

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

A REPORT ON THE RESTORATION OF PROJECT SITE No. 9

KILLYCONNY BOG, Co. CAVAN



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Project Site No. 9 - Killyconny Bog, Co. Cavan

1. Introduction

Grid Reference IN6700 8203	Elevation (m) 125	Bedrock Geology Limestone
SAC Name and Number Killyconny Bog cSAC (006)	Project Site Area (ha) 11.6	Main Restoration Methods Clear-fell mature conifer crop Block drains with peat dams Control natural regeneration
SAC Area (ha) 191		
Area of Conifer Cover (ha) 11.6	Area of Open Bog (ha) 0	Area of Birch Woodland (ha) 0
Noteworthy habitats/plant/animal species present Merlin were noted breeding adjacent to the site.		

General site description

Killyconny Bog is a small to medium-sized raised bog located 7km south-east of Virginia, Co. Cavan, close to the Cavan/ Meath border. This raised bog is comprised of two peat basins which have fused over a mineral ridge. In the past peat-cutting was extensive here and, as a result, the bog is now surrounded by large areas of cutover and the high bog is rather dry, especially along the cutover margins of high bog. The present intensity of peat-cutting is rather low with most of the cutover areas well vegetated by Common Cottongrass (*Eriophorum angustifolium*), Hare's tail Cottongrass (*E. vaginatum*) and Ling Heather (*Calluna vulgaris*). An area of planted conifers owned by Coillte occurs on cutover at the south-western end of the site.

Project Site Description (Pre-restoration)

The project site consists of 11.6 hectares of conifer plantation on cutover bog at the south-western end of the site. The site was surveyed in 2003, prior to restoration, which found that these conifers consisted largely of 24 year old Lodgepole Pine (*Pinus contorta*) and generally reached heights of between 5 and 8 metres (Conaghan, 2003). There were also areas where planted Downy Birch (*Betula pubescens*) was common. The northern section of the plantation was very dry with few, if any, active drains visible. In view of the dry nature of this portion of the plantation, this area will be subject to invasion by species such as Birch, Willow (*Salix* spp.) and Bramble (*Rubus* spp.).

Bog vegetation adjoins the plantation along the southern and eastern margins with a bog road occurring along the western and northern margins. To the east there is old cutover (not active) dominated by varying mixtures of Common Cotton-grass, Hare's-tail Cotton-grass and Ling Heather while to the south there is an area of uncut high bog dome. However, this uncut area is very dried out and, as a result the vegetation is dominated by Ling Heather, with sub-dominant Deer-grass (*Trichophorum caespitosum*). There are also many large cracks in the peat surface, especially in areas within 30 metres of the plantation edge (Conaghan, 2003).

Restoration Actions

At this site the main restoration measures undertaken were the clear-felling and removal of the mature conifer crop, 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. Birch woodland will be allowed to establish on the drier sections of cutover.

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 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 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

Prior to restoration, the ground vegetation underneath the tree canopy was very sparse with only the mosses *Hypnum cupressiforme* and *Thuidium tamariscinum* occurring with any degree of frequency. Other occasional plant species of the plantation floor included Broad Buckler-fern (*Dryopteris dilatata*), Hard fern (*Blechnum spicant*), Bramble, Bilberry (*Vaccinium myrtillus*) and Rowan (*Sorbus aucuparia*). However these species were largely confined to small breaks in the canopy where there was some light penetration. There was quite a prominent drainage network in the northern half of the plantation and these flowed into a deep drain which runs along the eastern edge of the plantation (Conaghan, 2003).

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 significant rise in the water-table, which allowed for the colonisation of *Sphagnum* mosses. A small section of Birch woodland was retained at the northern margin of the site, where the substrate is dry with few drains.

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. Three 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 a 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 towards the western margin of the plantation and occurred under closed canopy conifers with a ground cover containing some *Sphagnum recurvum*, but mainly consisted of pine needles. With the felling of the conifers and blocking of drains, it can be seen that Ling Heather cover and *Sphagnum* cover increased along with Purple Moor-grass and Bramble. Over time, if conditions remain wet, *Sphagnum* cover will increase further and the invasive Bramble will die out.

Killyconny Quadrat 1

Area: 10 x 10m

Location: 10m South W4

Grid Ref: N6710 8212

Altitude: 109m

Bog Type: Cutaway

Ecotope: NA

Slope Flat

Aspect: NA

Landuse: Forestry

Management: Clearfell

Date	04/08/2005	01/08/2006	09/08/2007	18/07/2008
Firmness	V Dry	Dry	Dry	Dry/Firm
Drains	Yes	Yes/Blocked	Yes/Blocked	Yes/Blocked
Canopy Cover %	90	0	0	0
Canopy Height	5m	0	0	0
Vegetation Cover %	20	25	40	55
Vegetation Height (cm)	5	5	30	50
Dwarf Shrub Cover %	0	1	10	10
Herb Cover %	8	20	30	45
Bryophyte Cover %	12	10	15	30
Sphagnum cover %	2	0	5	10
Open Water %	0	10	10	5
Brash cover %	5	20	10	20
Pine Needle cover %	80	40	40	10
Pine Needle Depth cm	10	5	5	1
Bare Peat %	0	5	0	10
Species number	9	12	7	12
<i>Pinus contorta</i>	80	0	0	0
<i>Betula pubescens</i>	10	3	2	5
<i>Quercus spp</i>		1		
<i>Rubus spp</i>	5	5	10	15
<i>Lonicaria periclymenum</i>		1		
<i>Gernanium robertanum</i>		1		
<i>Typha latifolia</i>		1		
<i>Luzula multiflora</i>		5		1
<i>Molinia caerulea</i>		1	15	15
<i>Agrostis spp</i>	3	2		
<i>Pteridium spp</i>	3			5
<i>Dryopteris spp</i>		1		
<i>Epiolobium spp</i>			3	5
<i>Myrica gale</i>		1		
<i>Calluna vulgaris</i>			10	10
<i>Hypnum cupressiforme</i>	1	10		5
<i>Hypnum jutlandicum</i>	5		10	10
<i>Polytricum commune</i>				5
<i>Dicranium spp</i>	2			
<i>Sphagnum recurvum</i>	2			5
<i>S cuspidatum</i>			5	5

Quadrat 1, Aug 2005



Quadrat 1, Aug 2007



Quadrat 2: This quadrat is located towards the northern margin of the plantation and occurred under mixed woodland of conifers and birch with a sparse groundflora containing some *Sphagnum recurvum*, but mainly dominated by Buckler Fern. With the felling of the conifers and blocking of drains, it can be seen that Ling Heather cover increased along with Bracken and Bramble. This area has remained dry, despite drain-blocking and Birch woodland will establish here at the bog margin.

Killyconny Quadrat 2

Area: 10 x 10m

Location: 10m North W2

Grid Ref: N6727 8222

Altitude: 110m

Bog Type: Cutaway

Ecotope: NA

Slope: Flat

Aspect: NA

Landuse: Forestry

Management: Fell to Waste

Date	04/08/2005	01/08/2006	09/08/2007	18/07/2008
Firmness	Dry	Dry	Dry	Dry/Firm
Drains	Yes	Yes/Blocked	Yes/Blocked	Yes/Blocked
Canopy Cover %	60	5	5	5
Canopy Height	5	5	2	2
Vegetation Cover %	70	30	55	70
Vegetation Height (cm)		15	30	30
Dwarf Shrub Cover %	0	0	5	40
Herb Cover %	55	20	50	30
Bryophyte Cover %	50	10	10	40
Sphagnum cover %	5	0	0	0
Open Water %	0	0	0	0
Brash cover %	20	20	15	10
Pine Needle cover %	30	30	25	5
Pine Needle Depth cm	1	5	5	1
Bare Peat %		20	5	15
Species number	10	6	6	11
<i>Pinus contorta</i>	20	0	0	0
<i>Betula pubescens</i>	40	10	10	10
<i>Sorbus</i>		1		
<i>Ilex aquilinum</i>	1			
<i>Rubus spp</i>	2	2	5	5
<i>Hedera helix</i>	1			
<i>Rumex acetosella</i>		1	10	1
<i>Lonicaria periclymenum</i>	1			
<i>Luzula multiflora</i>				1
<i>Molinia caerulea</i>				2
<i>Agrostis spp</i>		10		
<i>Pteridium spp</i>			20	10
<i>Dryopteris spp</i>	50			
<i>Epiobium spp</i>				1
<i>Calluna vulgaris</i>			5	40
<i>Campylopus atroverins</i>			5	
<i>Hypnum cupressiforme</i>		10		10
<i>Hypnum jutlandicum</i>	35		10	25
<i>Polytricum commune</i>	10			5
<i>Sphagnum recurvum</i>	5			

Quadrat 2, Aug 2005



Quadrat 2, July 2008



Quadrat 3: This quadrat is located towards the centre of the plantation and occurred under an open canopy of conifers along a firebreak with groundflora containing *Sphagnum* mosses but mainly dominated by Ling Heather. With the felling of the conifers and blocking of drains, it can be seen that Ling Heather cover decreased and *Sphagnum* cover increased along with Purple Moor-grass and Hare's-tail Cottongrass.

Killyconny Quadrat 3

Area: 10 x 10m

Location: 10m North W1 **Grid Ref:**N6718 8210

Altitude: 114m

Bog Type: Cutaway

Ecotope: NA

Slope: Flat

Aspect: NA

Landuse: Forestry

Management: Clearfell

Date	04/08/2005	01/08/2006	09/08/2007	18/07/2008
Firmness	Firm	V Soft	V. Soft	V. Soft
Drains	Yes	Yes/Blocked	Yes/Blocked	Yes/Blocked
Canopy Cover %	40	0	0	0
Canopy Height	5	0	0	0
Vegetation Cover %	60	75	50	60
Vegetation Height (cm)	5	5	30	50
Dwarf Shrub Cover %	40	10	10	5
Herb Cover %	1	20	40	55
Bryophyte Cover %	55	40	80	80
Sphagnum cover %	50	35	65	70
Open Water %	0	20	50	20
Brash cover %	10	0	0	0
Pine Needle cover %	30	5	1	0
Pine Needle Depth cm		10	1	0
Bare Peat %		0	1	0
Species number	10	11	16	16
<i>Pinus contorta</i>	40	1	1	0
<i>Betula pubescens</i>	1	5	2	2
<i>Potentilla erecta</i>			1	1
<i>Juncus</i> eff			5	4
<i>Luzula multiflora</i>		10		
<i>Molinia caerulea</i>			10	20
<i>Vaccinium myrtillus</i>	1			
<i>Myrica gale</i>		10		
<i>Calluna vulgaris</i>	40		10	5
<i>Carex</i> spp				3
<i>Trichophorum caespitosum</i>		2		
<i>Eriophorium vaginatum</i>			5	20
<i>E. angustifolium</i>	1		10	5
<i>Campylopus atroverins</i>				5
<i>Hypnum cupressiforme</i>		10	5	
<i>Hypnum jutlandicum</i>	4			5
<i>Polytricum commune</i>			5	
<i>Sphagnum recurvum</i>	10	5	5	5
<i>S. cuspidatum</i>			30	25
<i>S. capillifolium</i>	20		20	20
<i>S. subnitens</i>	20	20		5
<i>S. magellanicum</i>			10	15
Algae spp.				10

Quadrat 3, Aug 2005



Quadrat 3, July 2008



Over time, if conditions remain wet, *Sphagnum* cover will increase further and active peat formation may be established. It should be noted that an algal blooms occur due to a flush of nutrients after clear-felling, but this should reduce over time as ombrotrophic conditions return.

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 significant rise in the water-table within the project site. Extensive areas of open water were created and the water-table remains close to the bog surface throughout most of the year.

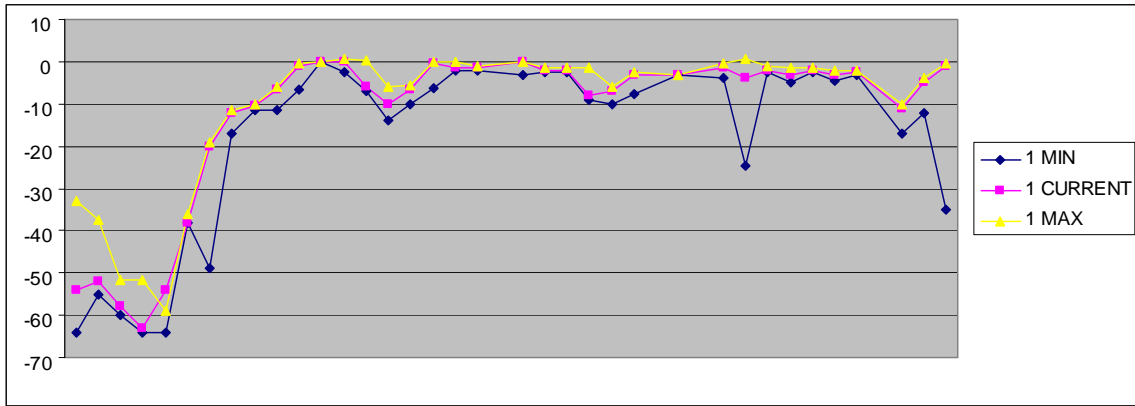


Water-levels rise on Killyconny after clear-felling

8. Hydrological Monitoring (Walrag) Graphs

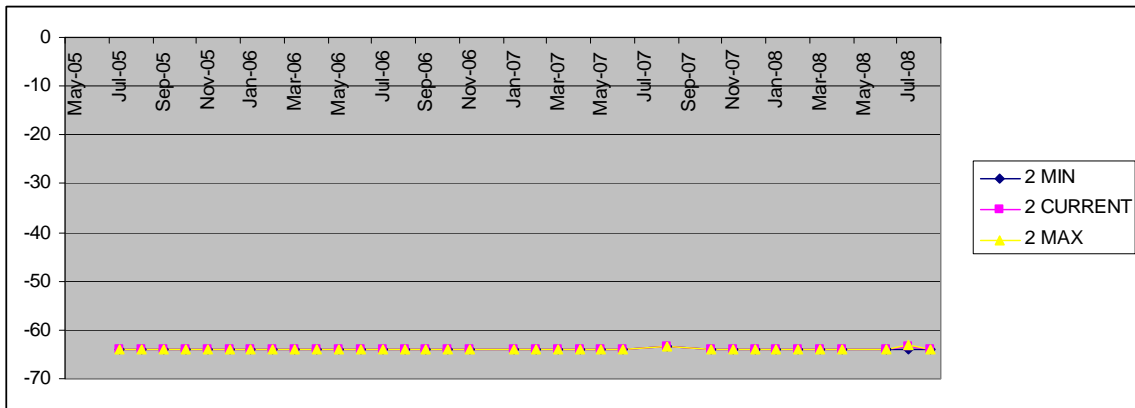
During the clear-felling operation, six Walrags were installed on this site to record the changes in water-levels. The rise in water-levels is clearly seen in the following graphs.

Killyconny Bog Walrag 1 (Cutover Bog, distinct rise in water-levels post restoration*)



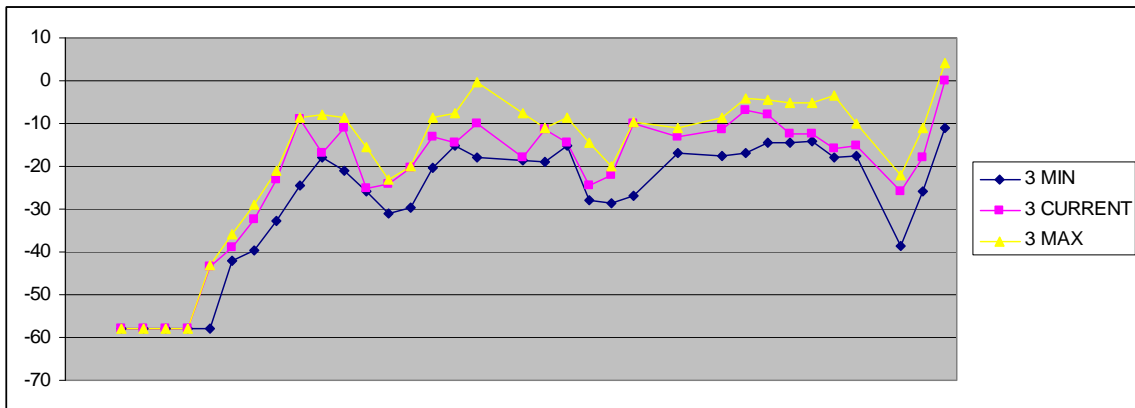
May 2005 (Installed) * May 2006 *Clearfell & Drain-blocking May 2007 Aug 2008

Killyconny Bog Walrag 2 (Dry Woodland Margin, no rise in water-levels)



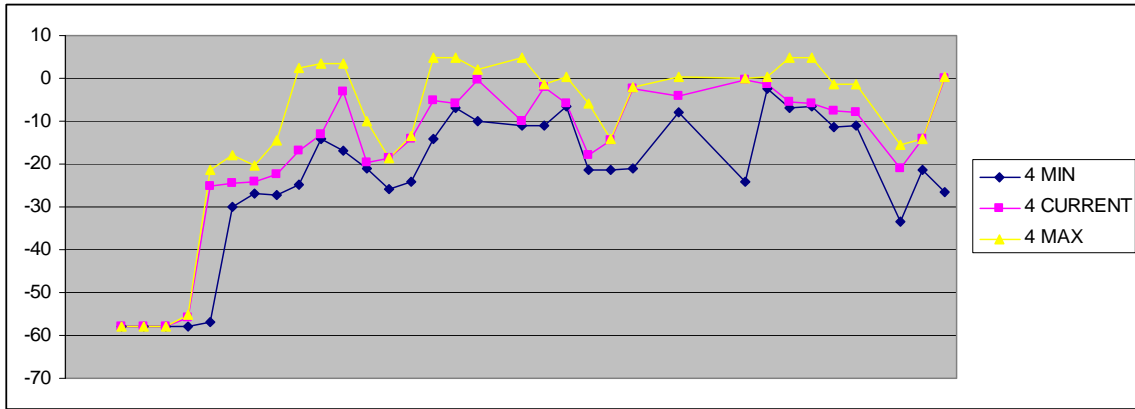
May 2005 (Installed) * May 2006 *Clearfell & Drain-blocking May 2007 Aug 2008

Killyconny Bog Walrag 3 (Cutover Bog, distinct rise in water-levels post restoration*)



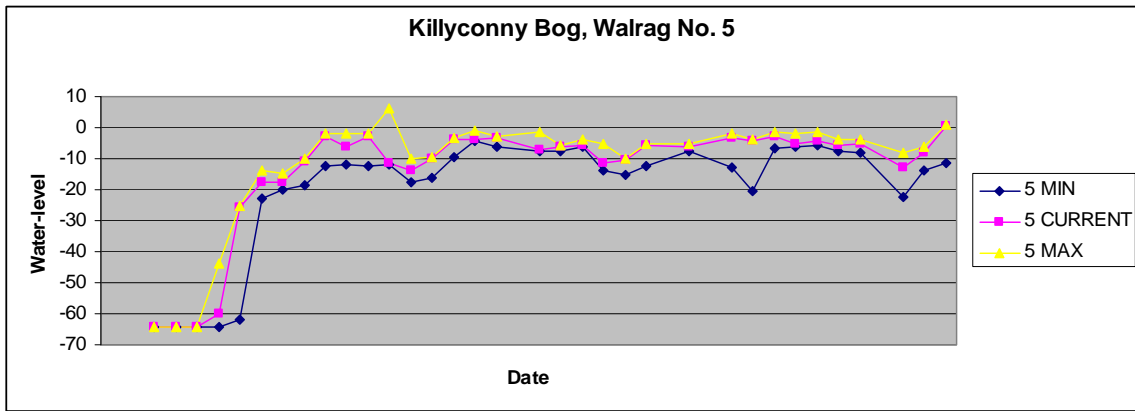
May 2005 (Installed) * May 2006 *Clearfell & Drain-blocking May 2007 Aug 2008

Killyconny Bog Walrag 4 (Cutover Bog, distinct rise in water-levels post restoration*)



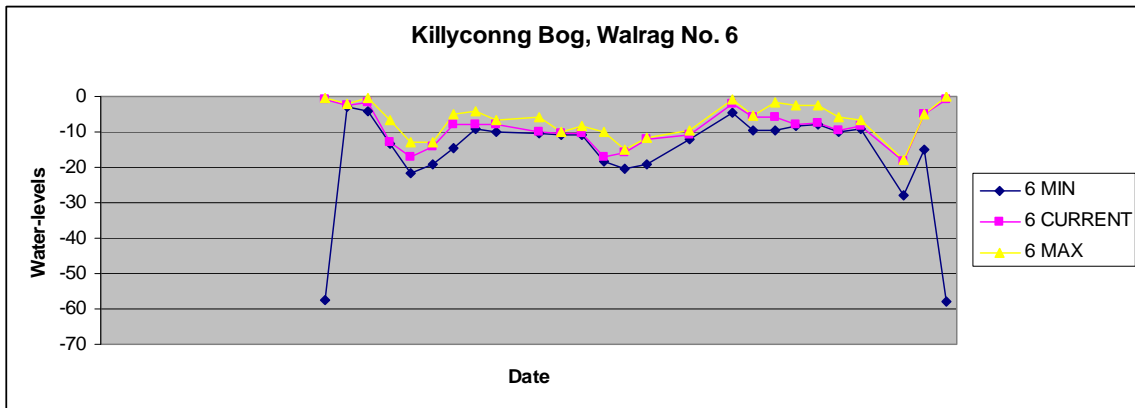
May 2005 (Installed) * May 2006 May 2007 Aug 2008
 *Clearfell & Drain-blocking

Killyconny Bog Walrag 5 (Cutover Bog, distinct rise in water-levels post restoration*)



May 2005 (Installed) * May 2006 May 2007 Aug 2008
 *Clearfell & Drain-blocking

Killyconny Bog Walrag 6 (Cutover Bog, high water-levels post restoration*)



May 2005 * May 2006 (Installed) May 2007 Aug 2008
 *Clearfell & Drain-blocking

9. Conclusion

This is one of the few relatively extensive areas of raised bogs remaining in the north-east of the country and any rehabilitation carried out, on the cutover areas, will ultimately enhance the conservation value of the site.

There has been a significant rise in water-levels on this site as a result of clear-felling and drain blocking. Furthermore in the wetter areas *Sphagnum* moss is dominating and active peat formation is likely, if conditions remain favourable.

10. References

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