

RESTORING ACTIVE BLANKET BOG IN IRELAND

Project reference: LIFE02NAT/IRL/8490

A REPORT ON THE RESTORATION OF PROJECT SITE No. 9.
OWENANIRRAGH, CO. MAYO.



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Project Site No. 9 – Owenanirragh , Co. Mayo

1. Introduction

Grid reference F 937 379	Elevation (m) 60 to 70	Bedrock geology Sandstone
SAC Name and number Glenamoy Bog Complex (500)	Site area (ha) 166.0	Main restoration methods Fell to waste of conifer crop, wind-rowing and drain-blocking.
Area of conifer cover (ha) 107.0	Area of open bog (ha) 46.0	Area of oligotrophic lake (ha) 13.0
Noteworthy plant/animal species occurring <i>Vaccinium oxycoccus</i> , <i>Eriocaulon aquaticum</i> , <i>Listera cordata</i> , <i>Juniperus communis</i> subsp. <i>nana</i>		

Owenanirragh is an isolated area of conifer plantation which lies 6 kilometres north-east of Glenamoy village in north-west Co. Mayo. It is one of the larger sites in the project covering an area of 166 hectares, 107 hectares of which were planted with conifers. Much of the western half of the site lies within the Glenamoy Bog Complex Special Area of Conservation which is an extensive blanket bog area with an excellent representation of blanket bog habitats.

Much of the afforested portion of the site comprises relatively young conifer trees under which there still exists a bog flora, albeit modified and rather species-poor. Two main areas of high quality, unplanted blanket bog also occur within the site and these contain many well developed pool systems. The intact bog vegetation is generally dominated by purple moor-grass (*Molinia caerulea*) and black bog-rush (*Schoenus nigricans*), while the blanket bog pools are characterised by a sparse flora which includes bog bean (*Menyanthes trifoliata*), many-stemmed spike-rush (*Eleocharis multicaulis*) and pipewort (*Eriocaulon aquaticum*). The European distribution of this latter species is confined to lakes and pools in lowland blanket bog areas of Ireland and western Scotland. This area of bog has also a well-developed *Sphagnum* cover including some large hummocks of *Sphagnum imbricatum* and *S. fuscum*. The site also contains a portion of Lougherglass, which is a medium-sized lowland oligotrophic lake.

At this site the main restoration measures undertaken were the manual felling of the conifer crop most of which was subsequently wind-rowed by machine. Any significant artificial drains were blocked with plastic dams.

2. Methods

Prior to the start of restoration activities at the site the habitats and vegetation occurring were surveyed and described. Habitats occurring were mapped with the aid of a vertical aerial photograph of the site taken in the year 2000 by the Ordnance Survey of Ireland. At the end of the project the habitats present were mapped with the aid of a vertical aerial photograph of the site taken between 2004 and 2006.

The vegetation occurring at the site was described using the Zurich-Montpellier approach (Mueller-Dombois and Ellenberg, 1979), where the percentage cover of the various vegetation layers and plant species in a defined area is estimated visually. The cover of plant species in relevés was estimated in accordance with the Domin scale which is outlined in the table below.

Table 1. The Domin scale of cover/abundance.

1 = <4% cover with few individuals
2 = <4% cover with several individuals
3 = <4% cover with many individuals
4 = Cover between 4 and 10%
5 = Cover between 11 and 25%
6 = Cover between 26 and 33%
7 = Cover between 34 and 50%
8 = Cover between 51 and 75%
9 = Cover between 76 and 90%
10 = Cover between 91 and 100%

In addition to plant species presence and cover, the following parameters were noted for each relevé:

- (1) Size
- (2) Percentage cover of vegetation, bare soil, water and rock.
- (3) Percentage cover and height of the different vegetation layers, e.g. shrub, dwarf shrub, herb and bryophyte.
- (4) Soil type and depth.
- (5) Slope and aspect.
- (6) Additional details, such as the composition of the surrounding vegetation, degree of grazing and disturbance.

During the initial fieldwork a number of colour photographs of the site and vegetation encountered were taken with a digital camera and a selection of these are presented in this report in order to illustrate the vegetation descriptions and changes in the habitats/vegetation present over time. Mosses, liverworts and higher plants not readily identified in the field were collected and keyed out at a later date using keys in the appropriate publications (see below). During the field survey, particular attention was paid to the possible occurrence of plant and animal species which are considered to be rare in both a national

and local context with particular emphasis on animal species listed in Annex II of the E.U. Habitats Directive and plant species listed in the Irish Red Data Book for vascular plants (Curtis and McGough, 1988), the 1999 Flora Protection Order and Annex II of the E.U. Habitats Directive.

Plant species nomenclature in this report follows Stace (1997) for vascular plant, Smith (2004) for mosses, Smith (1991) for liverworts and Dahl (1968) for lichens.

3. Site Photographs

In order to illustrate the restoration activities which have taken place at this site a number of photographs are presented in the following pages. These include both aerial photographs, supplied by the Ordnance Survey of Ireland, and a selection of ground photographs taken by the author.



Bog bean (*Menyanthes trifoliata*) is a common species of bog pools at Owenanirragh.



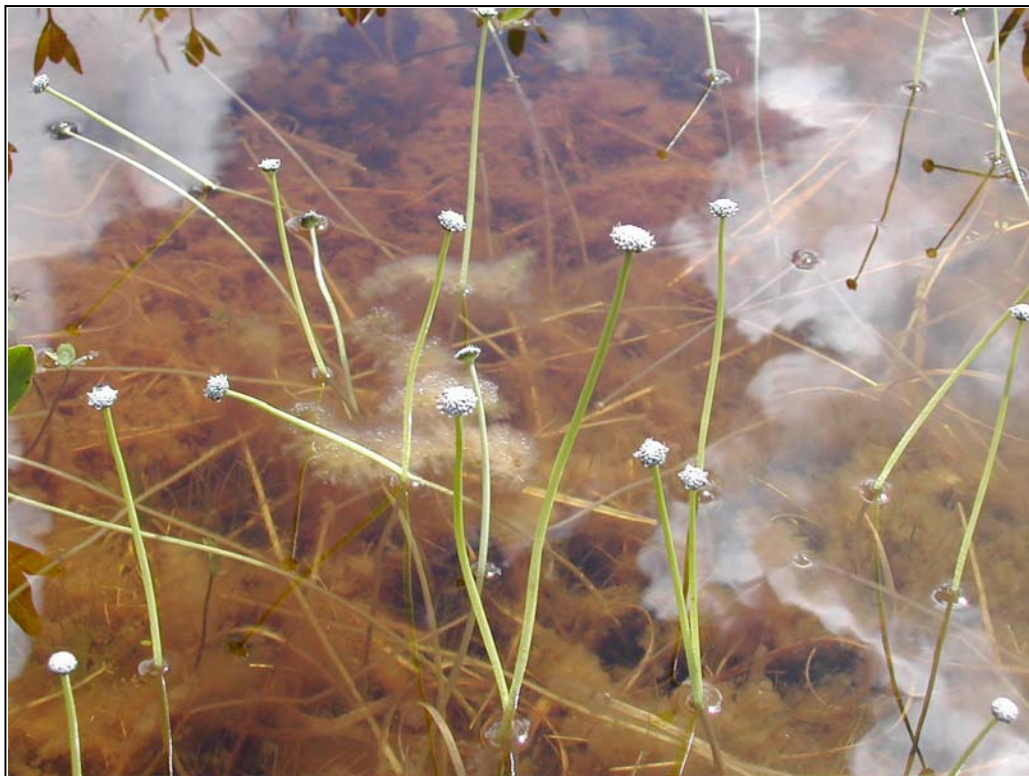
A view of the conifer crop at Owenanirragh viewed from the south, looking to the north. This photograph was taken only a few weeks after the start of conifer felling. Photograph taken in October 2003.



A photograph of the site taken from approximately the same position as above, almost 4 years after tree felling. Note the grey windrows of conifers. Photograph taken in August 2007.



In the south-western portion of this site the unplanted blanket bog contains a well developed system of large pools. *Menyanthes trifoliata* is the main plant species growing in them. Note the conifer wind-rows in the distance. Photograph taken in August 2007.



Bog pools within this site support populations of the rare aquatic plant species *Eriocaulon aquaticum*. The

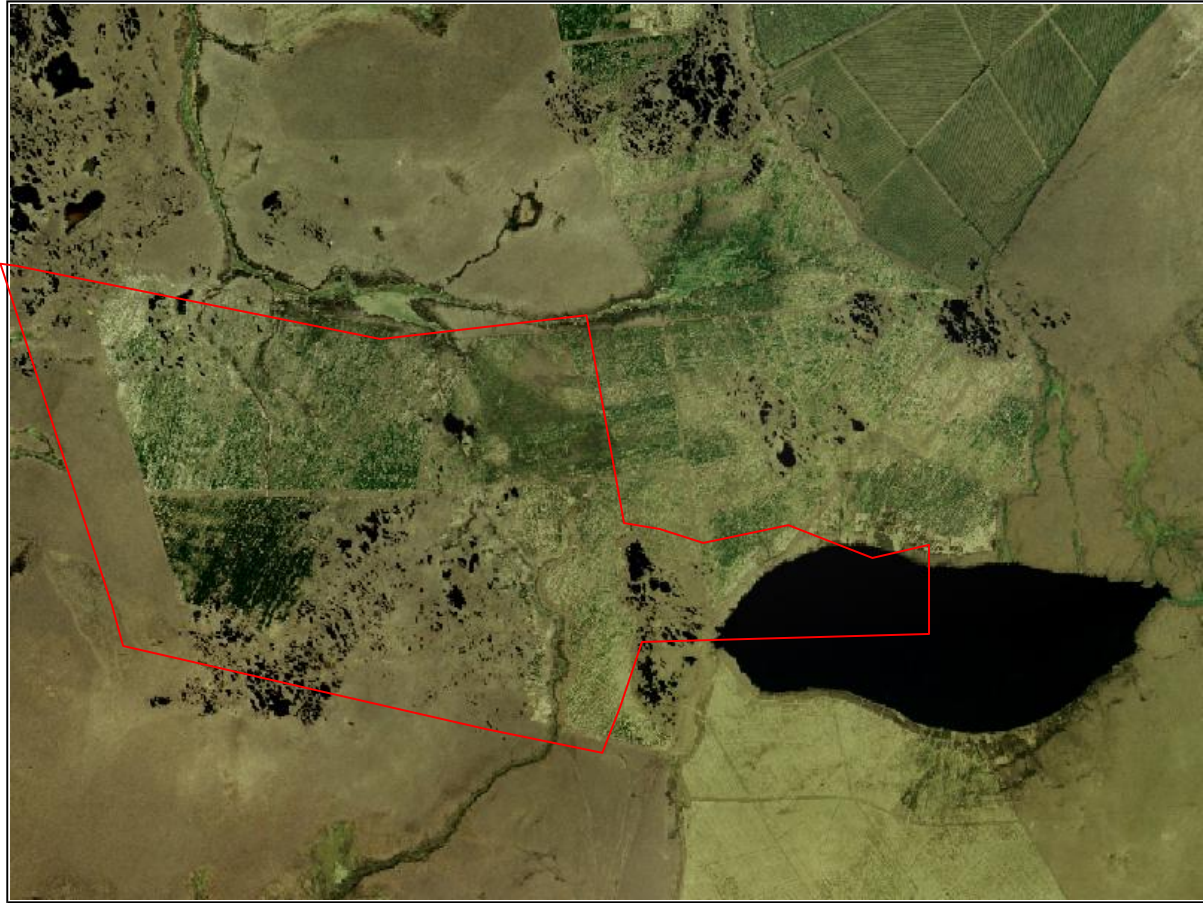
European distribution of this species is largely confined to blanket bog pools and lakes in the west of Ireland and western Scotland.



A close-up view of wind-rowed conifers at the site with cleared bog surface visible on the left. Photograph taken in March 2004.



A view of a plastic dam in a drain at the site. Note that the water level is higher on the right hand side of the dam which shows that water is being retained. Photograph taken in August 2007.



An aerial photograph of the Owenanirragh site prior to restoration work taking place. Aerial photograph taken in the year 2000. The site is outlined in red. Note the areas of open bog with well-developed pool systems.

2006 Aerial photograph is not available.

4. Vegetation of the site

This site is dominated by a conifer crop which was planted in 1990. The main tree species planted was Sitka spruce with lodgepole pine also planted in smaller amounts. By the start of this restoration project in 2003 these trees had not grown to the stage where the native blanket bog flora had been completely killed off. *Molinia caerulea* and *Calluna vulgaris* were still common in the ground layer with mosses such as *Hypnum cupressiforme*, *Rhytidiadelphus loreus* and *Sphagnum capillifolium* also present.

A remarkable feature of this site is the occurrence of two extensive areas of unplanted blanket bog with well-developed pool systems. *Menyanthes trifoliata* is the main species in these pools with *Sphagnum cuspidatum*, *S. auriculatum*, *Eriocaulon aquaticum* and *Eleocharis multicaulis* also characteristic. The rare shrub *Juniperus communis* subsp. *nana* was noted growing on the larger island hummocks within blanket bog pools and also along pool margins. The intact, undrained blanket bog vegetation itself is dominated by the typical blanket bog species *Schoenus nigricans*, *Trichophorum cespitosum*, *Erica tetralix* and *Narthecium ossifragum*. The composition of the bog vegetation is outlined in the following table.

Quite a well developed bog natural drainage channel runs in a southerly direction through the middle of the site. Frequent plant species in this channel include *Carex paniculata*, *Angelica sylvestris*, *Menyanthes trifoliata*, *Carex rostrata* and *Potentilla palustris*.

Table 2. Vegetation at Owenanirragh.

	A	A	A	A	A	B	B	B	B	B	C	C	C	C	C
Quadrat code	13	8	11	3	5	2	15	6	10	7	4	9	12	14	1
Quadrat size (m ²)	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4
Slope (degrees)	0	0	0	0	0	1-3	0	0	0	0	1-3	3-5	0	0	1-3
Vegetation cover (%)	30	15	95	95	40	95	99	98	98	95	100	100	100	100	100
Bare rock (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bare soil (%)	0	0	0	0	10	5	1	2	2	5	0	0	0	0	0
Surface water (%)	100	100	0	100	70	0	0	0	0	0	0	0	0	0	0
Dwarf shrub cover (%)	0	0	0	0	0	50	40	50	45	55	40	70	60	10	40
Herb cover (%)	30	15	40	15	35	70	60	65	60	60	65	40	50	95	70
Bryophyte cover (%)	0	0	95	95	12	70	50	60	70	40	35	50	5	15	5
Ht. of vegetation (cm)	10	15	10	5	8	10	10	15	10	15	35	35	40	35	30
No. of species	1	2	5	6	6	22	21	20	19	16	12	12	7	6	6
<i>Menyanthes trifoliata</i>	6	4	5	4	.	.	.	.	.	.	.	.	.	.	.
<i>Eriocaulon aquaticum</i>	.	5	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Sphagnum cuspidatum</i>	.	.	9	9	3	.	.	.	.	.	.	.	.	.	.
<i>Eleocharis multicaulis</i>	.	.	5	2	5	.	.	.	.	.	.	.	.	.	.
<i>Sphagnum auriculatum</i>	.	.	2	4	5	.	.	.	.	.	.	.	.	.	.
<i>Schoenus nigricans</i>	.	.	.	1	.	3	5	5	5	5	.	.	.	.	.
<i>Narthecium ossifragum</i>	.	.	.	.	.	4	4	3	4	4	.	.	.	.	.
<i>Racomitrium lanuginosum</i>	.	.	.	.	.	2	5	5	5	5	.	.	.	.	.
<i>Sphagnum tenellum</i>	.	.	.	.	.	2	4	3	4	4	.	.	.	.	.
<i>Eriophorum vaginatum</i>	.	.	.	.	.	4	5	4	4	.	.	.	.	.	.
<i>Cladonia uncialis</i>	.	.	.	.	.	3	1	4	4	.	.	.	.	.	.
<i>Pleurozia purpurea</i>	.	.	.	.	.	.	5	5	5	5	.	.	.	.	.
<i>Odontoschisma sphagni</i>	.	.	.	.	.	2	3	3	3	.	.	2	.	.	.
<i>Drosera rotundifolia</i>	.	.	.	.	.	2	1	1	1	.	.	.	.	.	.
<i>Trichophorum cespitosum</i>	.	.	.	.	.	4	3	.	2	4	.	.	.	.	.
<i>Rhynchospora alba</i>	.	.	.	.	1	.	3	2	.	3	.	.	.	.	.
<i>Sphagnum papillosum</i>	.	.	.	.	.	3	.	.	.	3	.	.	.	.	.
<i>Eriophorum angustifolium</i>	.	.	4	1	4	5	4	4	5	4	.	.	.	.	.
<i>Molinia caerulea</i>	.	.	.	.	3	6	6	7	7	7	8	7	7	10	8
<i>Calluna vulgaris</i>	.	.	.	.	.	5	5	5	5	6	6	8	8	3	7
<i>Potentilla erecta</i>	.	.	.	.	.	3	2	2	2	3	2	2	3	1	2
<i>Sphagnum capillifolium</i>	.	.	.	.	.	7	4	4	3	4	.	5	3	4	4
<i>Erica tetralix</i>	.	.	.	.	.	5	5	6	6	6	1	4	2	.	2
<i>Hypnum cupressiforme</i>	.	.	.	.	.	4	3	2	4	.	5	5	3	4	.
<i>Erica cinerea</i>	.	.	.	.	.	3	2	4	3	.	.	5	1	4	4
<i>Cladonia portentosa</i>	.	.	.	.	.	6	6	5	7	5	4	6	.	.	.
<i>Polygala serpyllifolia</i>	.	.	.	.	.	.	.	1	.	3	.	1	.	.	.
<i>Pleurozium schreberi</i>	.	.	.	.	.	.	.	.	.	.	3	1	.	.	.
<i>Carex panicea</i>	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.
<i>Leucobryum glaucum</i>	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
<i>Succisa pratensis</i>	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
<i>Campylopus atrovirens</i>	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.
<i>Dicranum scoparium</i>	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
<i>Dryopteris dilatata</i>	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.

<i>Rhytidiadelphus</i>	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
<i>loreus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Saccogyna viticulosa</i>	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
<i>Salix aurita</i>	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.
<i>Campylopus</i>	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
<i>introflexus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

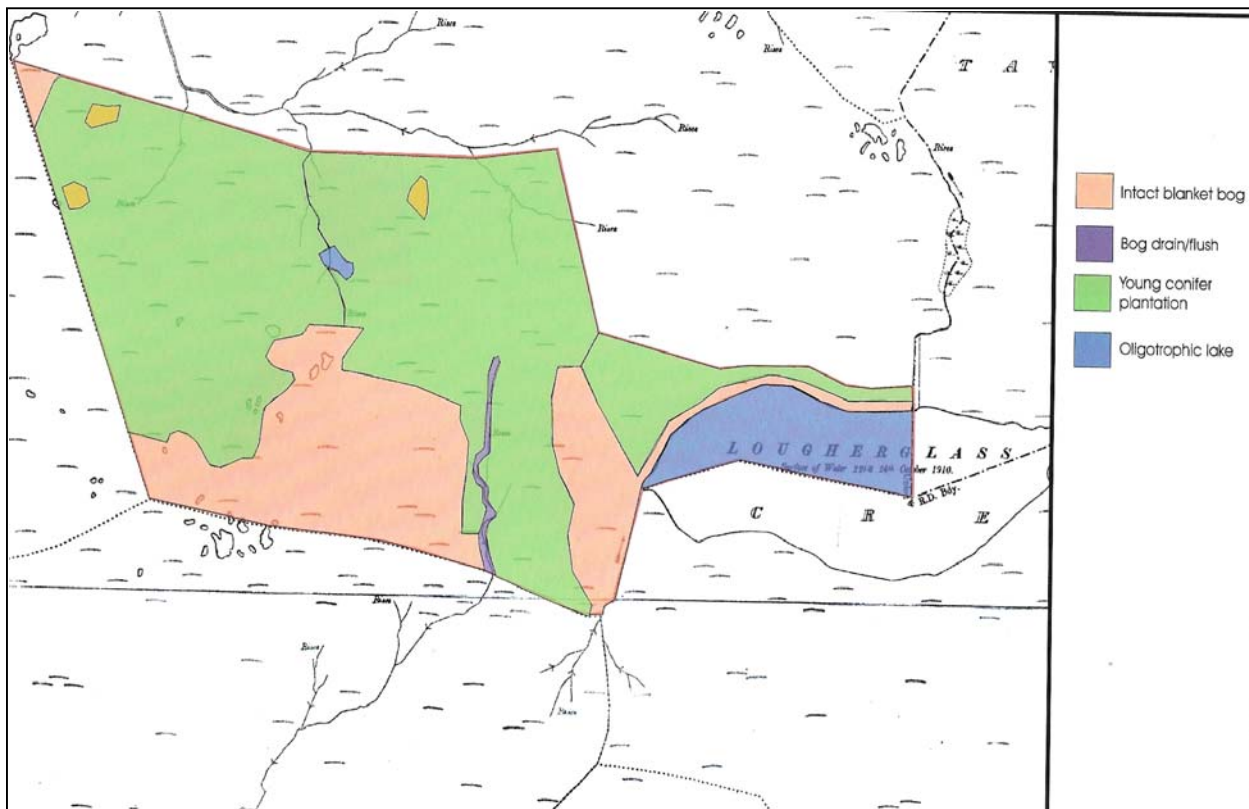
A = Blanket bog pools

B = Intact blanket bog dominated by *Schoenus nigricans* and *Molinia caerulea*

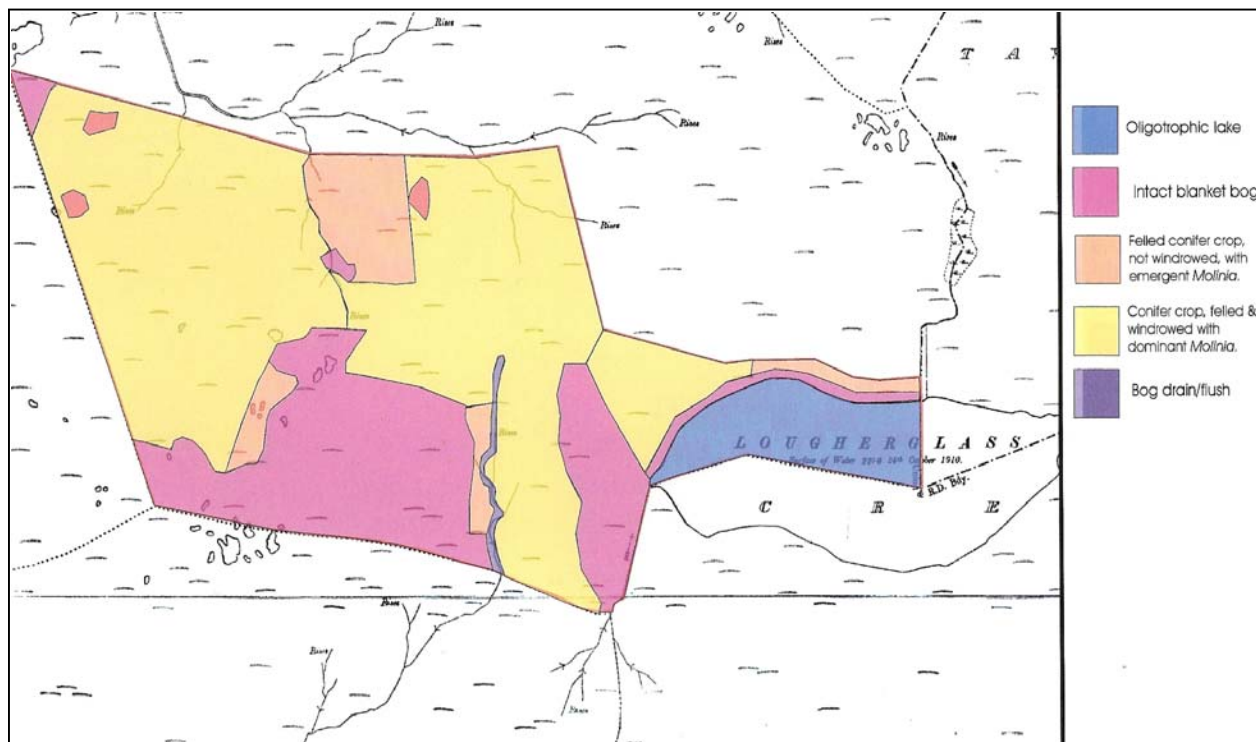
C = Drained blanket bog dominated by *Molinia caerulea*

5. Changes in overall vegetation/habitat cover

This site is now characterized by regenerating lowland blanket bog, dominated by *Molinia caerulea*, with numerous rows of felled conifers. In three small areas the trees were not windrowed for experimental purposes and *Molinia* is also attaining dominance in these. There has been little observable change in the open bog areas as they were not subject to any restoration work.



A map of habitat/vegetation cover at Owenanirragh prior to the start of restoration.



A map of habitat/vegetation cover at Owenanirragh prior at the end of restoration.

6. Monitoring quadrats

In the following pages the vegetation changes which have taken place within the site over the period of the restoration project are shown by means of observed changes in permanent quadrats. A total of 6 permanent quadrats were described and photographed. In the case of each quadrat photographs and vegetation tables are presented. In order to ensure the future relocation of quadrats the corners have been marked with short sticks and a 10-figure GPS reading was also recorded. The cover of plant species within the quadrats is presented in accordance with the scale outlined in the following table.

Cover of species in quadrat	Cover in presented quadrat tables
<1%	1
1 to 5%	2
5 to 10%	3
10 to 25%	4
25% to 50%	5
50 to 75%	6
75% to 100%	7

The portions of this site in which young spruce trees were felled and windrowed are characterised by a profuse and rapid regrowth of *Molinia caerulea* with >75% cover of the species in most areas within 3 years. The other main recolonizing species are *Hypnum cupressiforme*, *Campylopus* sp., *Calluna*

vulgaris, *Sphagnum capillifolium*, *Polytrichum commune* and *Potentilla erecta*.

In areas of the site where a cover of taller lodgepole pine trees was felled and windrowed the bog vegetation was largely killed off by the deposition of a layer of pine needles (see permanent quadrat 4 and 5). Although *Molinia* is also frequent in these areas the recovery of vegetation has been slower with a high cover of disturbed peatland species, e.g. *Campylopus* sp., and *Epilobium angustifolium*, evident.



Quadrat 1 – July 2004



Quadrat 1 – August 2007

Site - Owenanirragh			
Code - PQ1			
GPS - F 93981 37415			
Near Walrag? - No			
Size (m) - 8x8			
Slope (Degrees) - < 5			
Vegetation cover (%)	70	80	98
Needle litter cover (%)	30	20	0
Bare soil (%)	30	3	<3
Vegetation height (cm)	30 to 40	30 to 40	30 to 40
Dwarf shrub cover (%)	3	5	15
Herb cover (%)	65	80	95
Bryophyte cover (%)	40	50	70
No of species present	15	17	19
Date of survey	23/7/04	16/8/05	8/8/2007
<i>Molinia caerulea</i>	6	7	7
<i>Hypnum cupressiforme</i>	5	5	6
<i>Calluna vulgaris</i>	2	3	4
<i>Rhytidiadelphus squarrosus</i>	2	3	1
<i>Rhytidiadelphus loreus</i>	3	1	3
<i>Polytrichum commune</i>	2	2	3
<i>Campylopus</i> sp.	1	2	4
<i>Polygala serpyllifolia</i>	1	1	-
<i>Dicranum scoparium</i>	1	1	3
<i>Dryopteris dilatata</i>	1	1	1
<i>Erica tetralix</i>	1	1	2
<i>Peltigera</i> sp.	1	1	2
<i>Epilobium angustifolium</i>	1	1	2
<i>Erica cinerea</i>	1	-	1
<i>Pleurozium schreberi</i>	1	-	-
<i>Epilobium</i> sp.		1	1
<i>Pedicularis sylvatica</i>		1	-
<i>Palgiothecium undulatum</i>		1	1
<i>Salix aurita</i>		1	1
<i>Potentilla erecta</i>			2
<i>Angelica sylvestris</i>			1
<i>Sphagnum capillifolium</i>			1

History - Previously dominated by a young Sitka spruce plantation planted in 1990. Trees were generally between 4 and 7 metres tall. Ground vegetation was dominated by a sparse growth of purple moor grass and scattered mosses (mainly *Hypnum cupressiforme*). Trees felled to waste in early 2004.



Quadrat 2 – July 2004



Quadrat 2 – August 2007

Site - Owenanirragh			
Code – PQ2			
GPS – F 93889 37739			
Near Walrag? - No			
Size (m) – 8x8			
Slope (Degrees) – < 1			
Vegetation cover (%)	80	95	98
Needle litter cover (%)	30	10	3
Bare soil (%)	5	0	0
Vegetation height (cm)	30-40	40 to 50	40 to 50
Dwarf shrub cover (%)	3	8	10
Herb cover (%)	75	95	98
Bryophyte cover (%)	30	35	50
No of species present	15	18	22
Date of survey	23/7/04	16/8/05	8/8/2007
<i>Molinia caerulea</i>	6	7	7
<i>Hypnum cupressiforme</i>	4	4	5
<i>Sphagnum capillifolium</i>	3	2	3
<i>Calluna vulgaris</i>	2	3	3
<i>Polytrichum commune</i>	2	2	3
<i>Potentilla erecta</i>	2	2	2
<i>Rhytidiadelphus loreus</i>	2	1	3
<i>Agrostis</i> sp.	1	2	2
<i>Campylopus introflexus</i>	1	2	3
<i>Erica tetralix</i>	1	2	2
<i>Dryopteris dilatata</i>	1	1	1
<i>Epilobium angustifolium</i>	1	1	3
<i>Epilobium</i> sp.	1	1	1
<i>Dicranum scoparium</i>	1	-	1
<i>Leucobryum glaucum</i>	1	-	-
<i>Erica cinerea</i>		1	1
<i>Hylocomium splendens</i>		2	3
<i>Hypochoeris radicata</i>		1	-
<i>Polygala serpyllifolia</i>		1	1
<i>Rumex acetosa</i>		1	1
<i>Rhytidiadelphus squarrosus</i>			3
<i>Eurhynchium praelongum</i>			3
<i>Angelica sylvestris</i>			1
<i>Cladonia</i> sp.			1
History – Previously dominated by a young Sitka spruce plantation planted in 1990. Trees were generally between 4 and 7 metres tall. Ground vegetation was dominated by a sparse growth of purple moor grass and scattered mosses (mainly <i>Hypnum cupressiforme</i>). Trees felled to waste in early 2004.			



Quadrat 3 – July 2004



Quadrat 3 – August 2007

Site - Owenanirragh			
Code – PQ3			
GPS – F 93852 38066			
Near Walrag? - No			
Size (m) – 8x8			
Slope (Degrees) – 0			
Vegetation cover (%)	98	100	100
Needle litter cover (%)	0	0	0
Cut stumps (%)	2	0	0
Vegetation height (cm)	40-50	40-50	40 to 60
Dwarf shrub cover (%)	60	60	50
Herb cover (%)	40	40	45
Bryophyte cover (%)	20	25	30
No of species present	9	9	8
Date of survey	23/7/04	16/8/05	8/8/2007
<i>Calluna vulgaris</i>	6	6	6
<i>Molinia caerulea</i>	5	5	5
<i>Hypnum cupressiforme</i>	4	4	4
<i>Sphagnum capillifolium</i>	2	3	3
<i>Rhytidiadelphus loreus</i>	2	2	2
<i>Potentilla erecta</i>	1	2	2
<i>Cladonia portentosa</i>	1	1	-
<i>Erica tetralix</i>	1	1	-
<i>Aulocomium palustris</i>	-	1	-
<i>Dicranum scoparium</i>	1	-	-
<i>Pleurozium schreberi</i>			1
Liverwort species			1
<p>History – Previously dominated by a young Sitka spruce plantation planted in 1990. Trees were generally between 4 and 7 metres tall. Ground vegetation was dominated by heather and purple moor grass. Trees felled to waste in early 2004.</p>			



Quadrat 4 – July 2004



Quadrat 4 – August 2007

Site - Owenanirragh			
Code – PQ4			
GPS – F 93460 38014			
Near Walrag? - No			
Size (m) – 8x8			
Slope (Degrees) – < 5			
Vegetation cover (%)	15	60	90
Needle litter cover (%)	90	40	10
Bare soil (%)	5	3	3
Vegetation height (cm)	<20	10-20	20 to 30
Dwarf shrub cover (%)	1	10	20
Herb cover (%)	7	40	50
Bryophyte cover (%)	10	40	80
No of species present	12	19	24
Date of survey	23/7/04	16/8/05	8/8/2007
<i>Hypnum cupressiforme</i>	4	5	5
<i>Potentilla erecta</i>	2	4	4
<i>Molinia caerulea</i>	3	4	4
<i>Calluna vulgaris</i>	1	3	4
<i>Succisa pratensis</i>	1	2	3
<i>Pleurozium schreberi</i>	1	2	-
<i>Dryopteris dilatata</i>	1	1	1
<i>Epilobium angustifolium</i>	1	1	3
<i>Epilobium sp.</i>	1	1	-
<i>Pinus contorta</i> seedlings	1	1 (3 counted)	2
<i>Rhytidiadelphus loreus</i>	1	-	1
<i>Listera cordata</i>	1	-	-
<i>Campylopus introflexus</i>		4	4
<i>Polytrichum commune</i>		3	4
<i>Erica cinerea</i>		2	3
<i>Juncus bulbosus</i>		1	2
<i>Drosera rotundifolia</i>		1	-
<i>Erica tetralix</i>		1	2
<i>Juncus effusus</i>		1	1
<i>Rumex acetosella</i>		1	1
<i>Rubus fruticosus</i>		1	-
<i>Agrostis sp.</i>			2
<i>Eriophorum angustifolium</i>			1
<i>Eriophorum vaginatum</i>			1
<i>Luzula multiflora</i>			1
<i>Carex panicea</i>			1
<i>Peltigera canina</i>			1
<i>Anthoxanthum odoratum</i>			1
<i>Cladonia portentosa</i>			1

History – Previously dominated by a young pine plantation planted in 1990. Trees were generally between 4 and 7 metres tall. Ground vegetation was dominated by pine needles with a sparse growth of purple moor grass and scattered mosses (mainly *Hypnum cupressiforme*). Trees felled to waste in early 2004.



Quadrat 5 – July 2004



Quadrat 5 – August 2007

Site - Owenanirragh			
Code - PQ5			
GPS - F 93039 37750			
Near Walrag? - No			
Size (m) - 8x8			
Slope (Degrees) - 5 to 15			
Vegetation cover (%)	5	35	70
Needle litter cover (%)	95	70	30
Bare soil (%)	3	2	2
Vegetation height (cm)	<10	20 to 30	10 to 20
Dwarf shrub cover (%)	1	5	15
Herb cover (%)	2	8	40
Bryophyte cover (%)	5	20	50
No of species present	11	15	17
Date of survey	23/7/04	16/8/05	8/8/2007
<i>Hypnum cupressiforme</i>	3	4	5
<i>Molinia caerulea</i>	2	3	4
<i>Campylopus introflexus</i>	2	2	4
<i>Calluna vulgaris</i>	1	2	3
<i>Polytrichum commune</i>	1	2	4
<i>Potentilla erecta</i>	1	2	2
<i>Dicranum scoparium</i>	1	1	-
<i>Dryopteris dilatata</i>	1	1	2
<i>Epilobium angustifolium</i>	1	1	4
<i>Rhytidiadelphus loreus</i>	1	1	2
<i>Epilobium</i> sp.	1	1	-
<i>Erica cinerea</i>		1	3
<i>Erica tetralix</i>		1	2
<i>Rubus fruticosus</i>		1	1
<i>Sphagnum capillifolium</i>		1	2
<i>Polygala serpyllifolia</i>			1
<i>Jasione montana</i>			1
<i>Eriophorum angustifolium</i>			1
<i>Cladonia portentosa</i>			1
History - Previously dominated by a young pine plantation planted in 1990. Trees were generally between 4 and 7 metres tall. Ground vegetation was dominated by pine needles with a sparse growth of purple moor grass and scattered mosses (mainly <i>Hypnum cupressiforme</i>). Trees felled to waste in early 2004.			



Quadrat 6 – July 2004



Quadrat 7 – August 2007

Area with heavy cover of lodgepole pine felled in 2004. No permanent quadrat recorded. Note breakdown of conifers and emergent *Molinia caerulea*.

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