica* tetralix, *Calluna* vulgaris, *Sphagnum* mix, the amount and number of *Sphagnum* species reflecting water conditions of the habitat. *Molinia* and *Scirpus cespitosus* become more frequent as the surface dries out.

This community is easily recognized so species lists were not recorded on field cards. As well as this, previous Wildlife Service surveys had examined the better examples in the catchment. These all occur in the Owenmore close to Cloonakillina Lough. Here Flughany and Derrykinlough are responsible for the major part of the estimated 200 ha in the whole catchment.

# b) CUTOVER BOG (2P)

Cutover Bog is the most frequent vegetation type in the whole catchment, covering 15.7% of the total. This is bog with obvious signs of turf cutting, either in the past or at present. No reclamation has been attempted and neither has there been invasion by trees. Species lists were not taken for this community which is easily recognised. As would be expected, most of this vegetation occurs in the Owenmore catchment, where it covers one fifth of the affected land. It is much less common (7%) in the Unshin.

#### c) MOLINIA CUTOVER (2C)

Bogs that have been dried out by drainage or cutting usually develop vegetation dominated by Molinia with a high proportion of sedges (Carex panicea, Carex nigra), heather (Calluna) and some grass (Agrostis capillaris, Anthoxanthum). Two broadleaved species are characteristic, Succisa and Potentilla erecta and locally there are extensive patches of Cirsium dissectum. This is an even and monotonous vegetation and although the species list is long it contains no rare species. The community is open to grazing though rather unpalatable and cattle seem to encourage plants such as Holcus lanatus, Cirsium palustre, Plantago lanceolata and Juncus spp. As well as this, there is an element of heath with Juncus squarrosus, Carex binervis and Galium saxatile and sometimes hollows with Sphagnum spp.

Molinia Cutover occurs on the edges of bogs and on flat cutovers where there is surface water movement in wet weather and, probably, periodic burning. It covers 5.2% of the catchment, mostly in small patches on the fringes of bog areas. The largest area occurs near Killawee Lough, west of Cloonacleigha/Templehouse.

#### d) ENRICHED CUTAWAY (2H)

This community is separated from Dry sedge (above) by plant species that are nutrient demanding, though it may have the same dominant sedges or Molinia. Parnassia is a main indicator species together with Carex lepidocarpa, C. flacca and Mentha aquatica. A suite of fen species may occur, including Briza, Hydrocotyle, Anagallis tenella and Sagina nodosa. In the wetter sites rushes are frequent, Juncus acutiflorus, J. articulatus, J. subnodulosus and J. inflexus showing the availability of minerals.

The vegetation is found where peat cutting has reached ground water influence. Sometimes the underlying marl is visible and in extensive areas this gives rise to calcareous fen (4D). Because of its anthropogenic origins, enriched cutaway is normally heterogeneous and odd peat banks or fragments of other communities can be incorporated in it. It is usually

very species-rich for this reason and contains some of the less common species in the catchment, for example the orchids *Platanthera* spp and *Gymnadenia*. It covers 2.8% of the affected land and with greater frequency in the Owenbeg catchment than elsewhere.

#### e) DRY SEDGE (21)

The Dry Sedge community is a dwarf (20 cm) and distinctive type of vegetation dominated by Carex panicea, C. nigra, C. echinata and a little C. demissa. The blueness of the Carex panicea leaves is accentuated in late summer by the flowers of Succisa. The vegetation is obviously related to Molinia cutover (above) as it retains Potentilla erecta, Agrostis capillaris, Molinia and Cirsium dissectum. However there is also a group of wet grassland species such as Filipendula, Leontodon autumnale, Prunella and Cynosurus. A few clumps of Juncus are also found, Juncus effusus and J. conglomeratus being most frequent.

Dry Sedge is typical of low-lying cutover peat that is lightly grazed and trodden. It is now seldom if ever flooded though it does occur sometimes within a river flood plain marking the site of former bogland and often mapped as such on the O.S. sheet. With mineral enrichment from silt or fertiliser it grades into poor grassland.

The community occurs mostly in small patches but in total covers 2.5% of the affected land. It is relatively commoner in the Owenbeg catchment than elsewhere.

# f) RUSH-SEDGE (3G)

This community often seems intermediate between Rush-Grass (3H) and Dry Sedge (2I) but it is more than a mosaic of the two types. Juncus effusus though always present grows with reduced vigour and J. conglomeratus tends to replace it. The sedges Carex panicea and C. nigra form an important part of the cover while Anthoxanthum, Succisa, Potentilla erecta and Molinia also indicate its oligotrophic character. Mosses are noticeable: Rhytidiadelphus squarrosus is at its most frequent in this community and Calliergon cuspidatum is usually present Sometimes more nutrient demanding species occur also. in depressions, including Juncus Leontodon articulatus, autumnale, Centaurea nigra and Trifolium repens.

Rush-Sedge is found on peaty sites with limited mineral content. It seems to be widespread on old cutovers that have dried out but not been intensively drained or managed in other ways except by grazing. Water accumulates on the surface in winter but there is no river flooding. It is a relatively frequent vegetation type (6.4% of affected land) and occurs in small patches wherever there are areas of old bog. Some of the largest stands occur downstream of Templehouse Lough in Clooneen and Ballynacarrow.

## g) ACID GRASS (3I)

Acid grassland develops on drier, peaty sites which are lightly grazed. Tussocks of Festuca rubra and Anthoxanthum produce a sward 25cm in height with Agrostis capillaris filling much of the intervening ground. There is usually some Holcus lanatus, Poa pratensis and Agrostis stolonifera while Potentilla erecta and Succisa are of frequent occurrence. The community is species-poor (48 species in total) and usually some plants from damper grassland like J. effusus, pendula and Rumex acetosa. The grassiness of this has Filipendula and vegetation makes it stand out as well as its general occurrence on raised blocks of peat, above any flooding. Sometimes it appears that Calluna, which might be expected to occur, has been stripped off but grazing by sheep and former scything may have had the same effect. The community covers less than 1% of affected land, usually in small patches adjacent to Molinia cutover or dry sedge.

Π

Π

# h) PEATY CUTOVER (3C)

In a few places there is a distinct community on cutover, of weeds, brambles etc. with much bare peat. This seems to represent a break in the reclamation process where initial levelling and skimming has removed the original vegetation but then the site has been abandoned without reseeding. Arrhenatherum and Dactylis are the two most frequent plants: other grasses include Festuca rubra, Agrostis spp, Alopecurus pratensis and Molinia. Holcus lanatus is there too and occasionally H. mollis. The peat remains quite wet, Filipendula, Juncus effusus, Ranunculus repens and Potentilla anserina grow to large size and Iris and Deschampsia cespitosa also occur. The 'weed' species include Urtica dioica, Elymus repens, Rubus fruticosus and occasionally Pteridium aquilinum. Seedling Salix cinerea suggest that without attention such sites will revert to Scrub Cutover (2D).

The community covers a very small fraction (0.3%) of the affected land amongst the bog areas.

# i) SCRUB CUTOVER (2D)

Cutover bog is often colonised by birch and willow trees if left long enough without burning. The trees establish on the drier banks but eventually overhang and obscure the intervening pools and ditches. Pteridium, Rubus fruticosus and Molinia are characteristic of the ground flora, Betula pubescens, Salix aurita and Salix cinerea of the trees. Osmunda and other ferns occur locally on the sides of peat banks.

This community was mapped but not further analysed due to its uniformity. It covers 4% of the catchment.

# 2.1.1.5 <u>Woodland</u>

# a) FLOODING WOODS (4H)

These wet woods occur around lakes whose levels fluctuate over the year and along the larger rivers. They are dominated either by willows or alder and are mapped separately. In their natural form, the Willow Wood (4H-i) consists primarily of Salix cinerea growing in muddy (river) or stony (lakeshore) ground with Filipendula, Valeriana, Agrostis stolonifera and Caltha. The trees cast a light shade and where conditions are mesotrophic, sedges often grow, for example Carex rostrata, C. nigra, C. acutiformis or C. elata. Bryophytes are very frequent: Calliergon cuspidatum may cover the ground with some Plagiomnium while the trees are festooned with lichens (species of Usnea, Parmelia, Ramalina and locally Lobaria). Away from the water's edge the more normal woodland flora comes in, e.g. Carex remota, Chrysosplenium, Urtica etc.

Alder Wood (4H-ii) is more restricted than Willow Wood but occurs around peaty lakes (Toberscanavan) and on wet mineral soil with a constant seepage of water. In the first case *Molinia* shares the ground layer with *Carex acutiformis*, in the second *Deschampsia cespitosa* is most important.

Flooding woods cover 1% of affected land in the catchment and four-fifths of this is willow wood. The two main blocks are at Templehouse Lake and along the Owenmore near Annaghmore.

## b) DECIDUOUS WOOD (2N)

Planted in most cases, these woods contain a mixture of cinerea, species, out of which *Salix* Fraxinus, Acer pseudoplatanus and Quercus are the most frequent. Locally Aesculus, Tilia platyphyllos and even Fagus have been used, but only Acer and Fraxinus are regenerating well. These woods were not analysed in detail since they formed an obvious vegetation type. In many cases they are flooded for short periods in winter but only by exceptional floods in summer (e.g. 1988). They occur all over the area (2.2% of affected land), but are associated most with the estates in the northern parts of the catchments. The Markree and Templehouse woods are the major areas.

#### c) CONIFER WOOD (20)

Like the last woods these were not analysed floristically. They are formed almost exclusively of *Picea sitchensis* (sometimes with *Abies nobilis*) planted on cutover bog, lakeside peat soil, or gleyed mineral ground. They cover 5.5% of the affected land, more frequently in the Unshin than elsewhere. The two largest stands are Union Wood, north of Collooney and the wood around Cloonakillina Lough.

## 2.1.1.6 <u>Tillage</u>

Tilled fields were encountered rarely in the affected land, but there were some small areas of root crops (mainly potatoes) and some reseeded grassland.

Π

Π

Π

Π

Π

Π

Π

## 2.2 ORNITHOLOGICAL SURVEY

The objectives of the ornithological survey were firstly to establish overall bird populations in the catchment both in winter and summer and secondly to compare the density and distribution within the affected and unaffected land so that the impact of drainage could be assessed. Complete coverage of the larger waterbodies was achieved, at least in winter, and regular sampling of the rivers and farmland (Figure 7) was carried out over a 12-month period (August 1988 - July 1989). The methods used are described in detail in Buckley & McCarthy, 1987 and are only briefly summarised below. Some of the results of the survey are given below but assessment of their significance is held over to Section 3.

#### 2.2.1 WINTER

#### 2.2.1.1 <u>Site counts</u>

During 1988/89 winter, all permanent waterbodies and all turloughs within the catchment were visited on the ground and their waterfowl censused on a monthly basis. A single aerial count was carried out in March mainly to assess the combined populations of Templehouse and Cloonacleigha Loughs. The most important sites, those with a maximum of 50 waterfowl or more, are listed in Table 7, and shown in Figure 7. It can be seen that wigeon, teal and mallard were the most frequent species on wetlands other than Lough Arrow. Lough Arrow, by contrast, carried goldeneye, tufted duck, pochard and coot as well as quite large numbers of grebes. Whooper swans were widely distributed in small flocks. The turloughs were important to them when they were flooded, otherwise the birds fed in fields near the larger rivers. As regards waders, Ballysadare Bay stands apart as an estuarine habitat for large numbers of dunlin, curlew, godwit and redshank. Inland the lapwing was the major species with a few flocks of 100-200 and many smaller groups. Curlew were even more spread out and few substantial flocks occurred. However, road transects (see below) established an estimate for curlew that is six times the lapwing population. One of the turloughs (Doocastle) was used by a flock of golden plover early in the season.

- 1

NLAND CATCHMENT OTAL	I	129° 87 71	49° 122	2077.	2006 920	268 671	527	5 <del>4</del> 2 3	186 201	101	74	2 2 2	202	2566	۲ <b>-</b>	•	242	- 7	11 6	
arot baat bersell.	A										• • • •	<b>1</b> 1 1		2067.						
ivers total	ধ	141 444	37° 21	356	704 315		-	12	107		L L	רי	111	5 E E	m		m			
נהזבן צפאנה נובש	S	<u>6</u> 70	102	; <u>1</u>	66 100	14 26		m	۳ ۳ ۳	י	-	1	67	148			28	D	て1	
XV33ROWNACREEVY	5		σ	· -	0 17	7			Ч								۰÷	4		60
UARRYFIELD E.	ð		1 37 <b>°</b>	1	38 9						•	4					, 12	4		61 7
.W QIJITYAAAU(	5		9 <b>9</b> 77	5 E	160 23	Ч			0		10 1	1	1	95			72	4		473 14
<b>JUT2A000</b>	1	-	1 4 <sup>6</sup>	289	142 54	45 15			7		73	, -	7	92	4 4		53			551 19
<b>BELLAUASCARROW</b>	I		7	83	10	m								125						134
SWALLOW HOLE L.	1				4 0 0				7				S							0 64
ИТЯАНЭМ. Л		1	m	4 5	18 6				11 2	1										64
СОВЯВИ АИD Водтноце L.		12	110	10	32 8	9		7	5 P				-							36 13
FEENAGH LOUGH	•	1 5	7	25	12 6	26		1	moo		_									80 11
ARDLEY L. Area				35	9 <del>4</del> 0	4			m		• 19		9	8						116
СГООИАКІГГІИА Г.		7	9 0	28	46 86	4		1	7		210			Ś						11 11
BALLYGAWLEY L.		1 13	1, 7 3 3 7 3 7 3 7 3 7 3 7 3 7 3 7 4 7 4 7 4 7 4 7 4 7 4 7 4 7 4 7 4 7 4	416	163 38	- <del>-</del> -	4		- 10											528 1 14
JATOT X3J9MOD		23.	165. 167	827	654 200	79° 175	ת ٦	- <b>1</b> m	4 V)		1,224		6	22					Ś	24
CLOONACLEIGHA L.		3 12	11 11 12	460	642 200	4 8 r U U 1	<b>1</b>		ოთ		7		m	22					'n	1248 20
TEMPLEHOUSE L.		23 <b>°</b>	1 8 1	407	224 99	140,1	8/	H M	44		224		6							773 18
кояяа нопол		93 <b>.</b> 32 16	11 11 11	14	0.4 4 W	124 400	431	m⊣	170.					58			111	ì	4	194 23
YAB BAADASYJJAB		v r	122	83 52 1546	573 456	:	77	111		607	185 116 662	5760		979 1330	634 25	115	1004		46 73	11978 1 36
	Species	Little grebe Great crested grebe Cormorant	suay Grey heron Mute swan Whooper swan	Brent goose Shelduck Wigeon	Teal Mallard	Pochard Tufted duck	Goldeneye Red-breasted	merganser Water rail	Moorhen Coot	Oystercatcher	Ringed plover Golden plover Lanwing	Dunlin Sanderling	Snipe Bar-tailed	godwit Curlew	Redshank Greenshank	Turnstone Black-headed	gull Common gull	Greater black-	backed gull Herring gull	Max total count 1 Total species no.

Maximum winter counts for wildfowl and waders in main sites with totals for minor sites. Significance levels \*\*National \*Eocal (see Table 21)  $(ag_3^3/g_4)$ TABLE 7.

Notes: Complex total is greatest synchronous count on Templehouse and Cloonacleigha Loughs, maximum total count is the



TABLE 8. River populations of waterfowl in winter (actual census). \* Significance as in Table 7.

		Stre	am size	& location	(SO = Strea	m Order	)
	SO5 All	SO4 Owenmore	SO4 Unshin	SO4 Owenbeg	SO3 Owenmore	SO3 Unshin	TOTAL
Little grebe	1		3			10	14
Cormorant	2	2	5	2		3	*14
Grey heror	n 2	2	3	2			9
Mute Swan		6	7			8	21
Whooper swan		36	22			10	**68
Wigeon	2	261	1			92	356
Teal	3	233	39	21	100	308	**704
Mallard	5	132	37	4	18	64	*260
Water rail		4			•	8	12
Moorhen	8	16	9	2	18	26	79
Lapwing		35					35
Snipe		27	2		18	36	83
Curlew			2		31		33
Redshank	3						3

η

. |
Winter counts were also compiled on the larger sections of rivers. Stream order is used to define river size (see Table 1). These counts show very similar numbers of waterfowl on the lower Owenmore and Unshin (Table 8) but very few on the Owenbeg. The Owenmore does seem to carry more wigeon however, as well as lapwing rather than curlew.

Π

Π

Π

Π

Π

Π

Π

 $\Box$ 

Birds which winter in flocks or are confined to a specific habitat are relatively easy to find and census. Others are found widely dispersed over the countryside in general. In order to assess these populations and thereby to be able to estimate total catchment numbers, a transect method of sampling was used. Transects were of two types - road (car), and foot and so were of different lengths.

#### 2.2.1.2 Road Transects

Road transects are designed to sample species which are generally large, occur in flocks and feed in open fields. Eighteen species were counted in this way, waders (except snipe), corvids, thrushes and starling being the most important. Transects covering 1217 ha within sight of the roads were done in five months (October - February) on seven routes. Each transect was divided into affected and unaffected land. The results (Table 9, overleaf) show that the most abundant species are redwing, fieldfare, starling, jackdaw and rook, followed by magpie, lapwing, curlew and hooded crow. Most of these species are associated more with unaffected rather than affected land though curlew and lapwing did seem to prefer the damper land. The large monthly variation prevented this from being statistically significant.

TABLE 10. Bird species significantly located in S.E. as opposed to N.W. part of catchment.

Species	Chi-squared	Probability due to chance
Redwing	8.44	1%
Fieldfare	5.06	1%
Magpie	9.40	1%
Starling	6.22	1%
Lapwing	4.12	5%
Rook	3.95	5%
Woodpigeon	4.12	5%

TABLE 9. Density of bird species recorded on road transects (birds/ha)

	Affected land	Unaffected land	Average
Fieldfare	0.191	0.673	0.432
Redwing	0.170	0.673	0.422
Jackdaw	0.091	0.206	0.148
Starling	0.087	0.230	0.155
Rook	0.040	0.145	0.092
Lapwing	0.038	-	0.019
Curlew	0.022	0.033	0.012
Magpie	0.016	0.021	0.019
Hooded crow	0.013	0.012	0.013
Whooper swan	0.010	-	0.005
Mistle thrush	0.004	0.007	0.005
Wood pigeon	0.002	0.002	0.002
Pheasant	0.002	0.002	0.002
Kestrel	0.002	0.001	0.001

TABLE 11. Bird densities (birds/km) from foot transects on river channels in winter and summer listed in order of abundance.

Π

0.02

	WINTER			 SU	IMMER		
				~ ·	~ .		
Species	Stream 1 & 2	Order 3-5	All	Species 1	& 2	um Order 3-5	A11
Teal	-	3.58	2.11	Mallard 0	.17	3.1	1.91
Mallard	0.11	1.69	1.05	Grey			
				wagtail O	.44	0.77	0.64
Moorhen	0.06	0.62	0.39	Pied			
0				wagtail	-	0.58	0.34
Grey		0 25	0 01	Common		0 50	0.24
Wagtall	-	0.35	0.21	Sandpiper	-	0.58	0.34
wigeon	-	0.23	0.14	seuge	-	0 27	0 16
Snino	0 06	0 10	0 14	Dinner	_	0.27	0.10
Wron	0.00	0.15	0.14	Kinafisher	_	0.23	0.14
Little	0.11	0.15	0.14	Moorhen	_	0.23	0.14
arebe	-	0.19	0.11	Grev heron	-	0.19	0.11
Grev heron	0.06	0.08	0.07	Reed		0.120	
Mute swan	_	0.12	0.07	bunting	-	0.15	0.09
Dipper	_	0.12	0.07	Mute swan	_	0.12	0.07
Robin	_	0.08	0.05	Chaffinch	-	0.12	0.07
Cormorant	-	0.04	0.02	Red-breasted	L		4
				merganser	-	0.08	0.05/
Whooper sw	an -	0.04	0.02	Bullfinch	-	0.04	0.05
Water rail	-	0.04	0.02	Blackbird	-	0.04	0.05
Kingfisher	· _	0.04	0.02	Black-headed	L		
				gull	-	0.04	0.02
Pied wagta	il -	0.04	0.02	Lesser black	:		
Reed bunti	ng -	0.04	0.02	backed gull	. —	0.04	0.02
Red grouse	0.06	-	0.02	Meadow pipit	: -	0.04	0,02
				Robin	0.07	0.15 /	0.02
				Wren	0.06	- /	0.02

Song thrush 0.06 Wood pigeon 0.06

As regards the distribution of these species over the catchment, the Unshin and Owenmore held very similar densities of most birds (only curlew were more frequent in the Owenmore), which were generally higher than those in the Owenbeg. There were also density differences on a NW-SE axis. Seven birds occurred with greater frequency in the middle and SE parts of the catchment than in the NW (Table 10, previous page). The species concerned, for example, rook, lapwing, fieldfare and woodpigeon, may have a tendency to prefer sheltered drumlin areas with their differences in microclimate as well as trees and hedges.

#### 2.2.1.3 Foot transects

J

J

L

J

L

Transects were also carried out on foot with the purpose of obtaining density figures for solitary and usually small species in the various habitats and on affected and unaffected land. By counting the number of each species and recording their distance from the observer, a satisfactory measure of their density can be derived (Buckley & McCarthy 1987). These transects were walked once during the winter and again during the breeding season (see below). Their routes are marked on 6" O.S.maps deposited in the National Parks & Wildlife Service. They covered the following habitat types:

- A) River channels } All will be subject to drainage even
- B) River corridors if adjacent land is non-affected
- C) Lake margins similarly not all affected land.
- D) Bogs (as mapped by OPW drainage engineers).
- E) Other affected land.
- F) Unaffected land (control sites)
- G) Coniferous woods.

Census results for river channels are summarised in Table 11 and for the other habitats in Table 12. A correlation analysis was done between bird species and vegetation type (see Table 4) and the stasticially significant associations are listed in Table 13.

A) River channels: In this habitat, 22 transects were completed, totalling 44 km. The results are expressed in terms of stream order (approximate size) in Table 11. It may be seen that 19 species occurred in winter, in greatest numbers along the larger stream channels (Order 3-5). Mallard and teal occur at frequencies of 1.05 and 2.11 birds/km, moorhen at 0.39 and wigeon at 0.14 birds/km. First and second order streams and drains are very poor in birds except perhaps for wren and grey heron. As regards seasonality, water rail only occurs on the rivers in winter as do cormorant, snipe and little grebe. B) River corridors: The river corridor encompassess the strip of land on each side of the channel up to 25 m away. It was examined at the same time as the river channels above. Since the habitat includes trees or bushes on the banks and the near part of the floodplain it contains a high number (5.26 birds/ha) and diversity (32 species) of birds, most of which depend on the terrestrial rather than the aquatic environment. Robin, blackbird and wren are the most frequent species in winter (Table 12) followed by goldcrest, meadow pipit, fieldfare and redwing. The snipe is the commonest 'water' bird and the siskin is also found since it feeds on alder seeds.

Π

Π

Π

Π

Π

Most of the deciduous woodland occurs along rivers and those species correlated with woodland (Table 13) are in fact river birds that are associated with them for reasons of food and shelter. Mallard, moorhen, grey wagtail and water rail would qualify here.

C) Lake margins: The type of lakeshore is obviously important to the birds which feed there and those lakes with low-lying margins (i.e affected land) had many more aquatic species as well as greater overall numbers than those without. Snipe for example are restricted to the margins of such lakes as, in most cases, are curlew, water rail, moorhen, meadow pipit and reed bunting. The wintering thrushes by contrast are found on drier (unaffected) lake margins except for blackbird which occurs in both habitats.

All in all lake margins hold a large number of wintering birds at a higher density (5.69 birds/ha) than any other type of affected land. As a habitat, however, it is relatively rare in the catchment. The importance of bushes and trees within reedbeds is brought out by the bird species correlated with swamp vegetation (Table 13). Eight of these are dependent on trees, only one (snipe) on the ground vegetation.

D) Bogs: Bogs are the poorest habitat for birds in the affected land. The 3.7 km of transects recorded 9 species at an average density of 0.67 birds/ha. However they are relatively important to snipe, though only at the same level as general (agricultural) affected land. Meadow pipit and wren were the next most frequent species, while hooded crow were largely restricted to this habitat.

E, F) Affected and unaffected land: A large number (28) of transects were run through low-lying agricultural land away from the major habitat features dealt with above. These were extended into unaffected land as a control to assess the relative importance of the affected land for wintering species. The results (Table 12) show that this habitat supports a high number of species at a lower density than lakeshores, river corridors or indeed conifers. Meadow pipit is the most frequent bird followed by wren, goldcrest, coal

.

TABLE 12. Density of bird species (birds/ha) recorded by foot transects.

Meadow pipit $0.66$ Wren $0.42$ Wren $0.42$ Goldcrest $0.33$ Goldcrest $0.33$ Coal tit $0.30$ Redwing $0.30$ Blackbird $0.24$ Snipe $0.24$ Snipe $0.24$ Snipe $0.24$ Robin $0.18$ Robin $0.18$ Robin $0.18$ Redpoll $0.18$ Plue tit $0.18$ Redpoll $0.10$ Dunnock $0.09$ Song thrush $0.07$ Long-tailed tit $0.06$ Reed bunting $0.03$					
Wren         0.42           Wren         0.33           Goldcrest         0.33           Goldcrest         0.33           Coal tit         0.33           Blackbird         0.30           Snipe         0.24           Snipe         0.24           Snipe         0.24           Snipe         0.24           Snipe         0.18           Robin         0.18           Blue tit         0.18           Fieldfare         0.13           Redpoll         0.10           Dunnock         0.07           Song thrush         0.07           Long-tailed tit         0.06           Reed bunting         0.06					
Goldcrest       0.33         Coal tit       0.33         Coal tit       0.33         Redwing       0.30         Blackbird       0.31         Snipe       0.31         Snipe       0.31         Snipe       0.24         Snipe       0.21         Robin       0.21         Robin       0.18         Blue tit       0.18         Fieldfare       0.13         Redpoll       0.10         Dunnock       0.00         Song thrush       0.00         Keed bunting       0.05         Woodcock       0.06	0.28	0.19	0.32		0.16
Coal tit $0.30$ Redwing $0.30$ Blackbird $0.24$ Snipe $0.21$ Snipe $0.21$ Snipe $0.21$ Robin $0.18$ Robin $0.18$ Blue tit $0.18$ Fieldfare $0.13$ Fieldfare $0.10$ Song thrush $0.07$ Long-tailed tit $0.06$ Reed bunting $0.03$			0.03	0.10	0.21
Redwing         0.30           Blackbird         0.24           Snipe         0.21           Snipe         0.21           Snipe         0.21           Robin         0.21           Robin         0.21           Robin         0.18           Blue tit         0.18           Fieldfare         0.13           Fieldfare         0.10           Dunnock         0.00           Song thrush         0.07           Long-tailed tit         0.06           Reed bunting         0.06		00	0.43	0.07	2.16
Blackbird 0.24 Snipe 0.24 Snipe 0.21 Robin 0.18 Blue tit 0.18 Fieldfare 0.13 Redpoll 0.10 Dunnock 0.00 Song thrush 0.07 Long-tailed tit 0.06 Reed bunting 0.05 Woodcock 0.04		0.18 0	0.10	I	0.33
Distribution $0.24$ Snipe $0.21$ Robin $0.18$ Robin $0.18$ Blue tit $0.18$ Fieldfare $0.13$ Redpoll $0.10$ Dunnock $0.09$ Song thrush $0.07$ Long-tailed tit $0.05$ Woodcock $0.04$	90°0	0.02	0.25	I	ł
Surpe $0.21$ Robin $0.18$ Robin $0.18$ Blue tit $0.18$ Fieldfare $0.13$ Redpoll $0.10$ Dunnock $0.09$ Song thrush $0.07$ Long-tailed tit $0.06$ Reed bunting $0.05$ Woodcock $0.04$		0.18	0.67	ł	0.28
KODIN         0.18           Chaffinch         0.18           Blue tit         0.18           Fieldfare         0.13           Redpoll         0.10           Dunnock         0.00           Song thrush         0.06           Reed bunting         0.05           Woodcock         0.04	0.03	1.19	0.14	0.22	ł
Chaffinch $0.18$ Blue tit $0.18$ Fieldfare $0.13$ Redpoll $0.10$ Dunnock $0.09$ Song thrush $0.07$ Long-tailed tit $0.06$ Reed bunting $0.05$ Woodcock $0.04$	0.62	0.28	0.70	0.03	0,09
Blue tit 0.18 Fieldfare 0.13 Redpoll 0.10 Dunnock 0.09 Song thrush 0.07 Long-tailed tit 0.06 Reed bunting 0.05 Woodcock 0.04	0.19	0.07	0.15	) •	• 1
Fieldfare 0.13 Redpoll 0.10 Dunnock 0.09 Song thrush 0.07 Long-tailed tit 0.06 Reed bunting 0.05 Woodcock 0.04	0.05	0.10	0.14	I	C 1 7
Redpoll 0.10 Dunnock 0.09 Song thrush 0.07 Long-tailed tit 0.06 Reed bunting 0.05 Woodcock 0.04	5.89	0.25	0.27	ł	0.16 0
Dunnock 0.09 Song thrush 0.07 Long-tailed tit 0.06 Reed bunting 0.05 Woodcock 0.04	I	0.08	0.05	I	•
Song thrush 0.07 Long-tailed tit 0.06 Reed bunting 0.05 Woodcock 0.04	0.14	0.09	0.22	I	1
Long-tailed tit 0.06 Reed bunting 0.05 Woodcock 0.04	0.17	0.06	0.48	I	
Reed bunting 0.05 Woodcock 0.04	I	0.28	) •	I	00.1
Woodcock 0.04	0.04	0.19	0.05	0 0	1
	. 1	0.03		4 • •	
Goldfinch 0.03	0.06	• 1	2	1	4
Stonechat 0.03	) ) )	ı	1.	I	I
Mistle thrush 0.03	I	ļ	1 0	1	ı
Curlew 0.03	ì	, 1	0.02	I	I
Wallard 0.03	I	1.23	0.02	I	1
Churcherto U.U3	1	0.06	ł	ı	1
SKYLALK 0.03	0.06	I	I	0.03	I
Tree creeper 0.02	I	I	I	1	I
Bullfinch 0.02	I	1	0.07	0,03	ł
Jackdaw 0.02	1	I	0.04	• 1	1
Magpie –	ı	ł		I	
Great tit -	0.02	0 03			.
Hooded crow -	1	- I			I
Water rail -	1	0 07	1	· · · ·	1
Wood piqeon -	I	0.06		I i	I
Moorhen -	ł			I	1
Siskin –	I			I	ł
Rook	I	i	0. 14 10	I	I
	I	t	c0.0	ł	<b>I</b>
acatitiig –	I	I	0.05	I	I
No. of species 35	16	23	32	σ	+
				'n	4
TOTAL BIRDS 3.83	12.79	5.69	5.26	0.67	4.05

Statistically significant ( p> 0.05 ) correlations of bird species with vegetation types in winter TABLE 13

_	-	-		-	_					-	-	-		<u>,                                    </u>		<b>-</b>		-			-		
					1			1	ŀ	1	1	1			1							•	
$\vdash$	-		+	1		+	+	•	t	ł	┼──	1		i –	$\vdash$		-				1		
$\vdash$	+	-	╂──	1	F	+	+	+-	$\vdash$	├		1	$\vdash$	┣──	$\vdash$	├		$\vdash$		-	1	-	$\vdash$
	<u> </u>	•	<u> </u>	]			<u> </u>	•		L	_				<u> </u>			┣	<u> </u>	<u> </u>	-	Ľ	
					•			•													1		
		1		]		Γ		Γ	•		Γ		Γ								[	•	
$\vdash$			-	{	$\vdash$	╂──	+		$\vdash$		$\vdash$				-	-	$\vdash$				1	-	$\vdash$
	-	<u> </u>		-	$\vdash$	-	_		⊢	┝	<u> </u>	{	$\vdash$		+		<u> </u>	-		—	{	F	
	<u> </u>	•				_	<u> </u>		<u> </u>		<u> </u>	4			<b> </b> •			-			-	┡	-1
		•																•	٠				
	•									•	Ι	]	$\square$		T			•					
$\vdash$	-		-		-	-	-	├	<u> </u>	-		-	⊢		-	-	-			-	{	┢─	
			<u> </u>			<b> </b>	<u> </u>	L	<u> </u>	_	-	4	<u> </u>		<u> </u>	<u> </u>	<u> </u>	<u> </u>		<u> </u>	-	⊢	
															•		•		•		ļ		
																	•				i i		1
-	1 -				$\vdash$						1-	1	<u> </u>		1						1	•	
-	-	-	┣─	1	$\vdash$	-	$\vdash$	+		Ē	-	1	┢	<u> </u>			-	$\vdash$	$\vdash$		1	Ě	$\left  - \right $
⊢	<b> </b>	<u> </u>	┣-	ł	┣	●	<u> </u>	<u> </u>	<u> </u>	┣—		-	$\vdash$		<u> </u>	_	┣	<u> </u>		┣──	$\mathbf{I}$	$\vdash$	$\square$
	•			1		L		L				1				<u> </u>	•	1	<u> </u>	<u> </u>	1		Щ
			•										•					1					
	•			1	•		$\square$	t		i –		1				•	•		Ι		]		$\square$
$\vdash$	$\vdash$	<u> </u>	$\vdash$	1		$\vdash$	$\vdash$	$\vdash$	<u> </u>		-	1		1	1		1	1	t		1		$\square$
┣		<u> </u>	<u> </u>	1	F	┣	┢	-	<u> </u>	<u> </u>		1	⊢		<u> </u>	1	-	<u> </u>			{	┣	┝╼┥
		<u> </u>			•	<u> </u>	1					1			L	•	<u> </u>	1	<u> </u>	<u> </u>	1		$\square$
					L		•				•	]									]		
				]	$\left[ \right]$										•			•	•				
┢──	<u> </u>			1	┢	1	$\vdash$													•	1		•
H			┢	1	$\vdash$											†—					1		
	-			-	<u> </u>	-		-	<u> </u>			4	$\vdash$		<u> </u>	<u> </u>	┣	-	-	┣	1	F	
Ĺ														•								L	
	•																•						•
							ĺ																
$\vdash$			1-	1			İ					1	-					•			1		•
			<u>†</u> –	1	_		İ				-	1	-			-			l	-	1		
<u> </u>	-	<u> </u>	<u> </u>	{	┣-	-	-	<u> </u>	-			{	-		<u> </u>	├	<u> </u>	├		-	1	$\vdash$	
									· ·						<u> </u>	Ļ							•
											·												•
	•	•				<u> </u>					•						•		1				
					$\vdash$						1	1						1		•	1	<b></b>	
		<u> </u>	-	1	⊢	├─		-				ł	F	├──	-		<u> </u>	-	├	$\vdash$	1		$\left  - \right $
┝──			•	ł	┣		<u> </u>		-			l .	Ľ		<u> </u>	┣—	<u> </u>	_	<u> </u>		ł	ŀ	$\square$
•				l				L				l	•				<b> </b>			•			
							•	•.			•						l					•	
		-					•				•	1	t-					t		† -	1		
┣──	-				⊢	<u> </u>	Ļ				<u> </u>	1	┢──		Ļ	┢──			-		1	<b> </b>	$\left  - \right $
$\vdash$		•	<u> </u>		<u> </u>			<u> </u>				•	$\vdash$	-	<u> </u>	-	<u> </u>				{	⊢	$\square$
		•		l		•	<u> </u>							<u> </u>	<u> </u>				<u> </u>		Į	$\vdash$	
			•				•				•	ļ	•	٠									•
			•				•				•		•	•									
		-		t							$\vdash$	İ									1		$\square$
																						ĺ	
						ł				pu					ы	'ay						1	
	×			SS			e l		fen	sla	nd				ove	taw				GĽ	1	ns	
	Soc	5	25	SRA	3	Jow	tur,	ILE	15	ras.	sla.	9	Бc	Боq	Sut.	5		e e	s	l v	B	Inol	
ler	SUC:	L1	Ira	E.	add	lead	ast	is tr	eor	16 7	as	ILA	ă 	۲,	a l	led	åĝ,	iedc	Ira:	cut	LA	CI C	ы
4	L L	h-1	6-q	НОБ	ä	d d	14	pa	car	iuz	16	EAT	sed	ove	ini	ich	se	h-s	م م	q	8	de	ife
[a]	al	kus.	ku s.	ŝ	let	am	8	en	al	01	۲ ۲	<u>ب</u> م	ai	H	101	La la	2	sn	17	5	3	17	8

Water rail
Pied wagtail
Grey wagtail
αοιοί μετου
Моогћел
Teal
Mallard
Мите змал
Whooper swan
Snipe
Curlew
DUINDEI
κεεά bunting
Jiqiq wobseM
Stonechat
Hooded Crow
aiqqaa
Jackdaw
<u>אססא</u>
Mood piggeon
Pheasant
Moodcock
<b>Chaffinch</b>
Bullfinch
Goldfinch
Redpoll
Treecreeper
Long-tailed tit
Blue tit
Coal tit
Great tit
Goldcrest
Mren
Danack
Mistle thrush
γευτά τητυεή
Fieldfare
Kedwing
Blackbird
κορτυ

• •

• • • • • •

• •

• •

• •

• •

Emergent vegetation

SWAMP

Flood sedge TALL GRASS tit and redwing. For 'wetland' species this habitat is relatively important to snipe though not as much so as lakeshores: also for reed bunting, mallard and curlew.

The difference in the density of birds that occurs on unaffected land as opposed to affected land is striking. The unaffected land has four times as many birds but this is all due to fieldfare and redwing which prefer drier ground to feed on. The other thrushes were also somewhat commoner on unaffected land along with skylark, dunnock and robin. Goldcrest, snipe and blue tit seemed to favour affected land.

Within the affected land where the plant communities had been mapped the correlation of various bird species with vegetation was examined. From the results (Table 13) the following features may be picked out. Most species occur across a wide range of vegetation types, apparently being more influenced by physical features such as height or wetness rather than vegetation. The small passerine (garden) birds are found everywhere in fact, as, away from trees, is the meadow pipit. Certain other groups however favour relatively short but rough vegetation, e.g. mallard, pheasant, and curlew. Short grassland supports wood pigeon, rook, jackdaw and magpie, whereas tall rather rank grass is attractive to swans, both whooper and mute. The correlations do not seem definite enough to use in calculation of overall bird population in the catchment. Instead the average densities in affected land are used.

G) Conifers: Coniferous stands were sampled partly because they are a well-defined and distinctive habitat and partly because they are likely to cover more and more land in the catchment in the future whether it is subject to arterial drainage or not. Species richness is low, almost at bog levels, but the overall bird population is much higher, largely because of passerine birds that live in the trees, especially goldcrest, coal tit, blackbird and wren. Woodcock occur at a much higher density in this habitat than in any of the others sampled, as does the goldcrest. The age of stand is obviously important for the bird community. Most of the sampled area was 10-30 years planted.

#### 2.2.1.4 <u>Winter Bird Population</u>

J

 $\Box$ 

These are calculated by adding estimates for the habitats above to those obtained in the rest of the affected land. The results are shown in Table 14 where an indication of total catchment populations is also made. These figures are recognised as being very rough estimates since coverage of the unaffected land was much less complete than that given to affected land. Some dry ground species (e.g. coal tit, mistle thrush) were not met with in the samples often enough to give a reasonable estimate of their overall populations so are listed as ? in the Table.

		MINTER				INS	MMER		
Species	Populat scted land	ions Whole catchment	On affected Biomass(kg)	land \$	Species	Populatio	ns 	On affected	land
				đ	Affec	cted land W	nole catcoment	(fy) sepunta	P
Blackbird Black-headed gull	242	29910 242 4175	68.9 15 4	100 34	Blackbird Black-headed gull	1945 58	14339 58	184.8 16.5	100
Blue tit Bullfinch	315	C 7 1 4	7.6		Blue tit Bullfinch	648 70	3223 215	7.1	0 7 C
Chaffinch Chiffchaff	1413 -	-		1	Chaffinch Chiffchaff	1328 138	19269 2	29.2 1.1	~ ~
Coal tit Common gull	2097 47	2 47	18.9 18.8	7 100	Coal tit	722	- C- C-	6.5 5.6	41
Common sandpiper	102	- 201	- 142.7	- 100	Common gull Common sandpiper	14 57	01	0.3	50
coor Cormorant	71	71	156.2	100 80	Coot Cormorant	11	35	1 1	1 0
Curlew Dipper	3127 17	3921 17	1.1	100	Curlew Dinner	62 -	62 _	43.4	-
Dunnock	991 1375	9241 212528	21.8	11 0.4	Dunnock	672	8073	14.8	∞ 1
Fieldrest Goldcrest	3091	8261	18.6	37	Fieldfare Goldcrest	1578	2058	9.5	11
Goldeneye Golden plover	96 74	527 74	86.4	100	Goldeneye Golden plover	11	11	11	1 1
Goldfinch	186	3605 -	3.0	ι α	Goldfinch	1 5 4	- 114	10.8	1 65
Great black-	Ta				Great black-	4			1
backed gull	7 40 65	11 9 <i>4</i>	11.6	64 59	backed gull Groat created grab	11	46	1 1	1
Great crested git Grey heron	49	68	68.6	55	Grey heron	ر مر د	11	7.0	46
Great tit	107	1260	2.0	ω I	Great tit Greenfinch	3124	2520 1823	3.7	
Greenshank	. 4	1	0.2	100	Greenshank	1	1	1	1
Grey wagtail	51	51	0.9	100	Grey wagtail	1		11	11
Herring gull	9	9 0	6.U 34.R	100	Herring guil Hooded crow	124	330	70.7	38
Hooded Crow Jackdaw	198	·· ··	48.5	. ~	Jackdaw	822	7586	201.4	11
Kingfisher	9	9	0.3	100	Kingfisher Lanuing	- 258	470	59.3	55
Lapwing Torror black-	1052	1052	6.147	100	Lesser black-	2	9 1 		
backed gull	ł	t	ı	1	backed gull	157	60	2.8	1 04
Linnet Tittio crobo	- 04	- 133	ري ا 4.	30	Little grebe		40	, `,	1 6
Long-tailed tit	449	) (** ) 1	3.6	~ (	Long-tailed tit Marnie	73 62	220	0.6 14.0	31 31
Magpie	99 1070	2 1274	22.3	د 84	Mallard	124	204	127.1	61 76
Meadow pipit	4961	10567	104.2	45 2	Meadow pipit Mistle thrush	7903 62	30167	7.8	o ~
Mistle thrush	223	5 22	86.5	80	Moorhen	118	215	38.9	55
Moornen Mute swan	109	122	1166.3	89	Mute swan Ovsterratcher	18 2	20 2	1.1	100
Oystercatcher	; ;	1 0	- 68 7	1 04	Pheasant	ŝ	1843	 	0.1
Pheasant Pied wagtail	68		1.6	ć .	Pied wagtail Pochard	170		۰ ، ۲ ۱	<u>,</u> 1
Fochard	144	268	129.6 a 5	5 4 1 8	Reed bunting	2412	2793	45.8	86
Reed bunting Red-breasted	105	6107		)	Red-breasted mernameer	I	52	ı	ı
merganser	ŗ	4	1.1	25 100	Red grouse	I	I	1	1
Red grouse	30 735	05	8.8	2 C	Redpoll	202	2149	2.4	וח
Redshank	7	7	0.9	100	Redwing	ı	ı	I	1
Redwing	2330	326623	0.1C1	38	Robin	2493	23263	47.4	11
Kobin Rook	154	5010		· · ·	kook Sand martin	138	138	2.0	100
Sand martin	1	: 1	1	1 1	Sedge warbler Sickin	852 -	1104	10.2	
seage warnter Siskin	259	447	3.1	58	Skylark	1332	4678	51.9	28
Skylark	247	3666 4076	9.6 253.6	62	Snipe Song thrush	204 521	2524	40.6	21
snipe Song thrush	1341	11718	104.6	11	Spotted flycatche		32		ור
Spotted flycatch	er -	1 0	7.6	1 (~	Stonechat	501 73	2330	41.6	77 77
Stonechat	186	- (	3.0	2	Swallow	5	2387	1	
Swallow Toal	- 002	2006	- 650.6	100	leat Tree creeper	1 1	1	ł	1
Tree creeper	124	2	1.2	2 C 7	Tufted duck Water rail	1 ~	100	0.4	- 09
Tufted duck	271	671 104	12.8	66	Whinchat	62	200	1.2	31
Whinchat	1	1	ı	t I	Whitethroat Whoner swan	143 -	185 _	2.1 -	: '
Whitethroat Whomer swan	- 109	- 130	- 1035.5	- 84	Willow warbler	2389	15483	19.1	15
Willow warbler				1 0	wigeon Wood pigeon	- 151.	2862	73.2	5
Wigeon Wood niggon	2063 203	2077 ?	1444.1 98.5	<i>د</i> د ۲	Woodcock	- 1971	- 17315	21.6	- 11
Woodcock	293 1179	30496 S	96.7 45.9	7 20		•	1	)   	
IIDTM	.   .	-			TOTAL BIOMASS ON	AFFECTED LAND	1787.	3 kg	
TOTAL BLOMASS OF	N AFFECTED LA	NT DN	)716.9 кд						

An indication of biomass is given also in Table 14. (Bird weights were obtained from Perrins, 1987).

#### 2.2.2 BREEDING SEASON

Work on the breeding birds of the affected land was concentrated on waders and passerines as these are the species most likely to change after drainage. In addition the wildfowl nesting on Lough Arrow were censused as this was by far the largest aggregation in the catchment.

#### 2.2.2.1 <u>Wader Survey</u>

Transects were completed through likely wader habitat by 1-3 observers walking 100 m apart. All waders were noted and for snipe their activity recorded as a single drumming bird has been found to be equivalent to 1.74 pairs (Green, 1985).

Thirty-three sites (Figure 8) were surveyed and of these 17 held waders totalling 148 pairs of 7 species. Adding in casual records from sites in affected land, and from the regular transects, 77 further pairs were discovered. The main sites with waders are listed in Table 15.

Wader data collected on the regular transects can be used to obtain a total estimate for the catchment. This (Table 16) shows that in a total figure of 658 pairs, half are associated with the rivers, 28% with bogs and 21% with lakes. Snipe, lapwing, curlew and common sandpiper were recorded on the general transects but redshank was mainly recorded by the survey of likely habitat. The dunlin and oystercatcher were found exclusively in this way.

	Common sandpij	per	Redshank	Lapwing	Curlew	Snipe	Other spp
Cloonacleig Templehouse complex	jha/	_	2	11	9	39	<pre>1pr oyster- catcher(T'hse) 65 lapwing(Jul) 3 golden plover 2 whimbrel(May)</pre>
Cloonakilli	.na L.	2	2	2	1	2	1 pr dunlin
Tobercurry	Bog	-	1	2	1	8	
Loughymeana	ghan	-	-	-	-	7	
Doocastle t	urlough	-	2	8	-	-	
Quarryfield turlough	l W.	-	-	1	-	5	1 water rail
Turloughmor turlough	e	_	-	4	-	-	
Bunnanadden turlough	L	-	-	1	-	2	
Flughany Bc	g	-	-	-	8	5	
Corran Loug	h	-	-	-	-	13	
Totals		2	7	29	19	81	
TABLE 16. E	stimated	l to	otal wader	populati	.on nest	ing ir	n catchment.
В	og Rive	er	Lakes i Affected	in land Unaffect	Othe ced	er affe land	ected Total
Snipe Lapwing Curlew Redshank Common	97 11 26 3 63 3	5 88 88 3	29 13 - 5	90 - -		19 	260 167 101 8
sandpiper Dunlin	-	7 -	2 1	- -		-	7 1
catcher	-	-	-	1		-	1

TABLE 15 Main location of breeding waders(prs) in Owenmore catchment.

Π

Π

Π

Π

Π

42

### 2.2.2.2 Lough Arrow

Two full day censuses of Lough Arrow were completed by boat, on 15/6/89 and 9/7/89. The June census gives information on the potential number of breeding pairs of later nesting wildfowl species and actual numbers of gulls. The later brood census gives minimum figures for successful nests. (Table 17).

.

.

#### TABLE 17. Breeding waterbirds on Lough Arrow in 1989

Species	Potential Breeding Pairs	Broods	Nearest Estimate
Great crested grebe	19	23	23
Little grebe	16	25	20+
Red breasted merganser	14	26	26
Mallard	40	4	40
Common scoter	1	-	1
Tufted duck	101	28	50
Mute swan	3-6	1	1
Coot	3	8	8
Moorhen	0	1	
Herring gull	22+		25
Lesser black-backed gull	29+		30
Common gull	9+		10
Common sandpiper	3		3
Cormorant (non-bree	ding)		35 birds
Black-headed gull (non-breeding)			58 birds
Grey heron (non-bre	eding)		6

#### 2.2.2.3 <u>Other habitats</u>

The birds of other habitats were examined by a repetition of the regular winter transects of 600-700 m each, which were completed on six occasions. They can be described under the same habitat headings.

Π

Π

A) River channels: Birds breeding on river channels are listed in rough order of abundance in Table 11. It may be seen that mallard is the most abundant species varying between 0.17 and 3.1 birds per kilometre of river depending on size of channel. It is followed by grey wagtail, pied wagtail, common sandpiper, sedge warbler, moorhen, dipper and kingfisher. No sand martins were found nesting in the banks though this species was present in the area. As in the winter, most species were associated with the larger river channels and were more numerous in the lower reaches of the rivers (Stream Order 4 & 5). The birds include two migrants not present in winter and most other species also occur more frequently in summer, moving upriver to nest. These include reed bunting, kingfisher, dipper and both wagtails.

B) River corridors: This habitat supports slightly more birds in summer than winter and the species list changes with the departure of wintering thrushes and the arrival of the summer migrants. The densities of the major species are shown in Table 18 which indicates that, apart from lakes, this habitat supports more birds than any other. Robin maintains its position at the top of the table, with the same density as in winter. Meadow pipit, chaffinch and reed bunting have all increased markedly and willow warbler has appeared as the fifth most numerous species. Other new species to appear at low densities are skylark, grasshopper warbler, whitethroat, as well as sand martin and swallow, which take advantage of insect life and shelter to hunt over the river.

As in winter the size of channel makes little difference to the bird fauna. There is a slight increase in overall density downstream with more goldcrest, wren, robin and coal tit. Species which prefer open rough ground like grasshopper warbler, meadow pipit and whitethroat are concentrated more in the smaller stream orders, higher up in the catchment.

highest C) Lake margins: Lake margins support thedensity of birds in the habitats sampled. Reed bunting and sedge warbler are especially abundant but wren and willow warbler are also common, probably because of scattered willow trees. Of the water birds, lapwing, moorhen and common sandpiper are restricted (at least on the transects) to this habitat and snipe are also more frequent in it. The sand martin spends more time feeding over this type of area than the other habitats though it nests away from it. Species diversity is high on lakeshores and the bird fauna is more distinct from other habitats than elsewhere: seven species are unique to it.

TABLE 18. Bird densities (birds/ha) in major habitats in summer listed in order of abundance on affected land.

Species 2	Affected land	Unaffected land	Lakes	River Corridors	Bog	Conifers
Meadow pipit	1.02	0.38	0.65	0.71	0.69	0.48
Robin	0.37	0.33	0.50	0.72	0.03	0.43
Willow warbler	0.33	0.21	0.51	0.47	0.10	0.33
Reed bunting	0.33		1.04	0.27	0.04	
Blackbird	0.29	0.20	0.31	0.42	0.03	0.45
Wren	0.25	0.24	0.72	0.56	0.11	0.50
Goldcrest	0.24		0.33	0.29		1.26
Chaffinch	0.20	0.28	0.32	0.64	_	0.27
Skylark	0.13	0.06	0.07	0.04	0.25	
Jackdaw	0.13	0.12	0.06	0.02	_	
Sedge warbler	0.11		0.62	0.11	_	0.08
Dunnock	0.10	0.12	0.19	0.19	-	0.06
Blue tit	0.10	0.04	0.10	0.14	_	0.09
Coai tit	0.10		0.15	0.17	0.03	0.17
Song thrush	0.08	0.03	0.09	0.13	_	0.15
Starling	0.08	0.03	0.02	0.08		_
Rook	0.06	0.31	0.02	0.01		-
Wood pigeon	0.05	0.04	0.10	0.09	-	-
Hooded crow	0.05	_ ·	-	0.04		-
Redpcll	0.03	0.03	0.06	0.08	-	-
Linnet	0.02		0.12	0.01	-	-
Greenfinch	0.02	0.03	_	-	-	-
Snipe	0.02	<b>-</b>	0.07	-	0.03	-
Mallard	0.02	-		0.01	_	-
Chiffchaff	0.02	_	0.05	0.01		0.06
Sand martin	0.02	-	0.05	0.01		_
Magpie	0.01	-	_	0.05	-	-
Long-tailed tit	0.01	-	0.04	0.05	_	0.09
Curlew	0.01	-	-	-	-	-
Mistle thrush	0.01	-	-	0.01	-	-
Stonechat	0.01	-	0.04	-		
Bullfinch	0.01	-	0.03	0.05		
Whinchat	0.01	-	-	0.05	-	-
Grasshopper war	bler 0.01	-	0.02	0.02	-	-
Pied wagtail	0.01	-	0.10	0.03	0.04	
Spotted flycate	her -	-	-	0.01	-	
Swallow	-	0.04	-	0.02	-	-
Treecreeper	-	0.02		0.01	-	-
Whitethroat	0.01	-	-	0.02	0.04	
Lapwing	-	-	0.94	-	-	-
Moorhen	-	-	0.43	-	-	-
Common gull	-	-	0.05	-	-	-
Common sandpipe	r –	-	0.02	-	-	-
Water rail	-	-	0.01	-	-	-
Grey heron	-	-	0.02	-	-	
Pheasant	-	0.03	0.01	6.03	-	~
Great tit	-	0.04	0.01	0.06	-	~
No. of Species	36	20	36	36	11	14
TOTAL BIRDS	4.28	2.56	7.68	5.52	1.41	4.42

η Г r r r r 

r

۰.

•

The lakes with affected land around them have many more sedge warbler, meadow pipit, reed bunting than those without. Coal tit, goldcrest and chiffchaff are associated with non-affected land by contrast.

Π

Π

D) Bogs: Bogs are the major habitat for skylark in the breeding season and also support good numbers of meadow pipit. There are in fact 7-8 times as many of these species here in summer as in winter whereas the overall density of all birds increases by a factor of just over two. Small numbers of snipe and reed bunting also nest on bogs but curlews are restricted to a few major sites and were not picked up on these random transects.

E,F) Affected and unaffected land: A considerable difference occurs between winter and summer in these habitats, as is evident from Tables 12 and 18. In the breeding season, the numbers of birds increase on affected land from 3.8 - 4.3 birds/ha. However, on the drier, unaffected land they decline sharply from about 14-2.5 birds/ha. This is mainly due to the departure of the wintering thrushes. The species that arrive to boost numbers in the breeding season on affected land include willow warbler and grasshopoper warbler, as well as whinchat and whitethroat in small numbers. There are increases also in reed bunting, meadow pipit, skylark and jackdaw but declines in snipe and redpoll.

The most frequent species breeding on affected land is the meadow pipit, which occurs at almost three times the density of the robin, willow warbler and reed bunting. It occurs more on this habitat than on any of the others sampled, the only species that this is true for.

Unaffected land in summer has an impoverished bird fauna. Only twenty species occur and the overall density is 2.56 birds/ha. Meadow pipit, robin, rook and chaffinch are the main species. Species of damp land like reed bunting, sedge warbler and snipe are absent. Pheasant may move onto such drier ground to breed, though outside the breeding season it occurs on wet land.

From the correlation analysis with vegetation (Table 19) it appears that in the breeding season, birds become much more confined to a certain type of vegetation than they are at other times. In winter for example, several species have a high correlation with five or six types of vegetation. In summer, they mainly occur in 2-3 types, suggesting a nesting or feeding preference. Snipe are found in relatively short vegetation, either Calcareous Fen, Enriched Cutaway or Rush-Grass, mallard on Cutover Bog, sedge warbler in Tall Herb or woodland edge or along ditches in low lying meadows. Redpoll is correlated only with coniferous stands whereas goldcrest occurs more widely, on Scrub Cutover and in Tall Herb stands in addition to conifers. Rook is associated only with wet meadows, starlings here and in Rush-Iris stands. Woodpigeon is  $\Box$  $\Box$  $\Box$  $\Box$  $\Box$  $\Box$  $\Box$ 

•

Sedge warbler	_			ſ	•				ſ								Ī				Τ					ſ	•	
TIETRE WASTE				Ì			_			_	•						Ī				•							
Aby Stuff				Ì					Ī	٠							[		•							[		
MAILARD				Ĩ					[										•									
9dīn2														•			ļ			_	•		•		_			
Lueseaud				Ì		•			ſ					l	•								•					
Sconechat		•	•																		•		-			Í		
МАТЛСАЗЕ				Ì		•									•	_			•									
Grasshopper warbler					-†																						•	
WILLOW WARDLET		•	•																			_			•		_	
Aigid wobsam																									•			•
SKYLATK			_																					•				
Whitethroat						_													_			_						
Linnet											•										•	•						
кефојј		•											•															•
пілтыт эгион																					•				_			
Sand martin	i										•				•												•	
Mood pigeon	1												٠								•	•						
Rook										٠					•			_			•							
aiqpaM			•												_				_									
Starling							•											_										
Spallowbawk											•										· _							
Ласкаам											•										_							$\square$
Chiffchaff					•																	•						
Βη11ξιαςμ																									•			
Greentinch																									•	ļ		
Сраттасћ																•						•		•				$\square$
Long-tailed tit																·					_				•			
כספן בזב		•																_			_	_						-
קרפאל לגל																					_							•
Goldcrest										_											_				•			•
Dunnock	l	•	٠		•											<u> </u>												$\vdash$
Mistle thrush					•											•					_	•						
αευτά τρευερ						•										<u> </u>									•			
Blackbird										•				<u> </u>											•			•
Wren											L			<u> </u>		_									•			$\square$
піdоя											ļ					1									•			
			-	1			┢─		1	<u> </u>				1			, 											$\square$
-		vegetation	adge	SRASS	Ą	ssock	S	955	GRASS	dow	adow	sture	ture	ous fen	grassland	ssland	DND	bog	pog :	i cutover	ad cutover	lge	sdge	CA58	sutover	CAND	Suc	
	SWAMP	mergent	lood se	TALL G	rall her	Call tug	kush-Ir.	Rush-gri	SHORT	Wet mea	Damp me	Poor pa	Pen pas	Calcare	Lolium	Dry gra	FEATL	Raised	Cutover	Molinia	Enriche	Dry sed	Rush-se	Acid gı	Scrub c	IDOOM	Decicuc	Conife

.

Statistically significant ( p> 0.05 ) correlations of bird species with vegtetation types in summer TABLE 19

perhaps the most catholic in its tastes: it is correlated with open grasslands (possibly for clover) both natural (6F) and artificial (3A) and also with small sedge stands, i.e. Enriched Cutaway (2H) or Dry Sedge (2I). Π

Π

Π

Π

 $\prod$ 

Π

Π

G) Conifers: As in winter the goldcrest is the outstanding bird of coniferous woods, though its density declines from 2.16 to 1.26 birds/ha. The wren, blackbird and robin are next in abundance with meadow pipit, which moves into this habitat to nest (presumably in clearings). Three times as many pipits occur here in summer as in winter. Willow warbler and chiffchaff arrive too, the latter being more frequent in conifers than in any of the other habitats sampled. Fourteen species were met with in coniferous woods, the lowest in any of the habitats except bog but bird density at 4.42 birds/ha was the third highest.

#### 2.2.2.4 <u>Summer bird populations</u>

Estimates for the summer population and biomass of the species encountered by sampling are included in Table 14. Some species that were seen during the survey period, for example dipper and kingfisher, did not occur in the samples so an estimate of their density cannot be made.

#### SECTION 3 EVALUATION OF WILDLIFE

This section of the report examines the relative importance and ornithological features botanical the of value and described above. Such evaluation is done in heritage terms by comparison of the Owenmore area to other parts of the country where the flora or birdlife is known well enough. The purpose of the exercise is to determine if there are areas of the specific sites where there are grounds for catchment or preventing drainage proposals for wildlife modifying or The section ends with a description of the areas of reasons. scientific interest.

Ecological interest in a site is bound up with rarity and diversity in most evaluation schemes. It may be rarity of a particular species of plant or bird, the rare habitat conditions that give rise to a certain species or community flourishing better than elsewhere or the rare historical circumstances that have led to a vulnerable habitat surviving inroads of man's exploitation. Where sites are being the chosen to conserve the natural heritage their diversity and size becomes important - how many species or habitats are included within an area, and what size an area should be to of natural variation and to give an the range cover ecologically viable unit.

#### 3.1 VEGETATION

#### 3.1.1 SPECIES RARITY

The botanical data were examined for species and habitat rarity and for vegetation diversity. The fieldcards from mapping and channel recording gave rise to a species list of 299 higher plants and 39 bryophytes. Since the latter were not always recorded only the higher plants were used in analysis. A list of all those species recorded 22 times (1%) or less was constructed and refined further with the Atlas of the British Flora to assess regional distribution. Plants that were out of their normal habitat in affected land, such as woodland or The resulting list arable weed species were also excluded. (Table 20) shows the less common species in the catchment and summarises their distribution elsewhere in the country. The NW part of the country is taken to be that land west of a line linking Galway and Derry. Species which are noted on five field cards or fewer or that are new county records are mapped on Figure 9 which therefore shows possible areas of ecological interest. Certain patterns emerge from this map, for example the importance of the Unshin River for rare plants relative to either of the other branches. (Subcatchments are taken in their original form before any artificial changes). The Unshin has 72 records on 22 km of channel, the Owenmore has 71 on 43

TABLE 20 Occurrence of less common species of higher plant in the catchment. % frequency in 10km squares is taken from Perring & Walters (1990). \* indicates new vice-county record according to Scannell & Synnott, 1987

i

 $\Box$ 

 $\Box$ 

 $\Box$ 

No. field cards	Species	Vice- counties	%F1 NW	eq./10km Rest	squares Notes including site numbers (Table 3)
18	Achillea ptarmica	38	54	40	In for parture and anniabed subsure
4 6	Apium inundatum Baldellia	40	14	15	24,87,161,52. Lakes and turloughs.
	ranunculoides	40	2 <b>2</b>	13	10.39.61.139 213. Oligotrophic lakes & pond
16	Bidens cernua	40	13	16	Ditches, river margins. Quarryfield W. turlough
1	B.tripartitus	40	9	13	68 Spring near Riverstown
2	Callitricho	*21	0	4	4,49,75,90,189. Unshin below Markree:saltmarsh
-	obtusangula	*22	nc	data	43,90 }
1	C.platycarpa	*16	4	4	52 Ditches and slow rivers. Under recorded
4	Carex acuta	25	4	4	10,19,24,205. Lake scraws and river edges
15	C.acutiformis	31	1	12	River floodplains: tall fen by eutrophic lakes
9	C.aquatilis	*17	3	2	23,36,43,59. Flooded lakeshore & river. T'hse,
1	C.divulca	30	23	6	76,85,123,205. Highly calcareous seepages.
6	C lasiocarna	*20	22	9	61. Woodland east side of Ballygawley L.
ĩ	C.limosa	~27	22	5	10, 39, 52, 58, 61. Lake scraws and river edge.
1	C.riparia	34	21	9	10. Cloonakillina scraw.
1	C.strigosa	28	3	5	51. Woodland tracks near L. Arrow
15	Catabrosa aquatilis	40	13	16	Eutrophic ditches and lake edge.
5	Cladium mariscus	36	22	13	10,25,28,52,114. Lake edges
5	Cornus sericea	*6			75,90,106,138. Markree, Annaghmore:Ballinafad.
16	Dactylorhiza	40	20	16	94,141. Base-enriched marsh
1	Incarnata Drogora angliga	40	20	17	Basic marshes and scraws (Cloonakillina)
2	Eleocharia uniclumic	35	39	11	10. Cloonakillina scraws:also on Flughany Bog.
2	E.guingueflora	35	24	3	156. Calcareous marsh: saltmarsh at Ballysadare.
1	E.multicaulis	31	40	11	141,205. Calcarous marsh.
2	Epipactis palustris	36	11	9	107.123. Calcareous marsh
3	Equisetum variegatum	26	4	5	34,115,167. Calcareous marsh: also hedge bank.
6	Eriophorum latifoliu	m 28	4	5	34.76.85.123.141.205. Calcareous seepages
1	Erodium cicutarium	26	21	10	Reseeded pasture. Inland elsewhere in SE.Ireland.
1	Eupatorium cannabinu	m 40	17	23	41. Bunnamuck L. in ditch
4	Gallum uliginosum Gymnadenia gonopgaa	20	2	5	11,161. Drier parts of turloughs. N.edge of range
3	Heracleum	30	30	20	107,123,141,205. Base enrichment often on peat.
1	Lathyrus palustris	24 *15	0	,	90,106. Unshin below Markree
3	Leucojum aestivum	*18	0 0	۲ ۲	3. Oxbow below Templehouse L. in tall fen.
			0	•	Doocastle turlough.
3	Littorella uniflora	38	35	17	52,87,213. L. Arrow & Unshin for 3 km. L. Dargan
6	Lycopus europaeus	40	10	15	8,19,36,58,59,61. Owenmore around T'house. Unshin
14	Lysimachia vulgaris	40	9	15	Riverbanks & reedswamp. Upper Unshin: Cloonacleigha/Templehouse L.
5	L. nummularia	31	3	6	36,59,90. Open lakeshore & river bank. Templehouse L.
4	Mentha arvensis	40	24	37	5,11,12,100. Larger turloughs. Hedgebank. Templehouse L.
4	M. spicata	*16	1	1	74,78,82. Ditches & streams on Unshin
4	Mimulus guttatus	31	15	11	19,39,85,148. Riverbank & slow streams. Cloonacleigha
2	Myriophyllum				
	arcerniciorum	39	22	10	11,52. Turlough lake & Unshin R.
4	M. spicatum	40	11	14	Uligotrophic, base rich.
2	M. verticillatum	*28	4	8	13,39,52,87. Poorer lakes & rivers.
4	Nymphaea alba	37	29	13	39.41.87 213 Peaty corners of a few laker
4	Oenanthe aquatica	30	2	7	9,19,22,60. Owenmore R. above Templehouse L
4	0. crocata	37	24	36	58,68,75,90. Unshin R. below Ardagh
20	O. fluviatilis	*11	1	2	Frequent in all rivers and many smaller lakes
2	Parapholis stricos	n 40	14	13	8,11. Flooded ground by river and turloughs.
5	Petasites hybridue	*21	3	5	Brughmore saltmarsh in Ballysadare Bay.
2	Plantago maritima	29	<u>د د</u>	39 25	52, /4, /8. Unshin R. banks from L. Arrow north
<b>7</b> .	Platanthera bifolia	39	30	16	10.12.21.36.112 123 Baga on sight automa
1	P. chlorantha	40	18	12	123 Base-rich marsh
2	Poa palustris	*6	0	1	37,57. Eutrophic reedswamp & fen near Riverstown
1	Polygonum minus	28	4	6	161. Turlough floor & edge
6	Potamogeton alpinus	39	20	24	138. Riverside wood at Annaghmore
-	resumble con arpinus	47	'	4	10,25,90,162,213. Upper parts of rivers, L.Arrow.

•

	No. field cards 7 2 1 10 2	Species P.berchtoldii P.coloratus P.filiformis	Vice- count 40
<b>ר</b> ו	7 2 1 10 2	P.berchtoldii P.coloratus P.filiformis	40
	12	P.lucens P.obtusifolius P.pectinatus	34 18 35 30 35
	7	P.perfoliatus	39
	4 5 2 4 3 1 7	P.praelongus P.pusillus Pulicaria dysenter: Ranunculus aquatil: R. circinatus R.hederaceus R.lingua	*20 *16 ica 40 is 40 23 40 37
	8 1 6	R.peltatus R.sceleratus R.trichophyllus	29 40 37
	10	Rorippa palustris	39
	1 20	R. amphibia Rumex hydrolapathu	33 m 37
]	3 2 6	Salix pentandra S.triandra Samolus valerandi	35 *27 40
_	1 4	Scirpus fluitans Schrophularia	40
	10	auriculata Schoenus nigricans	40 40
_	5	galericulata	38
	7 6	Selaginella selaginoides Solanum dulcamara	35 40
Γ	5 13	Sparganium minimum Stellaria palustri:	38 s 25
	1 4 1 9	Trifolium medium Utricularia vulgar U. intermedia Veronica catenata	37 is 40 22 38
	3	Viola canina	38
	2	Zannichellia palustris	33
]			

10,5 52,1 87	0,52,131,213. Ditches & slow rivers. L.Arrow 41. Marl ditch and calcareous seepage
9,37	, 59,60,66,52,90. Deeper rivers & lakes
10,1 52,5	<ol> <li>B8. Lake and eutrophic river.</li> <li>8,78,75,90. Abundant in shallow stretches of</li> </ol>
Uns 39,5	hin 2,78,90,213. Unshin from L. Arrow.
Clo	onacleigha L.
10,5	2,76,213. Lakes in upper part of catchment 2.76,77. Lakes & ditches, incl. turlough.
116,	134. Calcareous marshes SE of Coolaney.
11,4	1,42,78. Eutrophic streams & rivers
10,4	2,82. Calcareous water over peat.
10.	Peaty seepage, Cloonakillina
lak	es
22,4	3,52,68,78,82,161. Unshin and upper Owenmore Bank of Unshin below Markree
8.11	
cal	careous fen.
3,9,	11,12,36,43,66. Turloughs & flooded river
mar	gins - Decreat trace shows Dellucreade Dr
IUDE	in R from L Arrow. Jower Owenmore &
Clo	oonacleigha.
10,2	1,148. SW part of Owenmore catchment
57,7	5. Unshin at Markree and Riverstown
39,4	13,59,87,156,213. Lakeshores and a few
riv	Versides
160.	bitch in turiough.
53,7	/4,90. Riverbanks in Unshin
18B,	33,34,107,112,116,123,141,170. Calcareous
see	page esp. in N.W.
1,10	),58,68,52. Tall fennear Unshin & at
CIC	onakillina
34.7	76.94.123.115.141.205. Calcareous seepage
52,5	7,58,68,78. Unshin R. only with some
tri	butaries. R. in NW of Britain & Ireland
52,6	1,76. Unshin near L. Arrow, peaty lakes
Wide	spread in fen in Owenmor& lower Unshin. Also
123.	Calcareous marsh & bank.
25,5	52. Ditches and lake
10.	Scraw at Cloonakillina in open Phragmites
3,8,	9,11,18,59,161. Owenmore catchment &
	Lougn. 259 Stony shore of Templohouse I. also
5,12 tur	cloudh wall
cui	
138,	158. Eutrophic ditches.

% Freq./10km squares NW Rest Notes including site numbers (Table 3)

Vice-counties

7 6

41

30

8

3

14

4

no data 9 14 8 13

2

5

13

6



 $\Box$ 

km and the Owenbeg no waterplants of interest on 13 km. There are other notable aggregations, as near the upper Owenbeg (Carrownabunny), around Templehouse and Cloonacleigha Loughs, at Feenagh, Cloonakillina L., and Doocastle turlough. At the northern end of the catchment Corhawnagh, Knockmullin and Lough Dargan stand out in addition to the lower Unshin.

The species growing in the catchment include many aquatic plants of interest: a few notes are included on 23 of them.

1) Butomus umbellatus (flowering rush) is a striking plant with grass-like leaves and a tall head of pink three-petalled flowers. It grows in abundance below Markree Castle and from there to Ballysadare, including a saltmarsh in Ballysadare Bay. It is found nowhere else in the north-west except Fermanagh. It was probably planted by the Coopers of Markree who tried to introduce many animals and plants.

2) Callitriche obtusangula and C. platycarpa (water starwort). The water starworts are submerged water plants that flower relatively seldom and are difficult to separate from each other without flowers/seeds. The fact that they have not been recorded from the county before may indicate that they have not been specifically looked for, not necessarily that they are rare.

3) Carex aquatilis (water sedge) forms extensive stands on the former bed of Templehouse Lough and occurs above and below the lake on the Owenmore. It is a rare species all over the country, having only 19 other locations with a northerly emphasis (Jermy et al. 1982).

4) C. divulsa (grey sedge) grows in woodland east of Ballygawley Lough. It has a predominantly S.E. distribution in the country and its nearest station to Sligo is in Westmeath. The plant grows in an artificial habitat (coniferous woodland) so may have been introduced on plants or machinery.

5) C. lasiocarpa (slender sedge) grows in less dense reedswamp in several places (e.g. Cloonakillina L., Unshin R. below Lake Arrow). It is found in most adjacent counties though these are the first records for Sligo.

6) C. riparia (greater pond sedge) was found in one obscure corner of the catchment near Gadden Bridge. It is relatively uncommon in the north-west and elsewhwere in Sligo only occurs at Enniscrone.

7) Cornus sericea (red osier dogwood). An introduced species, planted and spreading vegetatively in Markree Castle and Annaghmore. Not recorded before in the county.

8) Eleocharis uniglumis (spike rush). This small rush-like plant grows most often in saltmarshes (as in Ballysadare Bay) but it was found also in a highly calcareous marsh at

Ballynacarrow. It is scattered around the country, usually in coastal areas, and grows in both Mayo and Donegal.

9) Epipactis palustris (marsh helleborine) was found in two lime-rich marshes. It is uncommon in the country and is a protected species in the North of Ireland.

10) Galium uliginosum (fen bedstraw) is near the northern limit of its range in Ireland and is rare away from the centre. It occurs also in the Blackwater River in Tyrone.

11) Lathyrus palustris (marsh pea) grows only at the ox-bow below Templehouse Lake though it was recorded at Toberscanavan Lough before road widening (D. Cotton, pers. comm). Its nearest stations are in Fermanagh and Roscommon and it has been seen at 12 other sites in the Republic in recent years (Curtis and McGough, 1988). It was formerly a protected species in the Republic and remains such in Northern Ireland.

12) Leucojum aestivum (summer snowflake). Planted in Markree Castle along with snowdrops (*Galanthus*) and other species, this plant is now established on a backwater of the Unshin below Ballygrania Bridge. It also occurs on the floor of Doocastle Turlough at the other end of the catchment.

13) Mentha spicata (spearmint) is a cultivated mint that becomes naturalised rarely. It occurs in several places in the Unshin, usually by small streams.

14) Myriophyllum verticillatum (whorled water milfoil) is the least common of the three milfoils in Ireland but it has a north-western distribution. Its occurrence in Sligo is not unexpected since it grows in Mayo and Roscommon. The number of old (pre-1950) records in Scannell and Synnott (1987) suggests that it may be a declining species, sensitive perhaps to eutrophication.

15) Oenanthe fluviatilis and O. aquatica (river water dropworts). In apparent contrast with the rest of the country the dominant Oenanthe in the rivers and lakes of this catchment is O. fluviatile. It is widespread in all three branches but is still a new county record. O. aquatica was only identified positively four times, on the Owenmore River above Templehouse. It seems possible that these species have been confused in the past.

16) Parapholis strigosa (hard grass) is a saltmarsh species which was found on the north side of Ballysadare Bay. It is a local plant not previously found in Sligo and with its nearest sites in Donegal, and Connemara.

17) Poa palustris (swamp meadow grass) grows in two sites near Riverstown amongst tall herbs. In the Republic it has only been recorded before for Meath and Monaghan but in Northern Ireland it is more widespread, at Lough Neagh and in Fermanagh. It has always been considered an introduced species but at Lough Meharth in particular it has every appearance of being a native, competing with natural vegetation over quite a

large area. It is one of the most important discoveries made on this survey in biogeographical terms.

18) Potamogeton praelongus and P. pusillus (pondweeds). These submerged plants belong to a complex group whose distribution is not well worked out in Ireland. Neither had been recorded in Sligo before and P. pusillus in particular seems rare in the north-west.

19) Ranunculus peltatus (pond water crowfoot) is relatively widespread in both the Unshin and upper Owenmore systems. It grows in most of the nearby counties except Leitrim and Fermanagh but had not been recorded for Sligo before.

20) Salix triandra (almond-leaved willow) Planted on certain riverbanks in the Unshin, this species is only widespread (and possibly native) in S.E. Ireland.

#### 3.1.2 VEGETATION RARITY

Table 5 shows that certain vegetation types cover extremely small areas which could be vulnerable to drainage or other operations. Out of the semi-natural types, for anthropogenic vegetation can usually be recreated, Reedgrass along river channels (0.2% of total affected land), emergent vegetation at the water's edge (1.6%), Calcareous Fen (0.5%) and wet woodland or carr (1%) appear to be those habitats in small supply and under greatest threat from drainage. 'Intact' bogs (2.2%), turloughs and naturally flooded Fen Pasture (7.1%) are also habitats which are unusual and likely to be modified in future years. All these habitat types are worth emphasising in an evaluation of different parts of the catchment and they have been taken into account in determining the areas of scientific interest.

#### 3.1.3 SPECIES DIVERSITY

The number of species occurring in a particular habitat or location is of relevance when considering what sites to conserve as one of the goals of conservation must be the maintenance of genetic resources. A small site with many species may sometimes be more valuable then a large one with few, provided always that the plants in question can maintain themselves in the area protected. Examining the vegetation types for species richness (including bryophytes) insofar as this is available as in Table 6 shows that fen pasture, calcareous fen, tall herb and Molinia enriched cutaway, cutover are the communities that support most species (all more than 112). These figures include only those species written down in the course of classifying the vegetation in the field and are in no sense a complete species list. However, they provide an index of species diversity that is



useful in an evaluation process. It is most relevant in comparing similar vegetation on a site-to-site basis and cannot be used for example to suggest that fens are more valuable than bogs.

#### 3.1.4 HABITAT DIVERSITY

Habitat diversity was assessed by analysing the number of vegetation types mapped in each of the 214 sites against the area of the site. When these two things are graphed (Figure 10, previous page) the expected relationship emerges that vegetation types increase rapidly with increasing area to a level which then changes little with further increase in area. This is despite the fact that there are other vegetation types which could occur. Sites above the mean line show greater than average diversity. There are 64 of these (listed in Appendix 2) and they were examined in more detail with regard to vegetation type. An analysis favouring relatively small sites was done by dividing the percentage divergence from the mean by the site area. A diverse small site would therefore come out on top of a large one with similar diversity. From this 36 sites emerged where the diversity of semi-natural vegetation could be worth conserving for its own sake. These are shown on Figure 11 where the significance of the northern part of the catchment is apparent. The majority of such sites occupy the belt of country parallel to the Ox Mountain chain but some 3-5 km away from the geological divide. By contrast, the drumlin terrain above Templehouse Lake contains few sites of such diversity.

Statistically the Unshin catchment contains 17 of these high diversity sites, the Owenmore 14 and the (original) Owenbeg 8. There is an additional site downstream of the confluence of all branches.

These various analyses alongside the field experience led to the selection of a number of areas of ecological interest, the more important of which are described at the end of Section 3.

#### 3.2 BIRD LIFE

Evaluation of the ornithological data is dealt with along similar lines as in its description, namely wintering flocks, other wintering populations, breeding waders, breeding wildfowl (L. Arrow) and other breeding populations.

c



#### 3.2.1 WINTER

#### 3.2.1.1 <u>Wildfowl and waders</u>

Wintering wildfowl and waders may be evaluated on an existing rating scheme originated by the IWRB and refined for Ireland by Whilde (1986) and Sheppard (in prep.). Based on the maximum counts, wintering flocks, and by extension the sites they use, are rated as of international or national importance (criteria are given in Table 21). Local importance is not generally included but for this study it has been taken either as a site holding 20% of the total catchment population or as the only site with a certain species in the catchment (if more than 10 birds occur). The results of this rating process are included in Table 7 (Section 2.2.1). It is seen that Ballysadare Bay has significant populations of ten species and that the entire Owenmore catchment holds such numbers of eleven species. It is particularly important for little grebe (mostly at L. Arrow), teal (Templehouse/Cloonacleigha and rivers) goldeneye curlew (general affected land). Other Arrow) and (L. individual sites on the system that hold regionally or locally important flocks are Ballygawley Lough, Doocastle and the two Cloonakillina Lough. The Quarryfield turloughs, and Quarryfield turloughs and Ballygawley Lough qualify only on the grounds of their whooper swan numbers. This species was recorded at few sites consistently. Ballygawley supported a large flock (71) during November and December after which they disappeared. Some probably dispersed into fields in the northeastern section of the catchment, others went elsewhere, discrete population which perhaps joining а reasonably numbered 29 at maximum in Doocastle turlough. The total catchment population was estimated at 130-180 whooper swans.

#### 3.2.1.2 Other wintering populations

quantitive work has been done on wintering little So populations of birds other than wildfowl or waders, especially in Ireland, that comparison of the Owenmore figures with other places is difficult and limited in value. However, a single is available for the Dunkellin/Lavally car-transect study Galway), completed in 1985/86 (Buckley & (Co. catchment McCarthy, 1987). It should be noted that spurious differences may arise from the fact that different years are involved and also that vegetation is higher in the Owenmore catchment, thereby reducing the birds' visibility. In addition two observers in a van would have observed more birds than one in a car (this study).

In both studies there is a very large variation in most species densities on separate days. There were five additional species in the Dunkellin/Lavally and one (whooper swan) confined to the Owenmore. Where the species are directly comparable, the mean densities are similar for seven birds TABLE 21 Numerical criteria for identifying sites of significance for wintering waterbirds (Sheppard, in prep.). For local criteria, see 3.2.1.1.

 $\Box$ 

Π

Π

Π

Π

Π

 $\prod$ 

Species	International	National	Local
<u>Cormorant</u>	-	105	14
<u>Shag</u>		375	-
Little grebe	-	50	19
Great crested grebe	-	50	10
Grey heron	-	50	10
<u>Mute swan</u>	12,000	70	24
<u>Whooper swan</u>	160	105	26
<u>Brent goose</u>	200	200	-
Teal	2,000	500	401
Mallard	10,000	500	184
Wigeon	5,000	1,000	415
Pochard	2,500	300	54
Shelduck	1,250	125	. –
Red-breasted mergans	ser 400	75	10
Tufted duck	5,000	200	134
Goldeneye	2,000	100	105
Coot	10,000	300	40
Oystercatcher	7,500	700	
Ringed plover	400	100	-
Golden plover	10,000	1,000	15
Lapwing	20,000	2,000	210
Dunlin	20,000	1,000	10
Snipe	10,000	-	-
Sanderling	150	50	-
Bar-tailed godwit	5,500	230	-
Curlew	3,000	1,000	513
Redshank	2,000	250	10
Greenshank	500	50	-
Turnstone	500	100	-

Note: Accurate population estimates are only available for the underlined species. Duck estimates have possibly wide margins of error, inland waders are even less reliable. Absence of snipe figures indicates that the population cannot be estimated. Local importance not worked out for estuarine birds.

(jackdaw, fieldfare, redwing, mistle thrush, hen harrier, kestrel and sparrowhawk). For eight other species the numbers were much higher in the Dunkellin/Lavally. Magpie and song thrush occurred at densities twice as high, hooded crow and rook three times, curlew (x8) starling (x12), woodpigeon (x27) and lapwing (x30). This suggests that those species of the wintering population recorded by the road transect method are considerably less frequent in the Owenmore as compared to the Dunkellin/Levally catchment.

The birds counted on river channels in the Owenmore system in winter are generally similar to those (Table 22) found on the Dunkellin/Lavally (Buckley and McCarthy, 1987). There were some additional species on the Owenmore, perhaps related to a longer length was surveyed on this river. the fact that These were little grebe, wigeon, kingfisher, whooper swan, and Dipper occurred at greater density the on cormorant. grey the Owenmore, and heron and mute swan on Dunkellin/Lavally. These results suggest that the channel of the Owenmore supports average numbers of birds in winter for a river in the western part of the country. No concentrations of uncommon species were found in 1988/89, but the numbers of teal (704) are significant regionally. In addition, quite high numbers of mallard and whooper swan are associated with the Relatively speaking, the channel of the Owenmore is rivers. of greater importance than the affected land covered by road transects.

3.2.2 BREEDING SEASON

#### 3.2.2.1 <u>Waders</u>

Specialised wader surveys have been carried out in about six other places in the country and they provide a basis for evaluation of the Owenmore populations. Most of the surveys were done in likely wader habitat beside rivers and lakes and if the equivalent land is taken in the Owenmore catchment 100m of river (i.e. affected land and other land within channels) it is seen (Table 23) that the Owenmore figures are very low compared to virtually all the other sites. This conclusion may be slightly too extreme however, since most of the other studies concentrated on habitat good for waders: But even if only half the also different years were involved. Owenmore affected land is in fact suitable for breeding waders, the densities (now doubled) are still conspicuously low.

An overall density figure for the catchment is comparable to that obtained for all of Northern Ireland (Partridge, 1988) for snipe, lapwing and dunlin. This data suggests that the Owenmore had a much higher population of curlew (possibly through having more bogland) and a much lower number of redshank than Northern Ireland. TABLE 22. Bird densities (birds/km) in winter on river channels in the Owenmore, Dunkelly/Lavally and part of the Moy catchments (standard error in brackets)

Species	Owenmore	Dunkellin/Lavally	Моу
Little grebe	0.192(0.133)	_	-
Grey neron	0.077(0.052)	0.292	0.250
Cormorant	0.038(0.038)	_	-
	1.692(0.448)	1.26	3.250(1.051)
Teal	3.577(1.846)	2.919	-
wigeon	0.231(0.193)	-	-
Mute swan	0.115(0.115)	0.519	-
Whooper swan	0.038(0.038)	-	-
Snipe	0.192(0.070)	0.065	-
Moorhen	0.615(0.278)	0.876	0.625(0.125)
Water rail	0.038(0.238)	-	-
Kingisher	0.038(0.038)	-	-
Grey wagtail	0.346(0.191)	0.454	-
Pied wagtail	0.038(0.038)	-	-
Dipper	0.115(0.061)	0.032	-
Reed bunting	0.038(0.038)	-	
Wren	0.154(0.119)	_	_
Robin	0.077(0.052)	-	-
TOTAL BIRDS	7.615(2.540)	6.421	4.125(1.161)
Length surveye	ed 26km	6.2km	8km

.  $\Box$ . L

Density of breeding waders (prs/km) in different parts of Ireland. TABLE 23.

	Owenmore	Dunkellin/ Lavally	Shannon	Blackwater	Finn	Erne Basin	Neagh Basin	All N. Ireland
Lapwing	0.98(0.26)	3.5	9.8	2.8	10.0	9.1	7.9	0.38
Snipe	1.53(0.40)	31.5	21.8	10.2	0.8	23.4	16.4	0.36
Curlew	0.59(0.15)	3.5	1.4	4.2	1.7	6.8	2.1	0.04
Redshank	0.04(0.01)	1.5	11.5	I	5.8	6.9	10.2	0.73
Dunlin	0.005(0.00	1) –	I	I	I	ł	1	0.001
Golden plover	I I	I	I	I	1	I	I	0.003
Oystercatcher	0.005 (0.00	1) -	<b>I</b>	I	I	i	I	i

Bracketed figures for Owenmore are densities in whole catchment, comparable to all N. Ireland column. N.I. figures (Partridge, 1988), Shannon (in Hutchinson, 1989) Note:

The absence of accurate national population figures for breeding waders makes an evaluation exercise largely conjectural but a rough comparison is made in Table 24. It appears that no sites within the Owenmore are of major importance for waders. However the wet land west of and Cloonacleigha Templehouse Lough could probably be considered of local value as could Templehouse Lough itself oystercatcher which breed rarely inland) (for and Cloonakillina Lough (for dunlin).

#### 3.2.2.2 Lough Arrow

The waterfowl population that nest at Lough Arrow may be compared with five other sites where similar methods of census have been done. These other western lakes (Table 25) have a similar selection of species except that they lack gulls. Lough Arrow appears to have a relatively high number of redbreasted merganser, little grebe and tufted duck and good numbers also of great crested grebe. In terms of density it has higher numbers than any of the other lakes for great crested grebe, merganser and tufted duck. Looked at on a national basis with criteria as in Table 26, Lough Arrow is of at least regional importance as a nesting area for tufted duck, red-breasted merganser and the two grebes. In addition, it contains the major or only part of the breeding population of coot, common scoter, lesser black-backed and common gull in the catchment.

#### 3.2.2.3 <u>River Channels</u>

The river transects in this study may be compared with several waterways surveys elsewhere though these latter depend on delimiting birds' territories and not just recording their presence. Table 27 shows the results from eleven other sites though some have very few species present (or at least recorded). Some of the studies only record the range of densities (pairs/10km) present but the general conclusion must be that the Owenmore supports a high density of mallard: only two rivers contain higher figures and then only on certain stretches. It is also relatively high for kingfisher except for rivers in Northern Ireland, but average for grey and pied wagtail and heron. Dipper density is generally low (because of the absence of broken water), little grebe (not found) and moorhen especially so. The occurrence of common sandpiper would be expected in NW Ireland (Sharrock, 1976) though it is not a widespread bird on lowland rivers in most of the country.

#### 3.2.2.4 Other habitats

The survey of breeding birds in the Dunkellin/Lavally catchment (Buckley and McCarthy, 1987) allows comparison of density to be made for certain species since the same methods of data collection were used. The densities of five species

## $\Box$ $\Box$ η

Total catchment population (prs) of breeding waders compared to other areas. TABLE 24

	Owenmore	Middle Shannon	N. Ireland	Ireland	UK/Ireland	С Н
Lapwing	167	341	5250	26250	215000	506000
Curlew	101	48	5000	25000	47500	58700
Snipe	260	762	10075	50000	40000	63800
Redshank	7	400	550	2750	34500	8315(
Dunlin	1	0	40	200	9350	066

This may overestimate snipe. ი ა Ireland population in general is N.I. x Note:

•

		Pre-breeding	census			Brood Ce	snsu				
	L.Arrow	LWr. L.Erne	L.Conn/ Cullin	L. Arrow	LWr. L.Erne	L.Conn/ Cullin	L.Ree	L.Sheelin	Lwr	rib Upr	
Great crested grebe	19	28	1	16(23)	11	6	108	7	6		
Little grebe	16	4	I	0.013 3(25)	0.001	1	0.01	0.001	0.002	1	
Mallard	40	ı	I	2 (5+)	14+	I	ı	- 7	+ +	I	
Red-breasted merganser	14	22	26	12(25) 0.010	12 0.001	30+ 0.005	9 0.001	H H	22 0.006	8 0.004	
Common scoter	H	10	38	1	7	17	m	ı	I	, , ,	
Tufted duck	101	σ	ı	21(28) 0.017	7	25 0.004	16 0.002	0	17 0.005	n m	
Mute swan	3-6	14	ı	1(1)	S	ı	I	I	12	ı	
Coot	м	2	1	6(8)	1	I	ı	ı	I	ı	
NOTES: Figu Lower figures 1 are densities Partridge (1988	res in bra for great- (prs/ha). 3) and Buc.	ckets for L. Ar crested grebe, Data is taken f kley (1989).	rrow are the red-breased from Buckley	likely bre merganser (1987), Wi	eding pairs. and tufted c nston (1987)	, iuck					

 $\Box$ 

TABLE 25 Nesting waterfowl (prs) on various western Irish lakes

ŧ

TABLE 26 Suggested criteria for rating nesting waterbird sites in Ireland where estimate is available for total population (Sharrock, 1976, Hutchinson, 1989).

#### Significance

Species	Irish population (prs)	National(5%)	Regional(1%)
Great crested grebe	400	20	4
Mallard	20,000	1,000	200
Red-breasted merganser	675	34	7
Common scoter	80	4	1
Tufted duck	2,000	100	20
Mute swan	7,000	350	70
Common gull (i	nland) 3,000	150	30
Lesser black-b gull (inland)	acked 3,000	150	30
Density (prs/10 km) of river birds on eleven Irish rivers TABLE 27

NORTHERN IRELAND

		TITUON									
Ч	2	т	4	ъ	9	2	ω	6	Моу	Dunkellin/ Lavally	Owenmore
3.6-37.2	I	0-19.2	I	1	i	1	I	ł	` 1	1	I
4.6-10.7	4.6	1.9-16.7	2.0	1	ı	I	1	6-19.8	1.8	7.04	15.58
1.8-4.6	I	0-5.14	1	I	I	I	I	i	0.63	I	0.58
i	1	ì	i	ł	I	L	ł	I	1.88	0.97	0.96
3.3-6.7	14.4	9.3-54.1	23.5	I	I	1	30.7	i	0.63	3.42	1.16
I	I	I	2.0	I	8.1	I	ł	ł	5.63	ł	2.89
2.3-10.7	6.0	0.6-9.8	7.8	I	ł	ì	2.3	6 • 6	3.75	0.82	3.85
1.8-4.6	1.4	0.6-6.0	5.9	I	1	I	3.4	0-2.2	0.63	I	2.89
4.0	3.7	0-5.4	2.0	I	ŀ	i	I	I	1	0.16	1.16
0-1.8	4.2	0-2.1	3.9	5.6	ł	9.1	ł	6.6-8.8	I	0.05	1.16
3.3-6.7 - 2.3-10.7 1.8-4.6 4.0 0-1.8	14.4 6.0 3.7 4.2	9.3-54.1 - 0.6-9.8 0.6-6.0 0-5.4 0-2.1	23.5 2.6 5.9 3.7 5.9 3.5 5.9				1 1 1 1 1 0 5 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 9 1	i - - 30.7   i - 8.1 - 30.7   i - 8.1 - 2.3   i - - 2.3   i - - 3.4   i - - 3.4   i - - 3.4   i - - 3.4   i - - -   i 5.6 - 9.1	i - - 30.7 -   i - 8.1 - - -   i - 1 - 2.3 6.6   i - - 3.4 0-2.2   i - - - -   i - - - -   i - - 3.4 0-2.2   i - - - -   i - - -   i - - -	i   -   -   30.7   -   0.63     i   -   8.1   -   -   5.63     i   -   -   2.3   6.6   3.75     i   -   -   3.4   0-2.2   0.63     i   -   -   -   -   -   -     i   5.6   -   9.1   -   6.6-8.8   -	6   -   -   30.7   -   0.63   3.42     0   -   8.1   -   -   5.63   -     3   -   -   -   2.3   6.6   3.75   0.82     3   -   -   2.3   6.6   3.75   0.82   -     4   -   2.3   6.6   3.75   0.62   -   -     4   -   2.2   0.63   -   0.16   -     5   -   9.1   6.6-8.8   -   0.16   -

Π

TABLE 28 Density of land birds (birds/ha) in Owenmore and Dunkellin/Lavally catchments in breeding season on affected land

Dunkellin/Lavally

J

L

 $\Box$ 

Robin	0.0287	0.163
Blackbird	0.211	0.182
Song thrush	0.079	0.061
Skylark	0.156	0.190
Sedge warbler	0.089	0.025
Goldcrest	0.244	0.038

Owenmore

\_

(robin, blackbird, skylark, song thrush and sedge warbler) were roughly similar between the catchments (Table 28, previous page) though the sedge warbler was more frequent in the Owenmore - this is likely to have been caused by a general population increase in the country. The density of goldcrest was markedly higher in the Owenmore perhaps because of the preceding mild winter or because of the frequency of hedges, woods and tall herbaceous vegetation. It should be noted that affected land in the Dunkellin/Lavally included some areas of bog (with lower numbers of all those species). Therefore the broad comparability of densities in the two catchments may conceal slightly higher numbers on affected land per se in the Dunkellin/Lavally.

## 3.3 AREAS OF SCIENTIFIC INTEREST

Arising out of the botanical and ornithological survey work a number of sites in the catchment stand out as having features of ecological interest that should be protected in order to conserve the diversity and species richness of the Owenmore. These are summarised in Table 29 and Figure 12 and described below. It is always difficult to define the boundaries of such areas as birds, especially, may make daily flights to other habitats which may or may not be included. Also to actually conserve a site it may have to be made much larger than the immediate area of interest so as to secure hydrological or other features. A commonsense approach is adopted in this report as it is the first in-depth survey of the ecology of the affected land in the catchment. More superficial study has been given to the area in the context of the whole county by 1972, previous reports (An Foras Forbartha, 1978), two summarised in An Foras Forbartha, 1981 and most recently by Wildlife Service (1989). The importance rating is the highest given to any feature of the site. This may or may not correspond to the conservation value which must be decided with reference to the full range of ecological variables.

## 3.3.1 UNSHIN RIVER (Figure 13)

Extent: Main channel 23 km, all channels, 211 km Rating: International Importance

### Description and Ecology:

The Unshin is fed initially by Lough Arrow so it represents the overflow from the springs in this lake. It leaves the lake at Bellarush Bridge as a clear and shallow, stony stream colonised by clumps of *Phragmites* and *Typha latifolia*. The channel splits into several branches through the reed bed (Plate 1), their sides lined by *Menyanthes*. Within the reeds TABLE 29 - AREAS OF SCIENTIFIC INTEREST IN THE OWENMORE CATCHMENT

NAME	EXTENT(ha)	IMPORTANCE	INTEREST
Unshin River	23km	International	Unmodified river ecology:rare plants
Lough Arrow	1250	National	Breeding & wintering wildfowl, Lake ecology
Ballysadare Bay	<u>7</u> 1500	National	Wintering waterfowl: salt marsh plants
Flughany Bog	91	National	Partially intact raised bog
Doocastle turlo	ough 38	National	Eutrophic turlough. Interesting flora
Templehouse/ Cloonacleigha	406	Regional	Aquatic & marsh plants Wintering waterfowl, breeding waders
Cloonakillina I	67	Regional	Scraw vegetation transitional to bog
Lough Meharth	29	Regional	Fen vegetation with rare species
Quarryfield W. turlough	30	Regional	Turlough/fen vegetation of unusual type. Wintering swans
Turloughmore	26	Regional	Mesotrophic turlough
Ballygawley (Ballydawley) I	52	Regional	Wintering wildfowl: rare plant
Corhawnagh	36	Local	Acid/alkaline wetlands: rare plant species.
Carrownabunny	18	Local	Calcareous fen with rare plants
Knockmullin	22	Local	Calcareous fen & marsh
Feenagh/ Bunnamuck L.	45	Local	Varied wetland vegetation
Lough Dargan	33	Local	Oligotrophic lowland lake
Fin/Risheen Lou	ighs 30	Local	Limestone lake & marsh.
Greenan	7	Local	Fen with adjacent turlough

] ] Ŋ Ŋ  $\left[ \right]$ ] Ŋ  $\Box$  $\left[ \right]$  $\left[ \right]$ ]

٦

J





Ranunculus lingua is occasional, Valeriana officinalis and Lysimachia vulgaris more frequent and extending to drier ground. Potamageton crispus grows on shingle banks where there is also a little lime deposition. P. natans, Scirpus lacustris and Littorella occur in deeper water.

The channel soon becomes enclosed by peat, the depth increases to 2 m or so and flow diminshes. Nuphar, Menyanthes and Berula erecta are common in the river while the banks are lined by Phragmites with Lythrum salicaria, Valeriana, Solanum dulcamara, Cicuta and Vicia cracca (Plates 3,4). There are pockets of Salix aurita with some Phalaris and Festuca arundinacea while Rumex hydrolapathum is occasional. Equisetum fluviatile and Carex rostrata are important at the river's edqe with Hydrocotyle, Epilobium hirsutum and locally stretches of Juncus subnodulosus, Carex elata and С. the channel Oenanthe fluviatile, lasiocarpa. In Elodea. Potamogaton perfoliatus and P. lucens and Scirpus lacustris are frequent, the latter filling the width sometimes with its floating leaves. Sparganium emersum and S. minimum grow at the edge and with P. coloratus in drains nearby. In shallower places, *Hippuris*, *Apium nodiflorum* and *P. crispus* are characteristic (Plate 2). *P. pectinatus* appears first at the eel weir in a water depth of 20 cm. or so, with *Myriophyllum* spicatum, Fontinalis and Ranunculus peltatus. R. circinatus occurs in a deeper peaty stretch at Drumraine where P. praelongus is also found.

Below Doonsheheen Bog conditions change as the river bed falls more rapidly in an enclosed valley. The river is a stony stream with *Ranunculus peltatus*, *Fontinalis*, *Potamogeton crispus* and in unshaded parts of the channel, *P. pectinatus*. *Apium nodiflorum* and *Nasturtium officinale* grow at the edges which sometimes are overhung by *Alnus* and *Salix cinerea*. Below Ardagh where the Unshin is shaded by large deciduous trees (with *Oenanthe crocata*, *Angelica*, *Lycopus*, and *Epilobium hirsutum* beneath them) the river opens out to flow through a peaty area with willows growing on old cutovers nearby. *Carex diandra*, *Filipendula* and *Festuca arundinacea* are frequent and there is much Fen Pasture subject to flooding.

Above Riverstown Poa palustris occurs on the riverbank amongst tall herbs and *Phalaris*, then the river shallows at Riverstown and flows over a rocky ledge. Once in Cooperhill, the Unshin meets flat alluvial land and its deep channel meanders through rushy pastures with Iris. There are seepages in the fields with Deschampsia, Carex vesicaria, etc. Potamogeton х sparganifollus and P. natans, Nuphar, Sparganium emersum, Oenanthe fluviatilis and Alisma occur in the water with Lemna minor and L. trisulca. Below Coolbock Bridge, the gradient begins to increase again (Plate 9), stones appear and begins to increase again (Plate 9), stones appear and Potamogeton pectinatus grows mixed with P. natans. Notable rapids occur below Lisconny House (Plate 5) where the outcropping horizontal limestone produces three main falls. The channel divides around small islands overgrown with Phalaris, Berula, Solanum dulcamara and Petasites hybridus. Fontinalis and Eurynchium riparioides occur in abundance with clumps of Ranunculus peltatus, Scirpus lacustris, Oenanthe

fluviatilis and O. crocata (Plates 7,8). The rocky steps are of different heights, the water in the subchannels of different speeds so many micro-habitats are present. Just above the rapids a large stand of Carex acutiformis occurs on the banks.

In Markree the river enters a wooded valley, its sides lined with Cornus sericea, Salix cinerea and in places Fraxinus and Quercus. Epiphytes run riot in this situation and there is an abundance of Lobaria, Usnea and Parmelia species with some Sticta. Mosses are similarly well developed and festoon the trunks and branches. Planted woodland and gardens follow at Markree Castle where the river slows down once more, flowing through pasture with willows (including Salix triandra) along its banks. Butomus first appears as a marginal plant beneath the castle and extends from here to the sea. A small alder wood contains Rorippa amphibia, Lysimachia nummularia and Ranunculus repens on ground that floods.

Below Ballygrania Bridge there is a uniform stony stretch of with scattered Scirpus and Potamogeton pectinatus river growing throughout the shallows. P. crispus and P. natans are also found in lesser quantity. A fringe of Butomus in places forming a scraw because of its density, is a notable feature along both banks (Plate 10) with frequent *Eleocharis palustris* and Myosotis scorpioides and more scattered Phalaris and Salix sp. Soon the depth increases to 1-2m, the grazed banks are made of mineral soil and rise with vertical faces above the Lysimachia nummularia and Polygonum amphibium river. are conspicuous at the edges: Oenanthe crocata and Berula occur at intervals. In the water Potamogeton natans remains the most frequent species but P. alpinus is found also, with some Clumps of Salix cinerea become common along the Elodea. slowest stretch of the river towards Collooney (Plates 11,33). Behind them the damp fields have sizeable stands of sedges especially Carex acutiformis, C. disticha with Filipendula and Geum rivale. The river is deep in this lower section, it seems to be 2-3 m but even here occasional non-flowering individuals of Butomus occur. Otherwise submerged plants are few except for P. natans and P. lucens at the edges.

Bird life on the main channels of the Unshin includes about 575 wildfowl in winter, mainly teal with some mallard and wigeon and with whooper swan north of Markree. There seem to be above average numbers of little grebe and water rail also in the section below Lough Arrow while cormorant and red-breasted merganiser use the river for feeding and transit to the lake. Small numbers of curlew and snipe (+/-40) winter in the valley.

# Evaluation:

The Unshin is unusual in having a spring-fed lake as its source. Hydrologically, this means that flood peaks are reduced and middle order flows increased over other types of river. It is also likely to have a more even water temperature, summer and winter.

Ecologically, it is one of only four undrained limestone rivers in the country (also the Fergus and Dunkellin, and the smaller Cahir in the Burren). It has shallow lowland stretches which were not found in any undrained calcareous river during a major investigation of 56 sections of 22 rivers by Heuff (1987). At one time there were six other similar rivers (Whelan, pers.comm.) but all of these are now changed by drainage activities. In the rest of Europe, such rivers are almost unknown: the chalk streams like the Test and Itchen in Britain are perhaps the nearest equivalent but limestone does not occur in quantity nearer than Yugoslavia. It is unpolluted for almost its entire length (An Foras Forbartha, 1986), supports very fast growth rates in fish (Whelan, pers. comm.) and contains many plant species not found elsewhere in the catchment. Its community of submerged plants is unique in its composition and abundance: especially the Littorellion section below Bellarush Bridge where Littorella grows, unusually (Schoof Van Pelt, 1973), on peat. The vegetation most resembles that found in the Shivnen which was drained in or about 1978.

### 3.3.2 LOUGH ARROW (Figure 14)

Area: 1250 ha Rating: National Importance

## Description and ecology:

Lough Arrow was not given detailed attention during this survey as it was outside the scope of the proposed drainage scheme. It is a large limestone lake sheltered on three sides by hills. It has a small catchment area (6255 ha) and is in fact fed largely from springs on the lake bed. Underwater terrain is characterised by a steeply sloping floor which rapidly reaches a depth of 20 m (Champ & King 1987). The average depth is over 9m and the maximum 33m. The nutritional status of the lake is mesotrophic (OECD, 1982): it has relatively hard water and moderate alkalinity. In most years the lake water stratifies and planktonic algae peak in the autumn when mixing recommences. Although slight enrichment seems to have occurred in recent years the algal species are substantially the same now as in the 1950's (Round and Brook, 1959).

The depth of the lake limits attached plant growth but charophyte algae are widespread. Seven species of Chara as well as Nitella opaca and Tolypella glomerata are listed by Champ & King (1987). Three Potamogeton species also occur including the uncommon P. praelongus, as does Littorella. Water lilies are common in shelter particularly at the south end. They include both Nymphaea and Nuphar, the former

indicative of oligotrophic conditions. *Phragmites* and *Scirpus lacustris* form extensive reed beds, the latter is more common throughout the lake and grows in islands also, off Ballinfad Bay. The marginal vegetation is richest at the north end of the lake where a tall herb and reedswamp flora includes *Lysimachia vulgaris*, *Scutellaria galericulata* and *Ranunculus lingua*, all uncommon species in the catchment as a whole. *Baldellia* and *Apium inundatum* grow in shallow water at the lake's edge.

The bird counts (Table 7) indicate that Lough Arrow supports substantial numbers of certain waterbirds. A total of twenty three species was recorded during the winter. Goldeneye (431), tufted duck (400), pochard (124), and coot (170) were the most frequent. Numbers of other species, especially dabbling duck, were small although reasonable flocks of black-headed and common gull occurred in February. The most unexpected species was the long-tailed duck of which there were three in November.

The lake was divided into sections for counting (see Appendix 2). In general the more abundant species were widely distributed over it, but a few species notably coot and pochard were usually concentrated in one part which varied from month to month. This suggests that they are held together by the flocking instinct but utilised most sections of the lake at some stage during the winter. Numbers of some species changed over the winter period. For instance, the little and great crested grebe populations seemed to decline continually from peaks in September. The highest counts of coot were obtained from September to December while the goldeneye, absent in September and October had a mid-winter population of 175 followed by a peak of 431 in February.

In summer, tufted duck, red-breasted merganser, great crested and little grebes nest in good numbers and there is in addition a gull colony on Inishmore where 30 pairs of lesser black-backed and a few common gulls breed. Here also a single common scoter was seen. The islands and peninsulas are important to the nesting wildfowl because of the nearby security of the water. Broods take refuge often in *Scirpus* beds through mergansers head out to the middle if disturbed. The nesting birds are well spread around the lake with high numbers on sheltered shores and around the islands (except Annaghgowla).

## Evaluation:

Lough Arrow is unusual in being a mesotrophic natural lake which has changed little in the last 40 years. It is largely spring-fed and very sheltered for its size so its hydrology is also different from most lakes. Although supplied by groundwater in a limestone area, it is not a marl lake like Lough Carra. It has considerably more submerged plant life, some of which is of interest.

Apart from its notable trout and eel populations, the lake is included here because of its bird fauna. It is the most important lake in the Owenmore catchment having a substantial wintering and breeding population. Its maximum winter count ranked second to Cloonacleigha Lough on one occasion but Lough Arrow has more consistent high numbers. The numbers of diving duck in winter can be considered of regional importance as can the nesting population of four species. Relative to its size it supports the highest desnity of breeding grebes, mergansers and tufted duck of any of the large lakes in western Ireland.

Data collected on the present survey would rank the lake of regional importance, but its hydrological and fisheries interest must increase this to national, if not international, coupled with its value as the source of the Unshin River (q.v.).

Although the boundaries of the ASI are shown close to the lakeshore, some control over the inflowing streams would also be necessary before the lake could be considered ecologically secure.

### 3.3.3 BALLYSADARE BAY (Figure 15)

Area: 1500 ha Rating: National importance

### Description:

This extensive estuary is an integral part of the Owenmore catchment insofar as the river supplies almost 95% of the freshwater it contains. Organisms in the bay are adapted to the salinities and suspended sediment levels they experience and could be affected, especially the filter-feeders, by changes in the sediment load.

The Bay is an area of mudflats, 1500 ha in extent. The river channel meanders through it, flowing first along the northern shore, then to the south at Knockcrow and finally back to the north at Carrigeenduff, before escaping around the Strandhill spit. There are four main areas of saltmarsh. The largest, Brughmore, links a former island (Inishmore) to the northern shore. In the north-east corner below Ballydrehid Bridge, another extensive marsh occurs, largely freshwater at the back and brackish near the shore. Two smaller saltmarshes occur on the south side. A linear one follows the shore in Streamstown where, across the bay, a much larger area has been partially reclaimed in Tanrego. The newest saltmarsh is established on quarry waste below the old mines at Abbeytown. Sand from an active quarry is enlarging this site at present.

Brughmore saltmarsh (Figure 15A) has extensive areas of Juncus maritimus with Festuca rubra, Agrostis stolonifera and in places Oenanthe lachenalii. In hollows and ditches in this tussocky area, J. gerardii, Samolus, Triglochin maritima and





often Scirpus maritimus take over. The area is grazed to some extent and there are patches of more open turf with Leontodon autumnale, Trifolium repens, Carex flacca and C. nigra and Lychnis. At the shore, and to some degree behind Inishmore, the more frequently inundated ground has Armeria, Glaux, Plantago maritima and Spergularia sp. Parapholis strigosa occurs in one place at the transition with the Juncus zone.

The Ballydrehid marsh (Figure 15B) is somewhat more complex as the salt influence is much less intense. The back of the marsh is a wet meadow cut through by ditches of *Scirpus maritimus* and *Juncus subnodulosus*. Then there is an unmown section of *J*. *effusus*, *Iris* and *Carex nigra* with some *J*. *gerardii* and *Triglochin maritima*. This grades into a *Phragmites* reedbed where the reeds are sometimes cut in sections. Occasional ditches or saltpans have *Cochlearia* officinalis, *Glaux*, *Samolus* and *Eleocharis uniglumis* while in one place *Ranunculus trichophyllus* grows. *Carex* otrubae is scattered through the grassier places. *Apium nodiflorum*, *R*. *sceleratus* and a few plants of *Butomus* occur in more open habitats.

The main river skirts the back of the marsh flowing into the bay at its western end. Schoenus, Juncus inflexus, J. subnodulosus and Phragmites are found here with the Oenanthe, Senecio aquaticus etc. There are small patches of saltmarsh along the river with Scirpus maritimus in it. Carex distans is occasional.

Streamstown is a relatively sheltered bay and the mudflats are colonised by more *Ruppia maritima* and *Zostera* cf angustifolia than elsewhere. Onshore there is a typical zonation of *Salicornia* spp., *Puccinellia maritima*, *Aster tripolium* giving way upwards to *Plantago maritima* and *Armeria* and finally to *Juncus gerardii*, *J. maritima* and *Festuca rubra*. *Oenanthe* occurs again as it does all around the estuary.

The Abbeytown marsh is in a state of evolution because of quarry wastes being swept into the bay. Half of the saltmarsh found in 1972 (aerial photograph) has been eroded but there is a new bank at the eastern edge where the washing water escapes. A number of marsh plants are associated with this freshwater, Apium nodiflorum, Berula, Triglochin palustre, Eleocharis palustris and Mentha aquatica occur with a little Butomus. Away from the stream saltmarsh species become dominant with Puccinellia maritima, Spergularia marina, Carex extensa and Eleocharis uniglumis.

Ballysadare Bay supports large waterbird populations from August to March in any year. Counts varied during this survey from 4,700 to 12,000 birds of 36 species. Table 7 shows that dunlin (max 5,760), curlew (1,330), bar-tailed godwit (979), oystercatcher, (607) and redshank (634) are the most numerous waders. The numbers of greenshawk (25) and sanderling (50) are also notable. Of the wildfowl wigeon (1,546), teal (572) and mallard (456) are numerous; brent geese (83) feed on the mudflats and red breasted merganser (111) in the channels. The parts of the bay used most by feeding birds were



Streamstown and the mudflats of the inner bay. The outer bay held relatively few birds except at Portroyal.

Numbers of many species varied over the winter. The highest count of brent geese was in late winter (February-March) as were those of common gull (Jan/Feb) and shelduck (Feb). Peak numbers of lapwing occurred in November-December and of December-January. Bar-tailed godwit goldeneye in were especially numerous in September though substantial numbers also over-wintered. Redshank built up gradually over the winter: September-October numbers doubled in November-January and doubled again in February. Other species varied more irregularly, partly due to the inaccuracy of counting wildfowl at Tanrego. However, it is obvious that the bay is used by migrating as well as overwintering birds. Little movement was seen to occur from this site to the rest of the catchment and numbers did not seem to be related. For most species it seems that the populations are distinct.

### Evaluation:

The saltmarshes of Ballysadare Bay are relatively good examples for the west coast and that at Abbeytown is decidedly unusual in its artifical origin and current evolution. The presence of *Parapholis* (only Sligo station), *Eleocharis* uniglumis and *Butomus* is of interest.

The bay supports nationally important (i.e. 5% of total population) numbers of dunlin, and red-breasted merganser but these numbers were only achieved on one out of six counts, during the winter months. In addition, eight other species can be considered of regional importance.

Ballysadare is renowned for its common seal population which numbered about 70 adults in the late 1970's (Warner, 1980).

3.3.4 FLUGHANY BOG (Figure 16)

Area: 91 ha Rating: National Importance.

Description (after Douglas & Grogan, 1986):

Flughany Bog (Plate 32) lies east of Cloonakillina Lough. It is mostly in County Mayo, but two lobes extend eastwards into Sligo. The north-east section is much modified by drainage and turf-cutting: the plots are marked, rather unusually, on the O.S. sheet.

The south-west half is fairly intact and has a pool and hummock system on its eastern part. Sphagnum imbricatum and less frequently S. fuscum grow in low, wide hummocks. Narthecium and Rhynchospora alba are very common with some Drosera anglica and Campylopus atrovirens on wet, quaking



flats or in shallow depressions. Menyanthes and S. cuspitdatum occur here and also in the pools proper. The bog was lightly burnt some years ago and the Calluna, Erica tetralix and cyperaceous plants remain rather short. Fire effects are also to be seen on some of the larger S. imbricatum hummocks. Towards the western part of this area, the terrain is drier and more hummocky with somewhat steep-sided pools which become elongated and tear-like near the margins. They contain Menyanthes, S. cuspidatum and S. auriculatum.

The north-east part of the bog is burnt, dry and poached. Its vegetation is dominated by Narthecium, and Erica tetralix with Scirpus cespitosus, Carex panicea. Myrica and some Eriophorum vaginatum. Sphagnum, mostly S. papillosum, covers little of the ground. A partially grazed and cutover flush dominated by Molinia and Myrica separates this section from the wet south-east lobe. A small partly subterranean channel with Succisa, Heracleum sphondylium, Angelica and Rumex acetosa in addition to Molinia and Myrica also occurs.

Flughany supported about 160 snipe in winter 88/89. Snipe also nested (5 pairs) along with 8 pairs of curlew.

## Evaluation:

Flughany is the best developed raised bog in the catchment that is in anything approaching its original state. Parts have been much modified by drainage and turf-cutting but there is a section that remains wet with a good flora. Three liverworts (Kurzia pauciflora, Mylia anomala and Pleurozia purpurea) were recorded here as first vice-county records though they probably occur quite widely elsewhere. In all, 14 species of liverwort, 20 mosses (including 10 Sphagna) and 21 higher plants are noted by the survey. The quality of this bog puts it into the second category of a six-point scale (Cross, in prep.) and makes it therefore of national importance.

 $\prod$ 

3.3.5 DOOCASTLE TURLOUGH (Figure 17)

Area: 38 ha Rating: National Importance

### **Description:**

Doocastle turlough lies in a long depression filled for the most part with glacial till. It is divided into two basins, the western larger one floods regularly, the eastern one below the castle more intermittently. The turlough gives the impression of a flat grassy area dissected by frequent fences and drains and by a few walls. The main channel runs along the axis of the turlough close to its southern edge. Water remains in most of this ditch throughout the summer and there is also a fairly persistent pool west of the castle. A slight rise in the main basin is the only other topographic feature.



The vegetation over most of the area is closely grazed. There are extensive stands of short Phalaris with Filipendula, Potentilla palustris, Ranunculus flammula, Caltha and Galium palustre mixed into it. Carex vesicaria is locally common, as is C. nigra, while Mentha arvensis is scattered throughout, especially on ditch edges. Away from the richer, more frequently flooded parts, Agrostis stolonifera covers a lot of the ground with Alopecurus geniculatus, Senecio aquaticus, Ranunculus repens, Potentilla anserina, Carex nigra and C. hirta. The sedges come into their own on the central rise where conditions are more oligotrophic. C. panicea and C. hostiana grow here in abundance with Anthoxanthum, C. pulicaris, Eriophorum angustifolium, Ctenidium, Camyplium stellatum and, in small quantity, Galium uliginosum.

As the bed of the turlough falls towards the east and south, Calliergon cuspidatum, C. the mosses giganteum, and Leptodictyon become abundant. Fontinalis appears as the vegetation becomes more open and dominates the lowest point that remains flooded into June (Plate 30). It grows with Polygonum amphibium, Eleocharis palustris, Apium inundatum, Senecio aquaticus, and Rorippa palustris. There and elsewhere in the ditches is Hippuris, Sparganium emersum and erectum, Alisma, Ranunculus trichophyllus, R. aquatilis, and Chara vulgaris. Potamogeton natans is quite widespread and there are smaller amounts of P. pusillus and P. crispus.

The eastern basin is small and as a turlough less defined. It is an oblong area with several deep ditches, one with a stream. Carex vesicaria is an important ground cover with Eleocharis palustris, Filipendula, Phalaris and some Deschampsia cespitosa. Stellaria palustris is quite widespread and a few clumps of Leucojum aestivum grow at the south end where Fontinalis and Polygonum amphibium are also found. To the east and south-east the turlough runs away into wet hayfields with abundant Filipendula and some Phalaris, Alopecurus pratensis, Phleum etc.

Doocastle turlough is used by a number of wintering birds though their presence depends on the level of flooding at any given time. A maximum population of 551 waterbirds was recorded in 1988/89, tha main species being wigeon (289), teal (142), lapwing (115), curlew (92) and golden plover (73). Pochard, blackheaded gull and whooper swans occurred in smaller numbers and there were a further 11 species recorded including a greenshank. In the breeding season, lapwing occur in good numbers (8 pairs), and redshank (2 pairs) also nest. Coot and little grebe remain on the pond as long as it lasts and probably nest. There were in addition two broods of mallard and one of mute swan seen and, after the breeding season, a brood of teal.

### Evaluation:

Doocastle is the most important turlough in the catchment in terms of its wintering birds and rare plant species. Being intensively grazed the vegetation seldom reaches its maximum height, but it is varied because of the presence of the central rise which is flooded only irregularly, and of semipermanent water. Four of the aquatic plants are rare in the catchment while among the terrestrial ones, two (*Leucojum* and *Ophioglossum*) are recorded only in one other site.

The site is relatively important to wintering waterbirds. It comes third out of the inland sites (after L. Arrow and Cloonacleiga/Templehouse) although only three species occur in numbers of local significance. These are whooper swan, golden plover and black-headed gull. In national terms Doocastle is the most northerly of the large eutrophic turloughs in the country (Goodwillie, 1992) and, at the geographical extreme is therefore of inherent interest. In addition its vegetation is diverse as compared to the other nearby turloughs.

# 3.3.6 TEMPLEHOUSE/CLOONACLEIGHA LOUGHS (Figure 18)

Area: 406 ha Rating: Regional Importance

#### Description:

This is a relatively large area listed as one site because of its mobile bird populations. It extends from Cloonacleigha Lough westwards along the river to Killawee Lough and then eastwards to Templehouse and the oxbow lake below the bridge.

Starting at the south end, Cloonacleigha Lough (68 ha) lies among low hills and bog. It has a stony shore over much of its eastern part, the lake bed falls off quite rapidly with only scattered marginal growth. At the west end however, the land is almost flat and peatland which fills the valley forms the lakeshore. Reedbeds occupy extensive areas close to the entry and exit channels of the lake.

Offshore the substrate is very soft: Potamogeton perfoliatus, Elodea and Myriophyllum spicatum cover 20-30% of the ground in 2.5 m of water. A zone of Chara species occurs next. Five species were recorded along with P. crispus and Nuphar, Scorpidium scorpioides and numerous algal balls (Cladophora sp.). The reedbeds consist largely of Phragmites and Scirpus lacustris backed by Carex elata. Other aquatic plants grow between the tussocks of this sedge: Hippuris, Menyanthes and Rumex hydrolapathum are characteristic (Plate 22) while a few Salix cinerea are established on the tussocks themselves. Carex vesicaria, Phalaris and Lysimachia vulgaris grow in the upper part of the C. elata which then grades into a shorter more even vegetation of C. nigra, C. panicea, C. disticha, Galium palustre, Ranunculus flammula etc. Stellaria palustris is frequent in this vegetation which in places becomes a floating scraw of Potentilla palustris, Carex diandra, C. angustifolium. Lythrum and rostrata and Eriophorum Scutellaria galericulata are scattered through the community which becomes a typical fen pasture above, with Hydrocotyle, Senecio aquaticus, Deschampsia and Festuca arundinacea.





The river leaving the lake is very slow moving, meandering through river sediments interleaved with peat. The inflow from the south has been deepened and straightened quite recently but the other channel is unchanged. Clumps of Sparganium erectum, Equisetum fluviatile and Rumex hydrolapathum line the edges while the centre is filled with submerged or floating leaved species. Elodea and Alisma are frequent close to the lake with Nuphar and a little Nymphaea. Below this Oenanthe fluviatilis, Sparganium Potamogeton emersum, natans, Ρ. crispus, Callitriche stagnalis and C. platycarpa achieve almost 80% coverage in places (Plate 23). Mimulus guttatus is abundant over a considerable distance growing at the edge of the river channel and on the banks above (Plate 24).

Downstream as the bog impinges on the channel the banks become higher and are covered by dense *Phalaris*. The channel flora continues unchanged. After 1 km, the *Phalaris* gives way to rushy poor pasture on both sides which continues to the Templehouse reedbeds. In this lake *Scirpus* beds are confined to the western and part of the southern shore and continue as far north as Temple House. The rest of the shore is formed of old lake bed as the lake was lowered by 1.5m in the 1930's. Flat silty areas predominate in the south where a bog impinges on the lake and in the south-east, including the stretch that links the former island to the mainland. The island itself and the hill due north of it cause the shore to become stony and strewn with larger rocks. *Cinclidotus* on these boulders shows that the lake floods in winter up to its former size.

Between the stones the damp grassland consists of Alopecurus pratensis, Agrostis stolonifera and Carex nigra with Filipendula, Caltha, Eleocharis palustris, Bellis, Mentha arvensis and a little Viola canina. Carex elata tussocks are scattered along the shoreline and Alnus trees develop on the upper shore. The finer substrate in Portinch Bay and southeast of the island is covered by a mixed sedge stand of Carex elata, C. rostrata and C. vesicaria with large patches of C. aquatilis adjacent to the Salix cinerea trees. C. paniculata and Stellaria palustris are locally common as, on the south shore, is Lysimachia nummularia. Bidens cernua and Rorippa palustris also occur with much Equisetum fluviatile, Myosotis scorpioides, Polygonum amphibium etc. Close to the entry of the Cloonacleigha river there is an extensive scraw of Agrostis stolonifera, Sparganium erectum, Calliergon giganteum and C. cuspidatum, and Epilobium palustre.

Willow trees (Salix cinerea) mark much of the old shoreline from this river north to the bridge and south to Kilbrattan Point. They form an open stand with Alnus, interspersed with clearings full of Carex vesicaria, C. rostrata and C. elata with scattered Filipendula, Lysimachia vulgaris and Senecio aquaticus. All these areas are lightly grazed. The best developed willow wood (A on map) is just north of the oxbow lake in Kilbrattan (Plate 17). Here low Salix cinerea trees form a denser wood, apparently totally natural. The trees fall over in the soft substrate and resprout when they reach any size so they have a distinctive rounded shape. Their branches are covered by a dense growth of epiphytes, Cladonia coniocraea, C. pyxidata, Usnea comosa and U. rubicunda are noticeable (lichens from other parts of the area are listed in Alexander et al. 1989). The ground between the trees has the same species as above, the tussocks of Carex elata reaching a large size (Plate 19). Where mud is exposed by frequent flooding Galium palustre, Calliergon giganteum, Caltha, Cardamine pratensis and Rumex hydrolapathum are distinctive giving way to Cicuta, Urtica and Phalaris nearer the river.

The oxbow itself is a shallow pond when water levels are low (Plate 18). Hippuris, Oenanthe fluviatilis, Alisma and Nuphar are found in it with Rorippa palustris and Salix cinerea seedlings on temporarily dry patches. Reedbeds surround the pond with mostly *Scirpus* on the river side and *Phragmites* on the west. Behind the Phragmites a mixed tall fen occurs in which Carex lasiocarpa, C. elata, C. rostrata and Phalaris play important parts. Lysimachia vulgaris, Stellaria palustris and Lathyrus palustris (Plate 37) are abundant this in community in places, the latter sometimes swamping the tussocks of *C. elata*. To the west, lower vegetation which has been occasionally mown grows in the peaty ground. Much Carex nigra, C. panicea, Deschampsia, Festuca rubra and Juncus effusus occurs here with J. conglomeratus, Valeriana, Lychnis and Veronica scutellata. Stellaria palustris is scattered everywhere and Pedicularis palustris, Leontodon autumnale and Plantago lanceolata are also noticeable.

On the south side of the oxbow (Plate 17) an extensive area of floodgrass covers the riverbank. Carex vesicaria and a little C. elata grow in a mass of Agrostis stolonifera and Eleocharis palustris with Veronica anagallis-aquatica and V. catenata. In the damper parts Myosotis scorpioides, Bidens cernua and Sparganium spp. occur. A shorter sedge community marks the transition to the damp pastures behind.

The bird populations that use this whole complex are large and at least in winter they move over it in response to feeding roosting demands and disturbance. It is and likely that Cloonacleigha Lough is largely used as a roosting area, certainly for dabbling duck and as a refuge during shooting at Templehouse. Wildfowl numbers were very variable here: a peak of 1248 birds was the highest total for any inland waterbody though the average count was much lower. Teal (max. 642), wigeon (460) and mallard (200 + in August) were the most numerous species with lesser numbers of tufted duck, pochard, A total of 20 species occurred. Templehouse and goldeneye. Lough also carried sizeable numbers of birds. The dabbling duck seemed to feed here at the edges of the lake but diving duch were also numerous. The peak count of 773 waterfowl included a large flock of wigeon (407) with considerable numbers also of teal (224), tufted duck, lapwing, mallard and goldeneye.

When the rivers are in flood many of the birds leave the lake and occur in small groups to the west. At evening and when disturbed at other times, they fly back to the nearest lake and they obviously belong to a single population. This was

confirmed in March when an aerial census of the complex was arranged soon after ground counts of the lakes.

The wildfowl that nest in the area were not accurately counted. A single visit however showed 21 mute swan present (4 obvious pairs), 103 mallard (10 pairs), teal (1-2 pairs), tufted duck (1 pr), great crested grebe (4 pairs), moorhen (10+ pairs), coot (2+ pairs), and water rail (5+ pairs). In addition 5 pairs of whinchats were seen, mostly west of the lakes, where a short-eared owl occurred also, and, in autumn, a hen harrier. A heronry of 21 nests (1989) is located in beech trees on the eastern shore of Templehouse Lake.

The river valley and adjacent wetlands support a relatively large wader population including snipe (at least 40 pairs), lapwing (18), curlew (9), and redshank (2). Of these only 7 pairs lapwing (and 1 pair oystercatcher) nest on the lakeshores (Templehouse).

# Evaluation:

The area contains the greatest range of wetland vegetation in the catchment and the best development of willow carr, reedbed and tall fen. The west end of Cloonacleigha, the S.E. of Templehouse Lake and Portinch Bay, and the oxbow lake below Templehouse Bridge stand out, together with the river west and north-west from Cloonacleigha. Nowhere else in Sligo are comparable stands of vegetation found. The nearest equivalent areas are in Fermanagh, Monaghan and by the Shannon. A number of rare plants occur, Lathyrus palustris in only found in attains its the oxbow, Carex aquatilis best Sligo at development at Templehouse, while the abundance of Mimulus and more fully aquatic species in the connecting is river spectacular. The Unshin River is, in places, as full of aquatic plants but the species selection is distinct because of the water chemistry.

The overall waterbird figures show that this is the most important inland area for many wintering species within the catchment. It is certainly the premier site for dabbling duck with regionally important numbers of teal (642). For wigeon (827), mallard (200+), tufted duck (175), pochard (79) and lapwing (224) it has local importance. Templehouse Lake carried the only pintail and shoveler in the catchment in winter. The area has the major concentration of breeding waders within the Owenmore though it is only of local importance for snipe. However, there is an accumulation of lapwing within it at the end of the nesting period and it may be of value to a larger area for this reason. Templehouse Lake had the only nesting oystercathers seen: this is an unusual species inland since only 5-15 pairs are thought to occur (Dare, 1970). Its group of herons is also notable since it is the largest heronry in the county.

## 3.3.7 CLOONAKILLINA LOUGH (Figure 19)

Area: 66.5 ha Rating: Regional Importance

### Description:

Cloonakillina as mapped in 1915 was an oblong lake with three islands and extensive areas of reedswamp. Today after some drainage and the continued invasion of plants there is a V-shaped area of open water enclosing an extensive floating scraw which has incorporated the islands. A number of pools remain in it: an especially large one occurs at the west end.

The shores of the lake proper are stony on the north and east and peaty to the south and west. The former lake bed on the north shore is covered by Carex nigra, Juncus articulatus, Trifolium repens, Hydrocotyle etc. with C. lepidocarpa, and C. serotina on the sandy areas. Water drains through it from above with Ranunculus hederaceus in the streams. The lake itself has a silty bottom with peat on the south side. Thin growths of Scirpus lacustris occur in places with several submerged Potamogeton species (P. obtusifolius, P. crispus, P. praelongus, P. berchtoldii and P. alpinus) as well as Nitella flexilis and Ranunculus circinatus. Both Nymphaea and Nuphar grow in the lake, the latter especially in the northern limb.

The scraw is a complex community based on sedges, Phragmites and Menyanthes (Plate 21). In separate areas Phragmites, Carex acuta, C. lasiocarpa and C. diandra dominate the vegetation, C. rostrata, C. nigra and C. paniculata being more thinly are patches too of Juncus subnodulosus spread. There especially towards the southern shore. The C. acuta forms the tallest cover in which Lysimachia vulgaris, Lythrum, Filipendula, Phalaris and Phragmites grow along with smallish Salix cinerea and Alnus. The tall fen becomes quite species rich in places. There is an abundance of Lychnis, Valeriana officinalis, Pedicularis palustris, Myrica, Myosotis laxa, scutellata, Eriophorum angustifolium and Saqina Veronica nodosa with some Agrostis canina, Scutellaria galericulata, Dactylorhiza incarnata and Platanthera bifolia where the larger sedges have lost some of their vigour. *Cicuta* is characteristic beside areas of open water. As the peat Carex lasiocarpa seems take over accumulates, to with scattered Deschampsia and Juncus effusus. In the most oligotrophic sites C. diandra occurs with Menyanthes and there may be invasion by Sphagnum. S. squarrosum is found sparingly, S. contortum more commonly, as is Aulacomnium. Carex limosa decorates many of these areas with a little Eleocharis multicaulis, Drosera rotundifolia and Dactylorhiza maculata. At the south western side of the scraw a distinct development of this community includes scattered Phragmites with abundant C. limosa, Narthecium, Erica tetralix, Drosera anglica and Juncus bulbosus. Hummocks of Sphagnum palustre occur with a little Utricularia intermedia in the open peaty substrate.

At the west end of the site *Phragmites* (here with an abundance of very tall *Carex lepidocarpa*) runs into an extensive softer



scraw of Carex rostrata, Agrostis stolonifera and Equisetum fluviatale where water collects from the surrounding land. The pond in the north-west corner has Scirpus lacustris, E. fluviatile and Cladium leading landwards into sedges and tall herbs. The transition to the surrounding bog is marked by dense Molinia with Myrica and Calluna. Conifers have been planted along much of the southern shore so they obscure the tussocks of limit Carex zonation. At their vegetation paniculata with Alnus, Caltha and Epilobium palustre occur.

Cloonakillina holds relatively small numbers of wildfowl in winter, though the cover makes counting them accurately almost impossible. The highest total must be of the order of 200-300. On one occasion in winter 1988/89, 170 wildfowl were recorded, including mallard (86), teal (46) and wigeon (28) but many more teal could have been hidden. There was a large number of lapwing (210) there too in January. Two pairs of lapwing were found nesting at the lake along with redshank (2 pairs), common sandpiper (2), snipe (2), mute swan, curlew and dunlin (1). Two broods of mallard were also seen and it is one of the most likely lakes for nesting teal (3 pairs were seen). Whinchats use the surrounding area.

## Evaluation:

Cloonakillina is a unique lake in this catchment because of its extensive floating scraw. It is the location for ten of the rarer plant species and supports by far the largest stands of *Carex acuta* and *C. limosa*. Ecologically, it is of considerable interest, representing one of the pathways in the formation of a raised bog. This is an evolutionary process hidden in the base of most existing bogs and of rare occurrence today. The site is comparable to the Scragh Bog in County Westmeath. None of the bird population seem to reach significant levels though the numbers of lapwing are notable in catchment terms. The nesting of dunlin however, and of teal, is of interest.

3.3.8 LOUGH MEHARTH (Figure 20)

Area: 29 ha Rating: Regional Importance

### Description:

L

Lough Meharth is a long narrow lake set in low hills that run parallel to the Unshin River above Riverstown. It is quite shallow and sheltered for the most part and Alisma grows away from the shores as scattered plants. The lake edge is fairly uniform, a band of Scirpus lacustris is backed by a scraw of Carex rostrata, Menyanthes, Equisetum fluviatile, Rumex hydrolapathum and Cicuta. Phragmites and Phalaris are present around most of the lake growing amongst the fringing Salix bushes. Phalaris becomes very abundant along the exit stream where it forms a wide band on the southern side (Plates 27,28). Poa palustris is mixed into this stand, in places



abundantly, along with some Juncus effusus, Filipendula, Agrostis stolonifera and Carex disticha. Away from the channel the vegetation loses some of its luxuriance and becomes more fenny in character. Poa palustris still occurs but Ρ. trivialis is probably more frequent. The community is dominated by Juncus acutiflorus, Filipendula, Valeriana, and Vicia cracca. Accumulation of litter on the peat substrate a grassier community of Holcus lanatus, in brings Anthoxanthum, Carex nigra, C. disticha, Rhinanthus and Agrostis canina. This leads into meadowland as the ground rises.

The central section of lakeshore on the south side has a narrow strip of Phragmites into which willow trees have been bulldozed. Poa palustris is rare here, but is sometimes present on the upper flood line. Two bushes of Ribes nigrum also occur. The Poa dies out at the head of the lake where there is an extensive fen running into two adjacent valleys. The sward is composed largely of Carex disticha with Menyanthes, Sparganium erectum, Potentilla palustris, Angelica, Equisetum fluviatile and Juncus acutiflorus. In places this forms a scraw with Carex diandra, elsewhere large Alnus) or *Festuca* of C. paniculata (some with clumps arundinacea occur, especially at the flood line of the lake and between the two feeder streams. This fen is species-rich and homogeneous. The vegetation is about 1 m high and well stratified. The smaller species include Crepis paludosa, Lychnis, Succisa, Lotus uliginosus, Equisetum palustre, Trifolium spp. and Dactylorhiza fuchsii. Mosses are generally abundant, Calliergon cuspidatum, Rhytidiadelphus squarrosus, Plagiomnium affine and Cratoneuron filicinum are the most obvious.

Lough Meharth carried small numbers of waterfowl in winter. Wigeon (45), teal (18), mallard (6) and coot (11) are the main species.

# Evaluation:

The site is listed as an area of interest largely because of the presence of *Poa palustris*, a rare grass whose nearest known station is in Fermanagh. It occurs in only six of the forty Irish vice-counties (Scannell & Synnott, 1987) and at most of its sites (mainly in Ulster) it is considered an introduced species. At Lough Meharth, by contrast, it appears indigenous, being established in fully native vegetation over a wide area. It thus is of considerable interest here.

The fen at the head of the lake is well developed and being totally ungrazed is a good example of its kind.

# 3.3.9 QUARRYFIELD WEST TURLOUGH (Figure 21)

Area: 30 ha Rating: Regional Importance

#### <u>Description</u>:

This turlough (Plate 31) occupies a basin that receives stream drainage from the S.E. as well as flooding from the N.W. corner. Peat growth has occurred in the eastern half and there seems to have been some peat cutting in the past. What remains is a complex wetland much of which is a scraw. Base status seems directly related to the distance from the sinkholes in the NW corner so that a striking vegetational transition occurs along a NW-SE axis.

Near the sinkholes which are slightly above the floor of the turlough a semi-permanent pond occurs with Potamogeton natans, Alimsa plantago-aquatica, Apium inundatum, Ranunculus peltatus and Chara sp. The substrate is fine mud which is partially exposed in most summers. Carex vesicaria, Polygonum persicaria, P. minus and Veronica catenata grow near at hand vesicaria, Polygonum colonising inwards as water levels permit. South-eastwards the community changes to a scraw of C. vesicaria, Juncus articulatus, Eleocharis palustris, Equisetum fluviatile and Bidens cernua rooting in a fluid mud. Due south Stellaria palustris, Epilobium palustre, Polygonum amphibium and Menyanthes form an even softer scraw with Sparganium erectum, Hippuris and Carex acutiformis growing through it. Patches of floodgrass with Agrostis stolonifera, Potentilla purer palustris, Veronica scutellata occur towards the edges, again with much Bidens.

The vicinity of the stream is marked by *Phalaris*, Carex rostrata and Sparganium erectum with a few bushes of Salix aurita. Floodgrass species continue along its length giving way northwards to Carex nigra, Mentha etc. The stream appears to have been pushed northwards as a sort of lagg by peat growth from the south. Carex nigra, Molinia, Filipendula, C. rostrata and C. disticha form much of its present vegetation diandra, Galium palustre and Stellaria palustris with C. of the wetter ground. G. characteristic uliqinosum is sprinkled throughout, as small plants growing as likely in Sphagnum contortum as in the company of Lychnis, Trifolium repens and Rhytidiadelphus squarrosus. This fen community is replaced southwards by small sedges: Carex nigra, C. panicea and C. hostiana are frequent with Molinia, Succisa, Parnassia and Cirsium dissectum. The transition, perhaps the upper limit of frequent flooding is marked by tussocks of Deschampsia and Festuca arundinacea. The dry sedge community also extends to the wetter areas down old trackways.

### Evaluation:

Quarryfield West turlough is totally different to the other turloughs in the catchment, having only limited areas of firm



grassy vegetation. This is probably because of the inflowing stream and the fact that the sinkhole is above the lowest point of the basin. It cannot dry out completely for this reason, and the scraw vegetation floats on a permanent body of water. There are only a few turloughs known that have such a well-developed scraw, for example, Lough Croan in Roscommon. This makes the site at least of regional interest as does the presence of eight rare plants and the occurrence of a comparatively large flock of whooper swans.

3.3.10 TURLOUGHMORE (Figure 22)

Area: 26 ha Rating: Regional Importance

Description:

This is a flat grassy turlough with an undulating floor set in limestone land without a drift cover. A rise across the narrow point divides the depression into two main basins but each of them has a number of subsidiary hollows and sinkholes.

The vegetation is lightly grazed and is up to 25cm high or more in places. The turlough as a whole is oligotrophic but in the northern basin nutrients are sufficient to favour Phalaris, usually in association with Filipendula, Carex disticha and Ranunculus repens (Plate 29). The more open places have Agrostis stolonifera, Potentilla anserina, Plantago lanceolata, Trifolium repens, Carex hirta and Senecio aquaticus. Mentha arvensis is frequent, particularly along walls, and at the northern edge where a limestone outcrop occurs.

In the southern basin grasses are replaced by sedges to some extent: Carex nigra, C. disticha and C. hirta in order of abundance. Juncus articulatus, Hydrocotyle, Polygonum amphibium and Calliergon cuspidatum are relatively constant while Rumex crispus is also noticeable. Around the sinkholes it becomes common together with Capsella and Stellaria media and in one place Rorippa palustris.

On the central rise and around the south and west edges of the turlough the transition to heathy ground adds a considerable number of species. In this occasionally flooded community are *Carex panicea*, *C. demissa*, *C. ovalis* and *Bellis* as well as *Nardus*, *Deschampsia*, *Festuca pratensis*, *Potentilla erecta* and *Viola canina*. On the rise itself, *Molinia* forms rough grassland with *Carex hostiana*, *Succisa* and *Dactylorhiza fuchsii*. These occur at the top flood levels with *Cirsium dissectum*, *Leucanthemum* and *Juncus conglomeratus*. Above them an acid heath of *Calluna*, *Luzula multiflora*, *Galium saxatile* and *Juncus squarrosus* is present.

The turlough is crossed by a number of stone walls, each with its fringes of *Cinclidotus*.



ப

η

С U

L

J

]

.
The nutrient-poor nature of much of the grassland in the turlough probably contributes to an overall scarcity of wintering birds. In summer also waders and wildfowl were rare: only 4 pairs of lapwing were thought to breed. 32 lapwing occurred on one occasion in winter and a small group (6-7) of whooper swan in November and February. On a high flood in February 9 mallard and small numbers of four gull species (including lesser black-backed) were present.

#### Evaluation:

Turloughmore is an extensive turlough with a minimum of human interference. It is at one of the extremes of the nutritional scale in this habitat and the transitional vegetation between the oligotrophic basin and the surrounding heathand bog is unusually well developed. The corollary of this is that few birds use the site and only two plant species rare in the catchment occur.

# 3.3.11 BALLYGAWLEY (BALLYDAWLEY) LOUGH (Figure 23)

Area: 52 ha Rating: Regional Importance

# Description:

Ballygawley is a secluded acidic lake of considerable size surrounded by coniferous woodland. It is fringed by open reedswamp in which Phragmites and Scirpus play a part with some Carex lasiocarpa, C. rostrata, Equisetum fluviatile. Baldellia and Sparganium minimum also occur as, formerly, did Lobelia. This has now disappeared because of agricultural pollution (J. Ryan, pers. comm.). Behind this, Salix cinerea, Betula pubescens and Alnus grow on a peaty flat amongst Molinia and Myrica. On a sandy or stony substrate, the trees meet the water directly, and in the woodland conditions Scutellaria galericulata, Mentha aquatica and some Lycopus grow. At the south end of the lake, Carex paniculata and Osmunda characterise the ground layer of a forest that is flooded intermittently. Much Alnus incana has been planted here.

The lake holds considerable numbers of wildfowl at times during the winter. During this survey, the most numerous species were wigeon (max. 416), teal (167) and whooper swan (71). Lesser numbers of mallard (38) and mute swan (23) occurred with less than 20 of a further ten species including cormorant and goldeneye. As on all wetlands the counts of all species varied considerably, none more so than whooper swans. Relatively few swans were present in October, but they built up in November and December before declining again. Highest numbers of wigeon occurred in November/December and of teal in January.



# Evaluation:

Ballygawley is one of a relatively rare type of lake in the catchment, taking all its water from the acidic Ox Mountains. It is, however, surrounded by forest, which probably affects water quality and certainly has modified the nearby vegetation. Despite this it has a few uncommon species of plant and is the only site in Sligo for Carex divulsa (in woodland on the eastern shore).

The seclusion and absence of shooting does seem to favour wildfowl. The flock of whooper swan is large enough to be of regional importance and the wigeon of local importance (21% of all those in catchment). The dragonfly fauna is also interesting (Cotton, pers. comm.) being different to most of the lowland lakes.

# 3.3.12 CORHAWNAGH (Figure 24)

Area: 35.6 ha Rating: Local Importance

#### Description:

Two separate wetlands make up this site which is set on the very edge of the coastal limestone lowlands under the steeply (Plate 12). rising Ox Mountains till Glacial has been deposited against the acidic rocks which are covered by blanket peat and open oak woodland. At their base Corhawnagh Lough is relatively deep and reed-fringed. Cladium mariscus is backed by Phragmites, Carex rostrata, Carex elata, C. acuta and Juncus acutiflorus. Within this reedbed Breutelia, Hydrocotyle, Scorpidium and Campylium stellatum occur suggesting a high base status. East and west of the lake there is low cutover bog with dominant Carex nigra and patches of Molinia and Juncus acutiflorus. Old pools in this normally carry a scraw of Menyanthes, Potentilla palustris, Equisetum fluviatile, Carex diandra and Lychnis while peat banks have Erica tetralix, J. conglomeratus and Narthecium. There considerable limey infiltration into low places in t is this community and onto the northern shore of the lake. Such sites share species like Carex lepidocarpa, C. dioica, C. hostiana, Briza, Parnassia, Sagina nodosa and Ctenidium (Plate 14). The mineral soil has, in addition, Juncus inflexus, Pinguicula vulgaris, Plantago maritima, Selaginella, Gymnadenia and Eleocharis quinqueflora with scattered Juniperus leading into drier Thymus/Leucanthemum pasture.

Schoenus grows at some low points of the cutover with Chara sp. and it is also found in a good flush at the S.E. corner of the lake with an abundance of Eriophorum latifolium and Eleocharis quinqueflora. Juncus articulatus, J. bulbosus and Potamogeton polygonifolius are frequent in the streams that flow through this area.

106



Eastwards, the drainage stream is cut deeply into the mineral soil but several other depressions at the foot of the hills produce additional wetlands. The first is a small acidic pool set around with *Myrica*, *Molinia*, *Crepis paludosa*, *Juncus acutiflorus* and *Veronica scutellata*. A little *Schoenus* occurs also, an outlier of the large colony in Kilboglashy that covers the northern part of this wetland and the sloping hillside to its northwest (Plate 13). A strong calcareous influence brings in the same species as at Corhawnagh with the addition of Equisetum variegatum.

The main body of the eastern wetland is a grassy fen made up of Juncus subnodulosus, Carex disticha, Arrhenatherum, Festuca rubra and Phragmites. These grow to a height of 130 - 160 cm from dense of litter. The drier Phragmites а mat is infiltrated with а quite exceptional abundance of Ε. variegatum together with Galium palustre, Caltha, Holcus and Cardamine pratensis. Vicia cracca, Filipendula and Epilobium hirsutum are also noticeable. The wetter places have Equisetum fluviatile, Menyanthes, Epilobium palustre, Mentha aquatica and Calliergon giganteum while Catabrosa, Samolus, Veronica beccabunga and Nasturtium officinale fill the drains.

# Evaluation:

Corhawnagh is one of several wetlands in the catchment with a strong calcareous input but its vegetation types and contrasts are unique, as is the abundance of *Equisetum variegatum*. The most important factor is the juxtaposition of acid rocks and limestone till but the low intensity or absence of grazing is also notable. No bird populations of interest seem to occur and the site is primarily a botanical one. It contains six species rare in the catchment.

3.3.13 CARROWNABUNNY (Figure 25)

C-

Area: 17.8 ha Rating: Local Importance

#### Description:

The Owenboy River descends from the Ox Mountains at Carha and then swings northward through limestone land to Coolaney. At Carrownabunny it lies in a channel in a relatively narrow flood plain. Drift deposits on each side give rise to calcareous seepage water which infiltrates the ground in two places.

West of the river Juncus subnodulosus, J. articulatus, Briza and Succisa cover much of the ground with occasional patches of Iris. In this there is much Parnassia, Mentha aquatica, Molinia, Equisetum palustre and Cirsium dissectum with a little Rhinanthus, Anagallis tenella and Epipactis palustris (Plate 35). On the east side this community is more extensive. The level or slightly sloping floodplain is covered with





# Figure 25. Carrownabunny

Carex hostiana, C. panicea and Schoenus with Juncus subnodulosus and Eriophorum latifolium dominating wetter places. There is a nice transition between peaty ground at the edge with Carex binervis, Danthonia, Narthecium, Dactylorhiza maculata and Platanthera bifolia through a dry calcareous fen of Carex lepidocarpa, Euphrasia micrantha and Gymnadenia to the wettest Eriophorum latifolium patches with Dactylorhiza incarnata and Myrica. Epipactis palustris is frequent as are Pinguicula vulgaris and Selaginella. A little Platanthera chlorantha occurs while Trifolium medium grows around the southern end of the site on a bank.

The fen runs into grassland on the river bank with Cynosurus, Festuca arundinacea, Leucanthemum, Iris and Pteridium. To the north a smaller seepage area is colonised by a dense Plantago maritima stand with some Avenula and Danthonia.

# **Evaluation:**

Though it is a very small site Carrownabunny is a classic calcareous seepage fen, rich in plant species. Seven rare plants occur there: it is the only wetland area in the catchment for *Platanthera chlorantha* and *Trifolium medium*, one of two for *Epipactis palustris* and one of four for *Gymnadenia*. The site is totally unmodified at present.

#### 3.3.14 KNOCKMULLIN (Figure 26)

Area: 22.3 ha Rating: Local Importance

#### Description:

Knockmullin is a wide valley that drains south and east into the Toberscanavan Loughs. Turf has been cut from the valley bottom so that there are drains and damp scraws in places. On the higher ground acid heath prevails, but there are also base-rich springs so that the vegetation is complex.

The western half of the site is coniferous forest which extends down to the central stream. Elsewhere, however, dwarf sedges such as Carex panicea, C. hostiana, C. pulicaris, C. echinata and C. demissa make up a lot of the vegetation, their relative abundance corresponding to base enrichment. Molinia, Juncus subnodulosus, J. conglomeratus and J. bulbosus are also important with Succisa, Potentilla erecta, Salix repens, C. flacca and Briza. Where water accumulates on the valley bottom Menyanthes, Eriophorum angustifolium, Carex diandra, and Juncus acutiflorus are frequent dominants.

The more calcareous zones are marked by Carex lepidocarpa, Anagallis tenella, Pinguicula vulgaris and occasionally Coeloglossum while in extreme places Eriophorum latifolium, Selaginella, Scorpidium, Schoenus, Eleocharis quinqueflora and



Gymnadenia occur. Potamogeton coloratus was found at the base of one drain, P. polygonifolius and Chara hispida more widely.

The wetland supports small numbers of snipe in winter (10) and in summer.

#### Evaluation:

The area is interesting because it incorporates a wide range of habitats on the acidic/basic scale. It has a high number of species rare on a catchment basis and supports more orchid species than any other site.

3.3.15 FEENAGH LOUGH / BUNNAMUCK (Figure 27)

Area: 44.6 ha Rating: Local importance

# **Description**:

Feenagh Lough is set amidst rolling drumlins west of Keshcorran Mountain. The hills impinge on the lake at its eastern end and along the northern shore and also separate it from Bunnamuck to the south. The south-western side of Feenagh is low-lying and was formerly covered by bog, now cutover and grazed. Here open reedbed lines the edge of the lake with Phragmites, Filipendula, Valeriana, Carex rostrata and C. diandra growing from dense Calliergon cuspidatum. It gives way landwards to a grassier community consisting of Festuca rubra, Poa pratensis, Molinia and Anthoxanthum with Carex disticha, Eriophorum angustifolium and some Juncus conglomeratus and Salix repens. Towards the lake outflow the reedbed becomes more luxuriant: Carex acutiformis forms sizeable patches and adds to a scraw of Menyanthes, Carex rostrata and Hippuris. Cicuta is abundant next to the lakeshore while Nuphar and Potamogeton natans cover much of the open water near the outflow. The rest of the aquatic flora consists of Lemna trisulca, Elodea, Sparganium minimum, with three species of Potamogeton (including P. praelongus and P. pusillus) and two Charas. In the outlet channel, Catabrosa covers considerable ground along with Veronica beccabunga, Myosotis laxa and Apium nodiflorum.

The northern edge of the lake is narrow and of grassland. Cynosurus, Juncus effusus, Iris and Glyceria fluitans are frequent dominants with Carex nigra, C. panicea, Succisa, J.acutiflorus and sometimes Potentilla palustris. Ground water seepage sustains two areas of calcareous fen at the eastern end. North of the inflow Juncus inflexus and J. acutiflorus mark out a small sedge community which includes Briza, Parnassia, Sagina nodosa, Cirsium dissectum, Euphrasia sp. and Triglochin palustre. At the S.E. corner this is further enriched by Eriophorum latifolium, J. subnodulosus, Carex lepidocarpa, C. dioica, Avenula, Dactylorhiza incarnata, Ctenidium and Drepanocladus revolvens.



In summer Feenagh Lough holds a pair of great crested grebe and mute swan and about 4 pairs mallard. Water rail and moorhen also nest, perhaps also with teal. In winter a flock of 80 wildfowl occurs at maximum, made up of tufted duck, wigeon, teal and mallard.

Bunnamuck Lough has a small area of open water but it occurs in a much larger fen derived in part from flooded cutover bog. On the west side this largely consists of tussocks of Carex paniculata standing over flooded Menyanthes ground. Carex acutiformis is abundant near the lake and it forms a scraw with C. rostrata and Cicuta. Stellaria palustris grows quite frequently in this community with Equisetum fluviatile. Ranunculus lingua is occasional in channels, as is Eupatorium cannabinum.

# Evaluation:

This is a complex but quite small wetland area with a very good selection of plant communities. It contains eight species which are rare in the catchment including one, *Eupatorium*, which was seen nowhere else. The bird population is diverse for such a small lake though not large enough to be of local importance.

# 3.3.16 LOUGH DARGAN (Figure 28)

Area: 33.5 ha Rating: Local Importance

#### Description:

Lough Dargan lies astride the geological boundary between the gneiss and quartzite of the Ox Mountains and the limestone of the rest of the catchment. It receives practically all its drainage water from the mountains: only a little seepage enters from the east and south-east sides. The southern shore is obviously of limestone which rises into a cliff with the ruined Castle Dargan on top of it. Two caves are marked nearby but they seem to be dry and above the level of the lake.

The water is clear and the lake bed mostly stony at the edge. Littorella is common in inshore waters with some Potamogeton filiformis, P. alpinus, Chara globularis var. virgata and Myriophyllum spicatum. In deeper water Nymphaea and Nuphar, Scirpus lacustris and P. berchtoldii grow, giving way at about 1.7 m depth to Elodea and P. praelongus.

The marginal vegetation is a narrow strip because of the rising topography except at the lake outlet where former peat growth is now colonised by poor rush-sedge vegetation. Elsewhere around the lake Juncus acutiflorus, J. effusus, Carex nigra, Mentha aquatica, Lotus uliginosus and Lythrum are conspicuous. Where the calcareous influence is felt Carex lepidocarpa, C. panicea, J. articulatus, Pedicularis



palustris, Sagina nodosa, Parnassia and Calliergon cuspidatum are frequent. There is some iron apparent in these flushes, Anagallis tenella being common through it.

A few mallard and tufted duck use the lake in winter and there is a pair of mute swans also at all times. 32 curlew were present in November.

## Evaluation:

Lough Dargan is an interesting clean lake with habitat conditions intermediate between an acid mountain lake and a lowland calcareous one. It has a surprisingly rich flora including five species rare in the catchment, one of which (Potamogeton filiformis) was not seen elsewhere.

3.2.17 FIN / RISHEEN LOUGHS (Figure 29)

Area:	30.1 ł	na
Rating:	Local	Impoprtance

#### Description:

Fin Lough (Plate 36) is a small roadside lake with an extensive linear fen at its head that runs 800 m in a S.E. direction. The lake itself has a fringe of reedswamp which is thickest at each end. Phragmites and Typha latifolia are joined by Equisetum fluviatile, Carex paniculata and Cicuta in a thick and sometimes floating stand. A little Ranunculus lingua occurs here. Behind this the shorter fen vegetation is made up of Juncus acutiflorus, Carex rostrata, C. diandra, C. nigra, Lychnis, Parnassia and Filipendula. Succisa is frequent and becomes even more so as the peat influence of an old cutover makes itself felt to the south east. There are patches of calcicole vegetation also, however. Pedicularis palustris, Sagina nodosa, Dactylorhiza incarnata, Briza and Carex lepidocarpa are widespread and there is a little Schoenus.

Cutover peat in one form or another dominates the area between the lake and the minor road. Sphagnum palustre, Hylocomium splendens and Aulacomnium are conspicuous with Calluna, Carex echinata and Juncus squarrosus on the drier sites, Eriophorum angustifolium and Sagina nodosa on the wetter. Damp meadow communities take over west of the laneway.

Risheen Lough lies in a parallel valley some 400 m to the N.W. The vegetation types are largely similar but there is a more extensive area of calcareous seepage in the S.W. corner which is dominated by Juncus subnodulosus, Carex lepidocarpa, C. hostiana and C. flacca. South and south-east of the lake this vegetation recurs in cutaway where amidst old pine stumps, Campylium stellatum, Ctenidium, Drepanocladus revolvens, Parnassia and Salix repens grow with a little Equisetum variegatum, Philonotis sp. and Schoenus. Reedswamp is less



extensive than in Fin Lough but a small area of scraw lies at the head of the lake with Carex paniculata, Menyanthes, Juncus subnodulosus, Angelica and Epilobium palustre.

Small numbers of snipe were put up from both lakes in the autumn and the species winters there also; one jack snipe was seen in December. A flock of curlew is often present (34 in December) and probably visit Fin Lough too. This lake holds a pair of breeding mute swan every summer and in early September a whooper swan was present, probably having summered. Mallard and moorhen also nest.

# **Evaluation:**

These lakes are fine examples of a distinctive type found on this southern tributary of the Owenbeg (now linked to the Owenmore). The drift cover is thin and a limestone influence is frequent in the fen or cutover vegetation. This gives rise to a diversity of vegetation (Fig. 29) and plant species. The presence of Equisetum variegatum is notable.

3.3.18 GREENAN (Figure 30)

Area: 6.7 ha Rating: Local Importance

## Description:

The Greenan site is an area of fen subject to fluctuating water levels which are probably controlled by the heights of Lough Labe and Lough Gowra to the north. At the highest point there is a spring which feeds into a stand of Iris, Carex rostrata, Myosotis scorpioides, Nasturtium officinale and Phalaris. Eastwards this changes to a mixed Carex community with C.nigra and C.rostrata dominant but also with а substantial area of C. acutiformis and C. disticha. Additional species are Epilobium palustre, Juncus acutiformis and Galium palustre. In the centre a few willows (Salix viminalis, S.cinerea) grow on an island of peat indicating that peat has part of the been  $\operatorname{cut}$ from this site. Carex elata is established beneath the trees while a little Ranunculus lingua and a single clump of C.acuta grow nearby.

The water flows westwards into a pool (Plates 15,16) which is semi-permanent and supports *Hippuris*, *Apium inundatum*, *Ranunculus trichophyllus* and *Sparganium* erectum. A zone above the shore is covered by a turlough type of vegetation with much *Polygonum amphibium*, *Glyceria fluitans*, *Mentha aquatica*, *Eleocharis palustris* and *Potentilla anserina*. Further away the ground rises and the community changes to a sedge-rush one in which *Carex panicea*, *Juncus articulatus* and *Succisa* are important along with *Calliergon cuspidatum* and *Rhytidiadelphus squarrosus*.



The area contains a few pairs of nesting snipe, moorhen and lapwing.

Π

Π

[]

[]

# Evaluation:

The interest in this site stems partly from the vegetation diversity in such a small area but also from its resemblance to a turlough. At 118m this is close to the upper altitudinal limit of this habitat.

# SECTION 4 - IMPACTS OF PROPOSED DRAINAGE

The impacts of arterial drainage appear in two forms. There is the initial dredging of the channel which affects plants and animals within it and within lakes modified by the scheme. At this stage there is also the major landscape effect caused by channelisation and the dumping of spoil nearby. Following this lowering of the watertable adjacent to the there is a channels, augmented by field drainage. This leads to a gradual decline in the vigour of wetland communities and in the natural course of events their replacement by more terrestrial vegetation and birdlife. Field drainage, of course, allows much increased agricultural activity that further changes the habitat diversity which depends on Existing habitat. differences in management as well as ecological factors, will decline and a more uniform vegetation of grass is likely to predominate after drainage. Changes are possible even in places that are not subject to the full drainage effect as the livestock population will increase. This may bring about an increase in grazing intensity on the 'wild' vegetation left, as well as the reclamation of peatlands or other habitats not limited by groundwater conditions. Housing of livestock and the ensiling of grass will lead to waste production that may escape as pollution to eutrophy rivers and lakes. If the growth in agricultural activity leads to increased prosperity, field drainage will spread further from the channels and new lengths of channel may be deepened by private schemes. An increase in disturbance levels will also result from increased intensification.

Only the immediate effects of drainage on the catchment are examined in this report, i.e. the dredging of channels and the ensuing field drainage. It is the general experience that 50-90% (Martin, pers. comm.) of potential field drainage is carried out depending on land quality and population density. The actual figure is also influenced by the level of grant aid available which is not known as yet. For convenience the figure of 70% is taken in this instance in order to go some way towards quantifying the impacts of the proposed scheme. The economic assessment of such a scheme will assume that this 70% of affected land within reach of a river outfall will be suitable for grazing grassland or silage upgraded to production. This is also assumed in this report, as is a drop in soil water table of 0.6 - 1.0 m.

Since the channels to be deepened are \*known (Figure 5) the change in the vegetation of adjacent wetlands is quantifiable. Less easy to assess is the likely change in non-agricultural habitats affected by the scheme, for example, lakes which will

\*The design of the scheme may still be changed in response to economic factors.

be held at summer level all year round, bogs which will experience a drop in nearby watertables or flood plains that will no longer be regularly inundated.

Before looking at the scheme in detail it may be useful to consider likely changes in the absence of drainage. These are the alterations that will occur to vegetation and birdlife with a continuation of the current decline in population and farming intensity. The change in farming is not a uniform one. Rather it is a division into viable (development) farms which will, if anything, increase production and uneconomic units which will be progressively abandoned. In the current economic climate, such land will probably be given over to forestry in the long term. Turf cutting (on the raised bogs) is likely to continue at its present high level as long as the bogs are there because of the availability of the machinery and the fuel demands of local towns.

The evolution of vegetation in this scenario involves very little change in the wetlands of the catchment apart from the gradual infill of lakes and invasion by woodland or peatland depending on base status and hydrology. On the agricultural land however there will be less haymaking and grazing of the wetter areas resulting in an overall height increase of the vegetation, increased accumulation of plant litter and decline nutrient availability. Tall vegetation dominated in by grasses, rushes and herbs will increase followed by small areas of scrub and woodland. The response of the bird populations may include a decline in grassland feeding species (lapwing, wintering thrushes, and rook) but an increase in small passerine birds. Herbivorous birds like wigeon and whooper swan may become more localised to areas that flood in winter, especially if suitable agricultural land remains nearby for feeding. Given a declining human presence in the catchment, the numbers of nesting mallard, snipe and curlew could increase. The frequency of floods could increase gradually leading to a growth in overall wildfowl populations.

This section of the report is divided into three parts: the impact of the proposed scheme on the habitats and vegetation types in the catchment (4.1), its impact on particular species of plant and/or bird (4.2) and its impact on the areas of scientific interest (4.3). Possible ameliorative measures are mentioned throughout but mainly with regard to these specific areas.

#### 4.1 IMPACT ON VEGETATION TYPES

The direct effects of the drainage scheme include the dredging of channels over 79% of the catchment (Figure 5) followed by the field drainage of 70% of the adjacent land (totalling 4676 ha or 55% of affected land). But impacts do not stop here. They will be augmented by various indirect effects such as a cessation or at least a decline in the frequency of flooding and by a drop in watertable outside the immediate range of the scheme. This zone of impact will occur as a fringe around the its width depending on the hydraulic drained areas, conductivity of the soil at any point. Ten to twelve of the maintain annual flooding to vegetation types require themselves and they will largely disappear from drained areas even if field drainage is not put in place. Their decline in the catchment will therefore be of the order of 80-90% as they tend to occur in the lower reaches of the catchment where almost all channels will be drained.

The response of the various vegetation types to the changed hydrological condition is discussed in Appendix 1 and can be summarised as in Table 30. This suggests the changes that occur in the communities that are left unreclaimed. will Grassland and woodland communities will benefit in areas where management remains similar to what it is today. Although suffering an overall decline because of reclamation, such vegetation as Acid Grass (3I), Poor Pasture (3J), and even Fen Pasture (6F) may colonise areas from which the sensitive semiaquatic communities are displaced. Deciduous woodland (2N) should also spread into ground now covered by willow and alder stands (4H) and will also colonise cutover bog to some extent. Dry Grassland (3E) will also increase indirectly in addition to its major expansion by reclamation.

Table 31 gives an indication of vegetation in the catchment perhaps ten years after arterial drainage has been completed. At this time it is assumed that field drainage will have allowed the conversion of all suitable land to ryegrass, pasture or meadow. It is also assumed that land which benefits only indirectly will continue to be managed as it is today, including both coniferous and deciduous woodland. Reference to Table 30 will allow a judgement to be made given increased grazing, mowing or nutrient levels on such land but this seems too hypothetical to be useful at this stage.

It appears that nine vegetation types will disappear over 70-80% of the catchment. These are those that require flooding to persist, for example the emergent vegetation (4A) around lakes or slow moving rivers, riverbank communities like Reedgrass (1G) and Floodgrass (1D) which, if not altered during the works, will suffer from a lack of flooding. drainage Floodsedge (2E) may persist in cutover bog areas where it occurs in pools but the majority of lakeside examples will be The greater part of Fen Pasture (6F) will likewise removed. be affected but as mentioned above this community may take over from Phragmites or other lake edge vegetation if flooding occurs to a small extent on lakeshores. About 60% of Cutover Bog vegetation could be affected by drainage: much of the rest occurs high up the catchments where it is not proposed to the conversion of to peatland farmland drain. However, than just other although involves factors drainage so potentially affected, this community is not likely to be all modified. A general drying of cutover will however enable trees to become established, so converting some of the open areas into Scrub Cutover (2D).

TABLE 30 Possible responses of the vegetation types following drainage
TABLE 30 Possible responses of the vegetation types following drainage
DRAINAGE WITH NO
CHANGE IN MANAGEMENT GRAZING MOWING FERTILISER/MOWING
DRAINAGE IN MANAGEMENT GRAZING MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MOWING FERTILISER/MOWING
MO

Π

	DRAINAG	E WITH NO	DRAI	NAGE PLUS	INCREASE IN
	CHANGE IN	MANAGEMENT	GRAZING	MOWING	FERTILISER/MOWING
SWAMP					
Reedbed 4A-ii Emergent Sedge Scraw 4A-iii Floodsedge 2E	4A-i	4Ai/4H 6F/4H 6F/4H 6F	6F/3J 3J 1D/6F 6F	6A 6J 6A 6J	6J 3A 6J 3A
TALL GRASS					
Reedgrass 1G Tall herb 1B Tall tussock 1A Rush-grass 3H Rush- <i>Iris</i> 3K	<b>L</b>	1B 3K 3H 3G/3I 3H	3H 3J 3J 3J 3J 3J	6J 6J 6J 6J 6J	3A 3A 3A 3A 3A
SHORT GRASS					
Floodgrass 1D Wet meadow 6A Damp meadow 6J Fen pasture 6F Calcareous fen Poor pasture 3J Lolium grasslan Dry grassland 3	4D d 3A E	3J 6J 3J/3E 3J 2H 3J/3E 3E 3E	3J 3J 3J 3J 2H 3E 3E 3E	6A 6J 6J 2H 3E 3E 3E	6J 3A 3A 3J 3A 3A 3A 3A
PEAT					
Raised bog 2R Cutover bog 2P Molinia cutover Enriched cutawa Dry sedge 2I Rush-sedge 3G Acid grass 3I Peaty cutover 3 Scrub cutover 2	2С у 2н С D	2P/2D 2D 2I/3I 3G 3I 2I 3I 2D 2N	- 2I 3G/2I 3I 2I 3I -	- 2I 2I 3I 3I 6J	- 6J 6J 3A 3J 3E -
WOODLAND					
Willow/alder 4H Deciduous 2N Conifer 20		2N 2N 2O		- - -	

124

] Ŋ  $\Box$  $\Box$  $\Box$ J  $\Box$ ] ] η

Future vegetation of the Owenmore catchment after arterial and field drainage and after adjustments in the remaining natural vegetation. 31 TABLE

	VEGETATION TYPE	PRESENT COVERAGE (ha)	FUTURE COVERAGE (ha)	% CHANGE
1A*	Tall tussock	279	60	-79
4A*(ii)	Reedbed	52	11	-79
4A*(iii)	Scraw	23	Ŋ	-79
1D*	Floodgrass	46	10	-79
2E*	Floodsedge	74	15	-79
6A*	Wet meadow	314	66	-79
1B*	Tall herb	258	57	-78
1G*	Reedgrass	15	4	-73
6F*	Fen pasture	559	154	-72
2P	Cutover bog	1237	476	-62
3C	Peaty cutover	23	თ	-61
3G	Rush sedge	504	208	-59
2R	Raised bog	173	77	-56
2C	<i>Molinia</i> cutover	402	183	-54
4D	Calcareous fen	38	18	-53
2H	Enriched cutaway	218	105	-52
4A*(i)	Emergent Carex	47	23	-51
2D	Scrub cutover	307	151	-51
21	Drysedge	185	94	-49
3H	Rush-grass	370	193	-48
ЗK	Rush-Iris	467	250	-47
6Ј	Damp meadow	765	406	-47
31	Acid grassland	74	45	-40
4H*	Willow wood	66	32	-22
3.1	Poor pasture	405	360	-11
4H*	Alder wood	11	11	0
20	Coniferous wood	431	431	0
2N	Deciduous wood	171	184	80 +
3A+3F	Lolium/dry grassland	325	4811	+1480

\* Communities requiring periodic flooding

Communities which will be affected by drainage to the extent of 50-60% include Raised Bog and Calcareous Fen. It might be thought likely that such areas would be affected more seriously, but they escape the full affects of the scheme by their location. Raised bog occurs mainly near Cloonakillina Lough which is approached but not reached by the proposed drainage. Fens predominate in the Owenbeg catchment which will not be drained above Billa. In addition, in this area Calcareous Fen is largely controlled by groundwater seeping out of drumlins or other large collecting grounds which are less likely to be influenced by river drainage. The very large stand of emergent *Carex* (4A-i) at Cloonakillina and the strips along the Lough Arrow shore area mean that only 51% of this vegetation will disappear from the catchment.

Five vegetation types will be reduced by 40-50%. Among these are Rush-Grass (3H), Acid Grass (3I) and Dry Sedge (2I) which although removed from 55% of the catchment will expand to fill some of the space vacated by more aquatic communities. This is true for all the communities at the base of Table 31. Willow and alder wood will be inclined to colonise reed and beds once their watertable has been lowered. sedqe Poor Pasture (3J) is likely to replace much of the wet grassland occurs at present while ryegrass swards that will be established widely through management and may conceivably then cover 50-60% of the affected land in the catchment.

In order to examine the location of the greatest impacts on vegetation, the sites that will be influenced by drainage have been grouped together on a catchment basis (Table 32). The table refers to actual sites in which the vegetation is known and the areas in question have not been increased to apply to the whole catchment. In addition it includes only the direct drainage effect so is not strictly comparable to Table 31. Certain features can be picked out however, notably the lower impact in the Owenbeg catchment than in the others. The average impact here on communities of 5 ha area or more is 39% as opposed to 53% in the Unshin and 57% in the Owenmore. The greatest impacts in the Owenmore will be on the Tall Tussock (1A), Tall Herb (1B) and Rush-Grass (3H) communities that at present occupy the least managed corners of the floodplain. Floodsedge (2E) and Scraw (4A-iii) which occur in old meanders and around many small lakes will also be greatly affected as will woods of all sorts (2N, 4H) which mainly occupy the river Working from one bank will reduce bank. this impact significantly, particularly in the Markree and Annaghmore areas though it is unlikely to save the actual river communities because of increased scouring. The impacts on Calcareous Fen (4D) as well as on Raised Bog (2R), Reedbed and Emergent Sedge (4A-ii & i) are reduced because of the distribution of these communities high up the catchment. The figure for Floodgrass (1D) is low but it conceals the fact that only the distinct turlough variety will survive drainage. Floodgrass on the riverbanks will be almost totally removed.

In the Unshin, Floodgrass will again experience a major impact as will the small amount of intact bog that exists there.  $\Box$  $\int$ 

٦

Direct impact of scheme on vegetation within sub-catchments TABLE 32

	OWE	enmore	U	ıshin	Owen	beg	Greater	Owenmore	TO	TAL
EGETAȚION TYPE	AREA	%IMPACT	AREA	%IMPACT	AREA	%IMPACT	AREA %	SIMPACT S	AREA	%IMPACT
A Tall tussock	173	70	42	60	2	50	ε	67	220	68
N Deciduous wood	77	64	56	64	ᠳ	100	I	1	135	64
B Tall herb	63	65	102	61	ഹ	80	ო	67	202	63
P Cutover bog	782	63	127	53	51	62	I	1	974	63
I Acid grassland	32	63	26	61	1	I	1	ł	58	62
A Lolium grassland	82	63	47	64	20	45	ო	67	151	61
C Peaty cutover	12	67	9	67		0	I	1	18	61
J Poor pasture	215	63	70	56	34	50	1	1	319	60
G Reedgrass	7	50	9	56	I	I	I	I	12	59
Hs Willow wood	21	62	10	50	-	100	1	40	32	59
G Rush sedge	252	66	105	47	29	38	8	75	397	59
J Damp meadow	379	64	202	51	23	30	I	I	602	58
I Drysedge	96	60	33	55	15	47	I	I	146	57
H Rush-grass	145	66	118	57	28	4	I	I	291	56
Ha Alder wood	-	100	ω	50	I	I	ł	I	σ	56
E Dry pasture	55	64	30	50	15	33	ស	70	105	55
K Rush-Iris	166	61	170	51	27	52	4	13	368	55
H Enriched cutaway	86	65	42	64	41	22	ო	17	172	53
D Scrub cutover	104	60	120	45	21	62	I	I	242	52
A Wet meadow	168	55	62	42	13	23	1	I	247	51
O Conifer wood	140	48	138	51	δ	67	53	70	339	50
E Floodsedge	22	64	28	39	7	29	I	I	58	48
C <i>Molinia</i> cutover	227	60	51	53	39	15	1	I	317	47
f Fen pasture	166	53	234	45	33	39	9	12	440	47
A(iii) Scraw	9	67	12	33	-	100	I	I	18	45
R Raised bog	131	40	4	75	-	100	I	I	136	40
D Calcareous fen	17	53	4	25	പ	0	ប	20	31	35
D Floodgrass	27	22	9	67	1	1	I	ł	36	33
A(ii) Reedbed	22	18	13	31	⊣	50	ស	33	41	32
A(i) Emergent Care	x 35	23	2	50	-	20	I	ı	37	22

Otherwise the situation will be comparable to the Owenmore except for the survival of a good deal more Willow and Alder Wood (4H), Rush-Sedge (3G), Rush-Iris (3K), Floodsedge (2E), Scraw (4A-iii) [at Clooskirt and Clooneymeenaghan] and Fen Pasture (6F) at Bellarush and Ballinafad. Most of these communities are ecologically the more interesting ones so if the entire scheme goes ahead the Unshin will retain more interest than the Owenmore.

In the Owenbeg drainage will have a major impact on Tall Herb (1B) which covers a very small area, on Conifer Woods (20) and on cutover bogs (2P & 2D). It will remove the only examples of four communities from the sub-catchment but will not directly affect any of the Calcareous Fen (4D) in the Fin Lough area. The similar vegetation in the Lower Owenmore (i.e. below Collooney) will also mostly survive at Corhawhagh.

#### 4.1.1 VEGETATION DIVERSITY

Vegetation diversity can be expressed crudely by dividing the area of a site by the number of vegetation types included in it. On this method the most diverse site has a value of one or less and diversity decreases with increasing number. When sites to be drained are compared with those in areas outside the scheme it is seen that the drained sites are currently less diverse than the ones to be left undrained (12.86 to 10.72 - data in Appendix 1). This reflects their greater preponderance in the Owenbeg and Unshin catchments than in the Owenmore and also their location in the headwaters of the rivers. This analysis does not take into account the indirect drainage affects but these are not likely to change its general conclusion.

#### 4.2 IMPACTS ON SPECIES

#### 4.2.1 PLANTS

The assessment of drainage impacts on plants is perhaps most meaningfully applied to the less common species. A common plant occurs widely in the catchment today and is tolerant of a number of different habitats and conditions. Even if it is largely reduced during drainage works, it has the capacity to spread and recover to some extent from the damage. The total number of individuals may be much fewer after drainage and reclamation but the species survives in most of the area.

A rare plant has a much narrower tolerance. It requires special ecological conditions that are not widely found and its population is small. Drainage operations or later reclamation can have a much greater effect and lead to local or regional extinction. If the seed source is taken away the plant has little chance of re-invasion even if a suitable habitat develops in time.

The analysis of the impact of the scheme is therefore limited to those species listed in Table 20. Where a particularly rare species is involved (10 sites or less) each site is examined to see if it is included in the proposed scheme. In addition the ecology of the species is considered, for example whether it requires flooding, oligotrophic/eutrophic conditions, clear or silt-laden water or other factors that could be altered by arterial drainage (see Ellenburg, 1988). Where a more frequent species is involved (10-21 sites) the percentage impact on its habitat has been taken as the likely loss of its known sites with modifications where necessary.

It appears (Table 33) that eleven out of the 97 species are likely to disappear if the scheme is carried out. A further 36 species will lose half or more of their sites while 23 will be somewhat reduced. The remaining 26 will not be affected. The species that will become extinct include Lathyrus palustris at its only Sligo site, and Carex aquatilis in perhaps its most extensive site in the country. Both Eupatorium and Pulicaria are on the edges of their Irish range in the Owenmore while Rorippa amphibia, Bidens tripartitus, Carex riparia and Zannichellia are of catchment importance only.

The plants that will be greatly reduced include Poa palustris, nationally the rarest plant in the catchment. Also several during will removed channel Potamogeton species be excavation. Conditions are so different during and after drainage operations (i.e. silt load, deeper water, faster flows, lack of riffles) that many are unlikely to return even though individuals persist in the headwaters. P. pectinatus will disappear from all the lower Unshin for example. Several other submerged species, among them Callitriche, Oenanthe, Ranunculus circinatus and R. aquatilis will also suffer severe impact. Depending on the frequency of channel maintenance they may disappear from many sites. R. circinatus is one of the more sensitive aquatic plants requiring clear, hard water and a peaty substrate to grow in. R. aquatilis prefers gravel beds which are likely to be removed from many areas. It responds however to moderate eutrophication so may flourish if the habitat niche persists. The Chara species are submerged plants that also need particular ecological conditions (not included in Table 20 because they were not always identified species level). They are widespread in lakes in the to catchment but also grow in some river and drain channels. It has been found that some species multiply after drainage activities because of the removal of completing macrophytes 1986). However they are inhibited by increased (Moore, phosphate levels either from sediment or later agricultural intensification so can be expected to decline in the medium to long term.

It might be thought that some of the semi-aquatic species in Table 33, e.g. Oenanthe spp., Bidens cernua, Catabrosa, Lycopus, Lysimachia nummularia, Mimulus, Rorippa palustris and Rumex hydrolapathum will persist even on drained channel TABLE 33 Impact of scheme on rare plant species (01-21 sites in catchment)

Π

Π

1

Species	Number of	Sites
	Pre-drainage	Post-drainage
Achillea ptarmica	18	7
Apium inundatum	4	4
Baldellia ranunculoides	6	5
Bidens cernua	16	7
B. tripartitus	1	-
Butomus umbellatus	5	2
Callitricha obtusangula	2	-
C. platycarpa	1	1
Carex acuta	4	3
C. acutiformis	15	3
C. aquatilis	9	-
C. dioica	4	4
C. divulsa	1	1
C. lasiocarpa	6	5
C. limosa	1	1
C. riparia	1	-
C. strigosa	1	1
Catabrosa aquatilis	15	5
Cladium mariscus	5	4
Cornus sericea	4	4
Coeloglossum viride	2	-
Dactylorhiza incarnata	16	7
Drosera anglica	1	1
Eleocharis uniglumis	2	1
E. quinqueflora	2	1
E. multicaulis	1	1
Epipactis palustris	2	1
Equisetum variagatum	3	2
Eriophorum latifolium	6	5
Erodium cicutarium	1	1
Eupatorium cannabinum	1	
Gallum uliginosum	2	2
Gymnadenia conopsea	4	2
Heracleum mantegazzianum	3	2
Lathyrus palustris	1	-
Leucojum aestivum	3	2
Littorella unifiora	3	3
Lycopus europaeus	6	1
Lysimachia vulgaris	14	3
L. nummularia	3	2
Mentha arvensis	4	3
M. spicata	4	1
Mimulus guttatus	4	1
Myriopnyllum alterniflorum	2	2
M. spicatum	4	4
M. Verticiliatum	2	1
Nympnaea alba	4	3

Species	Number of Pre-drainage	Sites Post-drainage
Oenanthe aquatica	Δ	1
O grogata	4	2
O fluviatilic	20	8
Orbiogloggum uulgatum	20	1
Demorpholia atricoso	2	1
Parapholis strigosa	I F	1
Petasites hybridus	5	3
Plantago maritima Distruttore bifalia	2	2
Platantnera bilolla	1	4
P. Chlorantha	1	1
Poa palustris	2	1
Polygonum minus	1	1
Populus tremula	1	1
Potamogeton alpinus	6	4
P. berchtoldii	7	4
P. coloratus	2	1
P. filiformis	1	1
P. lucens	10	6
P. obtusifolius	2	1
P. pectinatus	12	3
P. perfoliatus	7	4
P. praelongus	4	4
P. pusillus	5	4
Pulicaria dysenterica	2	-
Ranunculus aquatilis	4	1
R. circinatus	3	1
R. hederaceus	1	1
R. lingua	7	3
R. peltatus	8	3
R. sceleratus	1	-
R. trichophyllus	5	4
Rorippa palustris	10	4
R. amphibia	1	•
Rumex hydrolanathum	20	Δ
Salix pentandra	20	2
S triandra	2	1
Samolus valerandi	6	3
Scirpus fluitans	1	J 1
Schrophylaria auriculata	1	2
Schoopus nigrigans	10	2
Soutollaria galarigulata	10	5
Sologinollo gologinoidog	5	2
Solanum dulgamara	í c	5
	6	2
Sparganium minimum	5	4
Stellaria palustris	13	5
	1	1
Utricularia vulgaris	4	2
U. Intermedia	1	1
veronica catenata	8	3
Viola canina	3	3
Zannichellia palustris	2	-

x

J 

.

sections if dredging takes place only from one side and the toe of the far bank is left unmodified. However, the increased flows causd by drainage usually have the effect of eroding the unmodified bank. For fen species that require flooding the position is less clear. Lysimachia vulgaris, Ranunculus lingua and Scutellaria galericulata could continue to grow on a morphologically diverse bank though probably not if the land above was reclaimed for grazing.

The twenty-six plant species that will not be affected by drainage activities all grow in places outside the range of the scheme, mainly in the headwaters of the Unshin, Cloonakillina Lough or in turloughs. If privately financed drainage follows the initial scheme it is quite likely that these species too will decline. This is a significant concern at Cloonakillina L. and at Quarryfield West (see below) where ten of the plants are located.

# 4.2.2 BIRDS

The impact of the drainage scheme on bird life will be brought about through habitat change to the river channel and banks and by the reclamation and agricultural intensification that will occur on the affected land. The larger water bodies will remain untouched in the case of Lough Arrow, Cloonakillina and Feenagh Loughs and at summer levels at Cloonacleigha, Templehouse and Ballygawley. Feeding areas on the surrounding land will become modified however, leading to changes in the bird populations that currently use these areas. In this section birds will be divided into aquatic types that require water or wetland areas at some stage of their life cycle and terrestrial ones which may feed there but are not dependant on wetness. The estuarine birds of Ballysadare Bay are dealt with separately in the next section.

# 4.2.2.1 <u>Aquatic species</u>

To assist with predicting the impacts of the Owenmore scheme, part of the (drained) Moy catchment was visited in both winter and summer and its birdlife examined by means of the transect method (four sections of 2 km each). There are certain obvious differences between the catchments, for example, the Moy has shallower soils with less alluvial peat and rather few hedges and little woodland. Nevertheless they must be comparable to some extent. The habitat considered in this analysis is the river channel since this had all been deepened. The surrounding affected land had been reclaimed to a very limited extent and certainly not the 70% projected for the Owenmore.

The results of this short survey are seen in Table 34. In winter the total number of birds on the drained channels was only 54% of that on the undrained; the number of species was also much lower, though possibly because of more limited coverage on the Moy. Teal, wigeon, little grebe, dipper, grey TABLE 34. Bird densities (birds/km) on an undrained (Owenmore) and drained (Moy) river in winter and summer.

L

•.

	WINTER		BREEDING	SEASON
	Owenmore	Моу	Owenmore	Моу
TOTAL BIRDS	7.615	4.125	6.615	3.375
No. of Species	1.577	1.125	1.962	1.750
Mallard	1.692	3.250	3.115	0.375
Moorhen	0.615	0.625	0.231	0.125
Grey heron	0.077	0.250	0.192	0.375
Mute swan			0.115	0.125
Grey wagtail			0.769	0.750
Pied wagtail			0.577	0.125
Common sandpip	er		0.577	0.125
Black-headed gu	111		0.038	0.250

Additional species in Owenmore are noted in Table 5.

•

wagtail and snipe were much fewer or absent while moorhen occurred at roughly the same frequency. Mallard and grey heron were commoner on the Moy. In the breeding season, total numbers on the Moy were again half those on the Owenmore. Mallard was one of the main causes, there were only 12% the number on the (drained) Moy as on the Owenmore. There were also fewer pied wagtail, sedge warbler, reed bunting, kingfisher and moorhen. Mute swan and grey wagtail were present at the same density on both rivers but the latter was probably increased by the amount of shingle at the edge of the Moy which also benefitted common sandpiper (twice the Owenmore figure). Grey heron and black-headed gull were more frequent on the drained river, perhaps reflecting an increased population of small fish which often happens after drainage.

These results are useful in projecting the impacts of drainage in the Owenmore as are the findings of the limited amount of published work (Williamson 1971, Williams 1980, Taylor 1984, Cadbury 1984). Table 35 is an attempt to pull together this with knowledge of individual species information а requirements and of the habitats that will be available after drainage (Table 31). It must be regarded as provisional as there has been no post-drainage work done in Ireland. It may be noted that major impacts will be made on the populations of whooper swan, water rail, snipe, curlew, dipper, and pied These are in the range of a 60-80% reduction. The waqtail. dabbling duck numbers will be approximately halved due to the lack of river flooding and the disappearance of wet meadows. Lapwing will suffer a similar reduction though will remain breeding in turloughs. The projected losses of the smaller waterbirds are dependant on single-bank working by drainage equipment. The cover for moorhen, grey wagtail, sedge warbler and reed bunting will be sufficient on one bank for a reasonable proportion of original numbers to survive. The species that will be least affected by drainage are those that occur outside its range (most diving duck and grebes) and those that can make use of the new habitat like common sandpiper, heron and kingfisher. Provided vertical banks are retained for this latter species in a few places numbers should return to their present levels once the silt load has declined.

# 4.2.2.2 <u>Terrestrial species</u>

Drainage of affected land will give rise to farmland similar in some respects to the present unaffected land. Therefore comparing the birds of the two types will give some sort of estimate of the impacts of drainage on birdlife. However it is likely that such affected land when reclaimed will be made of better quality than its currently unaffected counterpart. This is because of its peat content and greater ability to benefit from field drainage. It will also be more uniformly grassland without the scatter of hedges, tall rushes and herbs and scrub that occurs today.

The comparison of transects in affected and in unaffected land (control sites) has been taken as the main source of

Γ

information for predicting future changes if the drainage scheme is carried out. In view of the drawbacks mentioned above, however, the straightforward relationship has been modified in Table 36 by the results of other census studies of farm land in western Ireland (Lysaght, 1988) and density estimates quoted in Hutchinson (1989). In addition the correlations obtained in the present study of birds with grassland and other short vegatation have been taken into account.

Table 36 indicates that the fauna of 'land' birds on affected land will become simplified if it is drained and reclaimed. decline in numbers and of these About 18 species will whinchat, grasshopper warbler, whitethroat, chiffchaff and linnet may disappear. Birds of prey, although rare already, may cease to visit such land and woodcock are unlikely to winter because of the lack of cover, unless there is an increase in afforestation. Nineteen species or so will probably increase however. Of these the rook and jackdaw (at all times of the year), and the fieldfare, redwing, blackbird and song thrush (in winter) will be the most conspicuous. The percentages in Table 36 are derived from very limited data but suggest increases of 2-7 times the present populations on affected land. Some of the small passerines are also likely to increase, particularly chaffinch, greenfinch and goldfinch which will find more seeds in the improved farmland. Dunnock and starling (at least in winter) may increase also. The species dependant on open woodland and scrub will probably decline, including most of the tits, willow warbler and bullfinch. Figures for the goldcrest too suggest a major decline though this species could become more confined to woodland like the great tit and tree creeper and show an eventual increase if this habitat expands.

# 4.2.2.3 <u>Significance of bird population changes</u>

The majority of important aggregation of wintering birds (Table 7) occur outside the range of the proposed scheme, especially on Lough Arrow. However, there are some species that will be affected significantly. Whooper swan, teal and curlew are the main species in winter whose decline will have more than local impact. In the breeding season the loss of snipe and curlew populations will be important on a catchment basis as will the decline in mallard, water rail and lapwing. Whinchat, stonechat, grasshopper warbler and possibly whitethroat and cuckoo are likely to abandon large parts of the catchment if reclamation is carried through as planned. These species are rare at present but occur at similar frequency through much of the country. The projected increases all occur in common species which are abundant because they feed in pasture or meadow land.

# $\Box$ ٦

Estimated change in terrestrial bird species on affected land after drainage TABLE 36

SUMMER COMMENTS	- Lack of cover for hunting Decrease Removal of trees and scrub	Decrease Lack of cover for prey	Increase Lack of cover in winter	Increase Increased food supply	Decrease Decline in host species and food	+ 100% Increased food supply	- 60% Decline in rough land	- 15% Little change	+ 170% Increased food supply. Retain hedges.	Decrease Loss of cutover bog edge habitat	Decrease Loss of vegetation diversity & scrub	-10% Loss of habitat structure	-50% Loss of habitat structure	- Increased food supply	- Increased food supply	Lucrease Increased rood supply	Jecrease Loss of habitat	Jectease Loss of Habitat (trees)	-60% Loss of habitat (bushes) and food	Decrease Loss of trees, bushes, and tall herbs	Decrease Loss of trees and bushes	Decrease Loss of trees and bushes	Decrease Loss of trees and bushes	-15% Loss of trees and busiles Trees of Annianon in the design of the second s	LICTRASE LICTEASE OF WOOLLAND WOOLLAND TEANOOLS	Increase Increase in food	+ 170% Increase in grassland	+ 775% Increase in grassland	Decrease Loss of trees	Decrease Increas in feeding area: loss of nest sites	+ 300% Increased food supply	n.d. Loss of riverside alders	n.d. Increased food supply	Decrease Decline in scrub	
WINTER	Decrease Decrease	Decrease	Decrease	Increase	Decrease	,	-75%	-15%	+ 230%	I	Decrease	+ 270%	+ 340%	+ 650%	+ 250%	Increase	1	<b>!</b>	[	-65%	1	Decrease	Decrease	-60%	л.а.	n.d.	n.d.	n.d.	n.d.	Increase	n.d.	Decrease	+ 300%	n.d.	Dorroaro

# 4.3 IMPACTS ON AREAS OF SCIENTIFIC INTEREST

The sites are discussed in this section in the same order as they were described (Table 29).

# 4.3.1 UNSHIN RIVER

The Unshin is seen as a pristine unmanaged river full of plant and fish life and very rare in the Irish and European context. It is certainly the most ecologically interesting of the three rivers with unusual physico-chemical qualities and plant (and therefore invertebrate) communities not found elsewhere. It contains 38 stations of rare plants as defined in this report out of a total of 49 for all main river channels. The subcatchment as a whole supports 54% of the rare plants though it covers only 34% of the area. Visually the Unshin also stands out, the plant growth in the channel, the natural riverbanks and the section of rapids above Lisconny being notable.

Arterial drainage in the river will destroy this uniqueness along with most of the scientific values. The possibilities of reducing its impacts are non-existant because of the all-ornothing nature of the interest. Stretches of bank with rare plants could be left out of the scheme or the depth of dredging be limited in certain places to maintain some flooding nearby. The value of the intact ecosystem, however, is much higher than the sum of its parts and any major action is going to reduce it.

Leaving the main channel intact would also mean not going in on any of its tributaries. An alternative would be only to drain the main channel from Markree (C38/56), Cooperhill (C38/131) or Riverstown (C38/157) downstream. These options would allow an increasing area of affected land to benefit from drainage and would maintain part of the river channel in its present form. Arterial drainage up to and including these tributaries would have the impacts on flood-demanding vegetation outlined in Table 37 (overleaf).

Drainage to Markree would have a disproportionate effect on Tall Tussock (1A) vegetation as well as removing the feeding habitat of all whooper swan on the Unshin. Drainage to Cooperhill would remove 50-80% of most communities and also the rapids section. If extended to Riverstown the loss increases to 60-100% of wetland vegetation. At this point too, drainage would have an impact on the major concentration of dabbling duck on the Unshin.

Many trade-offs between agriculture and wildlife would be possible but they do not alter the fact that any drainage on this river would destroy the integrity of the system. The Unshin can be considered to become more valuable in ecological terms as it comes down the catchment. This is because a large undrained limestone river is much rarer than a small one (which it is at L. Arrow). TABLE 37. Percentage loss of flood-demanding vegetation types resulting from drainage of the lower Unshin.

Vegetation type		. %	loss	in	whole	catchm	ent
L	C38/56	to	C	38/2	L31	С3	8/157
SWAMP Reedbed (4A-ii) Emergent Sedge (4A-i) Scraw (4A-iii) Floodsedge (2E)	40 11 17 16			59 57 39 54			59 57 68 63
TALL GRASS Reedgrass (1G) Tall Tussock (1A) Tall Herb (1B)	8 54 25			66 82 54			73 97 82
SHORT GRASS Floodgrass (1D) Wet Meadow (6A) Fen Pasture (6F)	23 39 23			58 61 51			96 82 64
WOODLAND Willow Wood (4H-i) Alder Wood (4H-ii)	25 17			42 63			51 65

# 4.3.2 LOUGH ARROW

t i

 $\square$ 

 $\Box$ 

The drainage proposals extend to the eel weir 2.25 km downstream of Lough Arrow. The channel at the exit of the lake is shallow and full of vegetation so no change is expected to occur to the lake itself. The channel between the two points could experience marginally lower water levels but these are unlikely to affect the vegetation. It seems unlikely that this channel would be deepened by a private scheme as it is one of the main spawning areas for L. Arrow trout.

# 4.3.3 BALLYSADARE BAY

Ballysadare Bay is a wintering area for waterbirds, some of which feed on the few plants on the surface of the mudflats and others on the invertebrates within the sediment. It also has some interesting patches of saltmarsh and a sizeable common seal population.

The main way in which arterial drainage in the Owenmore would have an impact on the bay is through suspended sediment which would flocculate under the influence of salt water and be deposited on the mudflats. Most organisms are adapted to deal with such additional silt as tidal currents are frequently

139
eroding and depositing material. The plant Zostera however is not so adaptable and it grows only in stable sediment in sheltered parts of the estuary. It is possible that it would die out locally during the course of the drainage works which as long as they go on will be continuously releasing sediment. Zostera is unlikely to be displaced from all of the area and would probably re-invade in due course. Its decline could however have a small influence on the wigeon and brent goose population in the bay. In fact, it seems more likely that would be replaced by an abundant Zostera arowth of Enteromorpha given an increase in nutrient levels and these birds could actually increase in numbers.

Sediment levels in the water could also modify the invertebrate population, filter feeders being replaced by deposit filters. This might have a commercial impact (on oysters) but is unlikely to alter the birds, most of which are adaptable enough to change to alternative prey.

Suspended solids may also influence the return of salmon and sea trout to the river but this is outside the scope of this report. Limiting drainage work to one bank and leaving the opposite bank intact to the river bed will reduce the amounts of sediment released during the drainage work. The timescale of the works for will also have a major influence on the rate of release though the total quantity may be the same. The later erosion of the unexcavated bank will extend the period of sediment release.

## 4.3.4 FLUGHANY BOG

Flughany Bog is the best example of a raised bog in the catchment and of national value since it occurs in an area where most others have been cut over. Raised bogs are very sensitive to changes in hydrology and although the scheme does not extend in theory to the edge of the bog (it stops 480 m away), it is very likely to have an adverse impact. In practice it will allow a private operator to dig a drainage cut from the bog with the object of harvesting turf.

Some parts of the bog are wet enough to have pools and *Sphagnum* flats but ecologically a slight rise in watertable would benefit the communities. Any drop in watertable will devalue the area and bring about detrimental changes in the vegetation. There is no real room for compromise in this case. While a dam or sluice on the outlet would have some good effects, it is hard to see it surviving for long. It would be much more preferable from the ecological viewpoint to omit this channel (C330/83) and that approaching the western end of the bog (C330 above C330/112) from the scheme.

### 4.3.5 DOOCASTLE TURLOUGH

This area lies outside the range of the proposed drainage and it would require a private scheme of about 1.9 km to link it to the nearest channel (C330/112). It is possible that the general drop of soil watertable occasioned by drainage in this channel and C250 could cause changes at the turlough. For example a turlough 1.5 km from the Clare River in Galway has stopped flooding since that river was drained (Coxon, 1986) even though no excavation was carried out any nearer. Doocastle is a drift-filled turlough and it is possible that the soil is sufficiently impervious to maintain a perched watertable. This could keep some sections of the basin wet enough to retain part of the characteristic vegetation even if flooding becomes less frequent. A closer ground-water study would have to be made to determine this.

### 4.3.6 TEMPLEHOUSE/CLOONACLEIGHA AREA

The scientific interest of this area can be thought of in three main elements though they are closely linked together. There are the two lakes with their wintering wildfowl and, in places, their interesting swamp vegetation. There is the interconnecting river, full of aquatic plants in summer and acting with its floodplain as a feeding area for the wildfowl in winter. Finally there is the ox-bow lake on the main channel below Templehouse Bridge. The drainage proposals extend throughout this area and will lead to a drop in river water levels of 1-1.5m and to a stabilisation of the lakes at or near summer levels.

The effect of stabilising Impact on lakes: water levels will be greater on the vegetation of the lakes than on their birdlife. It will have a major impact on the fen communities at the west end of Cloonacleigha, and in Portinch Bay and near Large sedges form the basis of the Island in Templehouse. many of these communities and Carex elata, C. aquatilis and C. vesicaria require seasonal flooding to survive. Without it they are replaced by grasses and less sensitive marsh plants. If drainage is successful therefore their extent will be much reduced and what vegetation remains will have a changed composition. C. aquatilis could well disappear altogether, other sedges and fen plants would retreat to the vicinity of drains and streams. Changes will be further compounded by increased grazing pressure on the shores and in the trees nearby which again will have the effect of favouring grass species over broad-leaved herbs.

Strictly aquatic plants will mainly survive in the lakes by slightly deeper levels. some, However withdrawing to especially charophyte species, could decline because of decreased transparency in the water during dredging operations and later due to increased nutrient run-off. This impact is likely to be temporary though it could also have food chain effects on the diving duck and their prey organisms. These duck form 20% of all wildfowl on the lakes at present. The effects on dabbling duck which feed mostly on vegetation will be more significant. Not only will their feeding area on the lakeshores decrease in extent because of the lack of flooding but also the drainage and reclamation of the river floodplain around Killawee Lough will remove land that at present supports about 400 (25%) wildfowl in winter. Adding these

impacts together suggests that the overall population supported by the wetland complex could decline by 50-60% after drainage. To prevent this and minimise the impacts on vegetation, winter flooding should be retained and this requirement built into the design of the sluice at Templehouse Bridge.

river between Cloonacleigha Impact on river: The and Templehouse is slow moving, dropping only 0.6 m in 7400 m. Deepening it will have the immediate effect of removing aquatic plants from the bed and at least one bank. This is the area where significant amounts of vegetation could only survive on the opposite bank after drainage because of the very slight gradient and slow flows. Their disappearance will be temporary provided one bank is left intact but the changed conditions of flow and depth could preclude some of the submerged species, e.g. *Callitriche, Alisma, Potamogeton crispus* from growing in the future. However, re-invasion by some species is likely if the water depth does not increase beyond 1 m. Because of the nutrient-rich sediment, weed growth may continue to be a drainage problem in this stretch and weed cutting rather than further excavation may be a more suitable form of maintenance. It would certainly have less impact on the flora which has a considerable visual as well as ecological appeal. It probably also is an important spawning ground for coarse fish.

The river overflows its banks relatively rarely at present, taking in the narrow swathe of Phalaris on each side. Drainage water from the surrounding land however is held up because of the absence of an outfall. The area around Killawee Lough is especially susceptible to these shallow floods. If the proposed drainage does away with this, it will certainly cut down the feeding area for dabbling duck (see above) and will also curtail the feeding and nesting of waders. Although they occur only in numbers of local importance, this is the major wader site in the catchment. It is likely that reclamation will do away with 80% of breeding snipe and redshank and a slightly lesser percentage of wintering curlew, lapwing and snipe. It will modify an equivalent amount of the floodplain vegetation which includes small patches of Calcareous Fen (4D), Enriched Cutaway (2H) and Fen Pasture (6F) and considerable stretches of Tall Herb (1B) and Floodgrass (1D). No rare species are involved in this vegetation as far as is known.

Impact on ox-bow: The ox-bow area, though small, contains a microcosm of the best wetland communities in the whole catchment having examples of willow carr, Tall Herb, Fen Pasture and Floodgrass as well as small areas of Reedbed and Emergent Sedge. Once drainage is carried out it is likely that the water level in this section of channel will drop significantly: it seems now to be held up by a block at Clooneen (Perceval, pers. comm.). This means that the whole area will no longer flood and that all its plant communities will be changed markedly. The ox-bow itself will dry out and its muddy substrate will be colonised initially by willows. While these changes might be interesting in themselves they would bring about a total alteration of vegetation as it now is, and the loss of several plant species of interest, in particular, *Lathyrus palustris* and *Carex lasiocarpa*.

A high, but fluctuating, watertable is essential to maintain this area in its present form as it is the transitional ground between the river and dry land that is of value. Some sort of weir or sluice on the downstream side would therefore be essential, perhaps coupled with a berm to prevent flooding in Portinch and Emlaghnaghtan. The high water levels would maintain feeding conditions for wildfowl (mallard and teal) and also maintain the dense cover required by otters.

This area lies at the heart of the catchment in both the ecological and drainage sense. It contains a broad range of wetland communities which are unlikely to survive drainage: at the same time its drainage would be crucial to the success of the whole scheme. It seems that a clear choice must be made in this instance.

#### 4.3.7 CLOONAKILLINA LOUGH

Cloonakillina Lough is similarly omitted from the scheme but since an existing channel (C330) of 2.03 km length to the nearest outfall is present, and apparently was excavated once, there is a possibility that it could be cleared out again. Such a scheme could be introduced for agricultural improvement or bog drainage (for turf cutting on Derrykinlough/Flughany).

The lake has considerable ecological interest in its sedge and scraw communities which are totally untouched at present. They are thought to have developed in response to previous drainage so a further small lowering of water level could lead to their expansion over existing water areas. It would also lead to some invasion by willow carr and drying out in the central area. Without a thorough investigation of the waterbody beneath the scraw, how significant this would be cannot be assessed. Drainage would have more significance if it allowed cattle onto the marsh which could happen from the north side. The coniferous forests elsewhere would probably prevent such access. Loss of water area would have an effect on the wildfowl wintering on the lake but numbers are relatively small (150).

#### 4.3.8 LOUGH MEHARTH

The tributary that leads to Lough Meharth from the Unshin at Riverstown is not included in the drainage scheme as proposed. The area should therefore not be affected as it has its own catchment of hills around it.

The site is listed as an area of scientific interest because of the good fen at the head of the lake and the abundance of the grass *Poa palustris* which grows from the exit channel to two thirds the way up the lake. It flourishes best along the south side of the channel in a position very vulnerable to damage from drain clearance. Any spoil dug out by private works should be dumped on the east bank for this reason. This is important because the other site of this rare plant would be removed by drainage of the main Unshin.

## 4.3.9 QUARRYFIELD WEST TURLOUGH

This turlough is approached though not quite reached by the drainage scheme. Excavation in channel C250 comes to within 380 m of it and it is very likely that this would be extended at some stage by private action. Even if this did not happen the drop in watertable to the north would probably have a damaging effect. This alone would limit the amount of annual flooding and cause acidification of the fen communities in the SE section leading to a decline in *Galium uliginosum* and other demanding species. A change in vegetation type to Dry Sedge (21) would then occur which would in turn adversely affect snipe. Intentional drainage would endeavour to drain the permanent waterbody in the base of the turlough and if this happened all ecological interest in the area would be lost along with unusual plants such as *Polygonum minus* and *Apium inundatum* and the whooper swans and other wildfowl.

Quarryfield West is an interesting small turlough of a very restricted type and to retain its ecological value it should not be approached by any drainage channel nearer than 3 km (the NW road out of Bunnanadden).

### 4.3.10 TURLOUGHMORE

Turloughmore lies only 1.7 km to the south-west of the nearest channel (C250/32/20) included in the proposals and is therefore likely to be affected by drainage. This is an area of shallow or non-existent drift so a drop in watertables around Achory can be expected to have much more than local effects. The turlough would flood less often in the future and the vegetation would be modified accordingly. To avoid this it would be preferable to cease channel excavation 2.5 km away at the main road.

# 4.3.11 BALLYGAWLEY LOUGH

The drainage proposals reach the outlet of Ballygawley Lake but in view of its amenity importance and the very limited amount of affected land around the lake it is likely that it will be retained at summer level by a weir. This should preserve its scientific interest as its ecology scarcely depends on the periodic flooding of adjacent land. A slight decline in teal and other dabbling duck could occur if the marginal alder and sedge growth was to change with more stable water levels. The rare plants include *Carex lasiocarpa* which requires a certain amount of fluctuation but is generally flooded in summer.

144

The main importance of the lake in wildfowl terms is its population of whooper swan, a species that feeds on grassland and submerged water plants and is unlikely to be affected by drainage at Ballygawley through it could lose feeding grounds on the lower Unshin (q.v.).

#### 4.3.12 CORHAWNAGH

It is planned to drain the C4 tributary of the lower Owenmore Kilboglashy, although this depends southwards to on level reasonable lowering of the bed of the Collooney-Ballysadare channel (Martin, pers. comm.). As such the scheme is likely to have an impact on the eastern of the two wetlands which make up the Corhawnagh site. To reach this marsh would require extra excavation of the order of 250 m of channel which would probably be done by a private scheme. This would result in theelimination of the Phragmites/Equisetum variegatum stand with surrounding Calcareous Fen communities (91% of all on the north side of the Ox mountains, 5% of all remaining elsewhere in the catchment). The small area of affected land around Corhawnagh Lough which would benefit from drainage makes it unlikely (though still possible) for the works to be extended westwards by the required 520 m. It has been done once however, and despite the fact that groundwater plays a major part in supplying water to the vegetation of interest, it could be done again. Its result would be to restrict the fen communities here though probably not to eliminate them.

The best solution would be to terminate excavation in Knoxpark at the minor road 420 m from the area of the interest.

### 4.3.13 CARROWNABUNNY

The drainage work proposed on the Owenbeg stops at Billa which is 9.8 km downriver from this site. It therefore will suffer no impact.

### 4.3.14 KNOCKMULLIN

Knockmullin now drains eastwards to the Toberscanavan Loughs and the Unshin. It is included in the scheme (C38/72) so will be totally changed. The peaty channel will be dug out along the base of the valley and side drains put in to intercept the numerous springs and seepages from the east and north. The vegetation of interest is lime-demanding and thus dependant on this spring water infiltrating the peat. Without it, it will be modified into poor pasture, becoming gradually more leached and acidic in the absence of further management. No botanical interest will remain in this site after drainage and the five rare species of plant will disappear. The loss of calcareous fen vegetation at 6.4 ha comprises 49% of that in the Owenmore sub-catchment. The only amelioration possible is to omit this channel from the drainage scheme, probably at the junction of C38/72/19, which is 800 m away.

#### 4.3.15 FEENAGH LOUGH & BUNNAMUCK

These two lakes lie amongst drumlins at the extremity of the C355 branch of the Owenmore (called the Owenbeg). It is proposed to extend drainage to the outflow of Bunnamuck Lough but not to Feenagh which has relatively little affected land. Of the two areas, Bunnamuck is the most diverse in vegetational terms (Fig. 11), as well as having a plant (Eupatorium) recorded nowhere else in the catchment and two others relatively rare (Nymphaea and Ranunculus lingua). Feenagh shows a similar fairly oligotrophic aquatic flora with Sparganium minimum and two Potamogeton species of interest.

The two sites are complementary having different marginal communities. To maintain their interest the Bunnamuck channel should be sealed in its present condition by a weir set at summer level. The area is so overgrown by fen vegetation that it will continue to be flooded in winter in all probability.

Π

An alternative would be to omit the short length of channel up to C355/70 from the scheme. However it would probably be done privately at a later stage.

# 4.3.16 LOUGH DARGAN

Lough Dargan and its catchment is omitted from the current drainage proposals, the nearest channel to be affected being 1930 m away. In addition it is used as a source of drinking water so it must be an objective to preserve it in an unmodified form. This will favour its aquatic flora which is the feature of interest.

# 4.3.17 FIN & LISHEEN LOUGHS

These two wetlands lie on the C81/34/83 tributary of the Owenmore (formerly flowing to the Owenbeg) and are omitted from the drainage proposals which are confined at this point to the main channel - C81/34.

# 4.3.18 GREENAN

This site also is omitted from the drainage proposals and the nearest deepened channel is 1.06km away.

#### SECTION 5 - CONCLUSIONS

The foregoing chapters have shown that there is a high level of ecological interest associated with:-

1) Lough Arrow and the entire length of the Unshin River.

Three other main areas stand out:-

2) the Templehouse/Cloonacleigha complex

3) the wetlands (turloughs, raised bog and lake) at the headwaters of the Owenmore

4) Ballysadare Bay - the river estuary

Additional sites of interest are located elsewhere in the catchment with two in the Owenbeg and one off the greater Owenmore, close to Ballysadare.

This concluding section discusses wildlife conservation and the proposed arterial drainage, outlining where choices will have to be made and where mitigation is possible. It assumes that the conservation of both habitat and species diversity is desirable, as is the drainage of low-lying land.

The ecological value of the Lough Arrow/Unshin system is so great that every effort should be made to conserve it. There is no real room for compromise because it is the river itself which is the major part of the interest. For this reason there is no point considering the acquisition of certain sites or the removal of sections of the river from the proposed scheme. Nothing will protect this interest other than no drainage and, on ecological grounds it is considered essential to exclude the whole sub-catchment from the scheme. This will at a stroke ensure the survival of six of the eighteen areas of scientific interest recognised by this survey (including Lough Meharth, Lough Dargan, Knockmullin under its present drainage arrangements, and Ballygawley Lough). It would also mean the retention of half the stations for rare plants in the entire y catchment and of 40% of the wintering wildfowl.

Templehouse/Cloonacleigha also has considerable value but it is more localised as a site and does not extend over so much of the river's course. However the area straddles the lower part of the sub-catchment and takes all the flow. It seems that the conservation of its ecological features and the development of a successful drainage scheme are virtually incompatible and a decision must be taken between them. If the drainage scheme goes ahead there is a possibility that some form ecological interest could remain in modified at Templehouse but this should be regarded as a bonus and not as a consequence.

The upper Owenmore includes the turloughs of Doocastle and Ouarryfield West as well as Flughany Bog and Cloonakillina Lough, all in close proximity. It has already been stated that the drainage plans should be curtailed in the vicinity of the sites but the danger remains that all could be affected by private schemes. For this reason there is a strong case to be made for the acquisition of these four sites so that their essential hydrologies can be maintained. In the case of Flughany and Cloonakillina the deepening of channels could proceed right up to a sluice on their outflows. This would mean that almost no land that could benefit from drainage below the sites would be omitted. In the case of the turloughs however drainage works must cease much further away so that local watertable remains high enough to sustain the the present pattern of flooding. It is felt that a study of groundwater in this locality is required to define the point beyond which channel deepening should not go though a suggestion is made in the preceeding section (C330/112 for Doocastle and C250 at Sh 7 for Quaryfield West).

In the case of Ballysadare Bay no severe impacts on its birdlife or flora have been identified so no recommendations are made other than to minimise the sediment load during the course of drainage work.

Turloughmore is likely to be affected by the proposals and as a site of at least regional importance, it must be given a wider berth by channel excavation. It is thought that the channel 250/32/20 should not be modified west of the road from Achonry to Bunnanaddan though, as in the case of the other turloughs, a groundwater study would be needed to confirm this.

The other sites of interest are not expected to suffer any impacts from the proposed scheme with the exception of Feenagh/Bunnamuck. This is a locally important area for its flora and birdlife. It is an obvious candidate for acquisition since it is by-passed by channel 355 as it flows south from the drumlins by Feenagh Lough. Land that would otherwise benefit from the proposals is about 4ha in extent so it does not represent a major acquisition.

As well as these conclusions about specific sites it must be arterial drainage of any parts of the remembered that catchment will lead to the loss of the habitat- and speciesdiversity that is there today. Generalised species of bird and particularly those that benefit higher plant, from a nutritional regime, will multiply at the expense of the specialists, as land use becomes more uniform and more intensive. This process of ecological attrition in the general countryside will occur even if untouched areas are left as reserves and centres of diversity. This is because the lines of communication between them will become difficult if not impossible and so prevent many species from occurring in the intervening land.

6. <u>REFERENCES</u>

- Alexander, R.W., Richardson, D.H.S., Cotton, D. & Seaward, M.R.D. (1989) Field meeting to Sligo & Connemara National Park. Lichenologist 21(2): 159-168.
- An Foras Forbartha (1972) <u>Preliminary report on Areas of</u> <u>Scientific Interest in Co. Sligo</u>. Dublin.
- An Foras Forbartha (1981) Areas of Scientific Interest in Ireland. Dublin.
- An Foras Forbartha (1986) Water Quality in Ireland: The current position. Dublin.
- Buckley, P. (1987) A study of breeding Common Scoter in Ireland. Report to the R.S.P.B.
- Buckley, P. (1989) a) Summer waterbird populations and their productivity on Lough Corrib.b) Summer waterbird populations at Lough Sheelin.Reports to the Zoology Dept, University College, Galway.
- Buckley, P. & McCarthy, T.K. (1987) <u>Bird Communities in the</u> <u>Dunkellin/ Lavally Catchments</u>. University College Galway for Forest & Wildlife Service.
- Cadbury, C.J. (1984) The affects of flood alleviation and land drainage on the birds of wet grasslands. In: Jenkins, D. (ed) Agriculture and the Environment ITE Symposium No. 13, Cambridge.
- Champ, T. & King, J.J. (1987) <u>Lough Arrow: water quality and</u> <u>trophic status</u>. Central Fisheries Board.
- Coxon, C.E.(1986) A study of the hydrology and geomorphology of turloughs. Unpub. Ph.D. Thesis, Trinity College, Dublin.
- Cross, J (in prep) Raised bogs of Ireland their status and conservation. Office of Public Works.
- Curtis, T.G.F. & McGough, H.N. (1988). The Irish Red Data Book. Part I Vascular Plants. Stationery Office, Dublin.
- Dare, P.J. (1970) The movements of oystercatchers (Haematopus ostralegus) visiting or breeding in the British Isles. Fishery Invest. Lond. (Ser II) 25(9): 1-137.
- Douglas, C. & Grogan, H. (1986) <u>Survey to locate areas of raised</u> <u>bog in Longford, Westmeath and East Mayo</u>. Unpub. Report for Wildlife Service.
- Ellenberg, H.H. (1988) Vegetation Ecology of central Europe. C.U.P. 3rd Edition.

- Goodwilie, R.N. (1992) <u>Turloughs over 10ha: vegetation survey</u> <u>and evaluation</u>. Unpub. Report for National Parks & Wildlife Service.
- Green, R.E. (1985) Estimating the abundance of breeding snipe. Bird Study 32: 141-149.
- Hutchinson, C.D. (1989) Birds in Ireland. Poyser, Calton.
- Jermy, A.C., Chater, A.O. & David, R.W. (1982) Sedges of the British Isles. Botanical Society of the British Isles, London.
- Lockhart, N. (1982) <u>Lough Carra East vegetation report</u>. Unpub. Rept to Forest & Wildlife Service.
- Lysaght, L.S. (1989) Breeding bird populations of farmland in mid-west Ireland in 1987. *Bird Study* **36**: 91-98.
- Moore, J.A. (1986) Charophytes of Great Britain & Ireland. BSBI, London.
- OECD (1982) Eutrophication of waters. Monitoring, assessment and control. Paris.
- O'Sullivan, A.S. (1965) A phytosociological survey of Irish lowland meadows and pastures. Ph.D. Thesis, National University of Ireland, Dublin.
- O'Sullivan, A.S. (1982) The lowland grasslands of Ireland. J.Life Sci. R. Dubl. Soc. 3: 131-142.
- Partridge, J.K. (1988) <u>Northern Ireland breeding wader survey.</u> RSPB report to DoE(NI) Countryside & Wildlife Branch, Belfast.
- Rodwell, J.S. (1991, 1992 & in press) British Plant Communities. Vol 1: Woodlands & Scrub, Vol. 2: Mires & Heaths, Vol 3: Grasslands and Montane Communities, Vol 4: Aquatic communities, Swamps & Tall herb fens. Cambridge.
- Round, F.E. & Brook, A.J. (1959) The phytoplankton of some Irish loughs and an assessment of their trophic status. Proc. Roy. Ir. Acad. 60B(4): 167-191.
- Scannell, M.J.P. & Synnott, D.M. (1987) Census Catalogue of the Flora of Ireland. Stationery Office, Dublin.
- Schoof Van Pelt, M.M. (1973) Littorelletea: a study of the vegetation of some amphiphytic communities of western Ireland. Unpub. Thesis, Nijmegen, 216pp.
- Sharrock, J.T.R. (1976) The Atlas of Breeding Birds in Britain and Ireland. Berkhamstead.
- Sheppard, J.R. (in prep) Ireland's Wetland Wealth. Irish Wildbird Conservancy.

- Ц L I
- Taylor, K. (1984) The influence of watercourse management on moorhen breeding biology. Brit. Birds 77: 144-148.
- Whilde, A. (1986) <u>Computerisation, analysis and application of</u> <u>Irish wetland habitat and bird data</u>. Rosscahill, Co.Galway.
- White, J. & Doyle, G. (1982) The vegetation of Ireland a catalogue raisonee. J.Life Sci. R. Dubl. Soc. 3(2): 289-368.
- Wildlife Service (1989) <u>Index to Areas of Scientific Interest</u> -<u>1:126,720 O.S.Maps</u>. Dublin.
- Williams, G. (1980) Quiet flows the river. Birds 8: 19-22.
- Williamson, K. (1971) A bird census of a Dorset dairy farm. Bird Study 18: 80-96.
- Winston, D. (1987) Breeding Common Scoter on Lough Conn and Lough Cullin, Co Mayo. Report to the R.S.P.B.

# Captions for Plates 1 - 37 (pp 155-159)

Π

Π

1. Unshin river north of Bellarush Bridge showing the braided stony channel with some *Potamogeton crispus*, running through *Phragmites* beds.

2. Unshin river channel above the Eel Weir with abundant *Hippuris* and some *Berula*.

3. A peaty stretch of the upper Unshin enclosed by Scirpus lacustris and supporting Nuphar, Polygonum amphibium and (submerged) Littorella.

4. Tall herb (1B) vegetation of Filipendula, Iris and Vicia cracca with some Phalaris because of river flooding.

5. The Unshin rapids close to Lisconny House.

6. The Unshin at Doonsheheen with a flooded expanse of Rush-Grass (3H) on the right and mixed Floodgrass (1D) and Fen Pasture (6F) elsewhere.

7. Rapids on the Unshin showing the boulders covered in *Eurynchium riparioides* with some *Ranunculus peltatus*.

8. The sequence of rapids on the Unshin with clumps of Apium, Phalaris, Scirpus lacustris and Petasites hybridus and much Potamogeton pectinatus in the water.

9. The Unshin channel below Lisconny Bridge showing the abundance of *P.pectinatus*.

10. Unshin below Ballygrania Bridge with a fringing growth of Butomus umbellatus and some Phalaris and Nuphar.

11. Unshin above Collooney with a marginal growth of Salix cinerea and some scattered Potamogeton spp underwater.

12. Corhawnagh wetland to show its position at the junction of the Ox Mts and the lowland plain.

13. Corhawnagh looking NE to a mixed fen of Molinia, Calluna and Schoenus. The Phragmites/Equisetum variegatum stand is below the distant hill.

14. A stand of Eriophorum latifolium at Corhawnagh beneath the slope of the Ox Mountains. Eleocharis quinqueflora occurs in the foreground.

15. A dense stand of *Hippuris* and *Potamogeton natans* at the Greenan wetland.

in Greenan. 1.4 C.elata. Phalaris. (6F). Herb (1B). 

16. Ranunculus trichophyllus and Callitriche spp in the pond in Greenan.

17. Ox-bow below Templehouse Lough in flooded conditions, showing the willow wood at the north end and some inundated fen vegetation.

18. Looking westwards into the ox-bow in summer with *Hippuris* and *Alisma plantago-aquatica* on exposed mud and *Nuphar* and *Scirpus lacustris* elsewhere.

19. An open part of the willow wood at the ox-bow with much Carex elata and Lysimachia vulgaris beneath Salix cinerea.

20. Large stand of *Carex aquatilis* on the shore of Templehouse Lough with scattered *Scirpus lacustris* and some clumps of *C.elata*.

21. A dry part of the scraw at Cloonakillina Lough with Menyanthes and Myrica as well as scattered Phragmites, Carex lasiocarpa and Lychnis flos-cuculi.

22. Marginal vegetation at the western end of Cloonacleigha Lough showing bands of *Phragmites*, *Carex* elata and *Menyanthes* punctuated with *Rumex* hydrolapathum and *Stellaria* palustris.

23. River below Cloonacleigha Lough with a rich aquatic flora including Potamogeton crispus, Callitriche spp., Nuphar and Sparganium erectum as well as Oenanthe spp.

24. River channel between Cloonacleigha and Templehouse Loughs with abundant *Mimulus guttatus* below the marginal bands of *Phalaris*.

25. Unshin below Doonsheheen showing an ungrazed stand of Tall Herb (1B) surrounded by grazed and semi-flooded Fen Pasture (6F).

26. Owenmore at Clooncunny with Tall Tussock (1A) on the right bank. In the foreground Rush-Grass (3H) changes to Damp Meadow (6J) below a small Cutover Bog (2P).

27. The exit river at Lough Meharth with Reedgrass (1G) and Emergent Sedge (4A-i) to the left of an extensive area of Tall Herb (1B).

28. Poa palustris and Phalaris beside the river channel at Lough Meharth.

29. The effect of grazing at Turloughmore on a Phalaris/ Filipendula/Agrostis stolonifera community.

30. Pond at the lowest point of Doocastle turlough with *Polygonum amphibium* in the water and *Fontinalis* caught on the wires above.

31. Quarryfield West turlough looking towards the swallow hole over a Carex stand of C.nigra, C.disticha, C.diandra and C.rostrata with Filipendula.

32. Flughany Bog from the south.

33. Unshin at Cloonmacduff showing glacial till 'islands' on the far bank surrounded by Fen Pasture (6F). A large area of Tall Tussock (1A) occurs in the foreground. Reclamation in the centre has introduced *Lolium* grassland (3A) while a mown strip to the left is Wet Meadow (6A).

34. Pedicularis palustris, Eriophorum angustifolium and Carex panicea in Fen Pasture (6F) vegetation.

35. Epipactis palustris at Carrownabunny.

36. Fin Lough with its crannog from the south, showing a fringe of reedbed, Calcareous Fen (4D) and Fen Pasture (6F).

37. Lathyrus palustris growing on Phalaris at the ox-bow below Templehouse Lough.

Π

łI

















#### APPENDIX 1

# VEGETATION TYPES RECORDED IN THE OWENMORE CATCHMENT

### Caitriona Douglas & Roger Goodwillie

VEGETATION TYPES

1A	Tall Tussock	3A Lolium Pasture	6A	Wet Meadow
1B	Tall Herb	3C Peaty Cutover	6F	Fen Pasture
1D	Floodgrass	3E Dry Grassland	6J	Damp Meadow
1G	Reedgrass	3G Rush-Sedge		
	-	3H Rush-Grass		
2C	<i>Molinia</i> Cutover	3I Acid Grass		
2D	Scrub Cutover	3J Poor Pasture		
2E	Floodsedge	3K Rush-Iris		
2 H	Enriched Cutaway			
21	Drysedge	4A-i Emergent Sedge		
2N	Deciduous Wood	4A-ii Reedbed		
20	Conifer Wood	4A-iii Scraw		
2 P	Cutover Bog	4D Calcareous Fen		
2 R	Raised Bog	4H-i Willow Wood		
		4H-ii Alder Wood		

In the following descriptions of the vegetation types it should be remembered that the presence figures are those derived from the lists as written down in the field. They are not the absolute frequencies of species in the plant communities nor are they coverage values. A percentage presence figure indicates the proportion of lists a certain plant occurs in and the species are listed in order of abundance in each category (dominant and associated). Rare species have the same definition as in the main report.

NVC is the National Vegetation Classification of the Nature Conservancy Council which is currently being published. (Rodwell 1991 & in press). The 1987 draft version is used below.

The phytosociological references and authorities will be found in White & Doyle, 1982. VEGETATION TYPE 1A: TALL TUSSOCK

TOTAL AREA SAMPLED 220ha (3.6% of total)

DOMINANT SPECIESDeschampsia cespitosa, Agrostis(50% or greaterstolonifera, Filipendula ulmaria,presence)Juncus effusus

ASSOCIATED SPECIES Holcus lanatus, Ranunculus repens, Rumex (20-50% presence) acetosa, Potentilla anserina, Carex disticha, Iris pseudacorus, Cirsium palustre, Senecio aquaticus

Π

Π

Π

SPECIES DIVERSITY 38 species at 5% or more

RARE SPECIES None

STRUCTURE: This is a tall vegetation type (up to 1.5m) with a marked tussocky appearence because of the predominance of Deschampsia cespitosa and Juncus effusus. It is often dense though a low level of grazing opens up patches between the tussocks, allowing Holcus lanatus, Agrostis stolonifera and Ranunculus repens to grow. Senecio aquaticus and Cirsium palustre are apparently favoured by grazing also while in areas of uneven terrain the wet hollows may harbour Glyceria fluitans. If there is mineral enrichment Iris pseudacorus and Potentilla anserina may be present.

The community is relatively species-poor, both in higher plants and bryophytes. *Calliergon cuspidatum* and *Rhytidiadelphus* squarrosus are the main mosses which occur.

PHYTOSOCIOLOGY Order Alliance Association	MOLINIETALIA Koch 1926 Calthion palustris Tx. 1937 em. 1951 Senecioni-Juncetum acutiflori Br-Bl et Tx 1952 This is considered a poorly defined association by O'Sullivan (1982) but its diagnostic species include Juncus effusus, Senecio aquaticus, Agrostis stolonifera, Potentilla anserina and Poa trivialis as well as Lolium perenne and Carex hirta. The Tall Tussock vegetation type seems to be at the more oligotrophic end of this since the last two species are lacking.
NVC	<u>Juncus effusus/acutiflorus-Galium palustre</u>

SOIL: Damp and weakly acidic soils which are poor in nitrogen. The soil type is a poorly drained alluvial or cutaway peat.

rush-pasture: Juncus effusus sub-community.

HYDROLOGY: Flooding seems to occur for short periods in winter with a mixture of surface and river water.

MANAGEMENT: There is low intensity grazing by cattle and a few horses but the tussocky nature of the vegetation and its constituent species makes it generally unattractive.

CATCHMENT DISTRIBUTION: The community occurs chiefly along riverbanks, drainage channels and on cutaway areas. It is most frequent in the upper reaches of the Owenmore river and beside this river just south of Ballymote. It is rather scarce in the Owenbeg and Unshin catchments except on peaty soils at the confluence of the Unshin and Owenmore.

IMPACT OF DRAINAGE: In the absence of flooding Deschampsia cespitosa would be likely to die out. Juncus effusus would maintain its hold because of the poor draining quality of the soil and the vegetation would become Rush-grass. More intensive grazing would produce Poor Pasture or Damp Meadow depending on fertility levels and the frequency of mowing.

VEGETATION TYPE 1B: TALL HERB

TOTAL AREA SAMPLED 203ha (3.3% of total)

DOMINANT SPECIES Filipendula ulmaria, Juncus effusus (50% or greater presence)

ASSOCIATED SPECIES Agrostis stolonifera, Deschampsia (20-50% presence) Cespitosa, Carex disticha, Valeriana officinalis, Festuca arundinacea, Phalaris arundinacea, Angelica sylvestris, Holcus lanatus, Carex nigra, Ranunculus repens, Festuca rubra, Arrhenatherum elatius, Rumex acetosa, Iris pseudacorus

SPECIES DIVERSITY 42 species at 5% or more

RARE SPECIES Lycopus europaeus, Lysimachia vulgaris, Oenanthe crocata, Poa palustris, Rumex hydrolapathum, Scutellaria galericulata, Solanum dulcamara, Stellaria palustris

STRUCTURE: Tall, dense vegetation from 50-150 cm high, this community is dominated by *Filipendula ulmaria*. The species forms small mono-specific stands but other broad-leaved plants are usually found, especially the similarly tall *Valeriana* officinalis and Angelica sylvestris. In places Lythrum salicaria, Iris pseudacorus and Cirsium palustre occur and there is often some Juncus acutiflorus. The grasses include Deschampsia cespitosa, Festuca arundinacea, Phalaris arundinacea and, on richer sites, Arrhenatherum elatius. Carex disticha is characteristically present in the understory with Agrostis stolonifera, Potentilla anserina, Ranunculus repens and sometimes R.acris. Where there is abundant groundwater some of the large sedges such as Carex acutiformis, C. vesicaria and even C.rostrata occur.

Bryopytes are very poorly represented in this community and are probably inhibited by low light levels and the abundance of litter from the large herbs.

PHYTOSOCIOLOGYOrderMOLINIETALIA Koch 1926AllianceFilipendulion (as in White & Doyle, 1982)AssociationValeriano-Filipenduletum (ibid.)

Seldom grazed or mown tall grassland vegetation of continuously wet areas along rivers, streams and ditches on humus and mineral-rich soils where organic matter is deposited (White & Doyle, 1982).

NVC <u>Filipendula-Angelica mire</u>, mostly belonging to the V. officinalis-Rumex acetosa sub-group.

SOIL: Generally a peaty gley or peaty alluvial soil of good nutritional status.

HYDROLOGY: The community has a high watertable all year round and sometimes is associated with springs in valley bottoms. It experiences annual flooding with nutrient-rich water.

MANAGEMENT: The abundance of *Filipendula* is indicative of a lack of both grazing and mowing in this vegetation. In places it occurs beside Fen Pasture (6F) with only a fence between.

CATCHMENT DISTRIBUTION: The community is found along damp meadow margins, adjacent to ditches or other areas which flood and are inaccessible to animals. A large stand occurs between the road and railway embankment at Ballysadare but it may appear almost anywhere on the more eutrophic affected land in response to a cessation of management. The same vegetation occurs in open water transitions behind the emergent zone, as at Lough Corran and Boathole Lough. Overall it is recorded mostly in the Unshin catchment with somewhat less in the Owenmore and very little in the Owenbeg.

IMPACT OF DRAINAGE: Since drainage would reduce both the frequency of flooding and the amount of humus reaching the soil, dampness and nutritional status would decline. Poor Pasture (3J) is likely to the end-point with Rush-Iris (3K) where sufficient groundwater input is maintained.

### VEGETATION TYPE 1D: FLOODGRASS

TOTAL AREA SAMPLED 36ha (0.6% of total visited)

DOMINANT SPECIES Agrostis stolonifera, Glyceria (50% or greater fluitans, Ranunculus repens presence)

ASSOCIATED SPECIES Juncus effusus, Filipendula (20-50% presence) ulmaria, Myosotis scorpioides, Senecio aquaticus, Deschampsia cespitosa, Caltha palustris, Equisetum fluviatile

SPECIES DIVERSITY 40 species at 5% or more

STRUCTURE: Floodgrass is usually dominated by a mixture of Arostis stolonifera and Glyceria fluitans which, during flooded conditions, form a floating mat or scraw. The prostrate grass cover is punctuated by upright wetland plants, chiefly Juncus effusus, Filipendula ulmaria and Deschampsia cespitosa with Equisetum fluviatile, and even Phragmites australis and Sparganium erectum in water tracks and hollows. Ranunculus repens is a constant member of the community while Cardamine pratensis and Myosotis scorpioides are frequent, the latter especially in the more open parts of the plant cover. Veronica anagallis-aquatica, Bidens cernua and Alopecurus geniculatus are occasionally found in richer sites.

#### PHYTOSOCIOLOGY

Order Alliance Association	NASTURTIO-GLYCERIETALIA (White & Doyle 1982) Glycerio-Sparganion (ibid.) Glycerietum fluitantis Wilzek 1935 Apio-Veronicetum beccabungae Br-Bl & Tx 1952
	Both these associations seem to be included in our lists. White & Doyle (1982) describe this as the vegetation of the contact zone between land and water where the watertable may fluctuate to allow both aquatic and terrestrial plants to intermingle in relatively stable, fertile habitats.
NVC	<u>Agrostis stolonifera-Alopecurus geniculatus</u> <u>inundation grassland</u> . ALSO: <u>Glyceria fluitans swamp</u> , especially Alopecurus geniculatus sub-community.

SOIL: Eutrophic silty peats, alluvial silts and occasionally marls or peaty marls, sometimes subject to poaching.

RARE SPECIES Achillea ptarmica, Carex lasiocarpa, Mentha arvensis, Salix triandra

HYDROLOGY: This vegetation experiences frequent flooding at any time of high water but also dries out for periods in the summer. Poaching may establish a perched watertable in sites which are not so frequently flooded.

MANAGEMENT: The community is grazed through most of the year wherever cattle have access to it and the grasses seldom flower. It also seems to be chosen by herbivorous wildfowl such as swans and wigeon.

Π

CATCHMENT DISTRIBUTION: Floodgrass occurs in small patches along the courses of rivers and drainage channels. It is most frequent along the flatter parts of the river valleys and is scarcely found at all in the Owenbeg. The Owenmore around Templehouse Lough contains good stands.

IMPACT OF DRAINAGE: Arterial drainage would reduce flooding to such an extent that this vegetation type would disappear completly from any stretch affected. It would also often be covered by spoil dug from the channel and be altered by the passage of machinery.

VEGETATION	TYPE	1G:	REEDGRASS
------------	------	-----	-----------

TOTAL	AREA	SAMPLED	12ha	(0.2%	of	total	visited)	)
-------	------	---------	------	-------	----	-------	----------	---

- DOMINANT SPECIES Phalaris arundinacea, Urtica dioica (50% or greater Filipendula ulmaria presence)
- ASSOCIATED SPECIES Agrostis stolonifera (20-50% presence)

SPECIES DIVERSITY 21 species at 5% or more

RARE SPECIES Heracleum mantegazzianum, Poa palustris

STRUCTURE: Reedgrass is marked out by the occurrence of dense stands of *Phalaris arundinacea*, 1.5m or more in height. Few species can compete in such a cover though *Urtica dioica* and *Filipendula ulmaria* are relatively frequent, favoured by the eutrophic conditions that arise from flood debris. A few trees are often noticeable because of their size, *Salix cinerea* and *Alnus glutinosa* being widely spread and *S.viminalis* more localised. In more open places or at the edges of the stand *Agrostis stolonifera* makes an appearence but other low-growing species are almost absent; bryophytes completely so. This vegetation type usually adjoins Tall Herb (1B) and may grade into it.

PHYTOSOCIOLOGYOrderMOLINIETALIA Koch 1926AllianceFilipendulion (Duvigneaud 1946) Segal 1966

#### Magnocaricion Koch 1926

This community would seem to fit into both alliances in some cases. The Filipendulion is generally characteristic of slow rivers and ditches, while the Magnocaricion (in which there is a Phlaridetum arundinaceae Libbert, 1931) is found more often on sheltered lakeshores. The lack of *Phragmites* and most sedges suggests that the vegetation type in fact lies within the Filipendulion which is poorly investigated in Ireland (White & Doyle, 1982). These authors do not list an appropriate association.

NVC

Ĺ

Phragmites australis-Urtica dioica fen, the Filipendula ulmaria and Epilobium hirsutum sub-communities.

SOIL: The community is always associated with alluvial sites where flood debris accumulates as a peaty deposit together with silt. These soils would seem to be some of the most eutrophic in the whole catchment.

HYDROLOGY: The ditch and river sites are flooded regularly by high water at any time of the year. In winter they may be submerged for two or three months. They receive water both from the land side and the river.

MANAGEMENT: None except for occasional grazing or trampling by cattle.

CATCHMENT DISTRIBUTION: This community occurs in narrow strips along ditches and rivers and is most widely found in the Unshin catchment. The largest stand occurs at Kilmorgan on the tributary near Drumfin. Linear stands also surround the river linking Cloonacleigha and Templehouse Loughs.

IMPACTS OF DRAINAGE: Since arterial drainage will prevent almost all flooding this community will largely disappear from the catchment. It will often also be affected by the bankside operations. In certain places without grazing it may be replaced by Tall Herb (1B) but Rush-Grass (3H) seems more likely. Mowing will eventually convert it to Damp Meadow (6J). VEGETATION TYPE 2C: MOLINIA CUTOVER TOTAL AREA SAMPLED 438ha (of 5.2% in catchment) DOMINANT SPECIES Molinia caerulea, Succisa pratensis (50% or greater presence) ASSOCIATED SPECIES Potentilla erecta, Calluna vulgaris, Carex panicea, C.nigra, Anthoxanthum (20-50% presence) odoratum, Agrostis capillaris SPECIES DIVERSITY 33 species at 5% or more RARE SPECIES None recorded

STRUCTURE: This is a uniform heathy vegetation, 20-30cm in height which consists of Molinia caerulea growing in nontussocky form with a variable amount of Calluna vulgaris, depending on the history of burning. Both Succisa pratensis and Potentilla erecta are characteristic of this vegetation though they occur in several other communities: Cirsium dissectum is also locally abundant. Agrostis capillaris and Anthoxanthum odoratum are quite frequent though they cover a small overall area compared to the Molinia: Agrostis canina is locally found. Small sedges are a normal constituent of the low sward with Carex panicea and C.nigra the most frequent. Occasional clumps of rushes stand above the general level. Juncus effusus and J.conglomeratus are not uncommon and they seem to be encouraged by cattle, along with Cirsium palustre and Plantago lanceolata.

The ground surface often has undulations derived from old cuttings or trackways and the mixture of bog and heath species makes it a difficult vegetation type to categorize. The depressions are sometimes wet enough to allow Sphagnum species to grow with Narthecium ossifragum or Viola palustris while ridges may have Festuca rubra with Ulex europaeus and Hylocomium splendens.

PHYTOSOCIOLOGY Order Alliance	MOLINIETALIA Koch 1926 Junco conglomerati-Molinion Westhoff 1968
	The vegetation type seems to include elements from several different associations probably because its topography and management create a number of separate niches. It appears to be at the more oligotrophic end of this alliance and with slight enrichment the association can grade into the Cirsio-Molinietum of Siss. et De Vries 1942. The community is often derived from the Oxycocco-Sphagnetea BrBl. et Tx. 1943 by drainage and fire.
NVC	Molinia caerulea-Potentilla erecta mire,

Molinia caerulea-Potentilla erecta mire, including the Anthoxanthum odoratum and, less often, the Erica tetralix sub-communities. SOIL: The community is based on a peat soil, normally a remnant from raised bog.

HYDROLOGY: These areas are to some extent flushed by surface water during wet periods but are seldom if ever flooded by the rivers. The watertable falls during dry periods in summer.

MANAGEMENT: Molinia Cutover provides very little grazing except after periodic burning in the spring. At other times of the year cattle walk over it and may do some poaching of the wetter parts. The areas are generally open with few ditches or fences.

CATCHMENT DISTRIBUTION: Areas of this community surround most of the raised bogs in the region so it is most frequent in the Owenmore catchment. A large stand, partly afforested, occurs near Kilawee Lough, west of Cloonacleigha/Templehouse.

IMPACT OF DRAINAGE: Lowering the watertable in this vegetation will convert it to Dry Sedge (21) or Acid Grass (31) depending on nutritional levels. With fertilization and mowing a Damp Meadow (6J) could result. Since bog areas may be omitted from the arterial drainage scheme a proportion of this vegetation will probably remain unchanged.

#### VEGETATION TYPE 2D: SCRUB CUTOVER

TOTAL AREA MAPPED 242ha (3.9% of total visited)

STRUCTURE: This community was not analysed in detail since it was easily recognised at the outset of the survey. It is cutover raised bog which is being colonised by woodland, usually of *Betula pubescens* and *Salix cinerea*. Its characteristic structure is of peat banks which carry the trees, separated by flooded peat cuttings. On the edges of the cuttings, species such as *Osmunda regalis*, *Dryopteris dilatata* and *D.carthusiana*, *Salix aurita* and sometimes *Viburnum opulus* survive. In open conditions *Calluna vulgaris* and *Molinia caerulea* are abundant while after canopy closure woodland plants predominate, e.g. *Ilex aquifolium*, *Rubus fruticosus* and *Vaccinium myrtillus*. The ponds of open water retain *Menyanthes trifoliata*, *Carex rostrata* and *Sphagnum* spp. for a long period.

PHYTOSOCIOLOGY

Order Alliance Association SALICETALIA AURITAE Doing 1962 em. Westhoff 1968 Salicion cinereae Th. Muller et Gors 1958 Osmundo-Salicetum atrocinereae Br.-Bl. et Tx 1952 Salici-Betuletum pubescentis Gors 1961

The community is probably not fully developed in many cases since species are still invading it after the cessation of peat cutting. Therefore its phytosociological affinities are not clear. It could include some examples of the Blechno-Quercetum petraeae in the drier sites. SOIL: Peat, formed usually on a raised bog.

HYDROLOGY: Little fluctuation of water levels occurs over the year as the marginal bog drains that were dug for peat extraction still function.

#### MANAGEMENT: None

CATCHMENT DISTRIBUTION: Throughout bog areas of the catchments but it seems relatively widespread in the Unshin as at Brickeen. This is probably because the smaller amount of bog in this catchment was cutover earlier than that in the upper Owenmore. A good example of the community occurs at Carrigeenroe in the latter catchment. Π

Π

Π

IMPACTS OF DRAINAGE: It is assumed that this community would change to Deciduous Woodland (2N) after drainage in the absence of management. It is less likely to be planted with conifers than an open cutover site because of the costs involved in clearance.

VEGETATION TYPE 2E: FLOODSEDGE

TOTAL AREA SAMPLED 58ha (0.9% of total visited)

DOMINANT SPECIES Carex rostrata, C.nigra

ASSOCIATED SPECIES Equisetum fluviatile, Galium palustre, Potentilla palustris, Mentha aquatica, Menyanthes trifoliata, Calliergon cuspidatum, Lychnis flos-cuculi, Carex diandra, Juncus acutiflorus, Angelica sylvestris, Epilobium palustre, Juncus articulatus, Succisa pratensis

SPECIES DIVERSITY 38 species at 5% or more

RARE SPECIES Carex aquatilis

STRUCTURE: Flood Sedge is characterised by medium-sized sedge species growing in shallow water, sometimes as a scraw. It is an oligotrophic community usually with peat present. There are two semi-distinct types and for part of the survey they were recorded separately. The more frequent vegetation is a mixture of Carex rostrata and Equisetum fluviatile, about 50cm high and often with C.nigra, Potentilla palustris and Juncus acutiflorus. This is found most often close to lakes where there may have been peat cutting in the past. In sites of higher base status Carex diandra is the dominant plant with C.nigra, Lychnis floscuculi, Juncus articulatus and, in places, J.subnodulosus. The vegetation is more open and tussocky and generally lower in height. Both communities share such species as Galium palustre, Mentha aquatica and Menyanthes trifoliata. The vegetation is seldom homogenous and there are drier blocks of peat, sometimes floating, with Succisa pratensis, Epilobium palustre and Angelica sylvestris. They may also allow odd grasses into the community such as Molinia caerulea and Holcus lanatus as well as Juncus effusus and the occasional Salix species, either S.cinerea or S.repens.

PHYTOSOCIOLOGY Order Alliance Associations Caricion curto-nigrae Koch 1926 em. Nordh. 1936 Caricetum rostratae (Rubel 1912) Osvald 1923 Anagallido-Caricetum diandrae van Groenendal et al 1979 Drepanoclado exannulati-Caricetum aquatilis Nordh. 1926

> These are small sedge communities not as baserich as the Caricion davallianae. None of the associations listed is totally satisfactory. The Caricetum rostratae is a broad grouping found along the contact zone between lake and river shores and usually without Equisetum fluviatile which implies a Magnocaricion association. The Anagallido-Caricetum diandrae in this case lacks Anagallis tenella but otherwise fits well with the Connemara examples. The last association has not been recorded in Ireland as yet (White & Doyle, 1982) but despite the absence of Drepanocladus seems to fit some of the Owenmore stands well.

NVC <u>Carex rostrata-Calliergon cuspidatum mire</u> in part the *Carex diandra-Calliergon giganteum* subcommunity.

SOIL: Flood Sedge is established on a peaty soil, pure peat (with or without the underlying marl) when it has colonised old cuttings and alluvial peat where it grows in ox-bows or other depressions in a river valley.

HYDROLOGY: The alluvial sites receive river flooding but the others are generally flushed only by surface water. Both retain a high watertable throughout the summer.

MANAGEMENT: The wetness prevents any agricultural use though cattle may sometimes graze the edges of the stands.

CATCHMENT DISTRIBUTION: The community occurs in small patches in all the sub-catchments but with an emphasis in the Unshin, perhaps because of the flatness of the immediate surroundings of the river and the amount of cutaway bog there. The largest stand is, in fact, in the Owenmore, around Doongloon Lough.

IMPACT OF DRAINAGE: A lowering of the watertable would seem to convert much of this vegetation to a Fen Pasture (6F) with the loss of the taller aquatic species. With further management, e.g. mowing, Damp Meadow (6J) would result. VEGETATION TYPE 2H: ENRICHED CUTAWAY

TOTAL AREA SAMPLED 172ha (2.8% of total visited)

DOMINANT SPECIES Succisa pratensis, Carex panicea, C.nigra, Parnassia palustris, Molinia caerulea

ASSOCIATED SPECIES Carex lepidocarpa, Cirsium dissectum, Mentha aquatica, Anthoxanthum odoratum, Carex echinata, Cynosurus cristatus, Juncus effusus, Potentilla erecta, Prunella vulgaris, Juncus acutiflorus, J.articulatus, Calliergon cuspidatum, Festuca rubra, Carex flacca, Briza media, Juncus conglomeratus, J.subnodulosus, Agrostis capillaris, Filipendula ulmaria

SPECIES DIVERSITY 73 species at 5% or more

## RARE SPECIES Achillea ptarmica, Coeloglossum viride Gymnadenia conopsea, Platanthera bifolia

STRUCTURE: This vegetation type occurs on cutaway or other peatland where there is considerable flushing from calcareous groundwater. It thus has elements of Calcareous Fen (4D) as well as the Molinia Cutover (2C) and Dry Sedge (2I) communities. In appearence it resembles Dry Sedge (21) in that it consists of small sedges with Molinia caerulea. However it occupies a wetter habitat and usually contains some Juncus species. Like Dry Sedge (2I) it is an oligotrophic community but it is distinguished by the occurrence of calcicole plants, for example Parnassia palustris, Carex flacca, Briza media or Anagallis tenella. The dominant plants are usually Carex panicea, C.nigra and C.lepidocarpa and these produce a low vegetation above which the flowers of Molinia, Succisa pratensis and sometimes Cirsium dissectum stand out. Juncus acutiflorus and J.effusus are frequent in the peatier sites, J.articulatus and J.subnodulosus in the more calcareous ones. The community is a species-rich one, second only to Calcareous Fen (4D). Its anthropogenic origins mean that it is quite variable on a small scale. In places there are banks of peat with Calluna vulgaris, Agrostis capillaris or even Myrica gale or Ulex europaeus whereas near at hand there may be ditches with Menyanthes trifoliata, Eriophorum angustifolium or Potentilla palustris.

PHYTOSOCIOLOGY Order CARICETALIA DAVALLIANAE Br.-Bl. 1949 Alliance Caricion davallianae Klika 1934 Associations Juncetum subnodulosi Koch 1926 Cirsio dissecti-Schoenetum nigricantis Br.-Bl. et Tx. 1952

Most stands of this vegetation type seem to be

included in the Caricion davallianae but their placement in particular associations is more difficult because of their inherent variability. Many have affinities with the two listed associations but in some cases there are elements of the Caricion curto-nigrae alliance.

NVC

The most appropriate grouping is the Briza media-Pinguicula vulgaris sub-community of the <u>Schoenus nigricans-Juncus subnodulosus mire</u> though the sites lack Schoenus for the most part. The more calcareous examples may be better included in the <u>Carex dioica-Pinguicula vulgaris</u> <u>mire</u>, Carex demissa-Juncus bulbosus subcommunity. The relative rarity of Schoenus in the catchment means that this species has not yet colonised the patches of cutover which are of guite recent origin.

SOIL: Peat in contact with the basal marl either directly or by means of groundwater.

HYDROLOGY: Permanent infiltration by groundwater but seldom, if ever, flooded.

MANAGEMENT: Open to grazing cattle but little used because of the softness of the ground and the unpalatibility of the vegetation.

CATCHMENT DISTRIBUTION: Enriched Cutaway is found throughout all the catchments where peat cutting has been carried out. It is most widespread in the Owenmore and a large stand exists at Carrigeenroe above Templehouse Lough. It is also characteristic of the small lakes on the southern side of the Owenbeg valley.

IMPACT OF DRAINAGE: If drainage was to cut off the groundwater seepage the community would probably be converted to Rush-Sedge (3G) as the input of calcium declined. Further management of the stands by grazing would yield Acid Grassland (3I) or, with fertilization, Lolium Grassland (3A).

VEGETATION TYPE 2I: DRY SEDGE TOTAL AREA SAMPLED 146ha (2.4% of total visited) DOMINANT SPECIES Carex panicea, Succisa pratensis, Carex nigra ASSOCIATED SPECIES Juncus effusus, Anthoxanthum odoratum, Carex echinata, Molinia caerulea, Potentilla erecta, Agrostis capillaris, Juncus articulatus, Cynosurus cristatus, Rhytidiadelphus squarrosus, Juncus conglomeratus

172

#### SPECIES DIVERSITY 48 species at 5% or more

### RARE SPECIES None

STRUCTURE: This is a low, even community of small sedges with an admixture of oligotrophic grasses and rushes. It stands out as a distinctive, bluish vegetation because of the abundance of Carex panicea and Succisa pratensis. Other sedges that are frequently found are C.nigra, C.echinata and in some places C.demissa. The community is related to Molinia Cutover (2C) but this species grows in a non-tussocky form that does not monopolize the vegetation. A considerable amount of Anthoxanthum odoratum, Agrostis capillaris and, sometimes, Cynosurus cristatus or Festuca rubra occurs with it. Agrostis canina is found occasionally, more so in this community than elsewhere. The relationship with Molinia cutover is strengthened by the occurrence of a common group of broad-leaved herbs, among them Succisa pratensis, Potentilla erecta and Cirsium dissectum. Rushes are somewhat more frequent in the Dry Sedge community than in Molinia cutover. Juncus effusus or J.conglomeratus grow on the level ground with J.articulatus and J.acutiflorus in depressions. J. bulbosus is also relatively common in various water tracks. Bryophytes are generally distributed though they do not cover much ground in total. Rhytidiadelphus squarrosus is the commonest species followed by Calliergon cuspidatum, Hylocomium splendens and Pseudoscleropodium purum occur.

PHYTOSOCIOLOGY Order Alliance	MOLINIETALIA Koch 1926 Junco conglomerati-Molinion Westhoff 1968
·	Because of the element of grasses, the community seems to fit best into the Molinietalia which is sometimes developed on cutover peat (White & Doyle, 1982). The association would be related to the Cirsio-Molinietum Siss et De Vries 1942 though this is usually more nutrient- rich. However there are cases where a Parvocaricetea association, such as the Caricetum nigrae seems more appropriate.
NVC	The Anthoxanthum odoratum sub-community of the Molinia caerulea-Potentilla erecta mire is the most suitable category. It seems, however, that no identical community was encountered by this

SOIL: The community is restricted to peat soils, almost always derived from a cutover raised bog. The peat is deep enough to prevent uptake of bases from the underlying marl.

vegetation rather than farmland.

survey, probably since it dealt with semi-natural

HYDROLOGY: The sites are seldom if ever flooded by river water though there may be some infiltration from the ditches and cuts within them.

MANAGEMENT: Although open to grazing cattle the vegetation is very lightly used because of the high proportion of sedges and Molinia. In places where this community is mixed with others, there is some poaching from cattle crossing the area rather than grazing there.

CATCHMENT DISTRIBUTION: This vegetation type is related to cutover bog so it occurs in all catchments. It is relatively frequent in the Owenbeg though its largest stands occur in the Owenmore at Tawnavoultry, west of Templehouse and Shancarrigeen, south of Ballymote.

IMPACT OF DRAINAGE: Reducing the watertable in this vegetation would increase the oxidation of peat to the benefit of grass species rather than sedges. The result would be an Acid Grassland (3I) community though with added nutrients, *Lolium* Grassland (3A) could be produced.

#### VEGETATION TYPE 2N: DECIDUOUS WOODLAND

TOTAL AREA MAPPED 135ha (2.2% of total visited)

DESCRIPTION: This is dry woodland in contrast to the Willow or Alder Wood (4H) that occurs within the floodplain. It was not analysed for its species content during the survey since it was an easily recognised unit. Most usually deciduous woodland occurs in small patches and has a planted origin. Acer pseudoplatanus, Crataegus monogyna and Fraxinus excelsior are often the main species with Fagus sylvatica, Aesculus hippocastaneum and Tilia spp in the estate context. Some Alnus glutinosa usually occurs in the heavier soils. Corylus avellana is occasional where there are outcrops of drift and is especially prominent along the Unshin in Markree where some Quercus robur also occurs. A feature of these woodlands is the abundance of Lobaria and Sticta lichens.

SOIL: Usually on mineral soil, a partially gleyed clay-rich substrate derived from glacial drift.

HYDROLOGY: These sites are inundated by the highest floods but probably not in every year. A feature of many of them is groundwater seepage, occurring at the base of a slope.

MANAGEMENT: The woods are seldom securely fenced and are usually grazed lightly by cattle. This occurs mainly in winter when the soft soils in wet places may become highly poached.

IMPACT OF DRAINAGE: Lowering the watertable will stimulate the growth of most trees though Alnus glutinosa could gradually be replaced by Acer pseudoplatanus and Fraxinus excelsior.

## VEGETATION TYPE 20: CONIFEROUS WOODLAND

TOTAL AREA MAPPED 339ha (5.5% of total visited)

DESCRIPTION: Conifer stands were not included in the vegetation analysis but almost always consist of sitka spruce with a scant ground flora. North of Collooney a plantation of Abies nobilis is established beside the river as part of Union Wood. Many stands within the floodplain are subject to occasional flooding and contain wetland plant species like Galium palustre, Carex nigra and C.rostrata in their marginal drains.

SOIL: Plantations have generally been established on peaty soils, either in alluvial situations, around the edges of lake basins (as at Cloonakillina) or on cutaway bog.

HYDROLOGY: A high watertable is common at all times of the year in these sites but actual river flooding is limited.

MANAGEMENT: The stands are subject to normal forest management but are seldom thinned. Grazing animals are largely absent.

IMPACT OF DRAINAGE: Improved growth of the trees should result from drainage and the few stunted stands be eliminated.

#### VEGETATION TYPE 2R: RAISED BOG

TOTAL AREA MAPPED 586ha (8.3% of total visited)

DESCRIPTION: Bog vegetation was not sampled in this survey since its characteristics are well known. 2R refers to all raised bog with an intact surface, unmodified by cutting. This means that the category includes dried out and fragmented examples that carry modified vegetation. All semi-natural areas of this vegetation had been visited during the various raised bog surveys (Douglas & Grogan, 1985) so this category was mapped largely from existing information.

PHYTOSOCIOLOGY Order ERIOPHORO VAGINATI-SPHAGNETALIA PAPILLOSI Tx 1970 Alliance Calluno-Sphagnion papillosi (Schwick 1940) Tx 1970 Association Erico-Sphagnetum magellanici (Jonas 1932) Moore 1968

NVC <u>Erica tetralix-Sphagnum papillosum mire</u>.

MANAGEMENT: Peat cutting affects the fringes of all bogs so that even the intact areas are burnt from time to time.

CATCHMENT DISTRIBUTION: The major area of intact raised bog occurs in the upper Owenmore, near Cloonakillina Lough but there
are small sections of this community in the centre of many cutovers.

IMPACT OF DRAINAGE: Arterial drainage may not affect raised bogs that are isolated in basins away from the major channels but by lowering river beds it will allow new drains to be cut. Where the watertable is reduced trees may colonise an undeveloped bog. With inputs of fertilizers and lime, agricultural grassland may be produced.

VEGETATION TYPE 3A: LOLIUM GRASSLAND TOTAL AREA SAMPLED 151ha (2.4% of total visited) DOMINANT SPECIES Lolium perenne ASSOCIATED SPECIES Trifolium repens, Juncus effusus, Ranunculus repens, Cynosurus cristatus, Holcus lanatus, Rumex acetosa, Filipendula ulmariaSPECIES DIVERSITY 27 species at 5% or more RARE SPECIES None recorded

STRUCTURE: This vegetation consists of a uniform cover of Lolium perenne and Trifolium repens, often with a little Cynosurus cristatus. In contrast to almost all other grassland types, Agrostis stolonifera is relatively rare. The vegetation is usually derived from killing and reseeding existing pastures so that both dominant plants are varieties of native species. Annual fertilising with slurry is characteristic and brings with it eutrophic species like Urtica dioica and Rumex obtusifolius which are often scattered through the fields. The community seems to change with time so that when it was reseeded is an important factor to the composition of the present vegetation. Ranunculus repens (encouraged by close mowing), Holcus lanatus and Rumex acetosa are some of the first species to invade. The community is dependant on continual drainage and if this breaks down locally, patches of Juncus effusus may gain a hold with a little Filipendula ulmaria in vegetative form. The vegetation makes a close sward and there is no room for bryophytes.

PHYTOSOCIOLOGY Order ARRHENATHERATALIA Pawlowski 1928 Alliance Cynosurion cristati Tx. 1937 Lolio-Cynosuretum (Br.-Bl. et de Leeuw 1936) Tx. 1937 Intensively managed pastures on highly fertile soils, often poor in species. The stands tend to become Centaurio-Cynosuretum ones, especially in the sub-association juncetosum, where management becomes less intensive. SOIL: This vegetation is dependant on intensive management and seems to develop on either peaty or mineral soil if enough inputs are given.

HYDROLOGY: The sites are mixed, some being low-lying in river floodplains and others more elevated. Therefore the frequency of flooding differs considerably. A high water-retention capacity in the soils seems common.

MANAGEMENT: The fields are fertilised annually and mown once or twice for silage. Cattle are grazed on the aftergrass but are usually removed for the winter.

CATCHMENT DISTRIBUTION: Small patches of this vegetation occur throughout all the catchments but they are most common in the Owenbeg where the soils are naturally better drained. The largest stand occurs in the Unshin at Rossmore near Riverstown.

IMPACT OF DRAINAGE: Arterial drainage may improve the efficiency of field drainage and so prolong the life of this vegetation in places which receive less than the required management.

VEGETATION TYPE 3C: PEATY CUTOVER

TOTAL AREA SAMPLED 18ha (0.3% of total visited)

DOMINANT SPECIES Dactylis glomerata, Arrhenatherum elatius

- ASSOCIATED SPECIES Filipendula ulmaria, Ranunculus repens, Holcus lanatus, Agrostis stolonifera, Juncus effusus, Plantago lanceolata, Festuca rubra, Urtica dioica, Centaurea nigra, Anthoxanthum odoratum
- SPECIES DIVERSITY 34 species at 5% or more

RARE SPECIES None recorded

STRUCTURE: This is open vegetation established as a successional stage on abandoned peatland. The most frequent species are Dactylis glomerata and Arrhenatherum elatius but the vegetation cover is not closed so that many other and very varied species are found. Other grasses are generally of oligotrophic types: Agrostis stolonifera and A.capillaris, Holcus lanatus and, locally, H.mollis, Festuca rubra, Anthoxanthum odoratum and Molinia caerulea all occur in places. The characteristic broadleaved species include Filipendula ulmaria, Plantago lanceolata, Centaurea nigra and Urtica dioica and they grow as isolated plants or small stands, obviously quite newly arrived in the vegetation. The colonisation process also includes Rubus fruticosus, Pteridium aquilinum and Elymus repens with occasionally a few seedlings of Salix cinerea. These plants suggest that without management the vegetation will come to resemble Scrub Cutover (2D) in time.

PHYTOSOCIOLOGYOrderGLECHOMETALIA HEDERACEAE Tx. et Brun-Hool 1975AllianceAegopodion podagrariae Tx. 1967AssociationUrtico-Aegopodietum (Tx. 1947) 1967

The vegetation seems to have affinities with this unlikely association which is characteristic of woodland margins, usually in open or semi-shaded positions (White & Doyle, 1982). In our case it is more oligotrophic in character, being developed on peat, and it also lacks several introduced species such as Aegopodium podagraria, Petasites hybridus and Lamium album. In the wetter situations the community has Franguletea features also.

SOIL: Peat derived from cutover raised bog: occasional enrichment by marl.

HYDROLOGY: These sites are not flooded and having previously been cutover are relatively dry.

MANAGEMENT: In many cases this vegetation seems to develop during the process of reclamation for agriculture or forestry when, after initial levelling, the site is abandoned for a period without planting. The vegetation that develops is not grazed.

CATCHMENT DISTRIBUTION: The community is found in very small patches throughout the Owenmore and the Unshin but is quite rare in the Owenbeg. The largest stand was of 3.3ha in Ardraheen Beg, south of Ballymote.

IMPACT OF DRAINAGE: None

VEGETATION TYPE 3E:	DRY GRASSLAND
TOTAL AREA SAMPLED	105ha (1.7% of total visited)
DOMINANT SPECIES	Cynosurus cristatus, Cirsium arvense
ASSOCIATED SPECIES	Lolium perenne, Holcus lanatus, Ranunculus repens, Senecio jacobaea, Juncus effusus, Agrostis stolonifera A. capillaris, Plantago lanceolata, Iris pseudacorus, Trifolium repens
SPECIES DIVERSITY	26 species at 5% or more
RARE SPECIES	None recorded

STRUCTURE: This is a species-poor community which appears normally as a closely grazed sward of Cynosurus cristatus and Agrostis spp. On the richer soils A.stolonifera occurs along with Lolium perenne and occasionally a small quantity of Phleum pratense. On more oligotrophic sites these are replaced by A.capillaris and a little Anthoxanthum odoratum. Festuca rubra and Centaurea nigra occur throughout at low frequency. Cirsium arvense is usually conspicuous in this vegetation as the other plants are grazed down around it: Senecio jacobaea may also stand out in this way, particularly if sheep are absent. Juncus effusus grows only as scattered tufts in the community though its large size means that it is often recorded. There are few 'wetland' species with the exception of Iris pseudacorus. Senecio aquaticus is, for example, absent and Filipendula ulmaria and Carices almost so. Bryophytes occur only rarely.

ARRHENATHERATALIA Pawlowski 1928
Centaureo-Cynosuretum Br-Bl & Tx 1952
Most of the vegetation recorded as Dry
Grassland falls into the typicum sub-
association (White & Doyle, 1982) which
occurs on deep, fairly well-drained soil
derived from mixed till material as well
as limestone or sandstone. Some of our
examples approach the sub-association
juncetosum with a few Molinietalia

SOIL: This vegetation is normally found on mineral soils which are quite well drained but there are one or two examples on reclaimed peat when well fertilised and grazed.

elements present. These are normally missing, unlike in Poor Pasture (3J).

S

HYDROLOGY: The sites are not generally affected by flooding since they occur higher above the watertable than the poorer pastures.

MANAGEMENT: Used for all-year grazing by sheep and cattle but seldom managed in any other way.

CATCHMENT DISTRIBUTION: The vegetation occurs on mineral rises (and occasionally old spoil banks) adjacent to rivers and also on the valley sides at the edge of the floodplain. It is locally associated with *Iris*-dominated seepage areas (Rush-*Iris*, 3K). It is commonest in the Owenbeg catchment.

IMPACT OF DRAINAGE: The community is so seldom flooded that arterial drainage will have little if any impact. A general rise in farm prosperity would probably allow further intensification, converting it to Lolium Grassland. VEGETATION TYPE 3G: RUSH-SEDGE

TOTAL AREA SAMPLED 397ha (6.3% of total sampled)

DOMINANT SPECIES Juncus effusus, Carex panicea, C. nigra, Anthoxanthum odoratum, Succisa pratensis, Juncus conglomeratus, Agrostis capillaris

ASSOCIATED SPECIES Rhytidiadelphus squarrosus, Holcus lanatus, Potentilla erecta, Filipendula ulmaria, Festuca rubra, Molinia caerulea, Cirsium palustre, Agrostis stolonifera, Cynosurus cristatus, Plantago lanceolata, Rumex acetosa, Senecio aquaticus, Deschampsia cespitosa, Juncus acutiflorus, Carex echinata, Ranunculus repens, Leontodon autumnalis

SPECIES DIVERSITY 51 species at 5% or more

RARE SPECIES None recorded

STRUCTURE: This community has a broad resemblance to Rush-Grass in that it includes conspicuous tussocks of *Juncus* species with a mix of grasses and small sedges covering the ground in between. However the presence of *J.conglomeratus* at high frequency as well as the abundance of *Carex panicea* and *C.nigra* distinguishes it.

Oligotrophic grass species are frequent, such as Anthoxanthum odoratum, Agrostis capillaris, Holcus lanatus, Festuca rubra and Molinia caerulea. This vegetation is floristically more diverse than Rush-Grass and Succisa pratensis, Potentilla erecta and the moss Rhytidiadelphus squarrosus are of regular occurrence. Nutrient-demanding species may occur locally however, often in wetter pockets in the uneven terrain. They include Prunella vulgaris, Leontodon autumnalis, Juncus articulatus, Trifolium repens and Centaurea nigra.

PHYTOSOCIOLOGY Molinietalia Order Junco conglomerati - Molinion Westhoff 1968 Alliance Association Junco acutiflori-Molinietum (O'Sullivan 1968) Generally unmanured wet meadows on poor soils which dry out somewhat in summer (White & Doyle, 1982). The Juncus effusus sub-community of the Juncus NVC <u>effusus/acutiflorus-Galium palustre rush-pasture</u> is the most similar community but the constancy of Galium palustre and Lotus uliginosus in this indicates that it occurs on more mineral-rich sites with less peat. The convergence of the Molinia caerulea-Potentilla erecta grassland with this

community in the more oceanic parts of Britain is noted and it seems likely that both should be included in a Junco-Molinietum of some sort.

This community corrisponds with part of the broader category of <u>Improved Wet Pasture</u> outlined by Lockhart (1982).

SOIL: This community type is normally found on moist, base-poor peats. Such sites are often cutovers which have been partly reclaimed but not fertilized.

HYDROLOGY: Seldom flooded by river water because of its raised position on peat, this vegetation is subject to surface water accumulation in winter as well as some inflow, often from bog areas. It experiences significant drying out in summer.

MANAGEMENT: This is rough grazing land for cattle which receives little management of any sort. Rushes are occasionally cut but the inherent fertility is so low that much more extensive work is needed to bring such fields into production.

CATCHMENT DISTRIBUTION: Widely distributed through all the catchments, this is the fourth most frequent community type. It occurs on the margins of bogs, in cutaways and where enough peat remains in fen areas. Good examples are seen below Templehouse Lough.

IMPACT OF DRAINAGE: Drainage of this land would reduce the floristic diversity of the community and result in its conversion to Dry Sedge or Acid Grassland depending on grazing and mowing levels. It receives more flooding than either of these communities at present and this is presumably the critical factor in its maintenance. Fertilization would allow a Poor Grassland Cynosurion to become established.

VEGETATION TYPE 3H: RUSH-GRASS

TOTAL	AREA	SAMPLED	291ha	(4.7%	of	total	visited)
				<b>v</b>			,

- DOMINANT SP[ECIES Juncus effusus, Agrostis stolonifera, A. capillaris, Cirsium palustre
- ASSOCIATED SPECIES Filipendula ulmaria, Ranunculus repens, Holcus lanatus, Rumex acetosa, Festuca rubra, Senecio aquaticus, Anthoxanthum odoratum

SPECIES DIVERSITY 34 species recorded at 5% or more

RARE SPECIES None recorded

STRUCTURE: The vegetation is visually dominated by Juncus effusus which grows as large tussocks 80-100cm high. They are separated by close-cropped grassy patches, sometimes occupying 50% of the area. The open ground almost disappears however in an ungrazed site where rushes assume complete cover. This leads to some acidification and Agrostis capillaris, Potentilla erecta, Rumex acetosa and Deschampsia cespitosa become conspicuous, all except the latter growing out of the clumps of rushes. In a more eutrophic site Filipendula ulmaria is often found with Cynosurus cristatus, Agrostis stolonifera and even Arrhenatherum elatius. Cirsium palustre is characteristic of this community and its frequency seems to depend on the level of grazing experienced. Wet places where poaching may be pronounced bring additional species into the vegetation such as Caltha palustris and Glyceria fluitans. In extreme cases Juncus bulbosus and Sagina procumbens may colonize bare peaty ground. Two mosses, Calliergon cuspidatum and Rhytidiadelphus squarrosus are locally frequent. Cynosurion elements appear with a slight increase of soil nitrogen, as from adjacent improved fields. The transition to more acidic vegetation by contrast involves an increase in the small sedges, C. nigra and C. panicea which generally occur at low frequency (less than 20%).

PHYTOSOCIOLOGY

Order	Molinietalia Calthian nalustris TV 1927 om 1951
Alliance	Carchion parusciis ix. 1937 em. 1931
Association	Senecioni-Juncetum acutiflori BrBl.et Tx 1952
	Grassland vegetation of more fertile, more continuously wet and more biotically influenced soils than the Junco conglomerati-Molinion alliance (e.g. Rush-sedge 3G). This association also includes the Tall Tussock community which lies at its oligotrophic end, often on peaty soils.

NVC

Included in the more species-rich<u>Juncus</u> <u>effusus/acutiflorus-Galium palustre rush-</u> <u>pasture</u>, *Juncus effusus* sub-community which, similarly, is maintained by grazing.

SOIL: Gleyed peat and mineral soils, derived from limestone or shaley glacial till, or, more frequently, from alluvium.

HYDROLOGY: The sites are continuously wet except in drought conditions with a little groundwater and regular flooding in winter.

MANAGEMENT: The community is typical of unimproved pastures used by cattle at low intensity. In places it is occasionally mown and it can be converted into damp meadow after prolonged attention. It is the most frequent vegetation to take over abandoned pastures.

CATCHMENT DISTRIBUTION: Rush-Grass is very common in the catchment, particularly in the Owenmore and somewhat less so in

the Unshin. It is typical of interdrumlin land (also on the lower slopes of the drumlins themselves) where the clay soils promote gleying and impeded drainage. It is found also in bog areas around semi-reclaimed cutaways.

IMPACTS OF DRAINAGE: The rushes would decline in vigour converting the community either to Rush-Sedge (3G) on the peaty sites or Acid Grass (3I) on the mineral ones. In this, Anthoxanthum, Festuca rubra and Agrostis capillaris would be important.

VEGETATION TYPE 31: ACID GRASS

TOTAL AREA SAMPLED 58ha (0.9% of area visited)

DOMINANT SPECIES Agrostis capillaris, Festuca rubra, Anthoxanthum odoratum

ASSOCIATED SPECIES Agrostis stolonifera, Holcus lanatus, Potentilla erecta, Juncus effusus, Molinia caerulea, Poa pratensis, Succisa pratensis, Rumex acetosa

SPECIES DIVERSITY 30 species at 5% or more

RARE SPECIES None recorded

STRUCTURE: Acid Grass is a uniform oligotrophic vegetation on peat, dominated by the tussocks of low-growing grasses, especially Agrostis capillaris, Festuca rubra and Anthoxanthum odoratum. In between these clumps there are small quantities of more spreading species like Agrostis stolonifera, Holcus lanatus, Molinia caerulea and Poa pratensis. In a few places the Poa becomes very frequent and its flowering heads, if ungrazed, give the vegetation a distinctive appearence at certain times of the year. In general the grassiness of the vegetation is striking, created by the relative absence of small sedges and of Calluna vulgaris for which the sites seem suitable.

Potentilla erecta, Succisa pratensis and Rumex acetosa are the most frequent broad-leaved species. In most places the community is a dryish one but near to drains and old peat cuttings there may be damper places with Juncus effusus, Filipendula ulmaria and Carex nigra. Despite the nutrient-poor nature of the vegetation bryophytes are not common but there is usually some Rhytidiadelphus squarrosus, Hylocomium splendens or Calliergon cuspidatum present. PHYTOSOCIOLOGY Order MC

MOLINIETALIA Koch 1926 or NARDETALIA Prsg. 1949

The community has affinities with some of those in the Nardo-Galion saxatilis Prsg. 1949 but in view of its occurrence beside purer *Molinia* stands (2C) and Dry Sedge (2I), it is probably best to consider it in the Junco conglomerati-Molinion Westhoff 1968.

NVC

The nearest vegetation type is the Anthoxanthum odoratum sub-community of the <u>Molinia caerulea-</u> <u>Potentilla erecta mire</u> though this seems damper than our community.

SOIL: Peat

HYDROLOGY: The vegetation usually occurs on blocks of old cutover slightly higher than the surroundings and therefore removed from the influence of flooding.

MANAGEMENT: The present management of these stands is almost non-existent. They are occasionally grazed by sheep or cattle but not fertilized in any way. In some places it appears that *Calluna* has been stripped off by bulldozing, in others that long-continued mowing (probably scything) has been a formative influence.

CATCHMENT DISTRIBUTION: The community covers small areas in the Unshin and Owenmore catchments but is absent from the Owenbeg. It is relatively more frequent in the Unshin where bogs are fewer and were cutover at an earlier period. Its largest stands are at Cloneen, west of Riverstown.

IMPACT OF DRAINAGE: A drop in watertable by itself would have little influence on the vegetation but with some fertilization the community could probably become Dry Grassland (3E) or Damp Meadow (6J).

VEGETATION TYPE 3J:	POOR PASTURE
TOTAL AREA SAMPLED	319ha (5.1% of area visited)
DOMINANT SPECIES	Juncus effusus, Cynosurus cristatus, Agrostis stolonifera, Ranunculus repens
ASSOCIATED SPECIES	Holcus lanatus, Rumex acetosa, Filipendula ulmaria, Anthoxanthum odoratum, Agrostis capillaris, Festuca rubra, Plantago lanceolata, Cirsium palustre, Trifolium repens, Senecio aquaticus, Carex panicea
SPECIES DIVERSITY	32 species occurring at 5% or more
RARE SPECIES	Achillea ptarmica

STRUCTURE: This community is related to Rush-Grass (3H) though it differs in being lower and much more open. The rushes do not grow in tussock form and there is litle Deschampsia cespitosa. The slightly higher nutrient status, produced by continual grazing and dunging of cattle, allows a greater frequency of Cynosurus cristatus, Trifolium repens and Plantago lanceolata as well as the occurrence of Cerastium fontanum and Centaurea nigra. The vegetation is dominated by Agrostis stolonifera and Cynosurus but it contains the same moisture-loving species as 3H, Juncus effusus, Filipendula ulmaria, Senecio aquaticus and Carex panicea. Grasses correlated to low-base status such as Agrostis capillaris, Anthoxanthum odoratum and Festuca rubra are relatively frequent as is the moss Rhytidiadelphus squarrosus. A richer variant of the community containing Lolium perenne occurs in places, sometimes in the same field.

PHYTOSOCIOLOGY

Order	Arrhenatheretalia
Alliance	Cynosurion cristati
Association	Centaureo-Cynosuretum BrBl. et Tx. 1952
	sub-association of <u>Juncus effusus</u>

O'Sullivan (1965) characterises this as occurring on 'deep, imperfectly drained, often gleyed soils of moderate fertility which are derived from glacial drift'. It is very widespread in Cavan, Monaghan, Leitrim and parts of Mayo.

NVC This community is encompassed by the Juncus effusus sub-community of the Juncus effusus/ acutiflorus-Galium palustre rush-pasture though the level of grazing on our sites emphasises the pasture component, such as Cynosurus cristatus, Trifolium repens, Ranunculus repens and Plantago lanceolata. It may also lead to the removal of Galium palustre.

SOIL: The vegetation generally occurs on a heavy impermeable mineral soil, either clay or silty clay. It has poor conductivity and remains damp for most of the year. Poaching and seasonal gleying augment this drainage defect.

HYDROLOGY: River flooding of this vegetation seldom occurs though there is regular surface flooding after heavy rainfall. Most of the sites are isolated by ditches so there is little flushing from adjacent land.

MANAGEMENT: The fields are grazed by cattle for a large part of the year and are used especially by young stock on a cyclical basis. Thus grazing is heavy when it occurs and poaching may be a problem. Nutrient input seems to come mainly from the animals though fertiliser may be spread also. Occasional mowing of rushes is carried out in some fields when they become common. CATCHMENT DISTRIBUTION: Widespread in all parts of the catchment but especially in the Owenbeg where there is less peat than elsewhere.

IMPACTS OF DRAINAGE: The community is composed of two groups of species with opposing ecological requirements so is of an unstable nature. A drying out would increase the vitality of the Cynosurion element at the expense of the moisture-demanding species but without greater nutrient input might not alter the species composition all that much. Fertilisation and heavier grazing, possibly by sheep, would convert the vegetation to Dry Grassland (3E) or Lolium Grassland (3A).

## VEGETATION TYPE 3K: RUSH-IRIS

TOTAL AREA SAMPLED 368ha (5.9% of total visited)

DOMINANT SPECIES Iris pseudacorus, Juncus effusus, Agrostis stolonifera

ASSOCIATED SPECIES Filipendula ulmaria, Ranunculus repens, Holcus lanatus, Cynosurus cristatus, Carex disticha, C.nigra, Cirsium palustre, Anthoxanthum odoratum, Festuca rubra, Deschampsia cespitosa

SPECIES DIVERSITY 42 species recorded at 5% or more

RARE SPECIES Lysimachia nummularia

STRUCTURE: A tall community, 100cm or more in height, Rush-Iris is dominated by Iris pseudacorus and Juncus effusus. The Juncus never attains the monopoly it holds in Rush-Grass, perhaps because the sites are richer and other species more successful. A number of plants occur with similar frequency in both communities, for example Agrostis stolonifera, Filipendula ulmaria, Ranunculus repens and Holcus lanatus. However Rush-Iris has in addition Cynosurus cristatus, Trifolium repens, Lolium perenne and Juncus inflexus which indicate more nutrient-rich conditions. Also the wetness favours patches of J.acutiflorus, Glyceria fluitans, Carex nigra and Deschampsia cespitosa. Bryophyte density is low and Calliergon cuspidatum is the main species with some Rhytidiadelphus squarrosus.

PHYTOSOCIOLOGY

Order	Molinietalia
Alliance	Calthion palustris Tx.1937 em. 1951
Association	Senecioni-Juncetum acutiflori
	Br.Bl. et Tx. 1952
	This commununity does not fit well into the
	association having Cynosurion elements,
	especially Cynosurus itself but also Juncus
	inflexus and, at lower frequency, Trifolium
	repens and Phleum pratense. The presence of Iris

pseudacorus gives it a physiognomic unity but is not apparently of phytosociological significance.

Π

Π

This scheme identifies an Iris pseudacorus-Filipendula ulmaria mire which in Britain occurs in coastal situations where freshwater drains from the land. The Juncus spp. sub-community shares many features with Rush-Iris though it includes some maritime species and lacks Carex disticha. Some stands could be also covered under the Juncus effusus sub-community of the Juncus effusus/acutiflorus-Galium palustre rush-pasture, though this lacks Iris pseudacorus.

SOIL: Rush-Iris is associated especially with fairly rich mineral gleys where there is groundwater influence. It may occur also on silty peat. Poaching is characteristic of the mineral sites.

HYDROLOGY: The soils are moist or permanenly wet from groundwater and few receive significant flooding in winter.

MANAGEMENT: Pasture used, and frequently trampled, by cattle. Where this vegetation borders meadowland it is occasionally mown to give a measure of Iris control.

CATCHMENT DISTRIBUTION: Widespread in the catchment occurring around the base of drumlins and at the edge of river floodplains where there is some water movement in the soil. In such places it grades into Rush-Grass (3H) and Damp Meadow (6J) depending on local management. It also is present in some wet cutover bogs which receive nutrients from below. Some of the largest stands occur in Markree (site 106B) in the Unshin sub-catchment.

IMPACTS OF DRAINAGE: Effective drainage of this vegetation would lead to an increase in the Cynosurion elements at the expense of the more moisture-demanding ones like Iris and the Juncus species. Lolium perenne could be encouraged by fertilization. With regular mowing a damp meadow would be produced. However in the absence of further management after a drop in the watertable, it is likely that Juncus effusus would tend to dominate, producing Rush-Grass (3H).

NVC

EMERGENT VEGETATION VEGETATION TYPE 4A: (including Emergent Sedge, Reedbed and Scraw) 96ha (1.6% of total visited), made up of TOTAL AREA SAMPLED 37ha of Emergent Sedge, 41ha Reedbed and 18ha of Scraw. Phragmites australis DOMINANT SPECIES Equisetum fluviatile, Carex rostrata, ASSOCIATED SPECIES C.elata, Menyanthes trifoliata, Scirpus lacustris, Sparganium erectum, Agrostis stolonifera 40 species recorded at 5% or more SPECIES DIVERSITY Butomus umbellatus, Carex acuta, RARE SPECIES C.aquatilis, C.lasiocarpa, C.limosa, Cladium mariscus, Lathyrus palustris, Lycopus europaeus, Poa palustris, Ranunculus lingua, Scutellaria galericulata, Stellaria palustris

STRUCTURE: Emergent Vegetation is a tall community (1-3m in height) dominated by sedges or reeds. It is rooted either in the bed of a waterbody or in a floating raft (scraw) of dead and living plants. Dense Phragmites australis, Scirpus lacustris and Equisetum fluviatile characterises the species-poor Reedbed (4Aii) which occurs in the deepest water. On the landward side of this, Emergent Sedge (4A-i) frequently takes over, consisting of Carex rostrata with a scattering of the above species. C.elata is not uncommon in such stands and it produces a tussocky vegetation which has niches for 'drier' species on the tussocks (e.g. Salix cinerea, Phalaris arundinaceae, Epilobium hirsutum) and more aquatic ones in between such as Menyanthes trifoliata, Rumex hydrolapathum, Sparganium erectum and Berula erecta. Locally the community is further enriched with Carex acuta or C.aquatilis and with Juncus subnodulosus, Lysimachia vulgaris or Scutellaria galericulata. Scraw (4A-iii) may not differ in the dominant species - Carex acuta, C.elata, Menyanthes trifoliata and Phragmites australis are usually still important - but it is generally more species-rich. Agrostis stolonifera, Filipendula ulmaria, Angelica sylvestris, Epilobium palustre, Veronica scutellata and Lychnis flos-cuculi are distinctive to it. Bryophyte cover is sometimes considerable in a scraw with Calliergon cuspidatum, C.giganteum the most frequent species. In oligotrophic sites both Carex lasiocarpa and C.diandra may occur, grading this community into Floodsedge (2E). Occasionally the beginnings of acidification allow Sphagnum palustre, Myrica gale, Erica tetralix and Drosera spp into the vegetation.

PHYTOSOCIOLOGY Orders

PHRAGMITETELIA Westhoff & Den Held 1969 MAGNOCARICETALIA Pignatti 1953 CARICETALIA NIGRAE Tx 1937

Phragmition Koch 1926 em. Balatova-Tulackova Alliances 1963 Magnocaricion Koch 1926 Caricion curto-nigrae Koch 1926 em. Nordh. 1936 Associations Scirpo-Phragmitetum Westhoff & Den Held 1969 Typhetum latifoliae Soo 1927 Caricetum elatae Koch 1926 Caricetum acutiformis Sauer 1937 Caricetum paniculatae Wangerin 1916 Phlaridetum arundinaceae Libbert 1931 Caricetum lasiocarpae Osvald 1923 Caricetum rostratae (Rubel 1912) Osvald 1923 Drepanoclado exannulati-Caricetum aguatilis Nordh. 1928 In phytosociological terms this vegetation type is very varied because of the capacity of many of the larger species to dominate vegetation once they have become established. Thus Emergent Vegetation includes many different associations that are generally defined by single species. In this study it was decided to treat it as a physiognomic unit rather than an individual community, involving much of the Magnocaricion and Phragmition.

NVC

<u>Carex elata swamp</u>, <u>Carex paniculata swamp</u>, <u>Phragmites australis swamp and reed-beds</u>, <u>Carex</u> <u>acutiformis swamp</u>, <u>Scirpus lacustris swamp</u>, <u>Carex rostrata swamp</u>, <u>Equisetum fluviatile</u> <u>swamp</u>, <u>Phragmites australis-Peucadanum palustre</u> <u>tall-herb fen</u>, <u>Phragmites australis-Eupatorium</u> <u>cannabinum tall-herb fen</u>, <u>Carex rostrata-</u> <u>Potentilla palustris tall-herb fen</u>.

SOIL: Normally a peat soil either derived from the community itself or washed in as alluvium.

HYDROLOGY: Reedbed and Scraw is flooded for the greater part of the year as they occur in standing water. Emergent Sedge seems to have a more fluctuating watertable being dry for much of the growing season but flooded to a depth of 1-2m at times during winter.

MANAGEMENT: Grazing by cattle may occur at the margins of Reedbed and Scraw and throughout Emergent Sedge but only locally where animals are confined by a fence to the edge of a stand does it have much effect on the vegetaton.

CATCHMENT DISTRIBUTION: Emergent Vegetation is practically absent from the Owenbeg catchment, occurring only in small patches in the lakes about Killoran. Elsewhere it is more common in the Unshin than in the Owenmore because of the flat inundated land around Lough Arrow and near to Collooney. Well developed stands also occur in the upper Owenmore at Cloonakillina Lough and on the shores of Templehose Lough. IMPACT OF DRAINAGE: This community will be much modified by arterial drainage as it requires a considerable amount of flooding to survive. Reedbed in certain cases may be converted to a type of Emergent Sedge but it is more likely to go to Fen Pasture (6F) or even Wet Wood (4H). Further management of the fen will lead to Damp Meadow (6J) or Lolium grassland (3A).

VEGETATION TYPE 4D: CALCAREOUS FEN

TOTAL AREA SAMPLED 30ha (0.8% of total visited)

DOMINANT SPECIES Parnassia palustris, Carex lepidocarpa, C.panicea, Mentha aquatica, Succisa pratensis, Anagallis tenella

Carex nigra, Briza media, Campylium ASSOCIATED SPECIES stellatum, Sagina nodosa, Molinia caerulea, Triglochin palustris, Ctenidium molluscum, Juncus subnodulosus, J.articulatus, Cirsium dissectum, Carex hostiana, Pinguicula vulgaris, Pedicularis palustris, Drepanocladus revolvens, Carex flacca, Hydrocotyle vulgaris, Caltha palustris, Juncus acutiflorus, Calliergon cuspidatum, Cynosurus cristatus, Menyanthes trifoliata, Equisetum palustre, Agrostis stolonifera, Prunella vulgaris, Carex echinata, Filipendula ulmaria, Festuca rubra, Eriophorum angustifolium, Linum catharticum Carex rostrata, Anthoxanthum odoratum, Ranunculus flammula

SPECIES DIVERSITY 83 species recorded at 5% or more

RARE SPECIES Carex dioica, Eleocharis quinqueflora, Epipactis palustris, Equisetum variegatum, Eriophorum latifolium, Gymnodenia conopsea, Plantago maritima, Platanthera chlorantha, Selaginella selaginoides

STRUCTURE: This is an extremely species-rich community which is characterised by a mixture of small sedges, most often the calcicolous Carex lepidocarpa, C.panicea, C.hostiana and C.flacca, as well as the rushes, Juncus subnodulosus and J.articulatus. These narrow-leaved species do not achieve complete cover because of the oligotrophic conditions so that there are many niches for other herbs. At certain times of the year, Parnassia palustris, Anagallis tenella, Sagina nodosa and Pinguicula vulgaris are conspicuous while Mentha aquatica, Succisa pratensis, Triglochin palustris, Cirsium palustre and Pedicularis palustris are also easily seen.

The bryophyte flora is similarly distinctive, consisting of extensive patches of calcicole species, particularly *Campylium* 

stellatum, Ctenidium molluscum and Drepanocladus revolvens. The occurrence of charophytes is peculiar to this terrestrial community and is related to the springs and groundwater seepage that frequently arise within it. Chara vulgaris and C.globularis were both relatively common, given the right conditions.

Grasses are considerably less important in this vegetation type than in most others: Briza media, Molinia caerulea, Cynosurus cristatus, Agrostis stolonifera and Festuca rubra are the most frequent species. This is one of the reasons for the high overall diversity which includes a much greater number of rare species than any other community.

PHYTOSOCIOLOGY: Order Caricetalia davallianae Alliance Caricion davallianae Associations Juncetum subnodulosi Koch 1926 Cirsio dissecti-Schoenetum nigricantis Br.-Bl. et Tx. 1952

> This is the characteristic fen vegetation of most parts of the country occurring at the edges of limestone lakes behind the taller reed or sedge beds but also, as in this case, in calcareous seepages. It corrisponds to the *Schoenus* marsh of Lockhart (1982).

NVC

The equivalent community is the Cirsium palustre variant of the Briza media-Primula farinosa subcommunity of <u>Carex dioica-Pinguicula vulgaris</u> <u>mire</u>. The lack of low-level calcareous springs in Britain means that this is generally an upland community: hence its definition by Primula farinosa and other species.

SOIL: Usually a calcareous alkaline peat with local deposition of calcium carbonate. The site may be a spring below a drumlin or other raised land or alternatively be the lowest part of a cutover where the underlying marl is exposed.

HYDROLOGY: The sites have a permanently high watertable and are not usually flooded by river water though they may be flushed from above during heavy rainfall.

MANAGEMENT: The community is grazed at low intensity but is not attractive to cattle or sheep. There are few palatable grasses, an abundance of bryophytes and a tendancy to become poached.

CATCHMENT DISTRIBUTION: Of local distribution and most common on the thinner drift soils, e.g. at Knockmullin, Carrownabunny and on the northern side of the Ox Mts, at Corhawnagh.

IMPACTS OF DRAINAGE: Since the vegetation type usually depends on upwelling groundwater it is difficult to predict how it will be affected by arterial drainage. However a general intensification of land-use would result in such sites being drained into nearby ditches. Smaller areas of the related Enriched Cutaway (2H) would most probably result though with fertilisation a Poor Pasture (3J) could be created.

VEGETATION TYPE 4H: FLOODING WOODLAND (including Willow Wood 4H-i and Alder Wood 4H-ii)

TOTAL AREA MAPPED 61ha (1% of total visited)

DESCRIPTION: Wet woodlands dominated by Salix cinerea or Alnus glutinosa were encountered occasionally but because they were immediately recognizable were not further analysed. Willow Wood occurs most frequently around lakes slightly above the Phragmites beds and on land that is flooded in most winters. If ground conditions are stony the trees have a firm attachment and grow relatively straight to 6-8m. On alluvial land however they fall over when they have reached a certain height and resprout from the roots. For this reason the canopy may only be 3-4m. Whatever the height of the trees there is always enough light on the floor to allow herb growth though not always abundant flowering. Filipendula ulmaria, Senecio aquaticus, Valeriana officinalis, Agrostis stolonifera and Galium palustre are constant members of the flora with Cardamine flexuosa and Carex remota occasional. In wetter places Caltha palustris, Iris pseudacorus and Carex rostrata or C.vesicaria may be found while in the most eutrophic examples Lysimachia vulgaris, Carex acutiformis and C.elata form a distinct community, well seen at the exit of Templehouse Lough. The trees in these sites are festooned with epiphytes, Usnea comosa, U.subfloridana and U.rubicunda being noticeable along with Cladonia coniocraea, C.pyxidata and Parmelia spp. Both Calliergon giganteum and C.cuspidatum grow on the mud, locally with Leptodictyon riparium.

Alder Wood is more restricted than Willow Wood though a few alder trees are generally present in any damp wood. The actual alder woods occurred on peaty land around lakes, as at Toberscanavan Loughs where a drop in water level had revealed new land, and on rich mineral soils along seepage lines. The associated flora differed in each case. On the peaty sites Molinia caerulea and Carex acutiformis were most important with good quantities of Filipendula ulmaria and Lythrum salicaria. Rubus fruticosus grew sparingly here but more abundantly on the mineral sites with Deschampsia cespitosa, Urtica dioica and a little Carex paniculata. PHYTOSOCIOLOGY Orders SALICETALIA AURITAE Doing 1962 em. Westhoff 1968 ALNETALIA GLUTINOSAE Vlieger 1937 em. Th. Muller et Gors 1958 Salicion cinereae Th.Muller et Gors 1958 Alliances Alnion glutinosae Meijer Drees 1936 em Th Muller et Gors 1958 Associations Alno-Salicetum cinereae Westhoff et Den Held 1969 Most of the Flooding Woodland communities would seem to be included in this association which according to Klein (1975) occurs on shallow peat or on mineral soil. The Osmundo-Salicetum atrocinereae Br.-Bl. et Tx. 1952 is found on deeper peat and our alder wood on peat may best be included here. However there would seem to be a true Alnion association also on the mineral ground though its association is unclear.

NVC Most of the sites are included by the <u>Salix</u> <u>cinerea-Betula pubescens-Phragmites australis</u> <u>woodland</u>, Alnus glutinosa-Filipendula ulmaria sub-community. The alder wood on mineral soil fits better into the <u>Sambucus nigra</u> subcommunity of the <u>Alnus glutinosa-Urtica dioica</u> <u>woodland</u>, while the swampy willow wood, as at the Templehouse oxbow, seems to be the Lysimachia vulgaris sub-community of the <u>Alnus</u> glutinosa-Carex paniculata woodland.

SOIL: The soil beneath these stands appears very mixed. Alluvium is the most common type but Willow Wood also occurs on mineral ground by lakes if annually flooded. Alder Woods were located on peat and also mineral soil.

HYDROLOGY: Annual flooding occurs in all the willow woods which are inundated by lake or river water. In the alder wood on mineral soil flushing from surrounding areas and groundwater may replace actual river flooding.

MANAGEMENT: This community type requires an absence of grazing (and tree felling) to become established though once grown it can withstand a limited amount of both. Its relationship with adjacent Magnocaricion associations is probably partly due to management differences of this type in the past.

CATCHMENT DISTRIBUTION: Both these woodland types are present much more commonly in the Unshin catchment than in the Owenmore though the most striking stands do occur near Templehouse Lough, e.g. Lislea and the ox-bow.

IMPACT OF DRAINAGE: Preventing the annual flood in these woods will lead to the gradual replacement of willow and alder by other broad-leaved trees, presumably *Fraxinus excelsior* at first, followed by *Quercus robur*. VEGETATION TYPE 6A: WET MEADOW

TOTAL AREA SAMPLED 247ha (4.0% of area visited)

DOMINANT SPECIES Ranunculus repens, Agrostis stolonifera, Filipendula ulmaria, Carex disticha

ASSOCIATED SPECIES Juncus effusus, Caltha palustris, Glyceria fluitans, Holcus lanatus, Eleocharis palustris

SPECIES DIVERSITY 33 species occurred at 5% or more

RARE SPECIES None recorded

STRUCTURE: This low-lying grassland community is made up of a mixture of grasses and herbaceous plants of medium height, though the height naturally depends on the time of mowing. There is nearly always a sedge component and frequently some rushes also, depending on the management of the individual fields. The most frequent grasses are Agrostis stolonifera and Glyceria fluitans but Holcus lanatus, Phleum pratense and Poa pratensis also occur in places. A slightly higher nutritional status, possibly from fertilisation, allows Lolium perenne and Cynosurus cristatus to appear. The most frequent broad-leaved species are Ranunculus repens, Filipendula ulmaria and Caltha palustris while Rumex acetosa, Senecio aquaticus, Cardamine pratensis and Ranunculus acris are less constant associates. Juncus species include J.effusus which often grows in depauperate form because of annual mowing, and J.acutiflorus in the wetter sites. Here too there is some Eleocharis palustris which if newly mown may be confused with the rushes. The main sedge species which was used as an indicator of the community is Carex disticha but some C.nigra may also occur and even C.rostrata in the wettest corners. Bryophytes are poorly represented, probably because of the vigour of the higher plants - Calliergon cuspidatum is occasionally present.

PHYTOSOCIOLOGY

Order	Molinietalia
Alliance	Calthion palus
Association	Senecioni-June

Molinietalia Calthion palustris Senecioni-Juncetum acutiflori Br.-Bl. et Tx. 1952

These are generally unmanured wet meadows on soils of moderate fertility. The soils are typically ground- or surface-water gleys but O'Sullivan (1965) records stands of this alliance as occurring on alluvium, partly reclaimed fen peats and minerotrophic peats with a high watertable. He notes a variant of the main association with Carex disticha on soils subject to winter flooding. This has the same differential species as the present community with the exception of Equisetum fluviatile. SOIL: Mesotrophic and gleyed mineral soils and silty peats. There is a relatively high nutrient input from flooding though this is kept in balance by the removal of hay or silage.

HYDROLOGY: The community has a high watertable and flooding occurs every winter. The fields may also be partially inundated in high rainfall periods in summer and this may make mowing difficult for heavy machinery.

MANAGEMENT: The structure of the community is maintained by annual mowing and the subsequent grazing of the aftergrass. A cessation of mowing allows *Filipendula* to reassert itself to form Tall Herb (1B). Grazing rather than mowing seems to favour the growth of rushes.

CATCHMENT DISTRIBUTION: The vegetation type is found along the floodplains of the rivers and close to streams and ditches. It occurs with greatest frequency in the Owenmore where conditions are meso- to eutrophic. Good samples are found at Bunnamuck and Bellanalagh while a somewhat similar community occurs in Turloughmore. It is largely absent from the upper Unshin because of the oligotrophic nature of this system.

IMPACTS OF DRAINAGE: In the absence of flooding it is expected that the sedge and wet grass species would decrease and the vegetation change either to Damp Meadow (6J) if mowing was continued or Poor Pasture (3J) if the fields were grazed. With the addition of fertilizer and mowing a *Lolium*-dominated community would result.

VEGETATION TYPE 6F: FEN PASTURE TOTAL AREA SAMPLED 440ha (7.1% of total visited) DOMINANT SPECIES Carex nigra, Juncus acutiflorus, Filipendula ulmaria ASSOCIATED SPECIES Juncus effusus, Mentha aquatica, Succisa pratensis, Angelica sylvestris, Agrostis stolonifera, Carex disticha, C.panicea, Anthoxanthum odoratum, Cynosurus cristatus, Holcus lanatus, Festuca rubra, Caltha palustris, Lychnis flos-cuculi, Calliergon cuspidatum, Epilobium palustre, Senecio aquaticus, Trifolium pratense, Lathyrus pratensis, Potentilla palustris, Galium palustre, Ranunculus repens SPECIES DIVERSITY 68 species recorded at 5% or more RARE SPECIES Achillea ptarmica, Carex dioica, Galium uliginosum, Lysimachia nummularia, Ophioglossum vulgatum, Pulicaria dysenterica, Stellaria palustris, Trifolium medium, Viola canina

STRUCTURE: Fen pasture is a herb-rich wet grassland that is grazed but not otherwise managed. There is no overall dominant species: usually several different monocots are involved. This suggests that the community can be produced by management from a number of different vegetation types. The impression given by the vegetation is of a low sward with an uneven pattern of hummocks and depressions created by the poaching of cattle. Grasses usually cover most area but since a number of species are included, no one of them figures highly in the frequency lists. Agrostis stolonifera, Cynosurus cristatus, Festuca rubra, Holcus lanatus, Anthoxanthum odoratum and Molinia caerulea are all locally important species. The most frequent species are sedges, Carex nigra, C.disticha and C.panicea, and rushes, both Juncus acutiflorus and J.effusus. The presence of Juncus acutiflorus is often tied to a hollow or old ditch line though it spreads widely in the damp conditions. Frequently it is associated with Hydrocotyle vulgaris and Potentilla palustris and with Menyanthes trifoliata in a small-leaved form. Equisetum palustre is notable also.

In most stands Filipendula ulmaria is abundant and some of the clumps escape grazing and come to flowering height, as does Lychnis flos-cuculi, Angelica sylvestris, Senecio aquaticus and, later in the year, Succisa pratensis. As regards other herbs, leguminous species are prominent in the vegetation, probably because of the lack of fertilisers: Trifolium pratense, T.repens, Lathyrus pratensis and Vicia cracca are all quite common.

Fen Pasture in some ways resembles Calcareous Fen (4D) and Enriched Cutaway (2H) though these are more alkaline in reaction. All are species-rich sites with abundant bryophytes. In Fen Pasture the mosses seem to respond to grazing pressure rather than oligotrophy and consist of Calliergon cuspidatum, Climacium dendroides, Rhytidiadelphus squarrosus and Hylocomium splendens, the latter two generally associated with the small rises or hummocks.

PHYTOSOCIOLOGY Orders	MOLINIETALIA Koch 1926 CARICETALIA NIGRAE Koch 1926 em. Nordh. 1936 denuo em. Tx. 1937
Alliances	Calthion palustris Tx. 1937 em. 1951 Caricion curto-nigrae Koch 1926 em. Nordh. 1936
Associations	Valeriano-Filipenduletum Siss. in Westhoff <i>et al</i> 1946 Carici nigrae-Juncetum articulati BrBl. et Tx. 1952
	The affinities of Fen Pasture are some of the most difficult to determine amongst the community types. In many cases Molinietalia species are widespread if not dominant in the vegetation though the actual alliance and association in which to put the stands is

unclear. According to O'Sullivan (1976) Caltha palustris is rare in Irish Molinietalia communities as is Crepis paludosa. Both species are present in Fen Pasture which would tend to give more status to the occurrence of the Calthion alliance in Ireland than that ascribed by White & Doyle (1982). Fen Pasture would seem to be a grazed Filipendulion in many cases but in nutritionally poorer surroundings it may be better placed in a small sedge association.

Π

Π

Π

SOIL: Alluvial soils with some peat accumulation or occasionally on purer peat derived from a cutover.

HYDROLOGY: The sites are inundated in winter whenever there is flooding but are generally dry in summer. The watertable remains high however throughout the year.

MANAGEMENT: Fen pasture is consistently grazed by low numbers of cattle (and hares) when they can reach it and suffers from local poaching. Being interspersed by ditches there are times during most summers when it is inaccessible even if not flooded.

CATCHMENT DISTRIBUTION: This community type occurs in all catchments but with an emphasis in the Unshin. In fact it covers 44% of this catchment as opposed to 13% of the Owenmore. The reason for this would seem to be the amount of winter flooding that the Unshin experiences because of its flat valley and possibly the higher pH of the floodwaters. The largest expanse of the community occurs in Cloonmacduff along the winding river east of Collooney but there are substantial stands also at Bellarush below Lough Arrow and in Ballynacarrow, on a tributary of the Owenmore below Templehouse Lough.

IMPACT OF DRAINAGE: This vegetation seems to depend on winter flooding to sustain it, as well as grazing, so it will not survive arterial drainage in its present form. Losing its annual supply of nutrients it will be transformed in many cases into Poor Pasture (3J). If managed further it could change to either Damp Meadow (6J) or Lolium Grassland.

VEGETATION TYPE 6J:	DAMP MEADOW
TOTAL AREA SAMPLED	602ha (9.7% of area visited)
DOMINANT SPECIES	Ranunculus repens, Agrostis stolonifera, Filipendula ulmaria, Juncus effusus
ASSOCIATED SPECIES	Holcus lanatus, Lolium perenne, Rumex acetosa, Alopecurus pratensis, Carex disticha, Phleum pratense, Festuca pratensis, F. rubra, Cynosurus cristatus, Ranunculus acris, Taraxacum officinale

197

SPECIES DIVERSITY 36 species recorded at 5% or more

RARE SPECIES None recorded

STRUCTURE: This community is related to Wet Meadow (6A) and often adjoins it. However it has a lower watertable, at least in summer, and is more seldom flooded by river water. The dominant grass is often Agrostis stolonifera as in 6A but it is accompanied by a greater variety of pasture grasses such as Alopecurus pratensis, Phleum pratense, Lolium perenne, Festuca pratensis and Cynosurus cristatus accompany it. Holcus lanatus is also notably abundant as is Trifolium repens and Cerastium fontanum. The rarity of moisture-loving species like Eleocharis palustris, Juncus acutiflorus and Glyceria fluitans distinguishes this community from Wet Meadow (6A) but some more tolerant species remain, e.g. Caltha palustris, Carex disticha, C.nigra and Juncus effusus. The soil tends to acidify where flooding is irregular and this accounts for the greater frequency of Rumex acetosa and Anthoxanthum odoratum: it may also encourage the growth of Festuca rubra. A feature of stands of this vegetation is the abundance of certain broad-leaved species in dense patches, seemingly where mowing has been very close to the ground surface. Taraxacum officinale, Plantago lanceolata and Leontodon autumnalis are the most frequent, being able to sprout from their taproots when the grasses are reduced. The occurrence of Rumex species, often R.obtusifolius, seems to be linked with slurry spreading on these fields. [R.crispus occurs naturally close to ditches.]

PHYTOSOCIOLOGY

Order Alliance Molinietalia <u>or</u> Arrhenatheretalia Calthion palustris Centaureo-Cynosuretum

This community seems to have elements of both Molinietalia and Arrhenatheretalia associations and should probably be seen as a Calthion association modified by mowing and occasional fertilisation. If left undisturbed it would tend to revert to the nutritionally poorer Molinietalia.

SOIL: Damp Meadow occurs on seasonally waterlogged soils with a high organic content, often derived from alluvial clays.

HYDROLOGY: The sites with this vegetation are not usually affected by river flooding but, on flat and slightly sloping ground, they are slow to discharge rainfall run-off. They therefore have a high watertable for much of the year.

MANAGEMENT: The occurrence of this community is dependant on annual mowing for hay or silage. There is some grazing of the aftergrass depending on soil conditions. Slurry and/or manure is spread occasionally but not in every year so fertility levels are often not very high. If unfertilised both *Trifolium pratense* and *Rhinanthus minor* may become frequent. CATCHMENT DISTRIBUTION: Widely distributed throughout the catchments, the community occurs between drumlins and on reclaimed cutover bog just above the floodplain. It is the second commonest vegetation after Cutover Bog and is widespread in the Unshin and Owenmore, less so in the Owenbeg. There is a large expanse in the Ballynacarrow area downstream of Templehouse Lough. Π

Π

Π

Π

Π

Π

IMPACTS OF DRAINAGE: Drainage alone would promote oxidation of the organic matter in the soil and some immmediate enrichment of the community. Arrhenatheretalia species would become more prominent as the vegetation changed to a poor grassland (3J). Continued mowing would retain many of the plant species currently found while more frequent fertilisation would create a Lolium stand. APPENDIX 2

]

]

J

 $\left[ \right]$ 

]

]

]

٦

## LIST OF SITES WITH ABOVE AVERAGE DIVERSITY IN VEGETATION

Site(No) No.ha	abitats	Area ha	Divergence(D) from average diversity %	D/Area X 100
$T_{au}$	13	159	83	0.5
Greenan (24)	5	15	42.9	10.0
Tobernascanavan(25)	11	97	8.9	0.9
Aghalenane (28)	10	36	66.7	11.1
Clooneen(36)	15	267	4.2	0.2
Riverstown (37)	9	64	5.9	0.8
Bunnamuck(41)	12	9	500.0	111.0
Bellarush (52)	15	249	7.1	0.4
Clooneymeenaghan (55)	$10^{-10}$	89	2.0	0.2
Tawnagh (56)	, ÷0 4	12	14.3	4.2
Ardagh/Fidwog(58)	11	112	1.9	0.2
Cartronroe(59)	15	201	12.8	0.8
Clooneen $R_{1}(65)$	16	332	3,9	0.2
Coopershill(68)	16	303	6.7	0.3
Tunnagh $I_{\rm L}$ (72)	15	251	5.6	0.3
Srahnanagh(73)	13	170	4.0	0.3
Cartronduffy(74)	12	142	2.6	0.2
Feenagh(76)	11	97	8.9	0.9
Lisconny(78)	20	320	31.6	1.5
Dowrea(81)	5	8	150.0	37.5
Drumcormick (83)	10	82	2.0	0.2
$L_Dargan(87)$	4	16	14.3	3.1
Kilross(88)	14	182	9.3	0.7
Bellanalack/Ogham (	94) 20	405	24.0	0.9
Knocknageeha(95)	11	107	4.8	0.5
Douglas R. (99)	8	44	14.3	2.2
Doonally(110)	11	97	8.9	0.9
Fin L. (112)	8	37	33.3	5.4
Risheen L. (115)	7	38	16.7	2.6
Rathgran(116)	16	220	16.8	1.0
Killoran L. N(119)	8	26	60.0	11.5
Killoran(120)	11	103	4.8	0.5
Carrownabunny(123)	6	22	20.0	4.5
Carrowtany(125)	9	48	28.6	4.1
Clooneen[Drumfin](1)	31) 18	412	11.1	0.4
Ranaghan Mor(134)	14	167	13.9	1.0
Billa Bridge (136)	13	162	5.7	0.4
Lisaneeny Dem. (144)	4	16	14.3	2.6
Knocknahoo(146)	9	39	50.0	7.6
Gortygara(147)	7	35	16.7	2.9
Moyrush(148)	18	492	9	0.3
Claragh (152)	10	74	9.9	1.2
Coolteen(154)	19	229	38.7	2.3
Lisruntagh(155)	4	13	14.3	3.8
Ballynacarrow(156)	20	977	17.6	0.3

Achonry Hse(158)	10	86	2	0.2
Shancarrigeen(163)	13	185	1.6	0.1
Knocknahoo(164)	11	119	1.9	0.2
Woodhill(165)	17	568	1.8	0.05
Ragwood (167)	17	263	18.1	1.0
Kilfree(171)	7	30	16.7	3.3
Ballysumaghan(174)	6	28	20	3.6
Lurgan(175)	4	19	14.3	2.6
Castle Lough(176)	11	59	37.5	5.1
Derrylea(182)	15	149	28.8	2.2
Ballynary(183)	8	24	60	12.5
Knockadoo L(190)	6	29	20	3.5
Coolaney(191)	7	31	16.7	3.2
Coolaney W(192)	8	35	33.3	5.7
Cloghfin(197)	10	52	25	3.8
Gortalough(198)	12	117	11.1	1.0
Corhawnagh(205)	4	17	14.3	2.9
Drumshinnagh(208)	4	12	14.3	4.2
Carrowcushcly(209)	6	29	20	3.4

Π

Π

Π

Note: Sites of high diversity mapped on Figure 11 are those in final column with a score of 1 or more.