An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

2014

Review of Raised Bog Natural Heritage Area Network

Review of Raised Bog Natural Heritage Area Network

Summary

This document sets out the outcome of the review of the Natural Heritage Area (NHA) raised bogs network in Ireland. As part of the review over 270 raised bog sites were examined including 53 SAC raised bogs, the existing 75 NHA raised bogs, and over 100 other non-designated sites including many in public ownership.

The objectives of the review are to meet nature conservation obligations while having regard to national and local economic, social and cultural needs.

As a result of the review a reconfigured NHA network is proposed. That network has the following advantages over the current network:

1. The areas of both *Active Raised Bog* and *Degraded Raised Bog Still Capable of Natural Regeneration* (both protected habitats under the Habitats Directive) will be greater in the new network than in the current network.
2. The new network will significantly improve the geographical range of protected sites to the East, South, West and North.
3. In the short to medium term losses of active bog will be reduced, due to the lower intensity of recent turf-cutting in the new network.
4. Management complexity in the new network will be much lower due the lower number of sites, high bog area and number of active turf cutters and landowners.
5. The inclusion of some large Bord na Mona sites will facilitate more rapid restoration in comparison to smaller privately owned sites.
6. Costs to the tax-payer will be greatly reduced due to the smaller number of turf-cutters requiring to stop turf-cutting and requiring compensation (over. 2,500 fewer turf-cutters will be affected in the new network).

The Active Raised Bog national conservation objective is to achieve 3,600ha in the future in order to achieve favourable conservation status, which is a requirement of the Habitats

Directive. The new NHA network will contribute 765ha of Active Raised Bog to the achievement of that target. The remainder will be achieved in the Special Areas of Conservation.

The review identifies a series of steps to ensure that Ireland meets its Habitats Directive obligation to maintain or restore raised bog habitat to favourable conservation status and its Environmental Impact Assessment Directive obligations relating to the regulation of turf cutting on NHAs.

To meet this objective would require:

- The effective cessation of turf cutting on 36* NHAs, by 1 January 2017, in order to preserve their conservation value. Management plans, which will be subject to environmental assessment, will be prepared for each site, similar to those being prepared for the raised bog SACs.

- Existing levels of turf-cutting on these sites may continue until 2017 pending the development of management plans, subject to individual permit of turf bank owners and contractors, to prevent expansion of cutting in these sites. The compensation scheme available to SAC turf-cutters will be extended to these NHAs in 2014 to incentivise earlier cessation of cutting.

- That turf-cutting may continue on the remaining 46* NHAs whose conservation is not required to achieve national conservation objectives. The Minister will move to de-designate these sites and will undertake environmental assessment as part of the de-designation process.

- The designation as NHAs of 25 currently undesignated raised bogs, which are either in public ownership or where there is reduced turf-cutting pressure, to compensate for those NHA bogs where cutting is proposed to continue. Management plans will be developed for these bogs as above and any turf-cutting to be phased out by 2017. Compensation schemes will be made available to affected turf-cutters. The designation process for these new sites will commence later in 2014. Until that time, the names and locations of these sites will not be published.

- Each management plan will contain a set of time-bound actions to ensure that the conservation objectives are met.

This review should be read in conjunction with the overall draft National Peatlands Strategy and draft National Raised Bog SAC Management Plan.

*It has been possible to subdivide seven current NHAs in such as way as to allow for a continuation of turf-cutting in one part and conservation elsewhere on the site. This leads to 82 separate units within the original 75 NHAs.

Introduction

Ireland has designated 75 Natural Heritage Areas (NHAs) under national law (the Wildlife Acts, 1976 to 2010) for the protection of raised bog habitats. The NHAs complement the main areas of protected raised bog in Ireland which have been nominated as Special Areas of Conservation (SACs) in accordance with the Habitats Directive. The SAC raised bog network contains most of the national resource of the two relevant habitat types listed in the Habitats Directive: *Active Raised Bog* and *Degraded Raised Bogs Still Capable of Natural Regeneration*.

Additional habitat within the NHA network makes a contribution to the overall objectives of the Habitats Directive to maintain or restore these habitats to favourable conservation status (Article 2.2). Nonetheless, the SAC raised bog network - to which considerable effort and resources have been devoted since 2011 - remains the bedrock of Ireland's response to the conservation of raised bog under the Habitats Directive.

The designation of NHA raised bogs has also been identified as a qualifying criteria for applying the requirements of the Environmental Impact Assessment Directive, primarily through the operation of the planning system.

The Need for a Review

In a mirror of the "derogation" granted for continued domestic cutting on SAC raised bogs, a similar de facto 10 year derogation operated in respect of the 75 raised bogs designated for protection in 2004 under the Wildlife Acts. In that regard, the previous Government in May 2010 decided that cutting should end on raised bog NHAs from the beginning of 2014.

However, recognising that the same legal regime did not apply to NHAs as to SACs, the present Government in April 2011, when moving to ensure that SAC raised bogs were subject to the full requirements of the Habitats Directive, also decided to carry out a scientific review of the NHA raised bogs in advance of the 2014 turf cutting season.

This review was carried out by environmental consultants (RPS Ltd), with oversight by a Steering Committee which included technical experts and stakeholders from the Peatlands Council.

Aims of the Review

The aims of the scientific assessment of the NHA Raised Bog network and the non-designated raised bog sites of potential conservation value were to:

- fundamentally review the current raised bog NHA network in terms of its contribution to the national conservation objective for raised bog habitats;
- scientifically determine the most suitable sites to replace the losses of active raised bog habitat and high bog areas within the SAC network (which was required for the National Raised Bog SAC Management Plan) and to enhance the national network of NHAs; and
- to meet nature conservation obligations while having regard to national and local economic, social and cultural needs.

The main task has been to assess how the NHA network could contribute to the national conservation objective of restoring the Active Raised Bog habitat to favourable conservation status, while avoiding unnecessary impacts on the traditional rights of land-owners / turf-cutters and minimising the cost to the tax-payer arising from compensation and restoration.

Network Review Methodology

This section sets out the process used to select potential NHA and non-designated raised bogs to fulfil the conservation objective of replacing lost habitat and to review the current NHA network while having regard to national and local economic, social and cultural needs.

In order that the selection process adopts a sustainable approach, the selection criteria, while including the primary environmental and technical factors essential for a raised bog's existence now and into the future, also consider the supporting economic and social criteria. Such integration of environmental, technical and socio-economic knowledge, which attempts to balance the competing objectives of economic efficiency, social equity and environmental sustainability is employed by the internationally accepted Integrated Water Resources Management (IWRM) approach.

Multi Criteria Analysis (MCA) is an established decision support methodology (also often referred to as Multi Criteria Decision Analysis) enabling integration of these criteria to identify the bogs most suitable as replacement SAC habitats and those most suitable as part of a reviewed NHA network. A variety of MCA methods are available with a weighted score method being selected as a suitable technique for this application. Similar approaches have been applied in EU Member States to implement a variety of Plans and Programmes and a similar analysis is being applied in Ireland to support the Floods Directive implementation process.

This MCA approach demonstrates full consideration of environmental, technical and socio-economic factors in a logical and transparent manner so that these can be communicated to a range of stakeholders including bog users, regulators, the European Commission and the wider community.

The environmental, technical and socio-economic criteria used for the NHA review are given equal weighting and in all categories the highest scores are given to the most favourable of sites which are those with:

- the best existing **environmental** standing (described by area, range, habitat, structure and function, and other important ecological features see Appendix I Addendum 1);
- the best **restoration potential** (described by restorable habitat area and the likelihood of restoration measures being effective, see Appendix I Addendum 2);
- the most **socially** appropriate (described by factors which indicate how readily the site can be designated and restored and what wider social benefits might be achieved); and
- the most **economically** advantageous investment (described by how much habitat is supported by a unit of investment in the site).

  The specific factors considered under social and economic assessments were: number of active cutters, extent of restoration works already undertaken and extent of State ownership, estimated restoration cost and estimated compensation cost. These factors are also clear indicators of the resources that would be required to conserve the site and of potential resistance to conservation measures, including a requirement to bring turf-cutting to a halt.

If there are two sites with equal standing on the primary considerations of environmental (existing condition) and technical (future potential) criteria then the socio-economic criteria identifies those where restoration measures would be most cost effective and socially appropriate and consequentially most likely to be implemented quickly.

At the same time each site was examined by NPWS staff from a nature conservation and management perspective to ensure that the final outcomes of the MCA were practical and achievable. There was an on-going process of interaction and refinement on both sides so that the final conclusions of both methods in relation to the ranking and categorization of the sites came steadily closer together. Where significant conflicts remained best professional judgement on the importance of the site took precedence. Factors taken into account included: presence of outstanding ecological features, long term prospects and range. For example, some relatively low ranking sites which are at the extreme of the national range were promoted into the network to ensure this critical feature was fully represented.

Results

The consultants, working closely with Departmental officials, have now completed their review of the raised bog resource in Ireland. They examined over 270 individual raised bogs, including SACs, NHAs and undesignated sites. New scientific survey methods were employed and improved mathematical modelling methods used to identify the restoration potential of sites (see Appendix I Addendum 2). Available ownership information, the number of active turf plots and restoration associated cost (both past and future) were also considered as these give an indication of the importance of individual bogs in terms of their economic, social and cultural contribution to individual communities. This has been the most comprehensive analysis to date of Ireland's raised bog habitat resource.

Table 1 below includes the results of the MCA analysis for the current NHA network sites:

Table 1 MCA current NHA network results

NPWS Site Name	High bog (ha)	Weighted Environmental Score	Weighted Restoration Potential Score	Weighted Economic Score	Weighted Social Score	Overall Score
Aghnamona Bog NHA	238.62	320	384	210	120	1034
Anna More Bog NHA	54.94	240	72	120	80	512
Annaghbeg Bog NHA	164.84	200	216	150	100	666
Arragh More Bog NHA	226.19	280	240	210	260	990
Aughrim Bog NHA	167.15	280	72	90	300	742
Ayle Lower Bog NHA	30.37	320	120	90	120	650
Ballygar Bog NHA	107.78	240	192	300	300	1032
Ballymacegan Bog NHA	53.92	280	96	120	80	576
Ballynagrenia and Ballinderry Bog NHA *	129.96	320	96	180	220	816
Ballynagrenia and Ballinderry Bog NHA*	35.64	280	24	60	-20	304
Bella Bridge Bog NHA	120.41	80	72	30	80	262
Black Castle Bog NHA	95.86	280	72	150	-20	482
Bracklagh Bog NHA	57.61	280	120	60	100	560
Bunnaruddee Bog NHA	62.18	80	48	30	-20	128
Cangort Bog NHA	57.95	0	120	210	220	120
Capira/Derrew Bog NHA	45.90	80	24	0	-40	104
Carbury Bog NHA	77.30	120	96	210	220	646
Carrickynaghtan Bog NHA*	202.45	420	96	150	60	726
Carrickynaghtan Bog NHA*	45.29	NA	NA	NA	NA	NA

NPWS Site Name	High bog (ha)	Weighted Environmental Score	Weighted Restoration Potential Score	Weighted Economic Score	Weighted Social Score	Overall Score
Cashel Bog (Leitrim) NHA	66.17	360	120	240	100	820
Castle Ffrench East Bog NHA	74.87	320	72	300	200	892
Castle Ffrench West Bog NHA *	45.04	280	120	90	0	490
Castle Ffrench West Bog NHA*	16.48	NA	NA	NA	NA	NA
Cloncrow Bog (New Forest) NHA	131.38	240	192	150	160	742
Clonreher Bog NHA	65.90	80	48	300	120	128
Clonydonnin Bog NHA	91.02	280	120	120	100	620
Cloonageeher Bog NHA	136.40	280	96	90	-40	426
Clooncullaun Bog NHA	117.04	200	96	90	100	486
Cloonloum More Bog NHA	48.99	120	120	30	-40	230
Cloonoolish Bog NHA	56.46	240	24	0	-80	264
Cornaveagh Bog NHA	65.55	240	72	90	60	462
Corracramph Bog NHA	136.78	280	72	90	80	522
Crit Island West NHA	342.28	280	144	90	-60	454
Daingean Bog NHA	76.23	240	192	120	140	692
Derrinlough Bog NHA	139.82	320	72	90	300	782
Derrycanan Bog NHA	193.99	240	96	90	0	426
Derrynagran Bog and Esker NHA	31.20	40	72	30	40	112
Doon Lough NHA	10.15	120	0	0	0	120
Eskerboy Bog NHA	89.61	120	192	90	60	462
Forthill Bog NHA	54.32	280	72	150	-80	422
Funshin Bog NHA	111.33	80	96	30	0	206
Girley Bog NHA	72.48	200	120	60	280	660
Hawkswood Bog NHA	59.95	280	96	150	140	666
Hodgestown Bog NHA	35.59	80	72	30	-40	142
Jamestown Bog NHA	37.11	280	24	0	-40	304
Keeloges Bog NHA*	147.70	280	192	120	140	732
Keeloges Bog NHA*	86.52	0	96	30	80	96
Killaclogher Bog NHA	173.87	80	96	90	-80	186
Killeen Bog NHA	60.64	160	24	0	-80	184
Killure Bog NHA	282.57	200	216	30	40	486
Kilmore Bog NHA	73.10	240	72	60	-60	312
Kilnaborris Bog NHA	114.16	200	96	0	-40	256
Leaha Bog NHA	57.57	0	48	0	100	48
Lisnanarriagh Bog NHA	43.87	0	0	0	0	0

NPWS Site Name	High bog (ha)	Weighted Environmental Score	Weighted Restoration Potential Score	Weighted Economic Score	Weighted Social Score	Overall Score
Lorrha Bog NHA	22.61	0	24	0	-80	24
Lough Derravaragh NHA	48.16	320	120	90	160	690
Lough Garr NHA	62.57	80	72	180	160	492
Lough Kinale and Derragh Lough NHA	8.23	120	40	0	220	160
Lough Namucka Bog NHA	124.89	80	96	60	60	296
Lough Tee Bog NHA*	79.69	240	72	210	140	662
Lough Tee Bog NHA*	176.80	280	72	30	-60	322
Loughanilloon Bog NHA	15.10	120	48	300	120	168
Meeneen Bog NHA	108.53	240	72	30	-80	262
Milltownpass Bog NHA	46.30	200	72	150	80	502
Molerick Bog NHA	7.80	80	0	0	0	80
Monaincha Bog/Ballaghmore Bog NHA	74.38	280	96	210	200	786
Moorfield Bog NHA	76.82	200	96	30	-80	246
Moorfield Bog/Farm Cottage NHA	65.40	320	120	120	120	680
Mount Jessop Bog NHA	65.83	280	96	0	280	656
Nore Valley Bogs NHA	112.00	240	72	120	-100	332
Nure Bog NHA	85.53	120	48	30	-80	168
Raford River Bog NHA	111.13	420	96	120	100	736
Rinn River NHA*	24.01	80	72	0	100	252
Rinn River NHA*	75.61	280	96	150	-80	446
River Little Brosna Callows NHA*	23.74	80	72	0	100	252
River Little Brosna Callows NHA*	101.82	320	96	0	-20	396
Scohaboy Bog NHA	197.91	320	192	30	240	782
Screggan Bog NHA	50.96	280	24	0	-60	304
Slieve Bog NHA	171.29	160	144	30	-40	294
Suck River Callows NHA	56.32	120	96	30	-80	166
Tullaghan Bog (Roscommon) NHA	42.39	40	0	0	0	40
Wooddown Bog NHA	121.17	280	192	150	280	902

* 7 sites which have been divided with part of them to be de-designated and part conserved.

NA: Castle Ffrench West Bog NHA and Carrickynaghtan Bog NHA high bog has been divided in two separate units, but separate MCA ranking have not been calculated. The sections proposed for exclusion (i.e. redrawing of boundaries) contain little or no Active or Degraded Raised Bog.

Information on MCA analysis results for the non designated sites is not included in this document, as it could be used to identify those likely to be selected as NHAs and thus expose them to potential damage before they are given legal protection.

Based on the above MCA results and best professional judgement as described above the 75 raised bog NHAs and 110 non designated sites were divided into three categories (1, 2 and 3).

- **Category 1** – contains the best 36 NHA sites (29 NHAs and parts of a further 7 NHAs) from an ecological and restoration potential perspective with relatively low levels of active turf-cutting.

  Category 1 also includes 27 currently undesignated raised bogs of national conservation interest have also been identified for designation as NHAs (25 sites) as part of this process or as compensatory habitat for habitat losses within the SAC network (2 sites). These sites are either state owned (primarily Bord na Móna), or have relatively reduced turf-cutting pressure.

- **Category 2** – contains 46 current NHAs (39 NHAs and parts of a further 7 NHAs) which have been assessed as having some ecological value but their contribution to the attainment of the national conservation objective is expected to be marginal and/or restoration would be prohibitively expensive for the conservation benefits achieved.

- **Category 3** – 83 non designated sites have been assessed as being of little value in their contribution to the conservation of raised bog habitat in Ireland (i.e. sites with little or no active raised bog or restoration potential).

Table 2 below provides a list of the current NHAs MCA assessment results.

Table 2 Categorisation of the current NHA network

NPWS Site Name	High bog (ha)	County	ARB (ha)	DRB (ha)	Total ARB+ DRB (ha)	No of active turf-plots in past 7 years	Category
Aghnamona Bog NHA	238.62	Leitrim, Longford	13.83	33.70	47.53	25	1
Anna More Bog NHA	54.94	Kerry	0.16	5.64	5.80	10	1
Arragh More Bog NHA	226.19	Tipperary	13.07	14.85	27.92	10	1
Aughrim Bog NHA	167.15	Galway	4.64	5.65	10.29	6	1
Ayle Lower Bog NHA	30.37	Clare	0.24	1.96	2.20	1	1
Ballygar Bog NHA	107.78	Galway	9.56	16.87	26.43	3	1
Ballymacegan Bog NHA	53.92	Tipperary	4.59	3.58	8.17	8	1
Ballynagrenia and Ballinderry Bog NHA *	129.96	Westmeath	35.60	3.82	39.42	25	1
Bracklagh Bog NHA	57.61	Galway	9.58	2.35	11.93	18	1
Cangort Bog NHA	57.95	Offaly &	0.00	6.28	6.28	0	1

NPWS Site Name	High bog (ha)	County	ARB (ha)	DRB (ha)	Total ARB+ DRB (ha)	No of active turf-plots in past 7 years	Category
		Tipperary					
Carbury Bog NHA	77.30	Kildare	0.00	4.12	4.12	0	1
Carrickynaghtan Bog NHA*	202.45	Roscommon	46.90	3.01	49.91	46	1
Cashel Bog (Leitrim) NHA	66.17	Leitrim	11.29	8.45	19.74	8	1
Castle Ffrench East Bog NHA	74.87	Galway	11.95	4.46	16.41	3	1
Castle Ffrench West Bog NHA *	45.04	Galway	11.80	2.05	13.85	17	1
Cloncrow Bog (New Forest) NHA	131.38	Westmeath	2.08	17.35	19.43	9	1
Clonydonnin Bog NHA	91.02	Westmeath	14.51	4.53	19.04	18	1
Daingean Bog NHA	76.23	Offaly	2.50	10.19	12.69	13	1
Derrinlough Bog NHA	139.82	Galway	3.33	4.37	7.70	12	1
Girley Bog NHA	72.48	Meath	1.80	1.80	3.60	3	1
Hawkswood Bog NHA	59.95	Offaly	3.50	8.04	11.54	17	1
Keeloges Bog NHA*	147.70	Galway	9.78	9.94	19.72	15	1
Lough Derravaragh NHA	48.16	Westmeath	4.61	2.13	6.74	12	1
Lough Garr NHA	62.57	Westmeath	0.00	2.40	2.40	0	1
Lough Kinale and Derragh Lough NHA	8.23	Longford, Cavan & Westmeath	0.00	0.04	0.04	0	1
Lough Tee Bog NHA*	79.69	Galway	6.00	6.44	12.44	5	1
Loughanilloon Bog NHA	15.10	Clare	0.00	1.09	1.09	0	1
Milltownpass Bog NHA	46.30	Westmeath	2.00	3.34	5.34	9	1
Monaincha Bog/Ballaghmore Bog NHA	74.38	Tipperary, Laois	3.32	5.75	9.07	0	1
Moorfield Bog/Farm Cottage NHA	65.40	Galway	8.35	2.48	10.83	13	1
Mount Jessop Bog NHA	65.83	Longford	3.60	0.90	4.50	6	1
Raford River Bog NHA	111.13	Galway	5.74	8.32	14.06	19	1
Rinn River NHA*	24.01	Leitrim, Longford	0.00	0.94	0.94	2	1
River Little Brosna Callows NHA*	23.74	Offaly	0.00	0.48	0.48	0	1
Scohaboy Bog NHA	197.91	Tipperary	7.13	16.68	23.81	41	1
Wooddown Bog NHA	121.17	Westmeath	4.98	9.99	14.97	10	1
Annaghbeg Bog NHA	164.84	Galway	7.00	18.06	25.06	45	2
Ballynagrenia and Ballinderry Bog NHA*	35.64	Westmeath	5.30	0.06	5.36	58	2
Bella Bridge Bog NHA	120.41	Roscommon	0.00	4.58	4.58	26	2

NPWS Site Name	High bog (ha)	County	ARB (ha)	DRB (ha)	Total ARB+ DRB (ha)	No of active turf-plots in past 7 years	Category
Black Castle Bog NHA	95.86	Offaly	7.49	5.70	13.19	71	2
Bunnaruddee Bog NHA	62.18	Kerry	0.00	1.12	1.12	70	2
Capira/Derrew Bog NHA	45.90	Galway	0.00	0.05	0.05	63	2
Carrickynaghtan Bog NHA*	45.29	Roscommon	0.17	0.03	0.21	154	2
Castle Ffrench West Bog NHA*	16.48	Galway	0.00	0.00	0.00	38	2
Clonreher Bog NHA	65.90	Laois	0.00	1.10	1.10	0	2
Cloonageeher Bog NHA	136.40	Leitrim, Longford	6.05	3.67	9.72	53	2
Clooncullaun Bog NHA	117.04	Galway	2.73	2.27	5.00	34	2
Cloonloum More Bog NHA	48.99	Clare	0.00	2.36	2.36	20	2
Cloonoolish Bog NHA	56.46	Galway	1.06	0.52	1.58	33	2
Cornaveagh Bog NHA	65.55	Roscommon	1.87	4.38	6.25	16	2
Corracramph Bog NHA	136.78	Leitrim	2.15	8.71	10.86	37	2
Crit Island West NHA	342.28	Galway	9.33	23.93	33.26	164	2
Derrycanan Bog NHA	193.99	Roscommon	2.47	6.08	8.55	77	2
Derrynagran Bog and Esker NHA	31.20	Galway	0.00	2.00	2.00	9	2
Doon Lough NHA	10.15	Clare	0.00	0.00	0.00	1	2
Eskerboy Bog NHA	89.61	Galway	0.00	10.22	10.22	32	2
Forthill Bog NHA	54.32	Longford	1.10	2.54	3.64	50	2
Funshin Bog NHA	111.33	Galway	0.00	3.08	3.08	44	2
Hodgestown Bog NHA	35.59	Kildare	0.00	1.16	1.16	82	2
Jamestown Bog NHA	37.11	Meath	8.43	0.03	8.46	120	2
Keeloges Bog NHA*	86.52	Galway	0.00	2.98	2.98	12	2
Killaclogher Bog NHA	173.87	Galway	0.00	5.80	5.80	191	2
Killeen Bog NHA	60.64	Tipperary	0.85	0.58	1.43	37	2
Killure Bog NHA	282.57	Galway	2.88	25.37	28.25	83	2
Kilmore Bog NHA	73.10	Galway	2.10	1.35	3.45	66	2
Kilnaborris Bog NHA	114.16	Galway	1.00	0.41	1.41	65	2
Leaha Bog NHA	57.57	Galway	0.00	0.41	0.41	13	2
Lisnanarriagh Bog NHA	43.87	Roscommon	0.00	0.00	0.00	20	2
Lorrha Bog NHA	22.61	Tipperary	0.00	0.12	0.12	15	2
Lough Namucka Bog NHA	124.89	Galway	0.00	8.46	8.46	44	2
Lough Tee Bog NHA*	176.80	Galway	1.80	2.97	4.77	68	2
Meeneen Bog NHA	108.53	Galway	1.25	1.76	3.01	126	2
Molerick Bog NHA	7.80	Meath	0.00	0.00	0.00	58	2
Moorfield Bog NHA	76.82	Galway	1.39	1.77	3.16	38	2
Nore Valley Bogs NHA	112.00	Tipperary	6.74	6.27	13.01	114	2

NPWS Site Name	High bog (ha)	County	ARB (ha)	DRB (ha)	Total ARB+ DRB (ha)	No of active turf-plots in past 7 years	Category
Nure Bog NHA	85.53	Westmeath	0.00	2.53	2.53	100	2
Rinn River NHA*	75.61	Leitrim, Longford	12.80	2.25	15.05	35	2
River Little Brosna Callows NHA*	101.82	Offaly	9.40	0.56	9.96	97	2
Screggan Bog NHA	50.96	Offaly	1.20	0.12	1.32	120	2
Slieve Bog NHA	171.29	Galway	0.00	9.05	9.05	69	2
Suck River Callows NHA	56.32	Galway, Roscommon	0.00	1.90	1.90	26	2
Tullaghan Bog (Roscommon) NHA	42.39	Roscommon	0.00	0.00	0.00	13	2

Conclusions

Comparison of current and new raised bog NHA network

As a result of the review a new NHA network is proposed.

Table 3 below shows a comparison between the current and new raised bog NHA network.

Table 3 Comparison of current and new raised bog NHA network

	Active Raised Bog (ha)	Degraded Raised Bog (ha)	Total Active and Degraded (ha)	High Bog (ha)	N° of Sites*	N° of Bog Units	Approx N° of Active turf plots
Current NHA Network	284	410	694	7,477	75	82	3,091
New NHA Network	290	475	765	5,405	61	63	518

*Some sites contain more than one bog

The new network has the following advantages over the current network:

1. The areas of both *Active Raised Bog* and *Degraded Raised Bog Still Capable of Natural Regeneration* (both protected habitats under the Habitats Directive) will be greater in the new network than in the current network.
2. The new SAC+NHA network will have 14 sites less than the current network, but better represent the ecological and geographical diversity of raised bogs in the country. The new

network will significantly improve the geographical range of protected sites to the East, South, West and North (see table 4 below).

3. In the short to medium term losses of active bog will be reduced, due to the lower intensity of recent turf-cutting in the new network. Cutting causes drying out adjacent areas of the high bog for decades after the cutting has ceased. The less cutting there has been in recent times the less drying out would be expected to occur in the future.
4. Management complexity in the new network will be much lower due the lower number of sites, high bog area and number of active turf cutters and landowners. The reduced number of sites and high bog area will allow resources to be deployed in a more focused manner.
5. The inclusion of some large Bord na Mona sites, some of which have already had substantial restoration works carried out, will facilitate more rapid restoration in comparison to smaller more numerous privately owned sites where the restoration process will be expected to take longer and cost more per unit area restored.
6. Costs to the tax-payer will be greatly reduced (by about €60m) due to the significantly reduced number of turf-cutters that will be required to stop turf-cutting and who would require compensation (over. 2,500 fewer turf-cutters will be affected in the new network).

Range

As table 4 below indicates the new network slightly increases the overall number of 10km grids containing ARB+DRB within protected sites (i.e. SAC+NHA) by 3 - 10km grids. This consists of 20 gains and 17 losses. The gains tend to occur at the extremities if the distribution, while the losses mainly occur at the centre of the distribution. Overall, the range of protected sites increases by 20 - 10km grids and in every single direction: northwards, eastwards, southwards and westwards. These extensions at the extremity of the range are considered to be of major conservation value.

Table 4 Comparison of network range for current and new raised bog NHA networks

	Current network	New network
No of 10km grids within distribution	88	91
No of 10km grids within Range	145	165
Range spatial changes		
Is the Range extended northwards?		Yes
Is the Range extended southwards?		Yes
Is the Range extended eastwards?		Yes
Is the Range extended westwards?		Yes

A range map is not being provided as this could help identify the currently undesignated sites which it is proposed to add to the new NHA network. These sites will be publicly identified later in 2014.

Contribution of the new NHA network to the national conservation objectives

Under the Habitats Directive, Ireland is required to maintain or restore to favourable conservation status its raised bog habitats that are listed in Annex 1 of the Habitats Directive. The two principal habitats are *Active Raised Bogs* and D*egraded Raised Bogs Still Capable of Natural Regeneration*. *Active Raised Bogs* are "priority" habitat under the Habitats Directive and require special protection as they are considered to be particularly endangered in Europe. Ireland has s significant proportion of this habitat in Western Europe, but has been reporting Unfavourable Bad status for raised bog habitats under its Article 17 reports. That rating is the lowest possible for a habitat under the Habitats Directive assessment guidelines. Favourable conservation status is achieved when the overall area and range of the habitat within the national territory is stable or increasing and its structure and function including the presence of typical species is maintained or improved. In the case of these two habitats the objective of successful restoration is to turn Degraded Raised Bog habitat into Active Raised Bog.

As part of the process involved in the development of the SAC Management Plan and the NHA review National Conservation Objectives for Raised Bogs were established (see Appendix II). The **national conservation objective target area** for **Active Raised Bog** is **3,600ha**, which was the area of Active and Degraded Bog in the current SAC and NHA network in 1994 (see Table 5).

Table 5 Summary of Raised Bog Status Changes

Bog Habitat	Resource	1994	2012	Change	Conservation Objective (Target)
		(ha)	(ha)	(ha)	(ha)
Active Raised Bog (ARB)	SAC network	1,940 [A]	1,210	-730	2,590 [(A+C)]
	NHA network	490 [B]	284	-206	
	Non Designated Sites	200	145	-55	
	National Network	**2,630**	**1,639**	**-991**	**3,600** (A+B+C+D)
Degraded Raised Bog (DRB)	SAC network	650 [C]	1,200	+550	
	NHA network	520 [D]	410	-110	
	Non Designated Sites	625	520	-105	
	National Network	**1,795**	**2,130**	**+335**	
High Bog	SAC network	10,740	10,515	-225	

	NHA network	7,790	7,480	-310	

Ireland will undertake, through the National Raised Bog SAC Management Plan to deliver over **2,590ha** of Active Raised Bog **within its raised bog SACs**. This is based on 1,940ha of Active Raised Bog and 650ha Degraded Raised Bog (total 2,590ha) that existed within these sites in 1994 when the Habitats Directive came into force. Currently there is 1,210ha of Active Raised Bog and 1,200ha of Degraded Raised Bog in the current SAC network. Maintenance of Active Raised Bog and restoration of the Degraded Raised Bog will result in 2,410ha of Active Raised Bog in the long term. This leaves a short fall of 180ha of Active Raised Bog, which is being compensated for through the designation of a small number of additional SACs, which have the potential to support 195ha of Active Raised Bog. This will more than double the current area of Active Raised Bog in the current SAC network.

To achieve the national objective the **new NHA network** has been selected so that it will, following successful restoration, contribute **765ha** of Active Raised Bog to the achievement of that target (see Table 3 above).

This will leave a short fall of 230ha in the national objective of 3,600ha. Achieving this target will require restoration of active peat growth on 230ha of cutover bog within the SAC and NHA network.

If these targets are reached the SACs and NHAs would contain twice the current national resource of the habitat (1,639ha) and over 1,000ha more Active Raised Bog than existed in 1994 (2,630ha). As the new NHA network also improves the range and the number of sites of the habitat within protected areas it would significantly improve the protection of its biological and physical diversity. The larger and increasing area of more high quality habitat, in a large number of widely dispersed protected sites (over 100 SACs and NHAs), would make the National Network highly resistant to short term or local impacts. Under these circumstances the future of Active Raised Bog habitat will be secured and it would be considered to have achieved favourable conservation status in Ireland.

One of the key questions which the review sought to answer is whether it is possible to achieve this national target while reducing significantly the impact on communities in rural Ireland. At present, the review has indicated that there are approximately 3,090 active turf plots on the 75 NHAs. A cessation of turf-cutting similar to that applied to SACs would require over €70m in compensation costs alone. It would also give rise to very considerable difficulties in local communities, and would without any doubt greatly undermine the strides made to date in bringing an end to cutting on the SAC raised bog network.

The new network of NHAs would - in contrast – enable Ireland to reach favourable conservation status for Active Raised Bog Habitat, substantially lower economic costs by reducing the number of active turf cutters affected from approx. 3,090 to 520 which is a reduction of ca. 2,570. This should help address the concerns of local communities, and support ongoing efforts to safeguard the SAC network.

NHA network management issues

As mentioned above NHA sites in the current network have been allocated to two different management categories, which will be managed in the following way:

Category 1

Category 1 contains all the sites that will form the new NHA network.

The 36 NHAs (including parts of 7 NHAs) in category 1 (see table 2) are the best of the current NHAs from an ecological and restoration perspective and are relatively less encumbered by active turf-cutting than those in category 2. This category includes 7 NHAs where the particular hydro-geological circumstances allow for the exclusion of areas that are more intensively cut and are of little conservation value without compromising the conservation management of the rest of the site. This will reduce costs and allow for limited resources to be directed at areas with best restoration potential.

As a result of the review, 25 additional undesignated raised bog sites have been identified to ensure that the new NHA network contributes adequately to the achievement of the national conservation objectives. These sites will compensate for the loss of Active and Degraded Raised Bog habitat within the NHA sites in category 2. It is not proposed to identify these sites until the Minister is in a position to apply legal protections. Releasing the identities in advance would be likely to cause a surge of turf cutting in the coming season. However it is possible to say that some of the sites are in the ownership of Bord na Móna while the remainder are privately owned. Most of the sites have no or small numbers of active turf-cutters on them. However, some, including some Bord na Móna sites, have more significant numbers of turf cutters on the margins. In all up to 140 active turf cutters may be affected by these new designation.

The 765ha target, and the extension of the range of protected habitat, will be achieved through introducing management measures for NHAs in category 1, along with the addition of 25 new NHAs.

The suggested approach would include the designation of these sites as NHAs and - following individual assessment of each site - to bring damaging turf cutting to an end on them, as appropriate, by 2017. The approach suggested is that site specific conservation management plans would be drawn up which would include an examination the possibility of continued cutting

within the sites. Similar to the SACs, it is envisaged that turf-cutting will in most circumstances be incompatible with conservation on these sites and will need to be phased out.

To ensure that further pressure is not brought to bear on these sites, it is proposed that turf cutters on the 36 category 1 NHA sites will be required to apply for consent to continue turf-cutting. In addition, turf-cutting contractors will also require separate consent to cut on the NHAs in regulations to be made under the European Communities Acts. Permits to cut turf-plots will be provided where the Department is satisfied that they have been actively cut within the last 5 years. The information provided through the permitting system will be useful in preparing the site management plans.

In is intended that management plans would be in place by 2017. Each management plan will include a set of time bound actions to ensure that conservation objectives are met. A similar period will be implemented for active cutters on the new NHAs once the designations are in place.

Management plans will be subject to environmental assessment. Cutting on these sites will be brought to an end unless, as set out above, the management plan and EIA shows that continued cutting is compatible with conservation objectives.

Subject to the availability of finance, it would be proposed that the compensation schemes available to turf-cutters in SACs would be extended to Category 1 NHA sites immediately to incentivise earlier cessation.

Category 2

The conservation of these sites is not considered to be necessary to reach the national conservation objective and it is proposed to move towards the de-designation of these sites.

46 NHAs (including parts of 7 NHAs) have been placed in category 2 (see table 2). While most of these sites have been assessed as having some ecological value, they have not been included in Category 1 as their contribution to the attainment of the national conservation objective would be marginal and/or would be prohibitively expensive or impose undue burden on the local community due to the number of active turf-cutters on these sites.

Policy in relation to these sites is to allow cutting to continue within them with a view to de-designation where continued designation is not appropriate. The Department will follow a formal process in this regard. It is proposed that this would take the following format:

- A formal proposal will be drawn up to assess the implications of removing the designated status from the site.
- An Environmental Impact Statement will be prepared in relation to the proposal,

- There will be full public consultation on the proposal and EIS in accordance with the EIA Directive.

Consideration is being given to the appropriate legislative/regulatory controls needed to put this system in place.

Regulatory Issues

Giving full effect to the proposals set out in this document will require regulatory change to which the Department will now give detailed consideration. However, much preparatory work, including detailed examination of sites, will be progressed in parallel with any necessary regulatory changes and this should not impact on the timescales envisaged above.

Appendix I

Detailed methodologies and criteria used in the NHA review

Introduction

The following three major elements were assessed for each site during the review:

- **Ecological**
- **Restoration Potential (Hydrological)**
- **Socio-economic**

The results from the first two criteria were modified to take account of socio-economic factors by the use of a decision support tool and best professional judgement. Further detail information is provided in this Appendix in the Ecological and Hydrological assessments.

Ecological Assessment of Ireland's Raised Bog Resource

The current condition of Ireland's Raised Bog resource was determined from an ecological assessment of Ireland's network of Raised Bog SACs, NHAs and other non-designated raised bogs of potential conservation value. The non-designated bogs were selected as the remaining raised bogs of potential conservation value, based on recommendations from Bord na Móna, the Turf Cutters and Contractors Association (TCCA), the Irish Peatland Conservation Council (IPCC), and available wetland surveys mainly from the National Parks and Wildlife Service (NPWS) and Local Authorities. The national raised bog network assessed within this review is shown in Figure 1.

Methodology

The data used originated from various NPWS ecological surveys and associated reports (Cross 1990; Kelly et al. 1995; Derwin and MacGowan 2000; Fernandez et. al. 2005, Fernandez et. al. 2006; NPWS, 2008; Fernandez et. al. 2012; NPWS, 2013 and Fernandez et. al. in press) supplemented by selected site surveys to address data gaps in non-designated raised bogs.

The assessment considered the following six attributes for each bog, which are based on SAC selection criteria in Annex III of the Habitats Directive:

- Area (of Active Raised Bog ARB)
- Range (Geographic)
- Habitat quality

- Ecological diversity relating to each of the following three features:
    - Diversity of marginal habitats adjoining the high bog
    - Local distinctiveness (presence of features that represent the range of variation of the habitat)
    - Presence of other EU Habitats and Birds Directive species
- The occurrence of ‘negative species’
- The occurrence of ‘negative features’, notably the frequency and severity of burning

There was ecological mapping available for all 53 Raised Bog SACs with very few data gaps. The mapping was based on the identification of ecotopes, which are areas of relatively uniform vegetation associated with specific physical conditions. These are separated into central and sub-central ecotopes (active bog) and marginal and submarginal ecotopes which are dried out to varying extents.

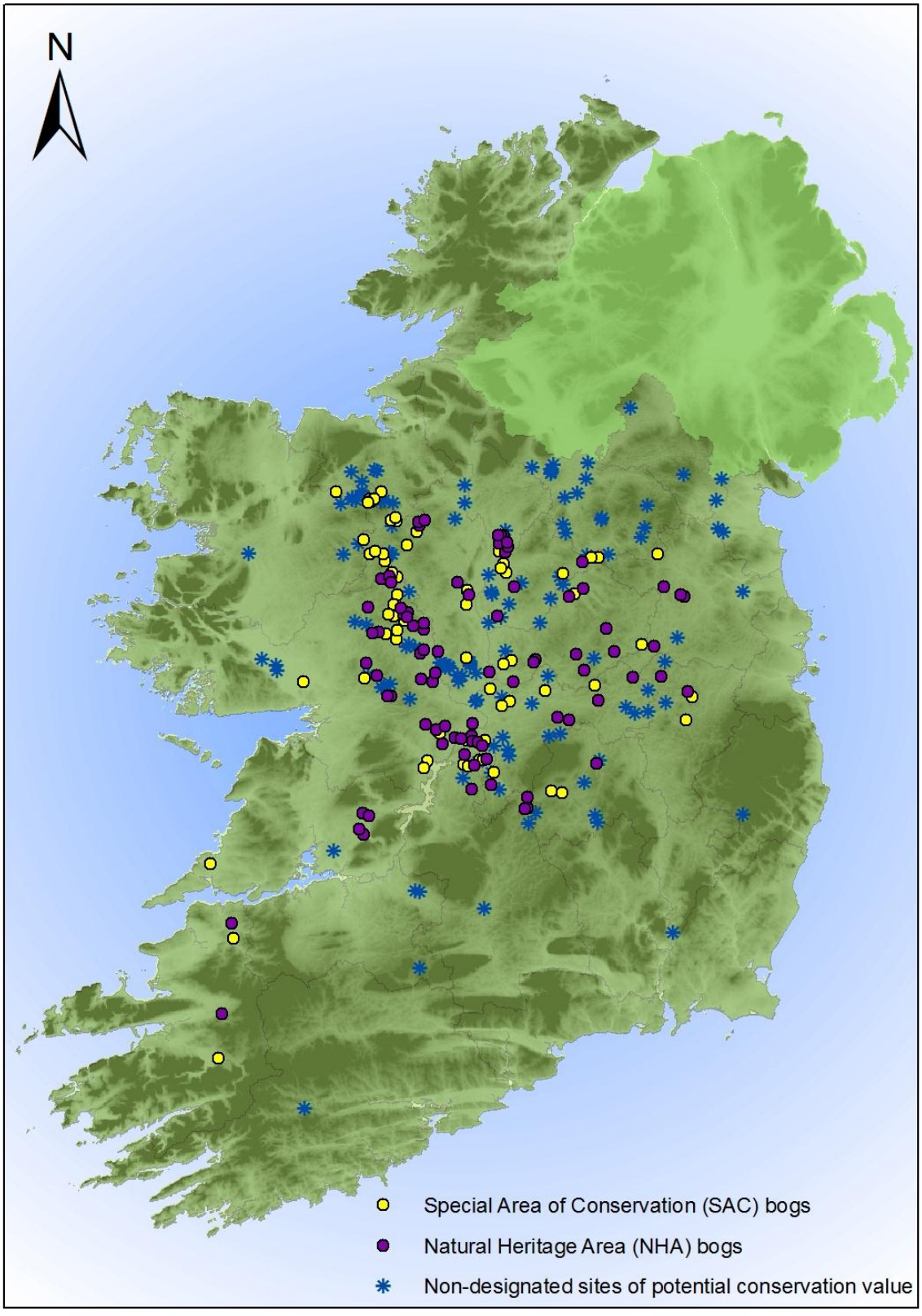

Figure 1. National raised bog network assessed

Ecological mapping was available for 72 of the NHAs mostly surveyed in 2003. Recent surveys were available for only four Raised Bog NHAs. The ecological assessment must therefore be viewed with caution as it is likely that there has been a significant decline in Active Raised Bog since they were last surveyed as a result of continued damaging activities. In some cases where it is known that high bog drainage took place after the sites were last surveyed and where a lower vegetation quality is now expected than previously mapped, the extent of the originally reported active raised bog was reduced by expert judgement.

Ecological data for the non-designated sites was limited to sites owned by Bord na Móna and a further 48 sites where targeted field surveys were undertaken.

Sites being considered for inclusion in the Raised Bog Network was assessed for each of the six attributes and assigned various categories as described in Table 1.

Table 1 Criteria used in determining the ecological condition of Ireland's Raised Bog Network

Attribute	Means of scoring	Criteria used
Area of Active Raised Bog (ARB)	A (excellent) B (high) C (moderate-high) D (moderate) E (low)	>35 ha >10 ha >5ha 0 - 5 ha 0 ha
Range (geographic) (Based on position within 10km^2 distribution squares)	B (high) D (moderate) E (low)	Site located at edge of known range and site increases current range of ARB Site located at edge of known range or site increases current range of ARB Site does not make a significant contribution to current range of ARB
Habitat quality	B (high) C (moderate-high) D (moderate) E (low)	>20% of ARB is of the best quality (i.e. central ecotope as described by Schouten and Kelly (2002)). Best quality ARB is present ARB is present No ARB present
Ecological diversity	**Highest of the following three criteria (see below)**	
Diversity of marginal habitats	B (high) D (moderate) E (low)	Good range of marginal habitats Low quality semi-natural marginal habitats No natural marginal habitats
Local distinctiveness	B (high) D (moderate) E (low)	Local distinctiveness is reported - specific features which contribute to the range of variation Possible occurrence of local distinctiveness No indication of local distinctiveness

Attribute	Means of scoring	Criteria used
Other Annex habitats or species	B (high) D (moderate) E (low)	Two bog related Annexed species or habitats present Single Annexed habitat or species present No Annexed habitats or species present
Negative species	B (high) D (moderate) E (low)	No negative species recorded Some negative species recorded; impact affecting <10% of site Low - Significant negative species recorded; affecting ≥ 10% of site
Negative features (burning)	B (high) D (moderate) E (low)	No fire reported in last 20 years (pre 1993) Post 1993 Fire reported; affecting up to 30% HB Post 1993 Fire reported; affecting greater than 30% HB

Results of the Ecological Assessment

The results of the ecological assessment for each individual NHA and Non Designated site are presented in Addendum 1 Current Ecological Condition of Ireland's Raised Bog NHAs and Non Designated Sites.

Restoration Potential Assessment of Ireland's Raised Bog Network

The ecological condition of Raised Bogs is fundamentally dependent on the hydrology (namely the availability of water close to the surface of the bog). Both the hydrology and dependent ecology of a raised bog can be significantly affected by the cutting of drains into the raised bog. An eco-hydrological assessment was therefore undertaken to assist with the understanding of the Raised Bogs' current condition and equally importantly, to determine their restoration potential.

Methodology

The methodology developed to undertake the eco-hydrological assessments makes use of detailed topographic data for each raised bog obtained from LiDAR surveys to assess the potential for the bog surface to support active raised bog. LiDAR is a remote sensing technology that measures vertical surface elevation by illuminating a target with a laser and analyzing the reflected light. The data is collected in the field using a low flying aeroplane. This gives much more detailed and accurate raised bog topographical maps than can be collected by traditional surveying techniques.

The use of the LiDAR data has supported a programme of scientific research which has greatly improved the knowledge of the eco-hydrological behaviour of raised bogs in Ireland. By using the detailed topographic survey data, it is now possible to model eco-hydrological conditions (based on the raised bog's slope, drainage patterns and rainfall) and relate these conditions to recent ecological surveys. In this way it is possible to determine the area of each bog that has suitable conditions for

the development of active raised bog habitat, whether or not active raised bog currently occurs on that area. Where active bog is absent from such areas, it is assumed that the area must have been impacted by a pressure that is preventing active raised bog growth. The eco-hydrological modelling process can therefore quantify each raised bog's restoration potential. A detailed description of the eco-hydrological modelling techniques use in the assessment is presented in Addendum 2 Current Eco-Hydrological Condition of Ireland's Raised Bog NHAs and Non Designated Sites - Modelling the potential for Raised Bog Restoration.

Results of the Eco-Hydrological Assessment

Examples of the Restoration Potential maps are presented for part Clara Bog SAC, Goat's Lough Bog South and Aghnamona Bog NHA (Figures 2– 4). Those areas with values over 30km are generally considered to have potential the maintenance of restoration of Active Raised Bog habitat.

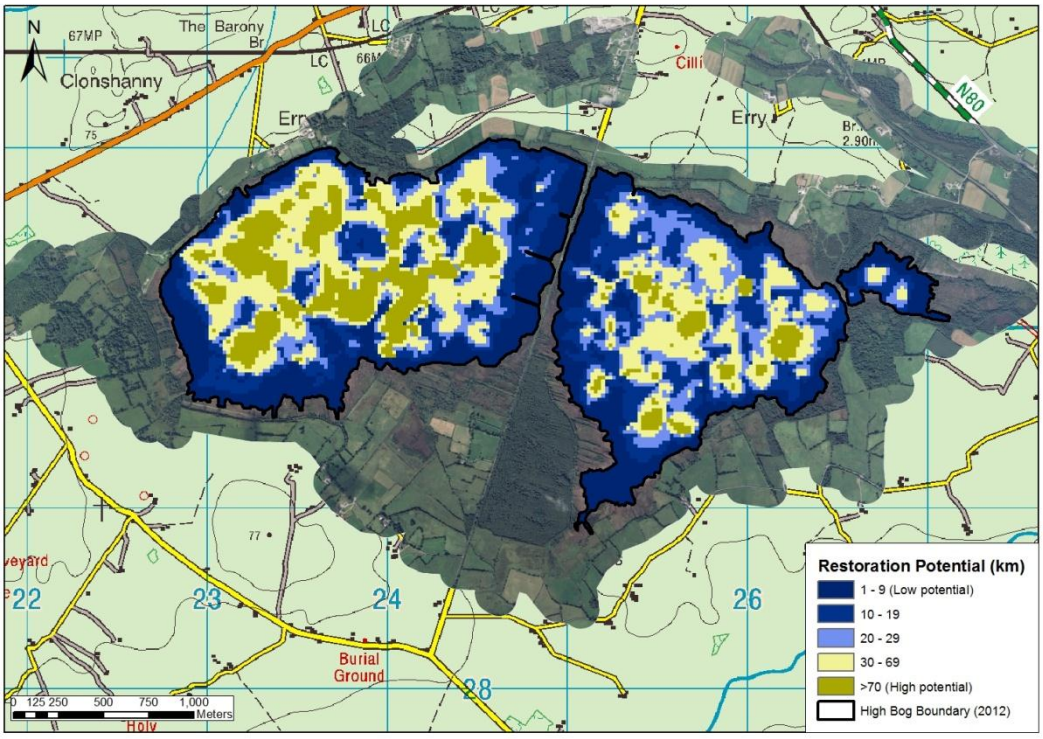

Figure 2 Clara Bog SAC. Restoration Potential derived from Eco-Hydrological Model

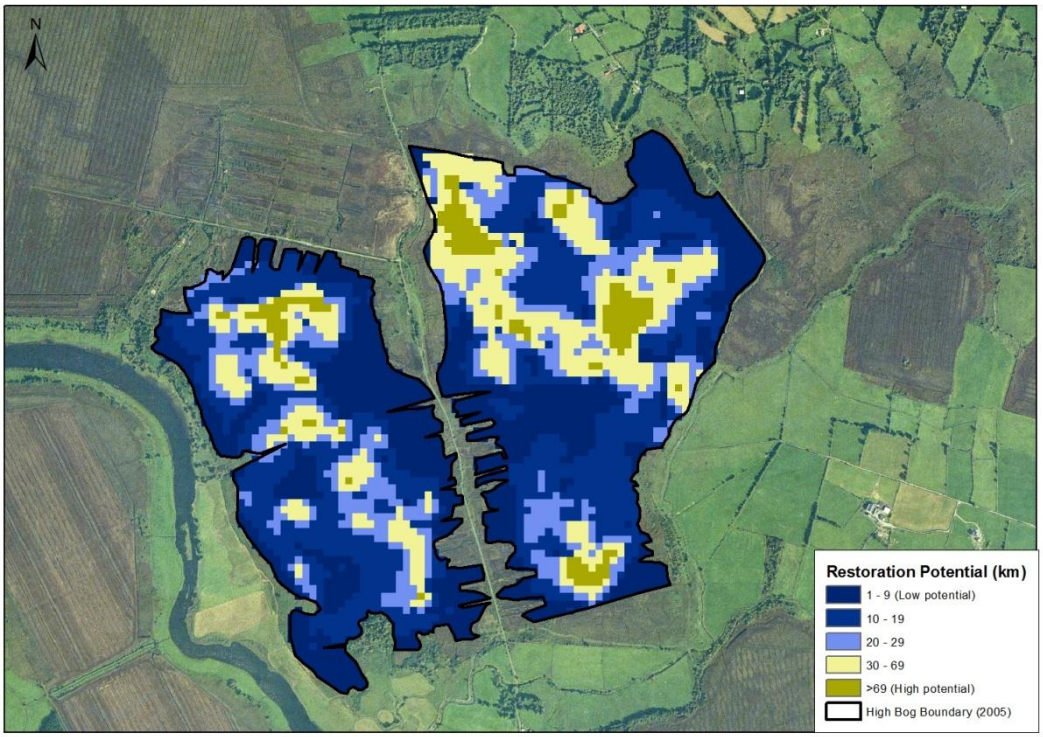

Figure 3 Goat's Lough Bog South - Restoration Potential derived from Eco-Hydrological Model

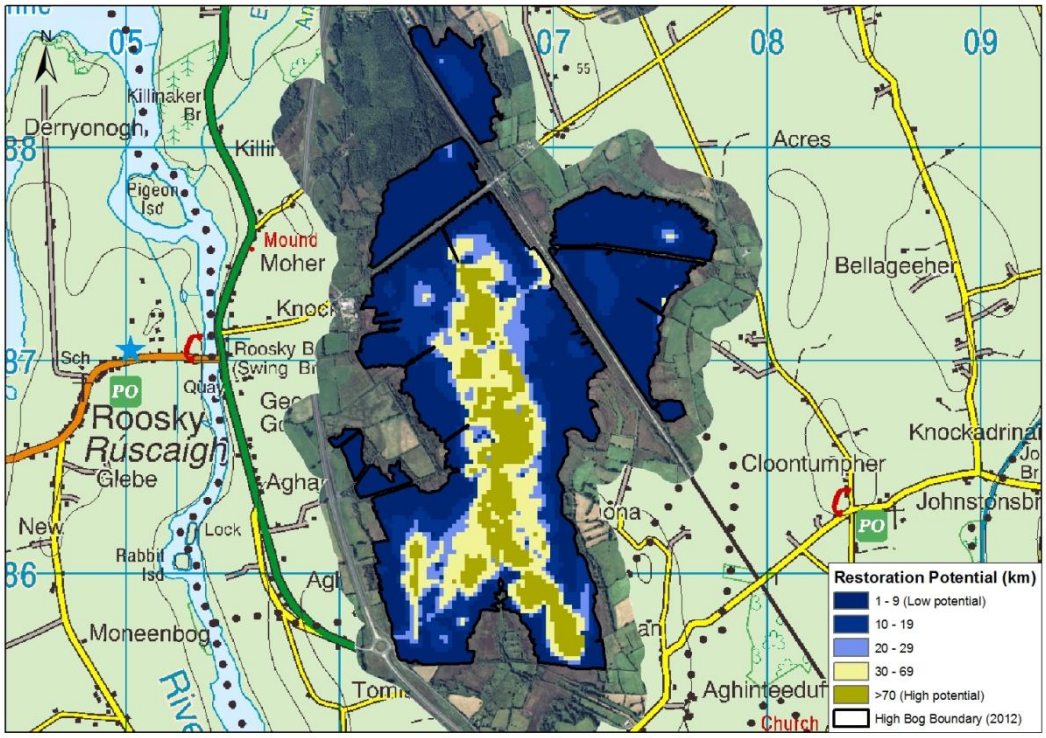

Figure 4 Aghnamona Bog NHA - Restoration Potential derived from Eco-Hydrological Model

The results of the eco-hydrological assessment for to the Raised Bog NHAs and Non-designated Sites are presented in Addendum 2 Current Eco-Hydrological Condition of Ireland's Raised Bog NHAs and Non Designated Sites.

The assessment is based on the assumption that drains on the High Bog and cutover bog are present but that the underlying peat substrate remains intact. Where deep drains have been cut through the underlying peat substrate into the mineral soils, a much greater loss of bog water may be occurring which cannot be addressed by the current eco-hydrological modelling process. The likelihood of this occurring can only be assessed through detailed survey work which is planned for 2014-15.

In other words the current models may over-predict the potential for restoration of the active raised bog (unless these vertical losses can be reduced substantially), this issue is addressed by assessment of the efficacy of potential restoration measures. For example, where there is an obvious reason for the absence of active bog in an area where the model predicts it should occur, such as the presence of functional drains in or adjacent to that area of the bog, it is assumed that restoration by drain blocking will be highly effective in restoring active bog (high efficacy). In contrast, where such obvious reasons for the absence of active bog are not apparent it is assumed that restoration will be relatively ineffective and the restoration potential predicted by the model is reduced (low efficacy).

The results of the eco-hydrological assessment, summarized in Addendum 2, shows the area of high bog which can be restored to active raised bog habitat. This can however only be achieved if the surrounding area of high bog remains intact. This is because the high bog is one hydrological unit with the habitat at the periphery of the high bog acting as the 'life support system' by reducing water losses to the surrounding cutover or drained areas.

Continued turf-cutting at the periphery of the high bog will, in almost all cases, have a disproportionate impact on the remaining active raised bog habitat and degraded raised bog habitat (area restorable) as illustrated in Figure 5.

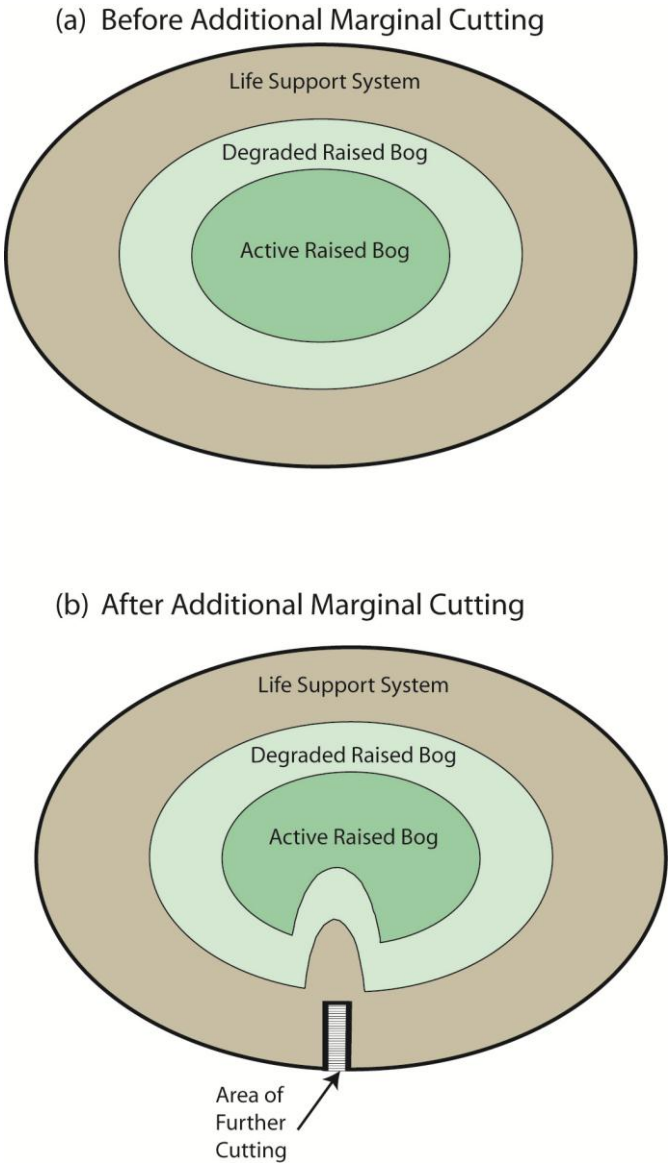

Figure 5 Schematic illustrating the disproportionate impact cutting of the "life support" system can have on active and degraded raised bog habitat

Appendix II

National Conservation Objectives

Introduction

One of the main aims of the Habitats Directive is to ensure that the habitats and species listed in it achieve “favourable conservation status”. In essence, this means that these habitats and species are being maintained in satisfactory condition and this situation is likely to continue for the foreseeable future.

The conservation status of bog habitats listed in the Habitats Directive has deteriorated in Ireland and continues to do so. As a first step in planning the restoration of active raised bog, this review sets out conservation objectives at different scales. A conservation objective aims to define how much, where and what conditions are necessary to bring the habitat back to favourable status.

Ireland’s commitment under the Habitats Directive is to have a robust raised bog network that is sustainable into the future. This includes the Raised Bog SACs, which are the best remaining examples of the habitat. This commitment includes replacing the area of active raised bog within the SAC network that has been lost since 1994.

Conservation objectives can be set at different scales, from site-specific (e.g. SAC or NHA) to national. This paper does not define detailed conservation objectives for each of the NHAs, as these will be developed on a site-by-site basis. However, it quantifies the overall area, distribution and the general conditions required to restore the NHA network. To put this in context, the National Conservation Objective for active raised bog is also defined. The restoration of raised bog habitats within NHAs to favourable conservation condition will contribute to the overall restoration of favourable conservation status of those habitats at a national level.

Setting conservation objectives

The setting of a conservation objective is a scientific process that aims to define favourable conservation status for a particular habitat. This is achieved by identifying relevant attributes (characteristics, qualities or properties) and setting targets for each one that can be used to define its favourable reference value.

For habitats listed in the Habitats Directive, Article 1 of the Directive provides a definition of favourable conservation status as follows:

"The **conservation status** of a natural habitat will be taken as "**favourable**" when:

its natural **range** and **areas** it covers within that range, is **stable or increasing**, and

the specific **structure and functions** which are necessary for its long-term maintenance **exist** and are **likely to continue to exist** for the foreseeable future, and

the **conservation status** of its **typical species** is **favourable**.

Because the current conservation status of active raised bog is bad, the conservation objective is:

To restore the favourable conservation status of active raised bog in Ireland.

The following sections set out the targets for range, area and a series of attributes relating to "structure and functions". This last parameter comprises the physical components of the habitats ("structure") and the ecological processes that drive them ("functions"). Targets for range and area are set at two levels - one for SACs and one for the national raised bog resource.

Range of Active Raised Bog

At a national scale, this is the geographic range that encompasses all significant ecological variations of the active raised bog habitat and must also be large enough to allow for long-term survival. The range for SACs cannot decline from the current.

Target		Notes
National	Range increasing from current situation	Target based on the current national range of active and degraded raised bog
SACs	Not less than current range subject to natural processes	Target based on the current range of 53 Raised Bog SACs

Area of Active Raised Bog

Target		Notes
National	Area increasing and not less than 3,600ha	Target based on the area of active raised bog (2,490 ha) and degraded raised bog (1,170 ha) present within the SAC and NHA network in 1994. The estimated area of active raised bog is 1,494 ha and degraded raised bog is 1,610 ha (totalling 3,104 ha) within the current SAC and NHA network.
SACs	Area increasing and not less than 2,590 ha	Target based on the area of active raised bog (1,940 ha) and degraded raised bog (650 ha) present within the SAC

		network in 1994. It is estimated that the area of active raised bog in the current SAC network is 1,210 ha.

Structure, Functions and Typical Species of Active Raised Bog

Ten attributes are listed which aim to encompass the conditions that are necessary for active raised bog to survive in the long term.

7. Hydrological regimes

Target	Notes
Maintain/restore appropriate water levels and flow directions on each bog	For active raised bog, mean water levels need to be near or above the surface of bog lawns for most of the year. Seasonal fluctuations should not exceed 20cm, and should only be 10-15cm below the surface for very short periods of time. Long and gentle slopes are the most favourable to achieve these conditions. Changes to flow directions due to subsidence of bogs can radically change water regimes and cause drying out of high quality active raised bog areas and soak systems

8. Supporting high bog habitat

Target	Notes
Maintain/restore adequate high bog to support development and maintenance of active raised bog	Raised bog habitat that is classified as neither active nor degraded raised bog capable of restoration is still important in its own right, particularly as a supporting habitat for those listed in Annex I of the Habitats Directive. It is an essential part of the hydrological unit which supports the active and degraded bog habitats. The area of high bog in the SAC network in 1994 was 10,740 ha. The corresponding area in 2012 is 10,515 ha – meaning there is 225 ha less than at the time of designation.

9. Transitional areas between high bog and adjacent mineral soils

Target	Notes
Maintain/restore semi-natural habitats with high water levels around as much of the bog margins as necessary	Transitional zones between raised bogs and surrounding mineral soils are typically cutover bog and drained lagg zones. The maintenance/restoration of these areas will help to maintain hydrological integrity of bogs and support high diversity of other wetland habitats (e.g. wet woodland, bog woodland, swamp and fen) as well as species requiring such wetland complexes. It will also provide flood attenuation and water purification services to the

	downstream areas. The estimated extent of such transitional areas within the SAC network is circa 3,000 ha

10. Vegetation quality

Target	Notes
Maintain/restore sufficient high quality vegetation (i.e. central ecotope and/or soaks). At least 50% of active raised bog habitat should be central ecotope and/or soaks	High quality indicators include hummock indicators: rusty bog-moss (*Sphagnum fuscum*) and Austin's bog-moss (*S. austinii* ssp. *austinii*); pool indicators: feathery bog moss (*S. cuspidatum*), lesser cow-horn bog-moss (*S.denticulatum*) and indicators of lack of burning events e.g. some lichen species (*Cladonia* spp.)

11. Micro-topographical features

Target	Notes
Maintain/restore adequate cover of high quality micro-topographical features	A diverse good quality micro-topography consists of bog moss-dominated pools, hollows, lawns and hummocks, which support the highest diversity of species

12. Cover of bog-moss species

Target	Notes
Maintain/restore adequate cover of bog-moss (*Sphagnum*) species to ensure peat-forming capacity	*Sphagnum* cover varies naturally across Ireland, ranging from relatively high cover in bogs in the east of the country to lower cover in the west in transitional areas of raised bog to blanket bog. Hummock forming species such as *Sphagnum austinii* ssp. *austinii* are particularly good peat-formers

13. Typical bog flora

Target	Notes
Maintain/restore typical raised bog flora	Typical species include widespread species, as well as those with more restricted distributions but typical of the habitat's subtypes or geographical range

14. Elements of local distinctiveness

Target	Notes
Maintain/restore indicators of local distinctiveness	Such features include geological, topographical, archaeological, hydrological features (e.g. soaks, flushes) as well as notable species. This includes species that are listed in the Habitats and Birds

	Directives, red-listed species and other rare or localised species (such as Red Grouse (*Lagopus lagopus*)

15. Negative physical indicators

Target	Notes
Bare peat and other indicators of degradation including algae-dominated pools and hollows and tear patterns are absent or insignificant	Such indicators are signs of degradation of active raised bog habitat

16. Negative indicator species

Target	Notes
Native negative indicators and non-native species are absent or under control	Indicators of disturbance include species indicative of drying out conditions such as abundant bog asphodel (*Narthecium ossifragum*) and deergrass (*Trichophorum germanicum*); harestail cotton-grass (*Eriophorum vaginatum*) forming tussocks; abundant magellanic bog-moss (*Sphagnum magellanicum*) in pools previously dominated by species typical of very wet conditions (e.g. feathery bog-moss (*S. cuspidatum*). Indicators of frequent burning events include abundant *Cladonia floerkeana* and high cover of carnation sedge (*Carex panicea*) (particularly in true "Midlands raised bogs"). Most common invasive species include lodgepole pine (*Pinus contorta*), rhododendron (*Rhododendron ponticum*) and pitcherplant (*Sarracenia purpurea*)

Site Specific Conservation Objectives

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at site level.

Following a similar process outlined above, conservation objectives will be set for each Category 1 NHA Raised Bog habitat and for all new Raised Bog NHAs. The site-specific conservation objectives will give a target area for active raised bog in each of the raised bog NHAs as well as giving site-specific targets for attributes relating to structure and functions.

Site-specific conservation objectives for each NHA will be used as a basis for restoration planning at each site. These objectives will be set during 2015 - 2016.

Addendum 1

Current Ecological Condition of Ireland's Raised Bog NHAs and Non Designated Sites

Table A2.1a Results of Ecological Assessment of Raised Bog NHAs

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
000220	Lough Namucka Bog	Galway	E (low)	E (low)	E (low)	B (high)
000221	Moorfield Bog/Farm Cottage Bog	Galway	B (high)	D (moderate)	C (moderate-high)	E (low)
000222	Ballyforan Bog	Galway / Roscommon	E (low)	D (moderate)	E (low)	B (high)
000229	Ballygar Bog	Galway	B (high)	E (low)	D (moderate)	E (low)
000235	Bracklagh Bog	Galway	B (high)	E (low)	D (moderate)	D (moderate)
000245	Clooncullaun Bog	Galway	D (moderate)	E (low)	D (moderate)	D (moderate)
000247	Slieve Bog	Galway	E (low)	B (high)	E (low)	B (high)
000249	Cloonoolish Bog	Galway	D (moderate)	E (low)	D (moderate)	B (high)
000254	Crit Island Bog	Galway	C (moderate-high)	D (moderate)	D (moderate)	D (moderate)
000267	Funshin Bog	Galway	E (low)	D (moderate)	E (low)	D (moderate)
000280	Castle Ffrench West Bog	Galway	B (high)	E (low)	D (moderate)	D (moderate)
000281	Keeloges Bog West	Galway	B (high)	E (low)	D (moderate)	D (moderate)
	Keeloges Bog East	Galway	E (low)	E (low)	E (low)	E (low)
000283	Kilmore Bog	Galway	D (moderate)	E (low)	D (moderate)	B (high)
000284	Kilnaborris Bog	Galway	D (moderate)	E (low)	D (moderate)	D (moderate)
000292	Leaha Bog	Galway	E (low)	E (low)	E (low)	E (low)
000307	Lough Tee Bog East	Galway	C (moderate-high)	D (moderate)	D (moderate)	E (low)
	Lough Tee Bog West	Galway	D (moderate)	D (moderate)	D (moderate)	B (high)
000310	Meeneen Bog	Galway	D (moderate)	E (low)	D (moderate)	B (high)
000321	Raford River Bog East	Galway	C (moderate-high)	B (high)	B (high)	D (moderate)

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
	Raford River Bog West	Galway	E (low)	B (high)	E (low)	D (moderate)
000333	Anna More Bog	Kerry	D (moderate)	B (high)	D (moderate)	E (low)
000337	Doon Lough Bog	Clare	E (low)	B (high)	E (low)	D (moderate)
000422	Aghnamona Bog	Leitrim / Longford	B (high)	E (low)	C (moderate-high)	D (moderate)
000564	Cloghan Demesne Bog	Offaly	B (high)	E (low)	D (moderate)	B (high)
	Coolross West Bog	Offaly	E (low)	E (low)	E (low)	E (low)
	Coolross/Ballyoughter /Clongowna Bog	Offaly	E (low)	E (low)	E (low)	D (moderate)
	Annagh Bog	Offaly	E (low)	E (low)	E (low)	B (high)
000565	Clonydonnin Bog	Westmeath	B (high)	D (moderate)	D (moderate)	E (low)
000570	Black Castle Bog	Offaly	C (moderate-high)	D (moderate)	D (moderate)	D (moderate)
000591	Bella Bridge Bog	Roscommon	E (low)	D (moderate)	E (low)	D (moderate)
000603	Cornaveagh Bog	Roscommon	C (moderate-high)	D (moderate)	D (moderate)	E (low)
000605	Derrycanan Bog	Roscommon	D (moderate)	D (moderate)	D (moderate)	D (moderate)
000640	Arragh More Bog	Tipperary	B (high)	E (low)	D (moderate)	D (moderate)
000642	Ballymacegan Bog	Tipperary	C (moderate-high)	E (low)	D (moderate)	B (high)
000648	Killeen Bog	Tipperary	D (moderate)	E (low)	D (moderate)	E (low)
000652	Monaincha Bog/Ballaghmore Bog	Tipperary / Laois	D (moderate)	D (moderate)	D (moderate)	B (high)
000674	Ballynagrenia Bog	Westmeath	B (high)	D (moderate)	D (moderate)	D (moderate)
	Ballinderry Bog	Westmeath	B (high)	E (low)	D (moderate)	D (moderate)

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
000677	Cloncrow Bog	Westmeath	D (moderate)	D (moderate)	D (moderate)	D (moderate)
000684	Lough Derravaragh Bog	Westmeath	B (high)	E (low)	D (moderate)	B (high)
000691	Annaghcooleen Bog	Leitrim, Longford	B (high)	E (low)	D (moderate)	D (moderate)
	Bellageeher Bog	Leitrim, Longford	E (low)	E (low)	E (low)	B (high)
000694	Wooddown Bog	Westmeath	C (moderate-high)	D (moderate)	D (moderate)	D (moderate)
000890	Cangort Bog	Offaly / Tipperary	E (low)	E (low)	E (low)	E (low)
000921	Screggan Bog	Offaly	D (moderate)	D (moderate)	D (moderate)	B (high)
000937	Scohaboy Bog	Tipperary	C (moderate-high)	B (high)	D (moderate)	D (moderate)
000985	Derragh Lough Bog	Longford / Cavan / Westmeath	E (low)	D (moderate)	E (low)	B (high)
000993	Ayle Lower Bog	Clare	D (moderate)	B (high)	D (moderate)	B (high)
001020	Loughanilloon Bog	Clare	E (low)	D (moderate)	E (low)	B (high)
001227	Aughrim Bog	Galway	C (moderate-high)	E (low)	D (moderate)	B (high)
001240	Capira/Derrew Bog	Galway	E (low)	D (moderate)	E (low)	D (moderate)
001244	Castle Ffrench East Bog	Galway	B (high)	E (low)	D (moderate)	B (high)
001254	Derrinlough Bog	Galway	D (moderate)	B (high)	D (moderate)	B (high)
001255	Derrynagran Bog	Galway	E (low)	D (moderate)	E (low)	E (low)
001264	Eskerboy Bog	Galway	E (low)	D (moderate)	E (low)	B (high)
001280	Killaclogher Bog	Galway	E (low)	D (moderate)	E (low)	D (moderate)
001283	Killure Bog	Galway	D (moderate)	E (low)	D (moderate)	D (moderate)
001303	Moorfield Bog	Galway	D (moderate)	E (low)	D	D

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
					(moderate)	(moderate)
001324	Jamestown Bog East	Meath	B (high)	D (moderate)	D (moderate)	E (low)
001324	Jamestown Bog West	Meath	E (low)	D (moderate)	E (low)	E (low)
001352	Bunnaruddee Bog	Kerry	E (low)	B (high)	E (low)	E (low)
001388	Carbury Bog	Kildare	E (low)	D (moderate)	E (low)	B (high)
001393	Hodgestown Bog	Kildare	E (low)	B (high)	E (low)	E (low)
001405	Cashel Bog	Leitrim	B (high)	D (moderate)	C (moderate-high)	D (moderate)
001420	Corracramph Bog East	Leitrim	D (moderate)	D (moderate)	D (moderate)	B (high)
	Corracramph Bog West	Leitrim	E (low)	D (moderate)	E (low)	E (low)
001423	Cloonageeher Bog	Leitrim / Longford	C (moderate-high)	D (moderate)	D (moderate)	D (moderate)
001448	Forthill Bog	Longford	D (moderate)	D (moderate)	D (moderate)	B (high)
001450	Mount Jessop Bog	Longford	C (moderate-high)	D (moderate)	D (moderate)	D (moderate)
001580	Girley Bog	Meath	D (moderate)	D (moderate)	D (moderate)	E (low)
001582	Molerick Bog	Meath	E (low)	D (moderate)	E (low)	D (moderate)
001623	Carrickynaghtan Bog	Roscommon	Green (+) - Excellent	E (low)	C (moderate-high)	D (moderate)
001652	Tullaghan Bog (Roscommon)	Roscommon	E (low)	D (moderate)	E (low)	E (low)
001684	Lorrha Bog	Tipperary	E (low)	E (low)	E (low)	E (low)
001725	Nure Bog	Westmeath	E (low)	D (moderate)	E (low)	B (high)
001812	Lough Garr Bog	Westmeath	E (low)	E (low)	E (low)	B (high)
001853	Cappalahan Bog	Tipperary	D (moderate)	D (moderate)	D (moderate)	D (moderate)
	Timoney Bog	Tipperary	D (moderate)	D (moderate)	E (low)	B (high)
002033	Daingean Bog	Offaly	D (moderate)	B (high)	D (moderate)	E (low)

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
002072	Lisnanarriagh Bog	Roscommon	E (low)	E (low)	E (low)	E (low)
002307	Cloonloum More Bog	Clare	E (low)	B (high)	E (low)	D (moderate)
002323	Milltownpass Bog	Westmeath	D (moderate)	E (low)	D (moderate)	D (moderate)
002344	Annaghbeg Bog	Galway	C (moderate-high)	E (low)	D (moderate)	E (low)
002355	Hawkswood Bog	Offaly	C (moderate-high)	B (high)	D (moderate)	E (low)
002357	Clonreher Bog	Laois	E (low)	B (high)	E (low)	E (low)

Table A2.1b Results of Ecological Assessment of 126 Non Designated Sites

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
000007	Drummany Bog	Cavan	D (moderate)	B (high)	D (moderate)	D (moderate)
	Derrywinny Bog	Cavan	E (low)	B (high)	E (low)	B (high)
	Drumgoon Bog	Cavan	E (low)	B (high)	E (low)	E (low)
	Inishbeg Bog	Cavan	E (low)	B (high)	E (low)	B (high)
000108	Dromkeen Bog	Cork	E (low)	B (high)	E (low)	E (low)
000216	Cloniff Bog	Offaly	E (low)	D (moderate)	E (low)	B (high)
	Raghra Bog	Offaly	E (low)	D (moderate)	E (low)	B (high)
000263	Drumbulcaun Bog	Galway	E (low)	D (moderate)	E (low)	B (high)
000297	Knockkillaree Bog	Galway	E (low)	B (high)	E (low)	D (moderate)
000390	Ballina Bog	Kildare	E (low)	B (high)	E (low)	E (low)
000413	Annaghmore Lough Bog	Laois-Offaly	E (low)	D (moderate)	E (low)	B (high)
000440	Forthill Bog	Longford	E (low)	E (low)	E (low)	B (high)
	Cleraun Bog	Longford	E (low)	E (low)	E (low)	NA
000447	Derrymore Bog	Longford	E (low)	E (low)	E (low)	E (low)
000449	Lough Bannow Bog South	Longford	E (low)	E (low)	E (low)	NA
	Lough Bannow Bog North	Longford	E (low)	D (moderate)	E (low)	E (low)
000578	Kilballyskea Bog	Offaly	E (low)	E (low)	E (low)	D (moderate)
000586	Woodfield Bog	Offaly	E (low)	E (low)	E (low)	D (moderate)
000636	Cloonacleigha Bog	Sligo	E (low)	B (high)	E (low)	D (moderate)
000859	Derry Bog	Laois	D (moderate)	E (low)	D (moderate)	B (high)
000869	Lisbigney Bog	Laois	NA	NA	NA	NA
000893	Clonlyon Glebe Bog	Offaly	E (low)	E (low)	E (low)	NA
000909	Lough Coura Bog	Offaly	E (low)	E (low)	E (low)	NA
000920	Ross Bog	Offaly	E (low)	E (low)	E (low)	D (moderate)
000932	Fiagh Bog	Tipperary	E (low)	D (moderate)	E (low)	NA
000978	Cordonaghy Bog	Cavan	E (low)	B (high)	E (low)	D

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
						(moderate)
000987	Lough Sheelin Bog	Cavan	E (low)	D (moderate)	E (low)	NA
000992	Swan Lough Bog	Cavan	E (low)	B (high)	E (low)	NA
001010	Fin Lough Bog	Clare	NA	NA	NA	NA
001271	Kylemore Bog	Galway	NA	NA	NA	NA
001454	Ardee Cutaway Bog	Louth	NA	NA	NA	NA
001577	Doolystown Bog	Meath	E (low)	B (high)	E (low)	NA
001593	Thomastown Bog	Meath	NA	NA	NA	NA
001605	Cooltrimegish Bog	Monaghan	E (low)	B (high)	E (low)	B (high)
001630	Cranberry Lough Bog	Roscommon	D (moderate)	D (moderate)	D (moderate)	B (high)
001643	Cleaheen Bog	Leitrim, Roscommon	E (low)	B (high)	E (low)	D (moderate)
001709	Tiaquin Bog	Galway	E (low)	D (moderate)	E (low)	D (moderate)
001819	Lough Bawn Bog	Longford	E (low)	E (low)	E (low)	B (high)
001850	Dromsallagh Bog	Limerick	E (low)	B (high)	E (low)	D (moderate)
002104	Pollagh Bog	Offaly	E (low)	E (low)	E (low)	B (high)
002165	Ballyvorheen Bog	Limerick	E (low)	B (high)	E (low)	D (moderate)
002298	Island Lake Bog	Mayo	NA	NA	NA	NA
002505	Griston Bog	Limerick	NA	NA	NA	NA
002748	Lodge Bog	Kildare	E (low)	D (moderate)	E (low)	D (moderate)
002937	Derrycricket Bog	Offaly	E (low)	B (high)	E (low)	E (low)
	Drummin Bog	Carlow	E (low)	B (high)	E (low)	E (low)
	Crossrah Bog	Cavan	E (low)	D (moderate)	E (low)	E (low)
	Fartrin Bog North	Cavan	E (low)	B (high)	E (low)	E (low)
	Derry East Bog	Cavan	E (low)	B (high)	E (low)	D (moderate)
	Derry West Bog	Cavan	E (low)	B (high)	E (low)	D (moderate)
	Gowlagh South Bog	Cavan	E (low)	B (high)	E (low)	E (low)
	Drumhillagh South Bog	Cavan	E (low)	B (high)	E (low)	E (low)
	Corradooa Bog	Cavan	E (low)	B (high)	E (low)	D (moderate)

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
	Lisnabantry Bog	Cavan	E (low)	D (moderate)	E (low)	E (low)
	Ballyconnell Bog	Cavan	E (low)	B (high)	E (low)	B (high)
	Fartrin Bog South	Cavan	E (low)	B (high)	E (low)	D (moderate)
	Clontygrigny Bog	Cavan	E (low)	B (high)	E (low)	D (moderate)
	Ower Bog	Galway	C (moderate - high)	B (high)	C (moderate - high)	D (moderate)
	Moyarwood Bog	Galway	E (low)	E (low)	E (low)	B (high)
	Cloonarkin Bog	Galway	E (low)	D (moderate)	E (low)	NA
	Lenareagh Bog	Galway	E (low)	E (low)	E (low)	D (moderate)
	Paul's Lough Bog	Galway	D (moderate)	E (low)	D (moderate)	B (high)
	Cappataggle Bog	Galway	E (low)	D (moderate)	E (low)	E (low)
	Ussey Bog	Galway	C (moderate - high)	D (moderate)	D (moderate)	D (moderate)
	Islands Bog	Galway	E (low)	E (low)	E (low)	D (moderate)
	Cloonfaris Killosolan Bog	Galway	E (low)	E (low)	E (low)	D (moderate)
	Cloonabricka Corrabaun Bog	Galway	E (low)	E (low)	E (low)	D (moderate)
	Abbeyleix Bog (Killamuck)	Laois	D (moderate)	B (high)	D (moderate)	B (high)
	Rossnagad Bog	Laois	E (low)	B (high)	E (low)	D (moderate)
	Moonbawn Bog	Laois	E (low)	B (high)	E (low)	E (low)
	Cullaun Bog	Laois	C (moderate - high)	B (high)	D (moderate)	D (moderate)
	Liscloonadee Bog	Leitrim	E (low)	D (moderate)	E (low)	B (high)
	Cloonshannagh/Mostrim Bog	Longford	C (moderate - high)	D (moderate)	D (moderate)	E (low)
	Corclaragh/Clonwhelan Bog	Longford, Westmeath	E (low)	E (low)	E (low)	D (moderate)
	Cloonceen Bog	Longford, Westmeath	E (low)	D (moderate)	E (low)	NA
	Killinagh/Glenlough Bog	Longford,	C	D	D	B (high)

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
		Westmeath	(moderate - high)	(moderate)	(moderate)	
	Redbog (Louth)	Louth	E (low)	B (high)	E (low)	D (moderate)
	Rassan Bog	Louth	NA	NA	NA	NA
	Stormanstown Bog	Louth	NA	NA	NA	NA
	Killadeer Bog	Mayo	NA	NA	NA	NA
	Tawnaghbeg (Gurteen) Bog	Mayo	E (low)	D (moderate)	E (low)	E (low)
	Shanwalla Bog	Mayo	B (high)	D (moderate)	B (high)	D (moderate)
	Botinny Bog	Mayo, Sligo	E (low)	D (moderate)	E (low)	NA
	Carnquill Bog	Monaghan	E (low)	B (high)	E (low)	D (moderate)
	The Derries Bog	Offaly	E (low)	D (moderate)	E (low)	E (low)
	Killaun Bog	Offaly	E (low)	D (moderate)	E (low)	B (high)
	Cloonaheen Bog	Offaly	E (low)	E (low)	E (low)	B (high)
	Clonavoe Bog	Offaly	D (moderate)	B (high)	D (moderate)	E (low)
	Cloncanon West Bog	Offaly	E (low)	D (moderate)	E (low)	E (low)
	Clonroosk Little Bog	Offaly, Kildare	C (moderate - high)	B (high)	D (moderate)	D (moderate)
	Clera Island Bog	Roscommon	C (moderate - high)	D (moderate)	D (moderate)	B (high)
	Ballydangan Bog South	Roscommon	B (high)	D (moderate)	D (moderate)	B (high)
	Ballydangan Bog North	Roscommon	D (moderate)	D (moderate)	D (moderate)	B (high)
	Cuckoo Hill Bog	Roscommon	D (moderate)	E (low)	D (moderate)	B (high)
	Cloonkeen Bog	Roscommon	E (low)	D (moderate)	E (low)	B (high)
	Goats Lough Bog South	Roscommon	D (moderate)	D (moderate)	D (moderate)	B (high)
	Cregganycarna Bog	Roscommon	E (low)	E (low)	E (low)	D (moderate)
	Goats Lough Bog North	Roscommon	E (low)	D (moderate)	E (low)	B (high)
	Camlagh Bog	Roscommon	E (low)	E (low)	E (low)	E (low)

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
	Annaghmaghera Bog	Roscommon	E (low)	E (low)	E (low)	NA
	Ballinaphuill Ballaghadreen Bog	Roscommon	E (low)	E (low)	E (low)	E (low)
	Curraghaleen Bog	Roscommon	C (moderate - high)	E (low)	D (moderate)	D (moderate)
	Drumerr Bog	Roscommon	E (low)	B (high)	E (low)	D (moderate)
	Derreenasoo Bog	Roscommon	C (moderate - high)	B (high)	B (high)	D (moderate)
	Derrycashel (Clondra) Bog	Roscommon	E (low)	E (low)	E (low)	B (high)
	Clooncoose Bog East	Roscommon	E (low)	E (low)	E (low)	NA
	Clooncoose Bog West	Roscommon	E (low)	E (low)	E (low)	NA
	Castlesampson Bog	Roscommon	C (moderate - high)	E (low)	B (high)	D (moderate)
	Rooskagh Bog	Roscommon	D (moderate)	E (low)	D (moderate)	D (moderate)
	Achonry Bog East	Sligo	C (moderate - high)	B (high)	B (high)	D (moderate)
	Annaghmore (Coolavin) Bog	Sligo	E (low)	D (moderate)	E (low)	E (low)
	Cloonsillagh Bog	Sligo	E (low)	D (moderate)	E (low)	E (low)
	Corsallagh Bog	Sligo	D (moderate)	B (high)	D (moderate)	D (moderate)
	Curryfule Bog North	Sligo	E (low)	D (moderate)	E (low)	E (low)
	Curryfule Bog South	Sligo	E (low)	D (moderate)	E (low)	E (low)
	Moylough Bog	Sligo	E (low)	D (moderate)	E (low)	D (moderate)
	Oghambaun Bog	Sligo	C (moderate - high)	B (high)	D (moderate)	B (high)
	Ballincurry Bog	Sligo, Mayo	B (high)	D (moderate)	D (moderate)	D (moderate)
	Lislaughna Bog	Sligo, Mayo	D (moderate)	D (moderate)	C (moderate - high)	E (low)
	Cuilmore Bog	Sligo; Galway	C (moderate - high)	D (moderate)	E (low)	E (low)

Site Code	Bog Name	County	Area	Geographic Range	Habitat Quality	Ecological Diversity
	Cappamura Ballymore Bog	Tipperary	NA	NA	NA	NA
	Sharragh Bog	Tipperary	E (low)	E (low)	E (low)	NA
	Cullahill Dromard Bog	Tipperary, Laois	E (low)	B (high)	E (low)	D (moderate)
	Waterstown Bog	Westmeath	E (low)	E (low)	E (low)	B (high)
	Kilbrennan (Gaybrook) Bog	Westmeath	D (moderate)	D (moderate)	D (moderate)	D (moderate)
	Knockananna Bog	Wicklow	C (moderate - high)	B (high)	D (moderate)	D (moderate)

Addendum 2

Current Eco-Hydrological Condition of Ireland's Raised Bog NHAs and Non Designated Sites

Modelling the potential for Raised Bog Restoration

The physical conditions under which active raised bog survives and develops (subsequently referred to as active raised bog), were assessed by modelling specific bogs to understand their hydrological function. The basis for this modelling process is research initially carried out on two Irish Midland raised bogs during the 1990s, and subsequently applied to an additional five Irish Midland raised bogs. The modelling process involved relating suitable supporting topographic conditions (including surface shape, slope and drainage patterns) to locations where active raised bog was found. These conditions were, in turn, used to forecast potential restoration areas where topography is suitable for active raised bog to be restored following engineered measures such as drain blockage.

The core aspect of the eco-hydrology model is based on the concept of Potential Acrotelm Capacity (PAC) developed by van der Schaaf (2002), where PAC indicates the potential of topography to support active raised bog. Overall, the model proposes a means of assessing whether areas will remain sufficiently wet to sustain raised bog vegetation. More precisely, the model assumes upstream flow path length (L) and local surface slope (s) are the fundamental physical parameters underpinning the survival of active raised bog. The resulting PAC (in terms of kilometres) is defined by the formula:

$$PAC = \frac{L}{fs}$$

PAC = Potential Acrotelm Capacity (km)
L = Upstream Flow Path Length (m)
s= Local surface slope (m km^{-1})
f = dimensionless flow path shape factor

However, it is has proven difficult to adequately define f, since there are often so many variations in flow path shape; van der Schaff considered a value of f=1 as a reasonable compromise in most cases. Overall this formula suggests that areas with long upstream flow paths coupled with gentle slopes are most likely to support active raised bog. In addition it is important to note that this formula assumes static topographic conditions. Where topographic conditions remain dynamic e.g. ongoing subsidence, the PAC values obtained would be expected to vary with time. It is also assumed that the only significant losses of effective rainfall occur via overland flow and not by various forms of vertical flow through fissured peat, cracks or swallow-holes.

The threshold value after which degraded raised bog occurs, using the PAC approach as defined by van der Schaaf and Streefkerk (2002), is based on typical PAC values observed in the ecology associated with bog margins based on the seven Irish Midland raised bogs studied. The study concluded that areas with a PAC value > 50km may eventually become active through restoration works. By contrast areas where PAC values are < 50km but > 30km recovery potential is unclear, while areas with a PAC value of < 30km would be impossible to recover without major technical operations such as large dams.

In the current programme of work being undertaken by Consultants RPS, the PAC formula was applied to all raised bog SACs making use of LiDAR technology which was not available to van der Schaaf and Streefkerk in 2002. LiDAR is a remote sensing technology that measures vertical surface elevation by illuminating a target with a laser and analyzing the reflected light. The data is collected in the field using a low flying aeroplane. This gives much more detailed and accurate raised bog topographical maps than can be collected by traditional surveying techniques.

LiDAR data was collected for all 53 Raised Bog SACs and 75 Raised Bog NHAs and enabled a much more accurate eco-hydrological model to be developed by providing detailed topographical information of the raised bog's drainage patterns and slope.

For the non-designated raised bogs, LiDAR data availability was limited to a small number of Bord na Móna sites. For the majority of sites where no LiDAR data was available, use was made of lower resolution radar topographical data. The results of the eco-hydrological assessments for these sites can therefore only be used for indicative purposes.

A number of observations were made when this process was applied to Ireland's Raised Bog SACs:

Firstly, there were areas where active raised bog was present, yet the model did not adequately indicate that conditions were suitable for ARB development. After assessing the local surface slope and flow path lengths in these areas, it was concluded that flow path length could be better represented by drainage density.

Secondly, it was observed that the model generated some over-estimation of areas of potential restoration of active raised bog on several Midland sites, indicating that threshold values obtained from the PAC method typically associated with bog margins are too low. Moreover, there was a notable under-estimation of coverage of areas of potential restoration of active raised bog in locations with much higher rainfall. This highlights bias arising in using the PAC formula developed for a limited number of sites in the Midlands. This discrepancy is suspected to arise since the model does not account for rainfall variation across the country.

To account for discrepancies in the PAC method, the following two modifications to the topographic model formula and modelling process were applied.

1. In order to account for accumulation along more than one flow path leading to a point, an alternative parameter was proposed in place of flow path length. This parameter accounts for contributing catchment area, providing an improved measure of the upstream catchment area contributing to a certain point, particularly when flow path convergence occurs. The altered formula, known as modified flow accumulation capacity (MFAC), also acts as a means of consistently accounting for the flow pattern/shape and therefore enables better use of the improved detail available with the LiDAR data. The formula was also adapted to produce the same units (km) as in the original PAC formula:

$$MFAC = \frac{\sqrt{A}}{s}$$

MFAC = Modified Flow Accumulation Capacity (km)

A = Upstream contributing catchment area (flow accumulation) (m2)

s = Local surface slope (m km-1)

2. After the model process had been modified to consider the correspondence between MFAC and active raised bog distribution, statistical analysis was undertaken to determine the median MFAC values within the main ecological categories (Figure A3.1). Using this relationship enabled a climatic factor to be developed to take account of regional variation in climatic conditions.

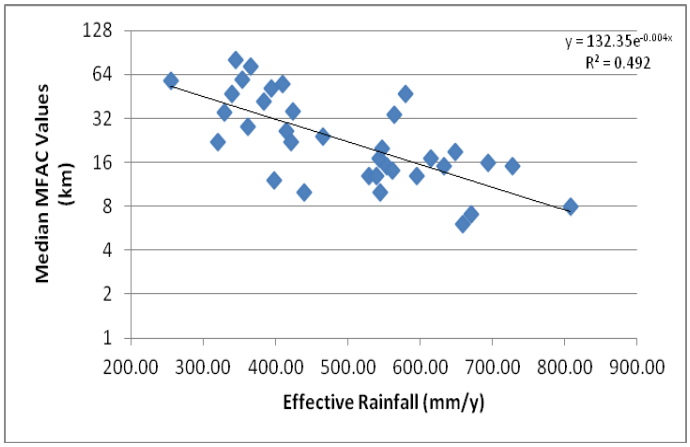

Figure A3.1 Correlation between median MFAC and Rainfall

The application of the eco-hydrological modelling process is illustrated by the following series of diagrams (Figures A3.2 – A3.7) related to Clara Bog SAC.

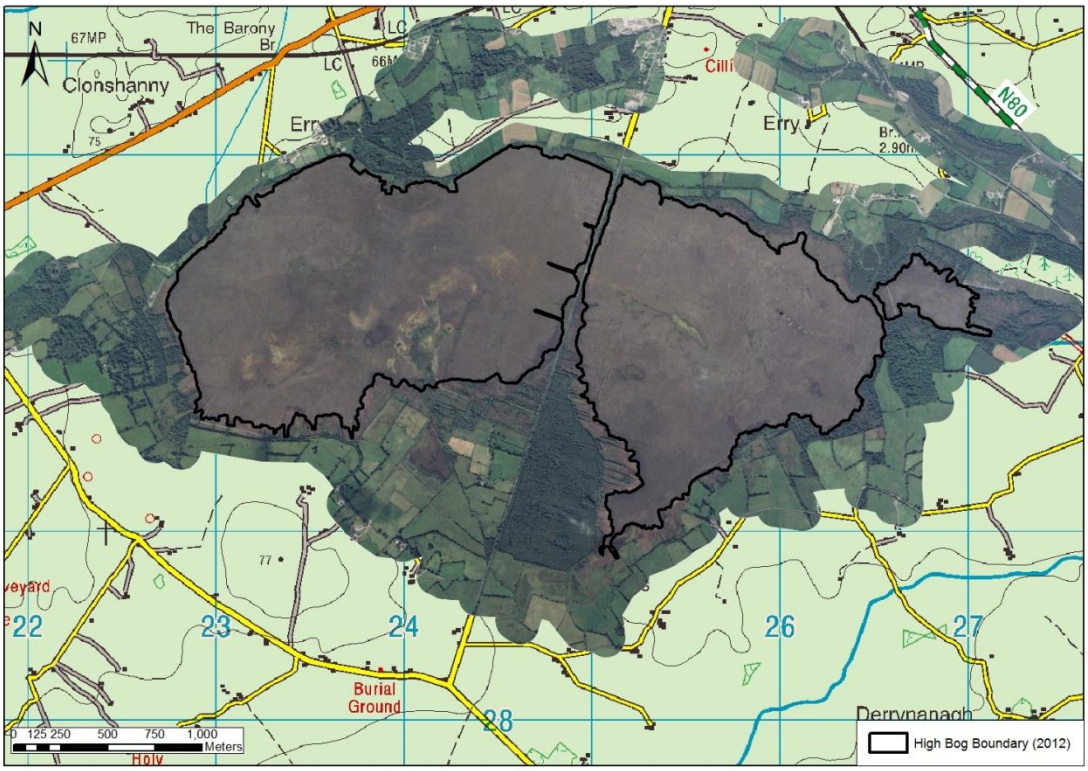

Figure A3.2 Clara Bog SAC, Ortho-Rectified Aerial Photo showing boundary of High Bog and SAC

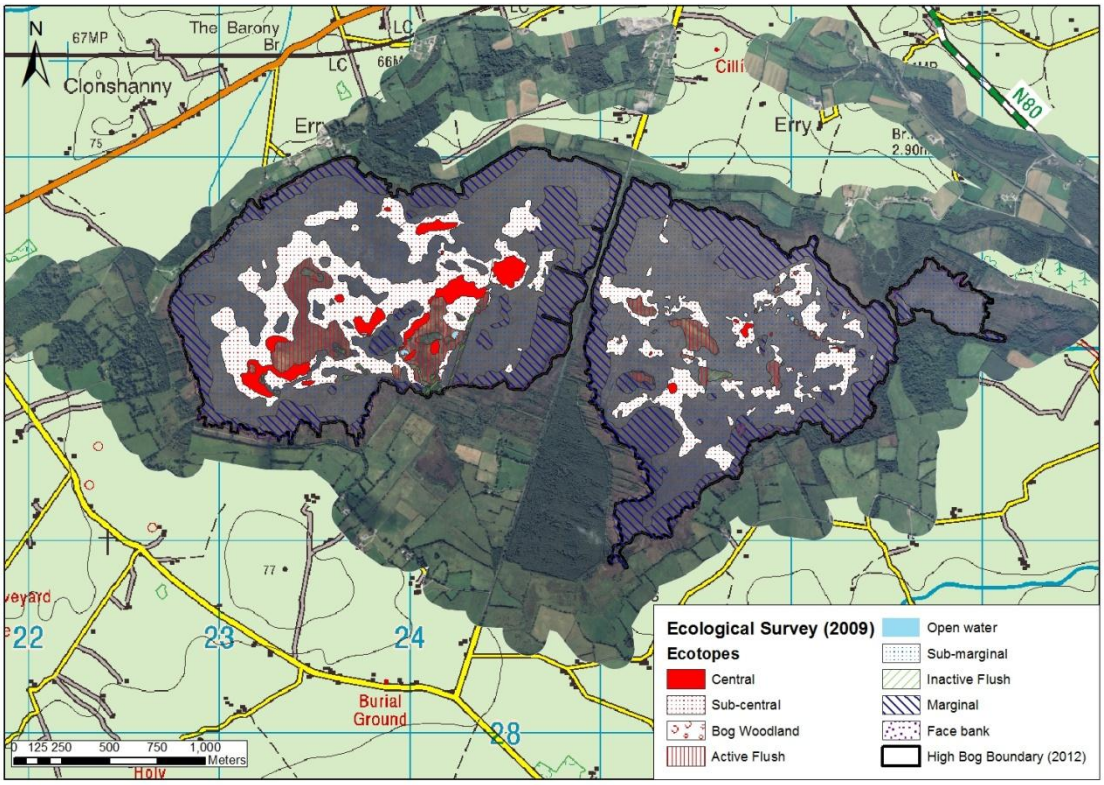

Figure A3.3 Clara Bog SAC, Ecological Survey Results 2009

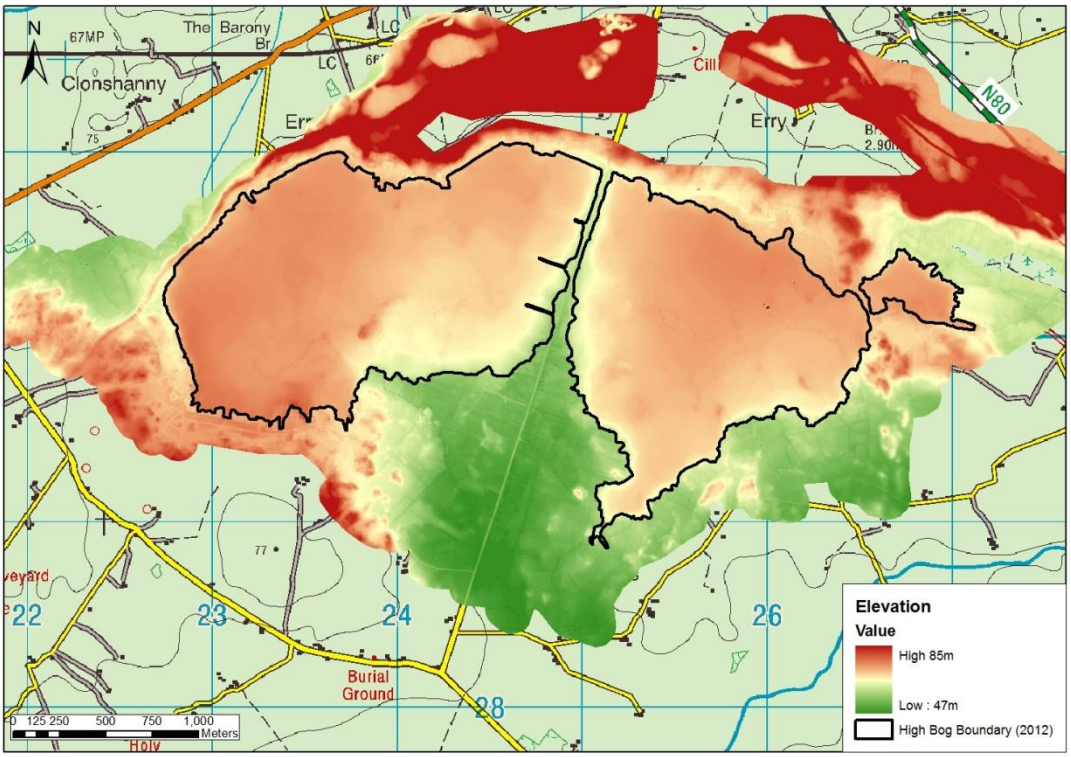

Figure A3.4 Clara Bog SAC LiDAR Imagery 2012

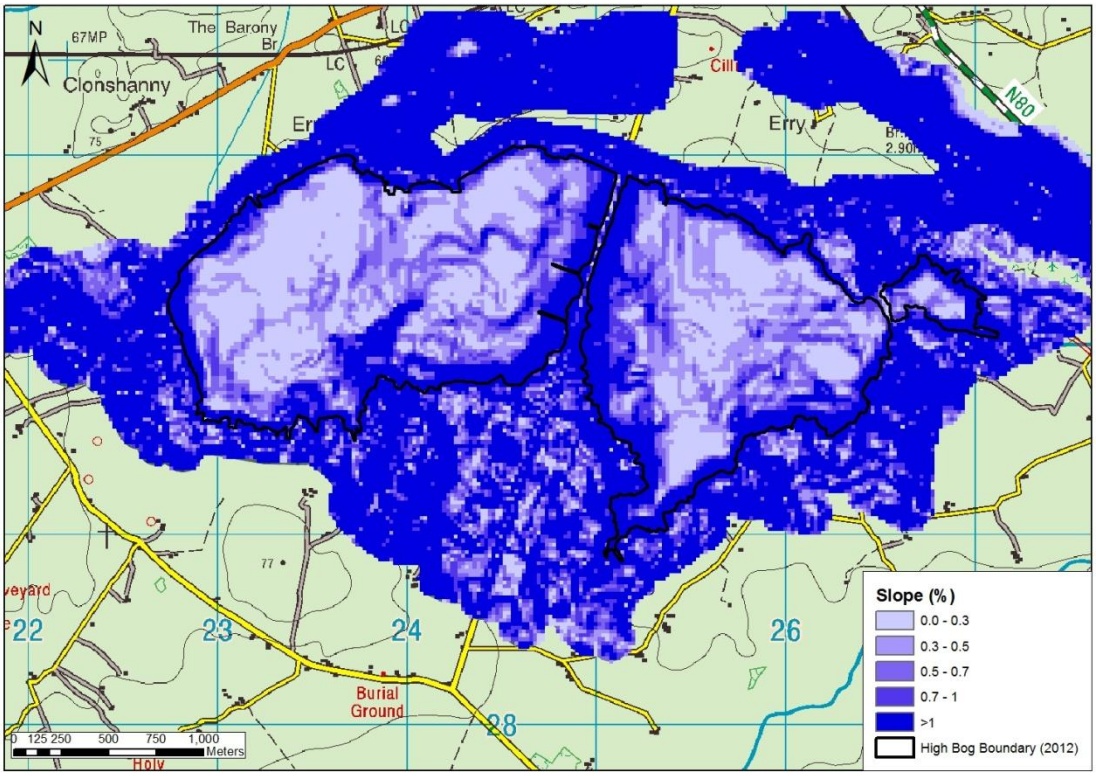

Figure A3.5 Clara Bog SAC. Slope derived from LiDAR Imagery 2012

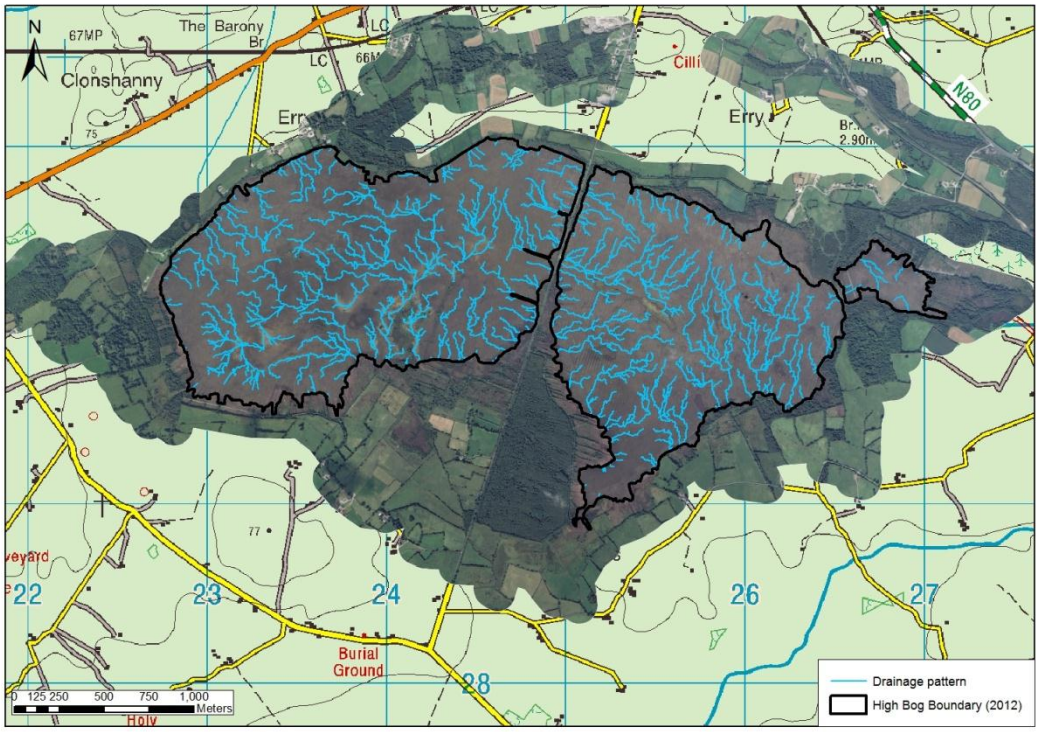

Figure A3.6 Clara Bog SAC. Drainage paths derived from LiDAR Imagery 2012

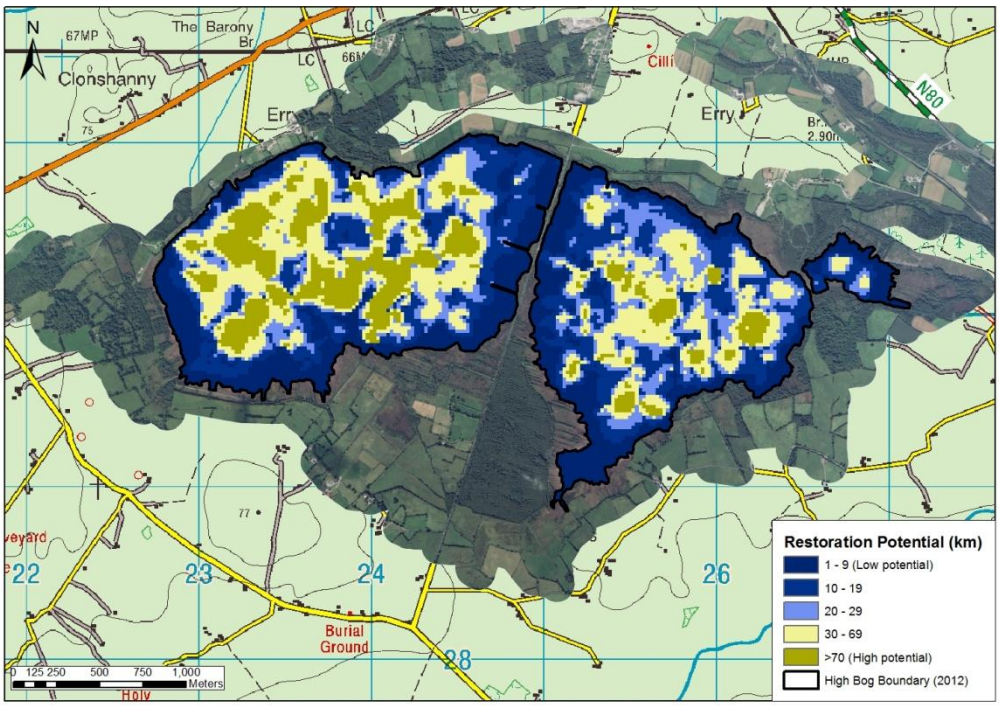

Figure A3.7 Clara Bog SAC. Restoration Potential derived from Eco-Hydrological Model

Table A3.1a Results of Eco-hydrological Assessment of Raised Bog NHAs

Site Code	Bog Name	Last Survey	Total high bog (Ha)	Active raised bog (ha)	Degraded raised bog (ha) (Area restorable)
000220	Lough Namucka Bog	2003	124.9	0.0	8.5
000221	Moorfield Bog/Farm Cottage Bog	2012	65.4	8.4	2.5
000222	Ballyforan Bog	2003	56.3	0.0	1.9
000229	Ballygar Bog	2000	107.8	9.6	16.9
000235	Bracklagh Bog	2003	57.6	9.6	2.4
000245	Clooncullaun Bog	2004	117.0	2.7	2.3
000247	Slieve Bog	2000	171.3	0.0	9.1
000249	Cloonoolish Bog	2003	56.5	1.1	<1
000254	Crit Island Bog	2003	342.3	9.3	23.9
000267	Funshin Bog	2003	111.3	0.0	3.1
000280	Castle Ffrench West Bog	2003	45.0	11.8	2.1
000281	Keeloges Bog West	2003	147.7	9.8	9.9
	Keeloges Bog East	2003	86.5	0.0	3.0
000283	Kilmore Bog	2003	73.1	2.1	1.3
000284	Kilnaborris Bog	2000	114.2	1.0	<1
000292	Leaha Bog	2003	57.6	0.0	<1
000307	Lough Tee Bog East	2003	79.7	6.0	6.4
	Lough Tee Bog West	2003	176.8	1.8	3.0
000310	Meeneen Bog	2003	108.5	1.3	1.8
000321	Raford River Bog East	1995	98.4	5.7	7.0
	Raford River Bog West	NA	12.7	0.0	1.3
000333	Anna More Bog	2003	54.9	0.2	5.6
000337	Doon Lough Bog	2003	10.2	0.0	0
000422	Aghnamona Bog	2003	238.6	13.8	33.7
000564	Cloghan Demesne Bog	2003	70.8	9.4	<1
	Coolross West Bog	2003	7.5	0.0	<1
	Coolross/Ballyoughter/Clongowna Bog	2003	23.5	0.0	<1
	Annagh Bog	NA	23.7	0.0	<1
000565	Clonydonnin Bog	2000	91.0	14.5	4.5
000570	Black Castle Bog	2004	95.9	7.5	5.7
000591	Bella Bridge Bog	2003	120.4	0.0	4.6
000603	Cornaveagh Bog	2003	65.5	1.9	4.4
000605	Derrycanan Bog	2003	194.0	2.5	6.1
000640	Arragh More Bog	2003	226.2	13.1	14.8
000642	Ballymacegan Bog	2003	53.9	4.6	3.6
000648	Killeen Bog	2013	60.6	0.9	<1
000652	Monaincha Bog/Ballaghmore Bog	2003	74.4	3.3	5.8

Site Code	Bog Name	Last Survey	Total high bog (Ha)	Active raised bog (ha)	Degraded raised bog (ha) (Area restorable)
000674	Ballynagrenia Bog	2000	130.0	35.6	3.8
	Ballinderry Bog	2000	35.6	5.3	<1
000677	Cloncrow Bog	2003	131.4	2.1	17.3
000684	Lough Derravaragh Bog	2003	48.2	4.6	2.1
000691	Annaghcooleen Bog	2003	75.6	12.8	2.3
	Bellageeher Bog	2013	24.0	0.0	<1
000694	Wooddown Bog	2003	121.2	5.0	10.0
000890	Cangort Bog	2013	57.9	0.0	6.3
000921	Screggan Bog	2003	51.0	1.2	<1
000937	Scohaboy Bog	2000	197.9	7.1	16.7
000985	Derragh Lough Bog	NA	8.2	0.0	<1
000993	Ayle Lower Bog	2003	30.4	0.2	2.0
001020	Loughanilloon Bog	2013	15.1	0.0	1.1
001227	Aughrim Bog	2000	167.1	4.6	5.7
001240	Capira/Derrew Bog	2003	45.9	0.0	0.1
001244	Castle Ffrench East Bog	2003	74.9	12.0	4.5
001254	Derrinlough Bog	2003	139.8	3.3	4.4
001255	Derrynagran Bog	2003	31.2	0.0	2.0
001264	Eskerboy Bog	2003	89.6	0.0	10.2
001280	Killaclogher Bog	2003	173.9	0.0	5.8
001283	Killure Bog	2003	282.6	2.9	25.4
001303	Moorfield Bog	2003	76.8	1.4	1.8
001324	Jamestown Bog East	2003	28.8	8.4	<1
	Jamestown Bog West	2003	8.3	0.0	0.0
001352	Bunnaruddee Bog	2003	62.2	0.0	1.1
001388	Carbury Bog	2013	77.3	0.0	4.1
001393	Hodgestown Bog	2013	35.6	0.0	1.2
001405	Cashel Bog	2003	66.2	11.3	8.5
001420	Corracramph Bog East	2003	121.2	2.2	8.6
	Corracramph Bog West	2003	15.5	0.0	<1
001423	Cloonageeher Bog	2003	136.4	6.1	3.7
001448	Forthill Bog	2003	54.3	1.1	2.5
001450	Mount Jessop Bog	2003	65.8	3.6	<1
001580	Girley Bog	2000	72.5	1.8	1.8
001582	Molerick Bog	2003	7.8	0.0	0.0
001623	Carrickynaghtan Bog	2003	202.4	46.9	3.0
001652	Tullaghan Bog (Roscommon)	2003	42.4	0.0	0.0
001684	Lorrha Bog	2003	22.6	0.0	<1

Site Code	Bog Name	Last Survey	Total high bog (Ha)	Active raised bog (ha)	Degraded raised bog (ha) (Area restorable)
001725	Nure Bog	2003	85.5	0.0	2.5
001812	Lough Garr Bog	2003	62.6	0.0	2.4
001853	Cappalahan Bog	2003	29.8	2.5	2.4
	Timoney Bog	2003	82.2	4.2	3.9
002033	Daingean Bog	2012	76.2	2.5	10.2
002072	Lisnanarriagh Bog	2003	43.9	0.0	0.0
002307	Cloonloum More Bog	2000	49.0	0.0	2.4
002323	Milltownpass Bog	2013	46.3	2.0	3.3
002344	Annaghbeg Bog	2003	164.8	7.0	18.1
002355	Hawkswood Bog	2010	60.0	3.5	8.0
002357	Clonreher Bog	2003	65.9	0.0	1.1

Table A3.1b Results of Eco-hydrological Assessment of 87 Selected Other Non Designated Sites

Site Code	Bog Name	County	Last Survey	Total high bog area (Ha)	Active raised bog (ha)	Degraded raised bog (ha) (Area restorable)
000007	Derrywinny Bog	Cavan	2013	8.5	0.0	0.0
	Drummany Bog	Cavan	2013	17.6	0.3	<1
000108	Dromkeen Bog	Cork	2013	22.1	0.0	8.4
000216	Raghra Bog	Offaly	2013	12.9	0.0	0.0
	Cloniff Bog	Offaly	2013	42.1	0.0	2.2
000263	Drumbulcaun Bog	Galway	2013	19.2	0.0	<1
000297	Knockkillaree Bog	Galway	2013	47.9	0.0	6.4
000390	Ballina Bog	Kildare	NA	42.1	0.0	0.0
000413	Annaghmore Lough Bog	Laois-Offaly	NA	40.2	0.0	1.2
000440	Forthill Bog	Longford	2013	20.9	0.0	0.0
000449	Lough Bannow Bog North	Longford	NA	35.3	0.0	<1
	Lough Bannow Bog South	Longford	2013	26.4	0.0	<1
000578	Kilballyskea Bog	Offaly	NA	40.3	0.0	2.1
000636	Cloonacleigha Bog	Sligo	NA	21.2	0.0	<1
000859	Derry Bog	Laois	2006	66.6	2.5	6.2
000992	Swan Lough Bog	Cavan	2013	32.2	0.0	<1
001271	Kylemore Bog	Galway	2013	40.1	0.0	1.7
001577	Doolystown Bog	Meath	NA	13.0	0.0	0.0
001593	Thomastown Bog	Meath	NA	39.1	0.0	<1
001605	Cooltrimegish Bog	Monaghan	NA	3.1	0.0	<1
001630	Cranberry Lough Bog	Roscommon	2011	131.7	1.8	26.6
001643	Cleaheen Bog	Leitrim, Roscommon	2013	47.3	0.0	<1
001850	Dromsallagh Bog	Limerick	NA	33.3	0.0	1.5
002165	Ballyvorheen Bog	Limerick	NA	0.8	0.0	0.0
002298	Island Lake Bog	Mayo	NA	59.6	0.0	1.0
002748	Lodge Bog	Kildare	2012	40.9	0.0	<1
NA	Drummin Bog	Carlow	2013	6.9	0.0	<1
NA	Ballyconnell Bog	Cavan	2013	12.2	0.0	<1
NA	Clontygrigny Bog	Cavan	NA	15.0	0.0	<1
NA	Derry West Bog	Cavan	NA	24.2	0.0	1.0
NA	Fartrin Bog North	Cavan	2013	16.6	0.0	1.5

NA	Fartrin Bog South	Cavan	2013	20.0	0.0	2.6
NA	Cappataggle Bog	Galway	2013	101.4	0.0	8.6
NA	Cloonabricka Corrabaun Bog	Galway	2010	91.3	0.0	16.3
NA	Cloonfaris Killosolan Bog	Galway	2010	123.8	0.0	16.8
NA	Islands Bog	Galway	2010	106.9	0.0	15.3
NA	Lenareagh Bog	Galway	2010	111.5	0.0	14.0
NA	Moyarwood Bog	Galway	2010	223.6	0.0	29.0
NA	Ower Bog	Galway	2013	89.0	7.5	17.7
NA	Paul's Lough Bog	Galway	2010	136.3	1.0	10.4
NA	Ussey Bog	Galway	2013	60.2	5.0	1.1
NA	Abbeyleix Bog (Killamuck)	Laois	2009	99.4	1.1	4.6
NA	Cullaun Bog	Laois	2013	52.7	3.0	<1
NA	Moonbawn Bog	Laois	NA	73.7	0.0	2.6
NA	Rossnagad Bog	Laois	NA	29.7	0.0	<1
NA	Liscloonadee Bog	Leitrim	2013	53.1	0.0	3.0
NA	Cloonshannagh/Mostrim Bog	Longford	2010	380.6	4.5	23.2
NA	Cloonceen Bog	Longford, Westmeath	NA	218.4	0.0	<1
NA	Corclaragh/Clonwhelan Bog	Longford, Westmeath	2010	129.0	0.0	17.9
NA	Killinagh/Glenlough Bog	Longford, Westmeath	2010	208.8	9.3	23.2
NA	Redbog (Louth)	Louth	NA	5.0	0.0	0.0
NA	Stormanstown Bog	Louth	2011	22.5	0.0	<1
NA	Killadeer Bog	Mayo	NA	51.8	0.0	1.5
NA	Shanwalla Bog	Mayo	2013	70.4	7.0	16.2
NA	Tawnaghbeg (Gurteen) Bog	Mayo	NA	55.5	0.0	2.4
NA	Clonavoe Bog	Offaly	2013	89.6	4.0	3.7
NA	Cloncanon West Bog	Offaly	NA	30.8	0.0	<1
NA	Cloonaheen Bog	Offaly	2013	62.2	0.0	1.3
NA	Clonroosk Little Bog	Offaly, Kildare	2013	68.9	4.0	<1
NA	Annaghmaghera Bog	Roscommon	NA	58.7	0.0	6.2
NA	Ballydangan Bog North	Roscommon	2010	180.3	1.8	16.8
NA	Ballydangan Bog South	Roscommon	2011	237.6	20.8	23.6
NA	Camlagh Bog	Roscommon	2010	12.5	0.0	<1
NA	Castlesampson Bog	Roscommon	2013	66.8	3.5	1.1
NA	Clera Island Bog	Roscommon	2010	184.5	5.2	26.8
NA	Clooncoose Bog East	Roscommon	NA	35.6	0.0	<1
NA	Clooncoose Bog West	Roscommon	NA	53.0	0.0	<1

NA	Cloonkeen Bog	Roscommon	2010	11.0	0.0	1.2
NA	Cregganycarna Bog	Roscommon	2010	22.7	0.0	3.9
NA	Cuckoo Hill Bog	Roscommon	2010	69.8	0.2	11.8
NA	Curraghaleen Bog	Roscommon	2013	33.5	5.0	1.1
NA	Derreenasoo Bog	Roscommon	2013	44.2	8.0	1.7
NA	Derrycashel (Clondra) Bog	Roscommon	NA	90.3	0.0	<1
NA	Drumerr Bog	Roscommon	2013	41.6	0.0	<1
NA	Goats Lough Bog North	Roscommon	2010	161.5	0.0	26.6
NA	Goats Lough Bog South	Roscommon	2010	139.1	4.1	23.2
NA	Rooskagh Bog	Roscommon	2013	55.6	2.0	<1
NA	Achonry Bog East	Sligo	2013	36.9	8.0	7.1
NA	Annaghmore (Coolavin) Bog	Sligo	NA	64.9	0.0	2.1
NA	Corsallagh Bog	Sligo	2013	41.2	2.5	6.1
NA	Oghambaun Bog	Sligo	2013	65.4	3.0	8.1
NA	Ballincurry Bog	Sligo, Mayo	2013	150.7	20.0	9.7
NA	Lislaughna Bog	Sligo, Mayo	2013	81.5	3.5	22.8
NA	Cuilmore Bog	Sligo; Galway	2011	26.2	2.0	<1
NA	Cullahill Dromard Bog	Tipperary, Laois	2010	310.4	0.0	26.3
NA	Kilbrennan (Gaybrook) Bog	Westmeath	2013	51.1	2.0	<1
NA	Knockananna Bog	Wicklow	2013	14.6	1.5	1.1