

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

A REPORT ON THE RESTORATION OF PROJECT SITE No. 6

LISNAGEERAGH BOG & BALLINASTACK TURLOUGH, Co. GALWAY



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Project Site No. 6 - Lisnageeragh Bog & Ballinastack Turlough, Co. Galway

1. Introduction

Grid Reference IM6727 6223	Elevation (m) 90	Bedrock Geology Limestone
SAC Name and Number Lisnageeragh Bog & Ballinastack Turlough cSAC (296)	Project Site Area (ha) 27.1	Main Restoration Methods Clear-fell mature conifer crop Fell to Waste young conifers Block drains with peat dams Control natural regeneration
SAC Area (ha) 455		
Area of Conifer Cover (ha) 9.6	Area of Open Bog (ha) 17.5	Area of Birch Woodland (ha) 0
Noteworthy habitats/plant/animal species present Raised Bog and Turlough habitats occur in close proximity Red Grouse has been recorded on open bog		

General site description

Lisnageeragh bog is a large area of relatively intact raised bog located 3 km north-east of Glenamaddy, Co. Galway. The site is a good example of a western raised bog and the most frequent plant species present on the intact high bog areas include Ling Heather (*Calluna vulgaris*), Cross-leaved Heath (*Erica tetralix*), Hare's tail Cottongrass (*Eriophorum vaginatum*) and various bog mosses (*Sphagnum* spp.).

The bog occurs in association with a small turlough, located at the north-western end of the site. The raised bog has a largely intact dome, of which approximately 50% is high quality raised-bog habitat. This includes a small but active hummock/pool system in an isolated portion to the south-west of the bog. Although fire has damaged this area, some large hummocks which occur as islands in the bog pools have escaped damage. Three separate areas of elongated pools occur, the best being in the centre of the bog. In these pool complexes, Bog Mosses (*Sphagnum* spp.) are colonizing the open water and are forming lawns between the pools. Brown-beaked Sedge (*Rhynchospora fusca*), a plant that is scarce in Ireland is abundant in the pool complexes. An unusual plant community, comprising Carnation Sedge (*Carex panicea*) and Bog Mosses also occurs. The presence of a number of flushes, some of which are dominated by Purple Moor-grass (*Molinia caerulea*) adds to the habitat diversity of the site (NPWS, 1997).

To the north of the site is Ballinastack Turlough, whose floodwaters abut the raised bog. Peat deposits are associated with the turlough, an unusual feature for a turlough, which is supplied with mineral-rich ground water. Vegetation dominated by Common Sedge (*Carex nigra*) occurs on the peaty substrate.

To the north-east of the site, there is an area of wet grassland associated with the bog, which occurs on heavy clay soils that grade into wet regenerating cutover bog, which is rich in bog mosses. There is also an extensive area of cutover bog in the south-west, comprising a mixture of dry banks dominated by Ling Heather (*Calluna vulgaris*) and wet pools.

The southern portion of this site has been subject to rather intensive peat-cutting in the past and this has resulted in the drying out of the adjacent high bog. At Ballyhard, in the south-eastern corner of the site, a significant area of bog has been planted with conifers within recent decades. Coillte owns areas of both afforested bog and unplanted bog at two locations within this site namely Ballyhard in the south-east of the site and Curraghmulmurry in the north-west (Conaghan, 2003).

The occurrence of a high proportion of good quality active raised bog in close association with a turlough, both habitats listed on Annex I of the EU Habitats Directive makes this site of considerable ecological interest.

Project Site Description (Pre-restoration)

The project area consists of 17.5 ha of open bog and 9.6 hectares of conifer plantation, which occur in two separate areas. A mature plantation of Lodgepole Pine (*Pinus contorta*) planted on high bog, occurs at **Ballyhard** to the south-east of the cSAC and a young plantation of Sitka Spruce (*Picea sitchensis*) occurs on cutover bog at **Curraghmulmurry** to the north-west of the SAC.

Description of bog vegetation adjoining planted areas

At **Ballyhard** a mixture of old cutover/flush dominated by Purple Moor-grass and dry high bog dominates in areas adjoining the forestry. Other plant species present in the rather dry flushed area include Devil's-bit Scabious (*Succisa pratensis*), Tormentil (*Potentilla erecta*), Bog Myrtle (*Myrica gale*), Cross-leaved Heath (*Erica tetralix*), Ling Heather and Common Gorse (*Ulex europeaus*). A small area of active cutover occurs along the bog road which delimits the northern edge of the plantation.

At **Curraghmulmurry** there is a small planted area within the SAC and this adjoins old cutover bog, some areas of which have been invaded by gorse scrub. Most of the cutover in this area is very wet underfoot (quaking and treacherous in many places) and the dominant species are generally Purple Moor-grass, Bog Myrtle, Common Cottongrass (*Eriophorum angustifolium*), Soft Rush (*Juncus effuses*) and various mosses and lichens.

Restoration Actions

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

2. Methods

Prior to the start of restoration activities at the site, the habitats and vegetation occurring was 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 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 international 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 a selection of 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

The site was surveyed in 2003, prior to restoration, which found that, the conifers at **Ballyhard** consist largely of Lodgepole Pine (*Pinus contorta*) which were planted in 1983. Although the conifers have not grown well at this site they have managed to achieve a closed-canopy and thus there is little or no bog vegetation present within these afforested areas. At **Curraghmulmurry** to the north-west of the SAC, the small plantation consists of young Sitka Spruce (*Picea sitchensis*) planted in 1991, which occurs on cutover bog.

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 was wind-rowed to allow bog vegetation to re-colonise exposed peat surface. After blocking of drains, water-levels rose on the high bog plantations and bog vegetation started to recolonise.

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 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. Each 10m x10m quadrat was photographed annually and vegetation tables are presented below.

Quadrat 1: This quadrat is located on the north-western ern margin of Lisnageeragh Bog and occurred on cutover bog with vegetation containing Purple Moor-grass, Ling Heather, Cross-leaved Heath, Bog Asphodel, Carnation Sedge and Bog Bean. There are a number of pools present with *Sphagnum* moss. With the blocking of drains in the adjacent plantation, *Sphagnum* cover will increase and over time, this wet regenerating cutover bog will develop raised bog habitat.

Lisnageeragh Quadrat 1

Area: 10 x 10m Location: 5m West W1 Grid Ref: IM6550 6457 Altitude: 76m
 Bog Type: Cutover Bog Ecotope: NA Slope: Slight Aspect: West
 Landuse: Unplanted Management: Non-intervention

Date	22/08/2005	31/08/2006	22/08/2007	07/08/2008
Firmness	Very soft	Soft	Very soft	Very soft
Drains	No	No	No	No
Canopy Cover %	0	0	0	0
Canopy Height	0	0	0	0
Vegetation Cover %	90	95	90	90
Vegetation Height (m)	40	40	50	50
Dwarf Shrub Cover %	15	15	15	15
Herb Cover %	85	80	75	75
Bryophyte Cover %	50	50	50	55
Sphagnum cover %	40	30	25	30
Open Water %	10	5	15	10
Brash cover %	0	0	0	0
Pine Needle cover %	0	0	0	0
Pine Needle Depth cm	0	0	0	0
Bare Peat %	0	0	0	0
Species number	14	18	13	20
Species List				
<i>Salix</i> spp.				1
<i>Dactylorhiza</i>	2	1		
<i>Potentilla erecta</i>	1	1	1	2
<i>Equisetum</i>	3	1	5	5
<i>Succisa pratensis</i>			1	3
<i>Molinia caerulea</i>	60	60	50	50
<i>Myrica gale</i>		5	5	5
<i>Calluna vulgaris</i>	5	5	5	5
<i>Erica tetralix</i>	5	5	5	5
<i>Menyanthes trifoliata</i>	5	5	5	3
<i>Narthecium ossifragum</i>		5		5
<i>Carex panicea</i>	2	10	10	5
<i>Eriophorum vaginatum</i>	5			3
<i>E. angustifolium</i>				2
<i>Drosera rotundifolia</i>	2	2	1	1
<i>Campylopus atroverins</i>		20	25	20
<i>Hypnum jutlandicum</i>		10		
<i>Polytricum commune</i>	10			5
<i>S. capillifolium</i>	10	10	20	20
<i>S. subnitens</i>	15	10		5
<i>S. magellanicum</i>	15	10	5	5
<i>S. imbricatum</i>		1		

Lisnageeragh Quadrat 1, 2005



Lisnageeragh Quadrat 1, 2008



Quadrat 2: This quadrat is located on the north-western margin of Lisnageeragh Bog and occurred on open high bog with vegetation containing Ling Heather, Cross-leaved Heath, Hare's-tail Cottongrass, Bog Asphodel, Carnation Sedge and Deergrass. With the blocking of drains, the raised bog habitat of this bog margin will be protected from further damage.

Lisnageeragh Quadrat 2

Area: 10 x 10m **Location:** 40m West W3 **Grid Ref:** IM6539 6462 **Altitude:** 77m
Bog Type: High Bog **Ecotope:** SM **Slope:** Slight **Aspect:** North
Landuse: Unplanted **Management:** Non-intervention

Date	22/08/2005	31/08/2006	22/08/2007	07/08/2008
Firmness	Soft	Soft	V.Soft	V.Soft
Drains	No	No	No	No
Canopy Cover %	0	0	0	0
Canopy Height	0	0	0	0
Vegetation Cover %	90	98	95	95
Vegetation Height (m)	30	30	30	30
Dwarf Shrub Cover %	35	25	30	30
Herb Cover %	60	70	65	65
Bryophyte Cover %	40	35	35	45
Sphagnum cover %	35	35	35	35
Open Water %	0	2	5	3
Brash cover %	0	0	0	0
Pine Needle cover %	0	0	0	0
Pine Needle Depth cm	0	0	0	0
Bare Peat %	5	3	0	2
Species number	14	13	13	18
Species List				
<i>Calluna vulgaris</i>	25	15	20	20
<i>Erica tetralix</i>	10	10	10	10
<i>Narthecium ossifragum</i>	30	25	25	20
<i>Carex panicea</i>	5	10	10	10
<i>Trichophorum caespitosum</i>	10	15	10	5
<i>Eriophorium vaginatum</i>			10	10
<i>E. angustifolium</i>	5	5		5
<i>Rhyncospora alba</i>	8	5	10	20
<i>Drosera rotundifolia</i>	2	1	1	1
<i>Cladonia portentosa</i>	10	5	10	10
<i>C. uncialis</i>		1		1
<i>C. introflexus</i>	2			5
<i>Hypnum jutlandicum</i>	3			5
<i>S cuspidatum</i>			5	1
<i>S. capillifolium</i>	10	20	20	15
<i>S. tenellum</i>				3
<i>S. subnitens</i>	10	5	5	10
<i>S. magellanicum</i>	15	10	10	5

Lisnageeragh Quadrat 2, 2005



Lisnageeragh Quadrat 2, 2008



Quadrat 3: This quadrat is located on the south-eastern margin of Lisnageeragh Bog and occurred within closed canopy conifer plantation on high bog with vegetation containing some Purple Moor-grass, *Hypnum* moss and *Sphagnum recurvum* but mainly dominated by pine needles. With the felling of conifers and blocking of drains, Purple Moor-grass cover has increased. Over time, *Sphagnum* cover will increase and this wet bog margin will develop raised bog habitat.

Lisnageeragh Quadrat 3

Area: 10 x 10m **Location:** 5m West W4 **Grid Ref:** IM6711 6273 **Altitude:** 89m
Bog Type: High Bog **Ecotope:** NA **Slope:** Slight **Aspect:** East
Landuse: Forestry **Management:** Clear-fell

Date	30/08/2005	30/08/2006	22/08/2007	07/08/2008
Firmness	Dry	Firm	Soft	Soft
Drains	Yes	Yes	Yes/Blocked	Yes/Blocked
Canopy Cover %	0	5	0	0
Canopy Height	0		0	0
Vegetation Cover %	45	30	90	80
Vegetation Height (m)		20	30	50
Dwarf Shrub Cover %		5	5	10
Herb Cover %	15	25	50	70
Bryophyte Cover %	30	40	35	40
Sphagnum cover %	15	7	1	2
Open Water %	0	2	20	10
Brash cover %	30	30	5	5
Pine Needle cover %	25	40	20	1
Pine Needle Depth cm	10	10	5	1
Bare Peat %	0	0	5	4
Species number	9	14	12	15
<i>Pinus contorta</i>		5		
<i>Picea sitchensis</i>				1
<i>Rubus spp</i>	5	1	3	5
<i>Rumex acetosella</i>			2	1
<i>Potentilla erecta</i>		1	5	5
<i>Juncus eff</i>			15	10
<i>Juncus sq.</i>				10
<i>Molinia caerulea</i>	10	15	20	35
<i>Holcus lanatus</i>		1		
<i>Agrostis spp</i>			3	5
<i>Pteridium spp</i>		1	2	1
<i>Dryopteris spp</i>	1			
<i>Calluna vulgaris</i>		5	5	10
<i>Campylopus atroverins</i>	2		5	5
<i>C. introflexus</i>		1		
<i>Hypnum jutlandicum</i>	10	30	20	20
<i>Polytricum commune</i>	2	5	10	13
<i>Sphagnum recurvum</i>	5	1		1
<i>S. capillifolium</i>	5	5		
<i>S. subnitens</i>	5			
<i>S. magellanicum</i>		2	1	1

Lisnageeragh Quadrat 3, 2008



Quadrat 4: This quadrat is located on the south-western margin of Lisnageeragh Bog and occurred within closed canopy conifer plantation on high bog with vegetation containing Purple Moor-grass and *Hypnum* moss, but ground layer dominated by pine needles. With the felling of conifers and blocking of drains, Ling Heather and Purple Moor-grass cover has increased. Over time, *Sphagnum* cover will increase and this wet bog margin will develop raised bog habitat

Lisnageeragh Quadrat 4

Area: 10 x 10m **Location:** 15m SW W5 **Grid Ref:** M6705 6248 **Altitude:** 92m
Bog Type: High Bog **Ecotope:** NA **Slope:** Slight **Aspect:** North
Landuse: Forestry **Management:** Clear-fell

Date	30/08/2005	30/08/2006	22/08/2007	07/08/2008
Firmness	Very Dry	Firm	Firm	Soft
Drains	Yes	Yes	Yes/Blocked	Yes/Blocked
Canopy Cover %	0	0	0	0
Canopy Height	0	0	0	0
Vegetation Cover %	25	20	50	75
Vegetation Height (m)	5	5	10	20
Dwarf Shrub Cover %	0	10	30	40
Herb Cover %	10	10	20	35
Bryophyte Cover %	15	20	25	45
Sphagnum cover %	0	0	0	1
Open Water %	0	0	5	5
Brash cover %	10	30	10	5
Pine Needle cover %	60	50	40	10
Pine Needle Depth cm	10	10	5	5
Bare Peat %	5	9	5	5
Species number	7	6	12	14
<i>Pinus contorta</i>		1		
<i>Picea sitchensis</i>				1
<i>Ulex eurpoeus</i>				1
<i>Rubus spp</i>			3	5
<i>Rumex acetosella</i>			1	5
<i>Digitalis purpurea</i>			5	3
<i>Juncus eff</i>			1	1
<i>Luzula spp</i>			1	
<i>Molinia caerulea</i>	5	7	5	15
<i>Agrostis spp</i>			3	5
<i>Pteridium spp</i>		1	3	1
<i>Calluna vulgaris</i>			30	40
<i>Campylopus atroverins</i>			10	
<i>C. introflexus</i>	2	15		
<i>Hypnum cupressiforme</i>				
<i>Hypnum jutlandicum</i>	10		10	10
<i>Polytricum commune</i>	3	5	5	5
<i>Sphagnum recurvum</i>		1		
<i>S. magellanicum</i>				1

Lisnageeragh Quadrat 4, 2008



Quadrat 5: This quadrat is located on the eastern margin of Lisnageeragh Bog within regenerating conifers on high bog after a recent plantation fire. The vegetation is dominated by densely growing young conifers and supports Purple Moor-grass and Ling Heather with *Sphagnum recurvum* and abundant *Hypnum* moss. With the felling to waste of conifers and blocking of drains, Purple Moor-grass and Ling Heather cover increased. *Sphagnum* cover will increase over time and this wet bog margin will develop raised bog habitat.

Lisnageeragh Quadrat 5

Area: 10 x 10m **Location:** 15m East W5 **Grid Ref:** IM6717 6282 **Altitude:** 89m
Bog Type: High Bog **Ecotope:** NA **Slope:** Slight **Aspect:** East
Landuse: Forestry **Management:** Fell to Waste

Date	30/08/2005	30/08/2006	22/08/2007	07/08/2008
Firmness	Firm	Firm	Soft	Soft
Drains	Yes	Yes	Yes/Blocked	Yes/Blocked
Canopy Cover %	100	0	0	0
Canopy Height	5	0	0	0
Vegetation Cover %	100	35	65	75
Vegetation Height (m)	50	50	80	50
Dwarf Shrub Cover %	8	5	5	20
Herb Cover %	7	30	45	55
Bryophyte Cover %	85	70	65	55
Sphagnum cover %	20	40	25	15
Open Water %	0	5	5	5
Brash cover %	0	50	10	5
Pine Needle cover %	10	10	15	10
Pine Needle Depth cm	10	5	5	5
Bare Peat %	0	10	5	5
Species number	7	10	6	14
<i>Pinus contorta</i>	100	1		
<i>Betula pubescens</i>				1
<i>Salix</i> spp.				1
<i>Rumex acetosella</i>				2
<i>Luzula</i>				2
<i>Molinia caerulea</i>	5	30	40	45
<i>Agrostis</i> spp				1
<i>Vaccinium myrtillus</i>	3	2		5
<i>Myrica gale</i>		1		
<i>Calluna vulgaris</i>	5	2	5	15
<i>Trichophorum caespitosum</i>		1		
<i>Eriophorium vaginatum</i>				3
<i>Cladonia portentosa</i>	2			
<i>Hypnum jutlandicum</i>	65	5	40	40
<i>Polytricum commune</i>				2
<i>Sphagnum recurvum</i>	20			1
<i>S. cuspidatum</i>				4
<i>S. capillifolium</i>		15	10	
<i>S. subnitens</i>		15	10	10
<i>S. magellanicum</i>		10	5	

Lisnageeragh Quadrat 5, 2008



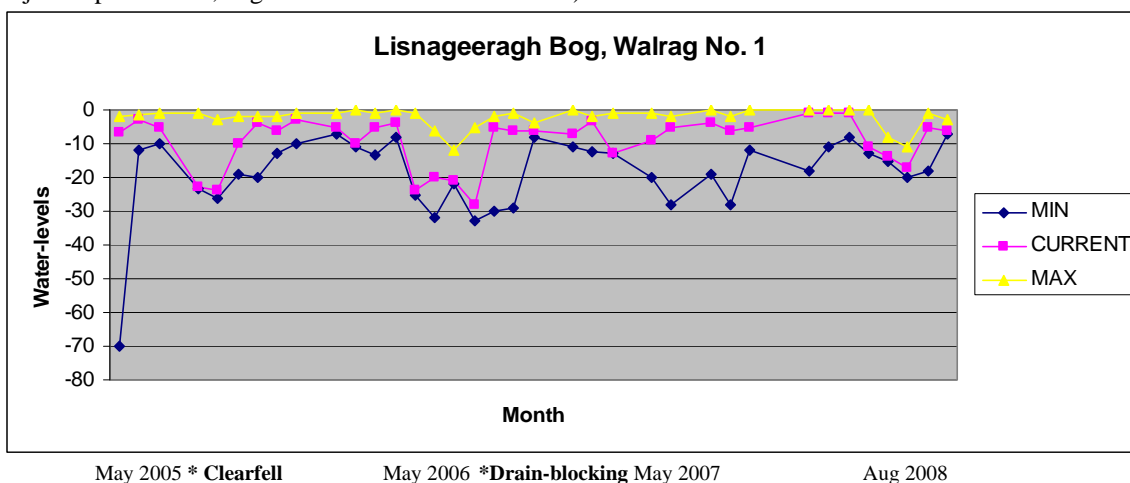
7. Changes in Water-levels

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 **60cm** below the surface. With the removal of conifers and drain-blocking, there was a rise in the water-table in the plantations on the high bog and the water-table remains close to the bog surface throughout most of the year.

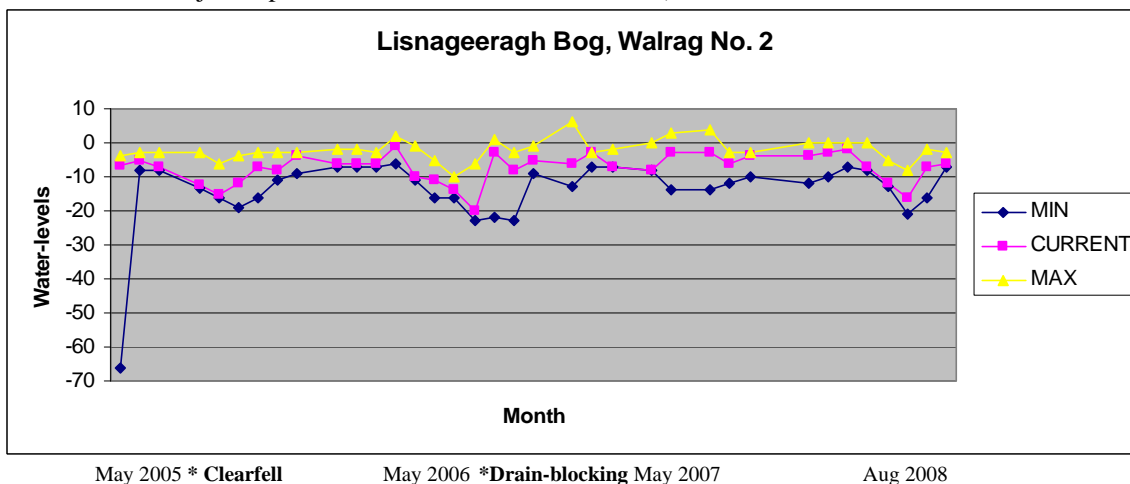
8. Hydrological Monitoring (Walrag) Graphs

During the clear-felling operation, eight Walrags were installed on this site to record the changes in water-levels. The rise in water-levels is clearly seen in the following graphs.

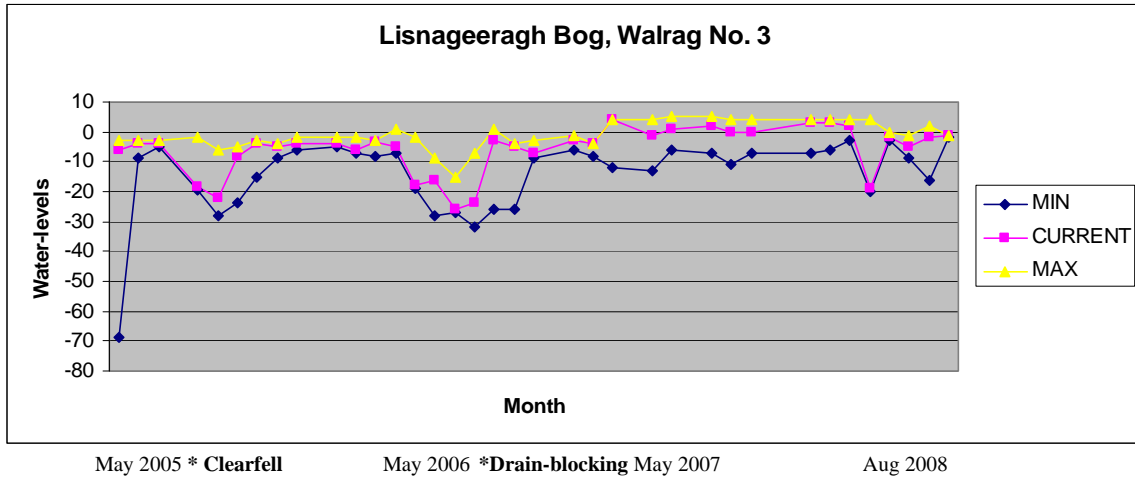
Lisnageeragh Bog Walrag 1: Open High Bog. (Water-levels within 20cm of surface post restoration* on adjacent plantations, slight decline in summer months)



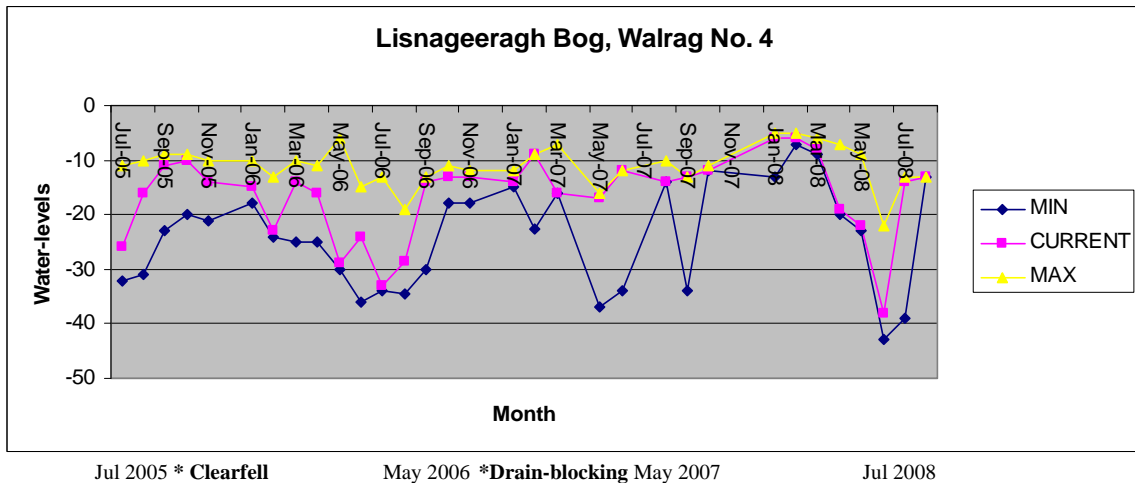
Lisnageeragh Bog Walrag 2: Open Cutover Bog. (Water-levels remain within 10cm of surface post restoration * on adjacent plantations, lower in summer months)



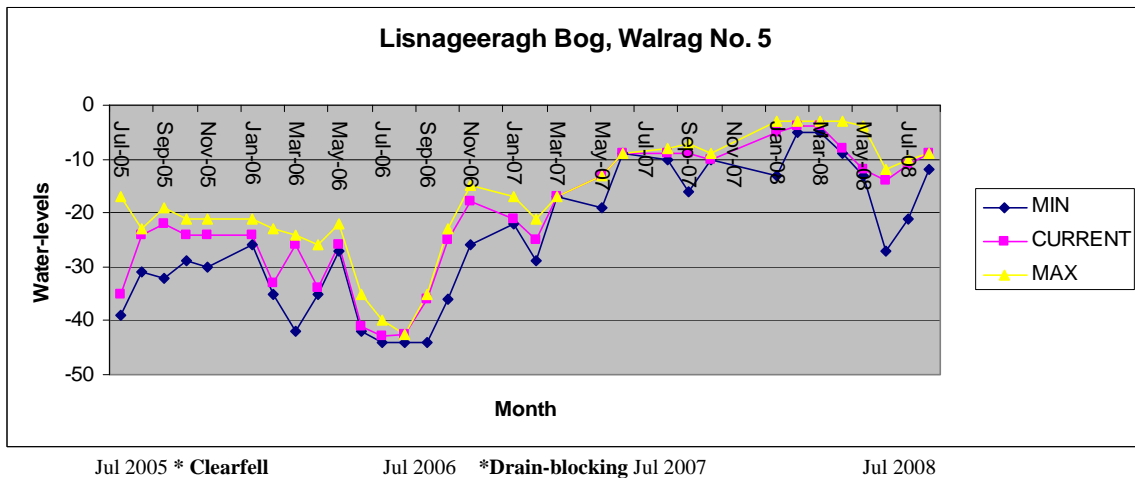
Lisnageeragh Bog Walrag 3: Open High Bog. (Water-levels within 10cm of surface post restoration* on adjacent plantations, slight decline in summer months)



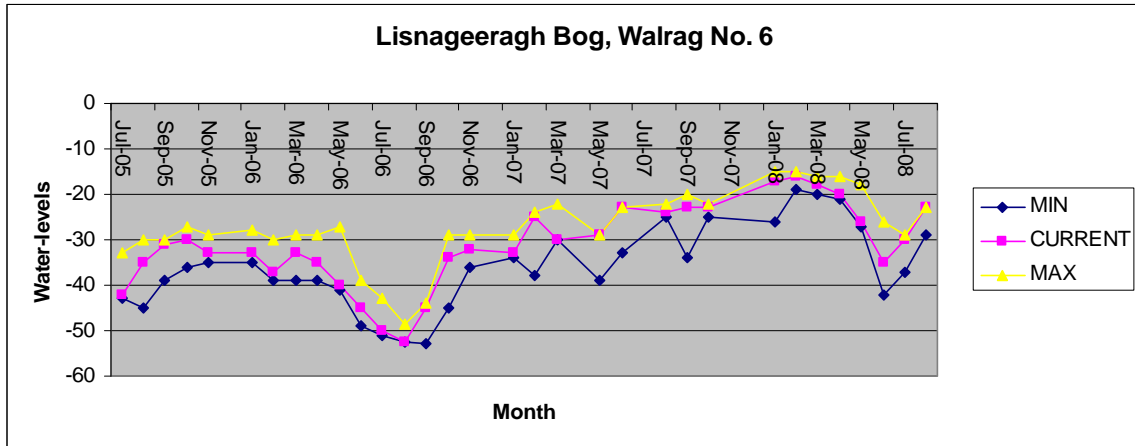
Lisnageeragh Bog Walrag 4: Closed Canopy on High Bog. (Water-levels remain below 20cm of surface post restoration*, lower in summer months)



Lisnageeragh Bog Walrag 5: Closed Canopy Conifer Plantation on High Bog. (Distinct rise in water-levels to within 10cm of bog surface post restoration*, slight decline in summer months)

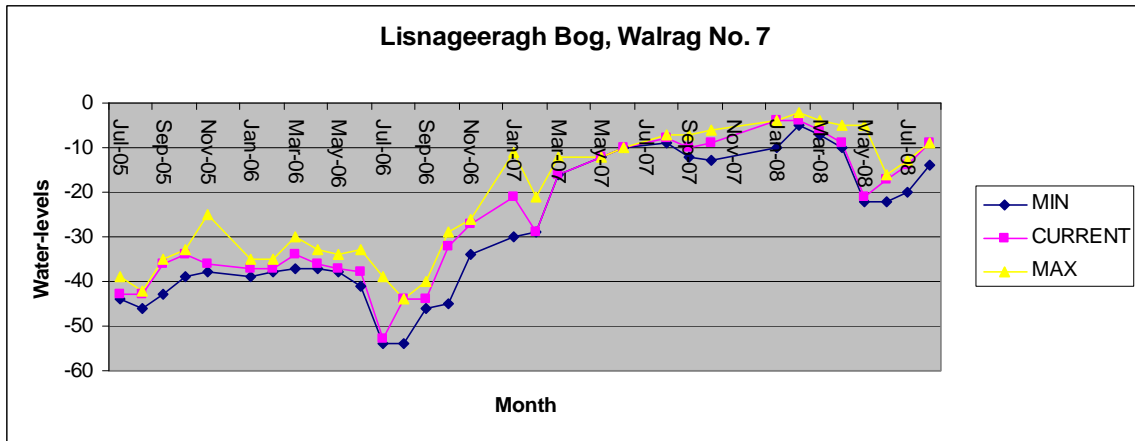


Lisnageeragh Bog Walrag 6: Closed Canopy Conifer Plantation on High Bog. (Distinct rise in water-levels post restoration*, decline in summer months)



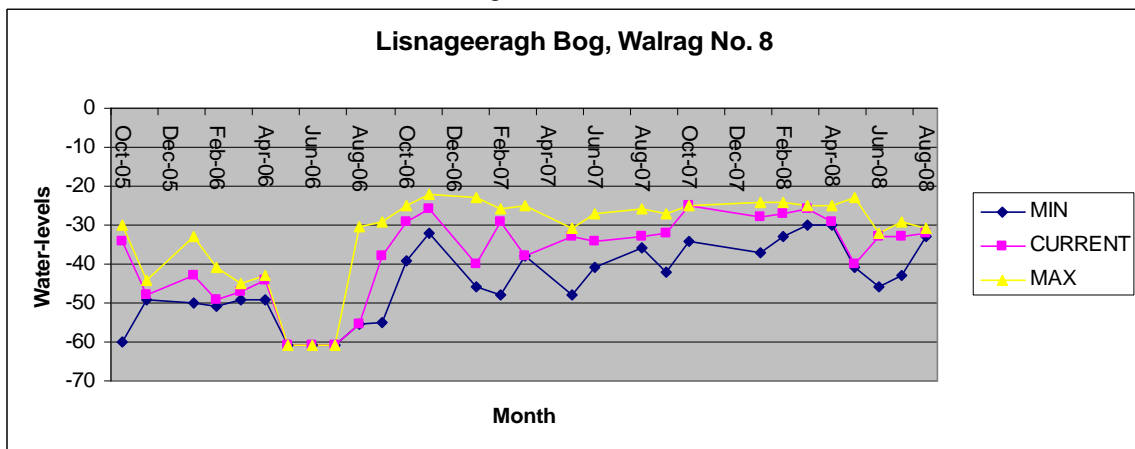
May 2005 * Clearfell May 2006 * Drain-blocking May 2007 Aug 2008

Lisnageeragh Bog Walrag 7: Closed Canopy Conifer Plantation on High Bog. (Distinct rise in water-levels post restoration*, slight decline in summer months).



Jul 2005 * Clearfell Jul 2006 * Drain-blocking Jul 2007 Jul 2008

Lisnageeragh Bog Walrag 8: Fell to Waste on High Bog. (Distinct rise in water-levels post restoration*, but water-levels remain below 30cm of the bog surface).



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

9. Conclusion

Although bog vegetation is slow to recolonise the clear-fell areas, there has been a distinct rise in water-levels within these areas post restoration. If these high water-levels are maintained within the project area raised bog habitat will become established over time.

10. References

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