

RESTORING RAISED BOG IN IRELAND
Project Reference: LIFE04 NAT/IE/000121

A REPORT ON THE RESTORATION OF PROJECT SITE No. 10

ARDAGULLION BOG, Co. LONGFORD



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Project Site No. 10 - Ardagullion Bog, Co. Longford

1. Introduction

Grid Reference IN3165 7463	Elevation (m) 100	Bedrock Geology Limestone
SAC Name and Number Ardagullion Bog cSAC (2341) SAC Area (ha) 101	Project Site Area (ha) 25.0	Main Restoration Methods Clear-fell mature conifer crop Fell to waste of young conifers Block drains with peat dams Control natural regeneration
Area of Conifer Cover (ha) 25.0	Area of Open Bog (ha) 0	Area of Birch Woodland (ha) 0
Noteworthy habitats/plant/animal species present		

General site description

Ardgullion Bog is a small raised bog located 5km north-east of Edgeworthstown Co. Longford. The site comprises a raised bog that included both areas of high bog and cutover bog. This site is a remnant of a much larger bog that is now cutover and afforested. There are areas of hummocks and pools in the centre of the high bog and the ground is wet and quaking. There is one flush in the centre of the high bog. There is a small area of coniferous forestry on a section of the high bog in the south-west of the site (NPWS, 2002).

Much of the high bog has vegetation typical of a Midland Raised Bog, consisting of Ling Heather (*Calluna vulgaris*), Cranberry (*Vaccinium oxycoccos*), Hare's-tail Cottongrass (*Eriophorum vaginatum*), White-beaked Sedge (*Rhynchospora alba*), Bog Asphodel (*Narthecium ossifragum*) and Bog-rosemary (*Andromeda polifolia*). The bog mosses *Sphagnum papillosum*, *S. capillifolium* and *S. magellanicum* are common on the high bog and *S. imbricatum* is found in the centre of the site. There are frequent pools in the centre of the high bog that contain the bog moss *S. cuspidatum*. Great Sundew (*Drosera anglica*) is found in all the pools and Bogbean (*Menyanthes trifoliata*) is found in some. There is one very wet flush in the centre of the high bog with Common Cottongrass (*Eriophorum angustifolium*), extensive lawns of the bog moss *S. cuspidatum* and some Purple Moor-grass (*Molinia caerulea*). The cutover in the north-west, east and south-east is dominated by Purple Moor-grass, Soft Rush (*Juncus effuses*) and Common Cottongrass. There is some Common Gorse (*Ulex europaeus*) scrub to the east of the site and extensive Downy Birch (*Betula pubescens*) scrub in the south-east (NPWS, 2002).

Current landuse on the site includes forestry, peat-cutting and agriculture. The forestry is found on a small section of high bog and adjoining cutover in the south-west of the site. Areas of cutover in the south and west of the site that were previously afforested have been recently clear-felled.

Active peat-cutting is taking place in the north-west, east and south-east of the site. Damaging activities associated with these landuses include drainage throughout the site and burning of the high bog. All these activities have resulted in the loss of habitat and damage to the hydrological status of the site (NPWS, 2002).

Project Site Description (Pre-restoration)

The project area consists of 25.0 hectares of conifer plantation. Most of the forestry at this site occurs on the cutover margins with the exception one area of mature conifer plantation of Lodgepole Pine (*Pinus contorta*) on the high bog. The site was surveyed in 2003, prior to restoration, which found that the conifers consisted largely of Lodgepole Pine, Norway Spruce (*Picea abies*) with some Sitka Spruce (*Picea stichiensis*). Most of the Coillte-owned areas within the site were replanted after felling within the past 5 years. The main replanted species is Norway spruce and typically these trees are between 1 and 2.5 metres tall (Conaghan, 2003).

In many places the growth of Downy Birch saplings was profuse and in some of these areas this growth had become largely impenetrable. The drains in these areas often had a shallow depth of pooled water in them and tend to be colonised by Soft Rush (*Juncus effuses*), Hare's Tail Cotton-grass and various *Sphagnum* mosses. In many areas however the drain networks are dry (Conaghan, 2003).

Description of bog vegetation adjoining planted areas

Most of the high bog adjoining the planted areas of the site is rather dry due to drainage effects from the surrounding cutover. The vegetation is dominated by Ling Heather and the lichen *Cladonia portentosa* with species such as Hare's-tail Cottongrass, Deer-grass (*Trichophorum caespitosum*), Bog Asphodel and Cross-leaved Heath (*Erica tetralix*) also common. In the eastern end of the site planted areas occur adjacent to areas of active cutover bog and, in places, there is good development of Downy Birch scrub. Between the newly planted areas and adjoining bog there is usually a band of Downy Birch scrub/woodland which can be up to 15 metres wide in places (Conaghan, 2003).

Restoration Actions

At this site the main restoration measures undertaken was the clear-felling and removal of the mature conifer crop, felling to waste of young conifers, wind-rowing of the remaining brash and blocking of drains with peat dams. Follow-up work included the control of the natural regeneration of conifer seedlings.

Scrub development is ongoing within most of the recently planted areas and it is likely that the removal of this scrub vegetation at this site would be an unsuccessful exercise. In general, the re-wetting of the recently planted areas of this site will be difficult due to their marginal position and well-drained nature. Most of these areas have had a long history of tree planting and this has contributed to their very dry state at present. It is anticipated that most of these areas will revert to Downy Birch woodland following restoration. Close to drains this woodland may develop a wetland ground-layer however the extent of this will depend upon the efficacy of drain blocking (Conaghan, 2003).

2. Methods

Prior to the start of restoration activities at the site, the habitats and vegetation occurring were surveyed and described (Conaghan, 2003). During the initial restoration work of 2005, permanent quadrats were established on each of the vegetation types within the project site.

During the initial 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.

3. Site Photographs

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. These include ground photographs taken by the Project Ecologist in order to illustrate the vegetation descriptions and changes in the habitats/vegetation present over time.

4. Vegetation of Project Site

Most of the Coillte-owned areas within the site were replanted after felling within the past 5 years. The main replanted species is Norway Spruce and typically these trees are between 1 and 2.5 metres tall. A dry bog ground layer occurs and this is dominated by Ling Heather. Other frequent species include Downy Birch, Common Gorse, Bramble, Hare's tail Cotton-grass, Willow, Bracken and Broad Buckler Fern.

5. Changes in Overall Vegetation/Habitat Cover

Much of the site is now cleared of conifers and brash. The brash which remained after clear-felling has been wind-rowed to allow bog vegetation to re-colonise the exposed peat surface. With the removal of conifers and blocking of drains, there was a rise in the water-table, which allowed for the colonisation of bog vegetation and *Sphagnum* mosses on the high bog areas. However due to the dry marginal nature of the young plantations on cutover bog, scrub dominated by Downy Birch is becoming established in these areas.

6. Vegetation Monitoring Quadrats

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. Five 10x10m permanent quadrats were installed on this site, which were described and photographed to monitor changes in vegetation over time. In order to ensure the future position of quadrats the corners have been marked with short stakes and an 8-figure GPS reading was also recorded. Vegetation tables for these are presented below.

Quadrat 1: This quadrat is located on the north-east margin of Ardagullion and occurred within young conifer plantation with a ground cover containing Ling Heather, Bramble and *Hypnum* moss. This margin adjoined active peat-cutting and so drain-blocking was restricted. With the felling to waste of the conifers, it can be seen that Downy Birch and Ling Heather cover increased. Over time, this dry bog margin will develop into wet birch woodland.

Ardagullion Quadrat 1

Area: 10 x 10m

Location: 10m South W2

Grid Ref: N3199 7489

Altitude: 90m

Bog Type: Cutaway

Ecotope: NA

Slope: Flat

Aspect: NA

Landuse: Forestry

Management: Fell to Waste

Date	09/08/2005	02/08/2006	14/08/2007	05/08/2008
Firmness	Firm	Dry	Firm	Firm
Drains	Yes	Yes	Yes	Yes
Canopy Cover %	10	20	20	20
Canopy Height	2		2	2
Vegetation Cover %	80	90	95	95
Vegetation Height (m)		50	50	50
Dwarf Shrub Cover %	65	80	75	75
Herb Cover %	10	20	20	20
Bryophyte Cover %	45	56	65	65
Sphagnum cover %	0	1	0	0
Open Water %	0	0	0	0
Brash cover %	5	5	0	3
Pine Needle cover %		0	0	0
Pine Needle Depth cm		0	0	0
Bare Peat %	5	5	1	2
Species number	10	12	8	11
<i>Pinus contorta</i>	1			
<i>Picea sitchensis</i>		1	1	2
<i>Betula pubescens</i>	10	25	25	25
<i>Rubus spp</i>	10	10	10	5
<i>Hedera helix</i>				1
<i>Pteridium spp</i>	5	3	5	5
<i>Epiolobium spp</i>	1	1		1
<i>Vaccinium myrtillus</i>	5	10	5	5
<i>Calluna vulgaris</i>	60	70	70	70
<i>Eriophorium vaginatum</i>				1
<i>Campylopus atroverins</i>		1		5
<i>Hypnum cupressiforme</i>	20	10		
<i>Hypnum jutlandicum</i>	20	40	60	60
<i>Polytricum commune</i>	5	5	5	
<i>S. magellanicum</i>		1		

Ardagullion Quadrat 1, 2005



Ardagullion Quadrat 1, 2008



Quadrat 2: This quadrat is located on the south-east margin of Ardagullion and occurred within young conifer plantation with a ground cover containing Ling Heather, Bramble and *Hypnum* moss. This margin adjoined active peat-cutting and so drain- blocking was restricted. With the felling to waste of the conifers, it can be seen that Downy Birch, Bramble and Ling Heather cover increased. Over time, this dry bog margin will develop into wet birch woodland.

Ardagullion Quadrat 2

Area: 10 x 10m

Location: 5m South W4

Grid Ref: N3180 7470

Altitude: 91m

Bog Type: Cutaway

Ecotope: NA

Slop: Flat

Aspect: NA

Landuse: Forestry

Management: Fell to Waste

Date	09/08/2005	02/08/2006	14/08/2007	05/08/2008
Firmness	Soft	Dry	Firm	Firm
Drains	Yes	Yes	Yes/Blocked	Yes/Blocked
Canopy Cover %	40	35	60	50
Canopy Height	3		2	3
Vegetation Cover %	85	95	95	100
Vegetation Height (m)		50	100	50
Dwarf Shrub Cover %	70	40	40	40
Herb Cover %	15	55	60	60
Bryophyte Cover %	30	35	40	40
Sphagnum cover %	0	0	0	0
Open Water %	0	0	0	0
Brash cover %	10	5	5	0
Pine Needle cover %		0	1	0
Pine Needle Depth cm		0	1	0
Bare Peat %	5	5	0	0
Species number	8	9	10	9
<i>Pinus contorta</i>		2	2	5
<i>Picea sitchensis</i>		2	1	
<i>Betula pubescens</i>	25	35	60	40
<i>Salix spp.</i>	10	5	5	10
<i>Ulex eurpoeus</i>			1	
<i>Rubus spp</i>	25	40	40	30
<i>Juncus spp</i>	2	5	1	5
<i>Pteridium spp</i>	2	2		
<i>Epiobium spp</i>	5	1	5	5
<i>Vaccinium myrtillus</i>				5
<i>Calluna vulgaris</i>	50	40	40	35
<i>Hypnum cupressiforme</i>		5		
<i>Hypnum jutlandicum</i>	20	25	40	40
<i>Polytricum commune</i>	10	5		

Ardagullion Quadrat 2, 2005



Ardagullion Quadrat 2, 2008



Quadrat 3: This quadrat is located towards on the southern margin of Ardagullion and occurred within young conifer plantation with a ground cover containing Ling Heather, Bilberry, Bramble and *Hypnum* moss. With the felling to waste of the conifers and blocking of drains, it can be seen that Downy Birch, Bramble and Ling Heather cover dominated. Over time, this bog margin will develop into wet birch woodland.

Ardagullion Quadrat 3

Area: 10 x 10m

Location: 10m North W7

Grid Ref: N3103 7486

Altitude: 95m

Bog Type: Cutaway

Ecotope: NA

Slope: Flat

Aspect: NA

Landuse: Forestry

Management: Fell to Waste

Date	09/08/2005	11/08/2006	14/08/2007	05/08/2008
Firmness	Firm	Firm	Firm	Firm
Drains	Yes	Yes/Blocked	Yes/Blocked	Yes/Blocked
Canopy Cover %	6	5	15	10
Canopy Height	2	1.5	1	1
Vegetation Cover %	70	90	95	90
Vegetation Height (m)		100	100	100
Dwarf Shrub Cover %	70	50	50	50
Herb Cover %	10	40	40	40
Bryophyte Cover %	40	30	40	40
Sphagnum cover %	10	5	0	0
Open Water %	0	0	0	0
Brash cover %	10	5	0	5
Pine Needle cover %		5	5	5
Pine Needle Depth cm		1	1	1
Bare Peat %		0	0	0
Species number	11	14	11	8
<i>Pinus contorta</i>	1	1	1	
<i>Betula pubescens</i>	4	10	15	10
<i>Salix</i> spp.		1	5	
<i>Sorbus</i>	1	1	5	5
<i>Rubus</i> spp	5	15	10	15
<i>Digitalis purpurea?</i>			1	
<i>Molinia caerulea</i>	10	10	10	
<i>Pteridium</i> spp	1	2		1
<i>Epiobium</i> spp	5	5	5	5
<i>Vaccinium myrtilus</i>	20	15	15	10
<i>Calluna vulgaris</i>	50	35	35	40
<i>Eriophorium vaginatum</i>		1		
<i>Hypnum jutlandicum</i>	30	25	40	40
<i>Sphagnum recurvum</i>	10	3		
<i>S. magellanicum</i>		2		

Ardagullion Quadrat 3, 2005



Ardagullion Quadrat 3, 2008



Quadrat 4: This quadrat is located towards the centre of the conifer plantation on the south-west margin of Ardagullion Bog and occurred under closed canopy conifers with a ground cover containing some *Sphagnum recurvum*, but mainly consisted of brash and pine needles. With the felling of the conifers and blocking of drains, it can be seen that Ling Heather and *Sphagnum* cover. Over time, if conditions remain wet, *Sphagnum* cover will increase further and active peat formation will occur.

Ardagullion Quadrat 4

Area: 10 x 10m

Location: 10m West W5

Grid Ref: N3092 7518

Altitude: 96m

Bog Type: Highbog

Ecotope: NA

Slope: Flat

Aspect: NA

Landuse: Forestry

Management: Clearfell

Date	09/08/2005	11/08/2006	14/08/2007	05/08/2008
Firmness	Dry	Dry	Soft	Soft
Drains	Yes	Yes/Blocked	Yes/Blocked	Yes/Blocked
Canopy Cover %	5	0	0	0
Canopy Height		0	0	0
Vegetation Cover %	10	40	60	80
Vegetation Height (m)		60	50	50
Dwarf Shrub Cover %	7	15	20	30
Herb Cover %	1	35	40	50
Bryophyte Cover %	7	30	60	70
Sphagnum cover %	6	20	30	35
Open Water %	0	0	10	5
Brash cover %	50	25	20	10
Pine Needle cover %	40	35	10	5
Pine Needle Depth cm	10	10	5	5
Bare Peat %		0	0	5
Species number	10	17	17	20
<i>Pinus contorta</i>	1	1	5	2
<i>Picea sitchensis</i>		1	1	1
<i>Betula pubescens</i>	5	5	15	50
<i>Quercus spp</i>	1	1	1	
<i>Rubus spp</i>	1	10	5	2
<i>Juncus spp</i>		1	1	2
<i>Holcus lanatus</i>	2	3	5	5
<i>Pteridium spp</i>	1			1
<i>Epiolobium spp</i>	2	15	10	10
<i>Vaccinium myrtillus</i>	1	5	1	3
<i>Calluna vulgaris</i>		10	20	25
<i>Erica tetralix</i>				2
<i>Eriophorium vaginatum</i>		2	5	5
<i>E. angustifolium</i>				1
<i>Campylopus atrovirens</i>		2		5
<i>Hypnum jutlandicum</i>		10	20	25
<i>Polytricum commune</i>			5	5
<i>Sphagnum recurvum</i>	1	5		10
<i>S cuspidatum</i>			5	5
<i>S. capillifolium</i>	5	3	10	
<i>S. subnitens</i>		10	10	10
<i>S. magellanicum</i>		2	5	10

Ardagullion Quadrat 4, 2005



Ardagullion Quadrat 4, 2008



Quadrat 5: This quadrat is located towards the south-west margin of Ardagullion and occurred under closed canopy birch woodland with a ground cover containing Bracken, Tufted Hair-grass and *Sphagnum recurvum*. This area will be retained as birch woodland, which naturally occurs on raised bog margins.

Ardagullion Quadrat 5

Area: 10 x 10m **Location:** Wet Woodland **Grid Ref:** N3083 7512 **Altitude:** 109m
Bog Type: Cutaway **Ecotope:** NA **Slope:** Flat **Aspect:** NA
Landuse: Wet Woodland **Management:** Non-intervention

Date	09/08/2005	11/08/2006	14/08/2007	05/08/2008
Firmness	Soft	Firm	Soft	Soft
Drains	Yes	Yes	Yes	Yes
Canopy Cover %	80	90	80	90
Canopy Height			5	5
Vegetation Cover %	75	80	90	80
Vegetation Height (m)		50	50	100
Dwarf Shrub Cover %	10	10	10	5
Herb Cover %	65	80	80	75
Bryophyte Cover %	42	40	20	35
Sphagnum cover %	30	15	5	10
Open Water %	0	0	0	0
Brash cover %	5	0	5	5
Pine Needle cover %		0	0	0
Pine Needle Depth cm		0	0	0
Leaf Litter	20	0	5	10
Bare Peat %		5	0	0
Species number	10	10	9	9
<i>Picea sitchensis</i>		1	1	1
<i>Betula pubescens</i>	80	90	80	85
<i>Rubus spp</i>	10	10	10	10
<i>Hedera helix</i>	1			
<i>Deschampsia</i>	30	40	30	20
<i>Pteridium spp</i>	25	20	30	40
<i>Vaccinium myrtillus</i>	10	10	10	5
<i>Hypnum jutlandicum</i>	10	25	10	20
<i>Polytricum commune</i>	1	10	5	5
<i>Dicranium spp</i>	1			
<i>Sphagnum recurvum</i>	30	5	5	10
<i>S. magellanicum</i>		1		

Ardagullion Quadrat 5, 2005



Ardagullion Quadrat 5, 2008



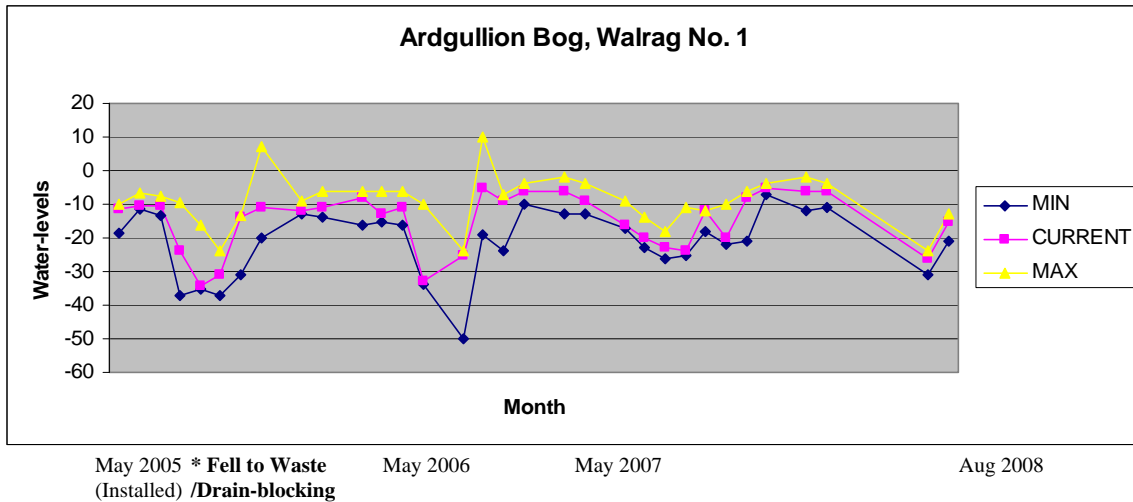
7. Changes in Water-levels

Prior to restoration, Walrags were installed in the conifer plantation to record any changes in water-levels, due to tree removal and drain blocking. Water-levels were found to be up to **70cm** below the surface. With the removal of conifers and drain-blocking, there was a rise in the water-table in the plantation on the high bog project and the water-table remains close to the bog surface throughout most of the year. However there was little rise in water-levels in marginal cutover bog areas, due to shallow peat depth and proximity of turbury. These areas will revert to wet birch woodland.

8. Hydrological Monitoring (Walrag) Graphs

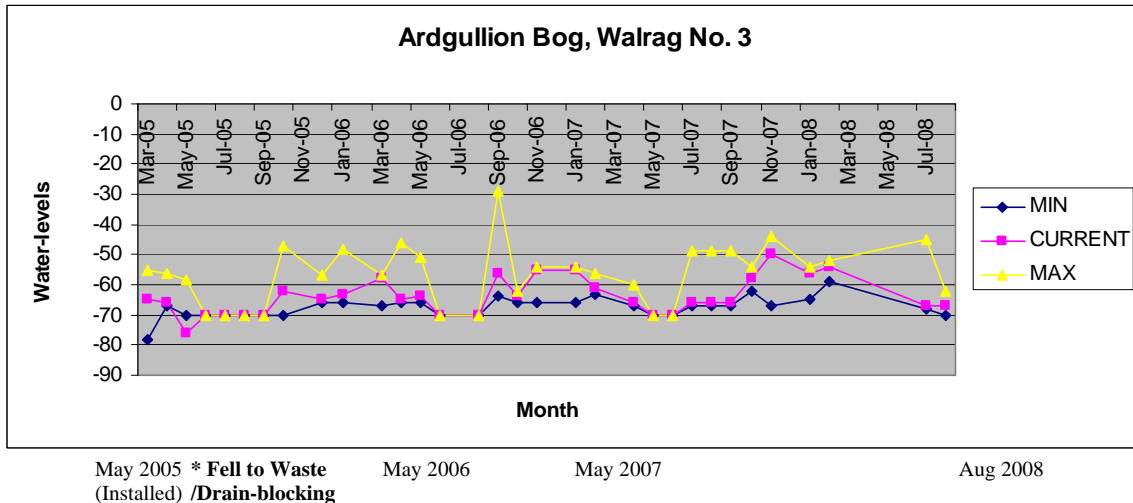
During the clear-felling operation, eight Walrags were installed on this site to record the changes in water-levels.

Ardgullion Bog Walrag 1: Fell to Waste on Cutover Bog (Water-levels remain below 10cm of bog surface post restoration*, due to shallow peat depth)

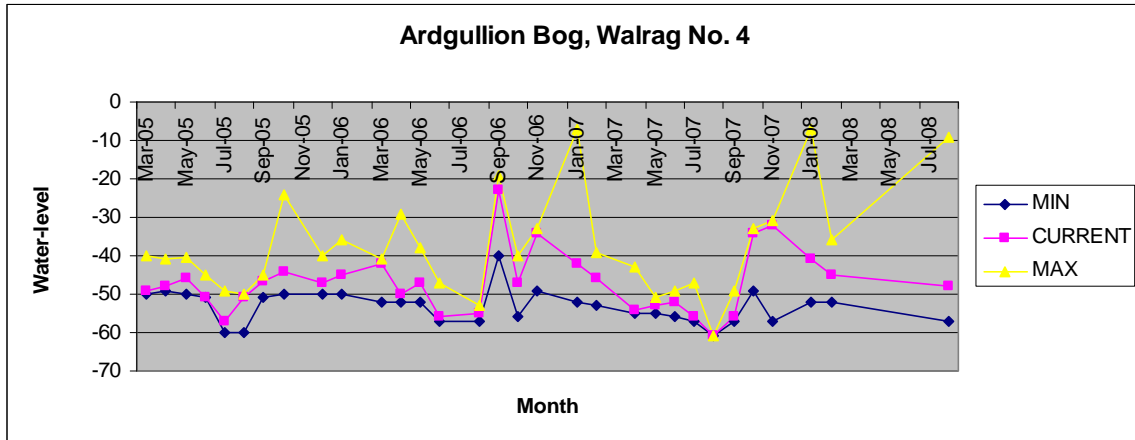


Ardgullion Bog Walrag 2: Fell to Waste on Cutover Bog (Remained dry despite drain blocking due to shallow peat depth)

Ardgullion Bog Walrag 3: Fell to Waste on Cutover Bog (Water-levels remain 60cm below bog surface post restoration*, due to shallow peat depth)

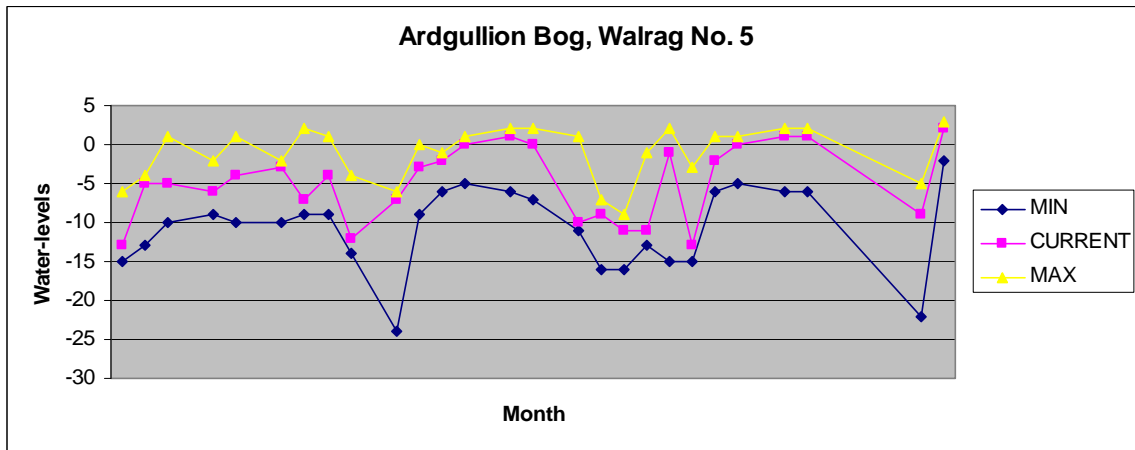


Ardgullion Bog Walrag 4: Fell to Waste on Cutover Bog (Water-levels remain 40cm below bog surface post restoration*, due to shallow peat depth)



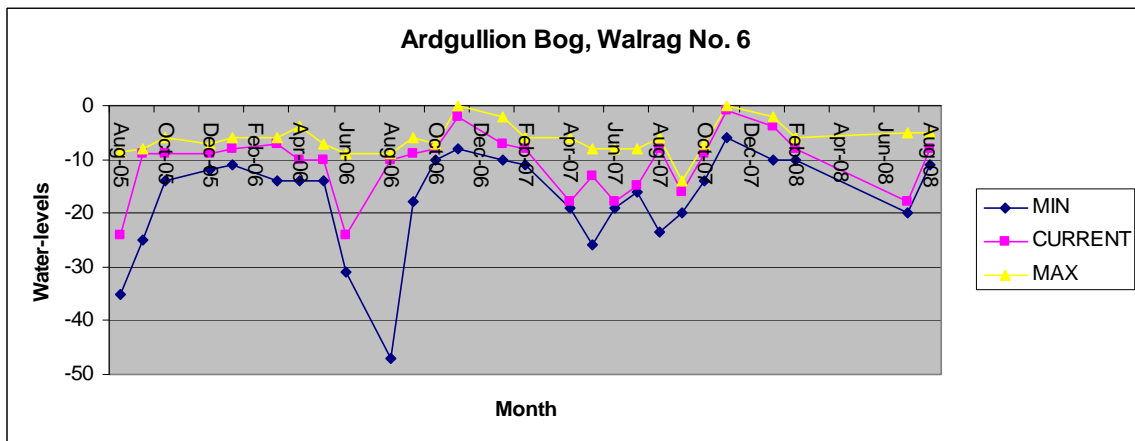
May 2005 * Fell to Waste May 2006 May 2007 Aug 2008
/Drain-blocking

Ardgullion Bog Walrag 5: Clearfell on High Bog (Water-levels remain within 10cm of bog surface post restoration*, but decline in summer months)



May 2005 * Fell to Waste May 2006 May 2007 Aug 2008
/Drain-blocking

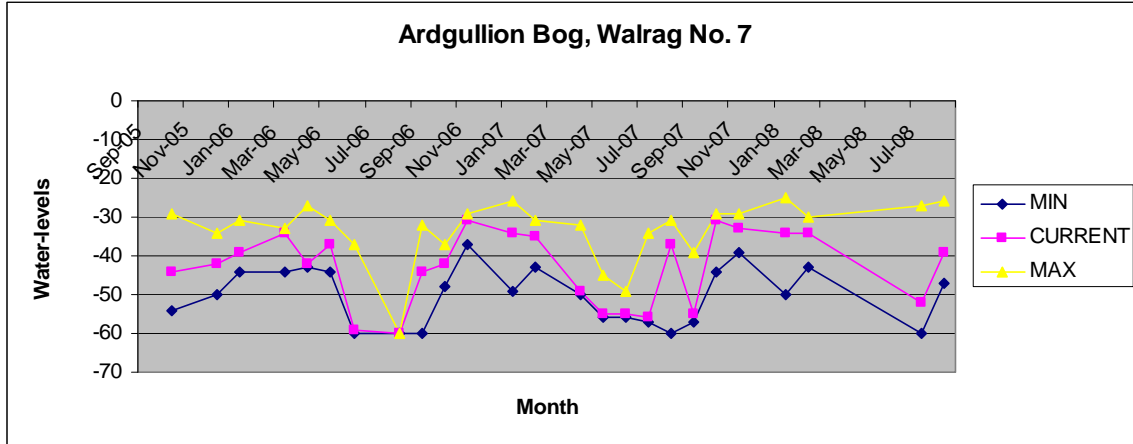
Ardgullion Bog Walrag 6: Open High Bog (Water-levels remain within 10cm of bog surface post restoration* on adjacent plantations, but a slight decline during summer months remains)



May 2005 * Fell to Waste May 2006 May 2007 Aug 2008
/Drain-blocking

Ardgullion Bog Walrag 7: Fell to Waste on Cutover Bog

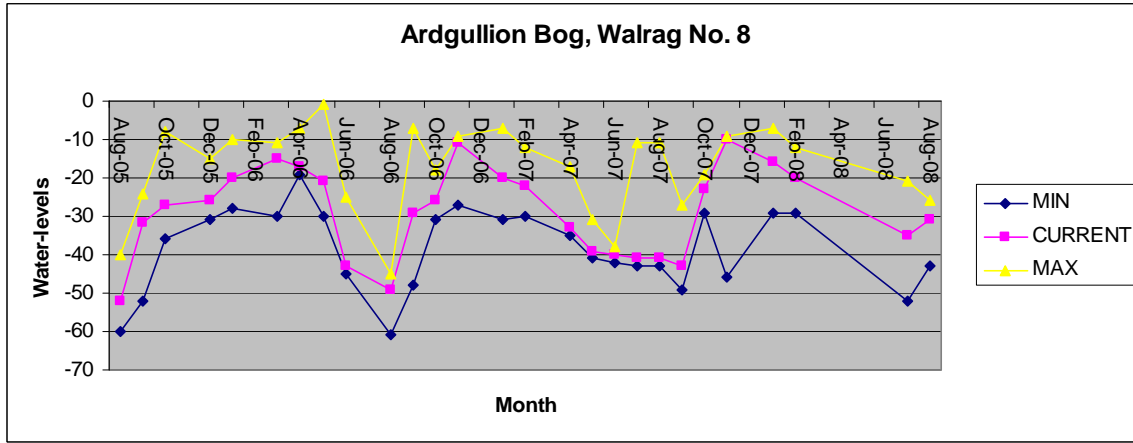
(Water-levels remain below 40cm of bog surface post restoration*, due to shallow peat depth)



May 2005 * Fell to Waste / Drain-blocking May 2006 May 2007 Aug 2008

Ardgullion Bog Walrag 8: Fell to Waste on Cutover Bog

(Water-levels remain below 30cm of bog surface post restoration*, due to shallow peat depth)



May 2005 * Fell to Waste / Drain-blocking May 2006 May 2007 Aug 2008

9. Conclusion

Overall the restoration potential of this site is limited, due to the marginal nature of the restoration areas and the proximity of turbury. However the restoration measures will protect the adjoining high bog from further water-loss and raised bog habitat will become established on the clear-fell plantation on high bog. The fell to waste areas on cutover bog will revert to wet birch woodland, which has already established around the bog margin.

10. References

Brooks, S. (2005). *Assessment of Project Sites, Restoring Raised Bog in Ireland*. Coillte LIFE Nature Project. Peatland Consulting

Conaghan, J. (2003). *Raised Bog Ecological Report*. Coillte

Curtis, T.G.F. & McGough, H.N. (1988). *The Irish Red Data Book. 1: Vascular Plants*. The Stationery Office, Dublin.

NPWS Site Synopsis