European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC)

Fourth Report by the United Kingdom under Article 17

on the implementation of the Directive
from January 2013 to December 2018

Supporting documentation for the
conservation status assessment for the habitat:

H7110 - Active raised bogs

WALES

IMPORTANT NOTE - PLEASE READ

- The information in this document is a country-level contribution to the UK Report on the conservation status of this habitat, submitted to the European Commission as part of the 2019 UK Reporting under Article 17 of the EU Habitats Directive.
- The 2019 Article 17 UK Approach document provides details on how this supporting information was used to produce the UK Report.
- The UK Report on the conservation status of this habitat is provided in a separate document.
- The reporting fields and options used are aligned to those set out in the European Commission guidance.
- Explanatory notes (where provided) by the country are included at the end. These provide an audit trail of relevant supporting information.
- Some of the reporting fields have been left blank because either: (i) there was insufficient information to complete the field; (ii) completion of the field was not obligatory; and/or (iii) the field was only relevant at UK-level (sections 10 Future prospects and 11 Conclusions).
- For technical reasons, the country-level future trends for Range, Area covered by habitat and Structure and functions are only available in a separate spreadsheet that contains all the country-level supporting information.
- The country-level reporting information for all habitats and species is also available in spreadsheet format.

Visit the JNCC website, https://jncc.gov.uk/article17, for further information on UK Article 17 reporting.

Report on the main results of the surveillance under Article 17 for Annex I habitat types (Annex D)

NATIONAL LEVEL

1. General information

1.1 Member State	**UK (Wales information only)**
1.2 Habitat code	**7110 - Active raised bogs**

2. Maps

2.1 Year or period	1979-2018
2.3 Distribution map	Yes
2.3 Distribution map Method used	Based mainly on extrapolation from a limited amount of data
2.4 Additional maps	No

BIOGEOGRAPHICAL LEVEL

3. Biogeographical and marine regions

3.1 Biogeographical or marine region where the habitat occurs: **Atlantic (ATL)**

3.2 Sources of information:

Artz, R., Chapman, S., Potts, J., Wilson, D., Heinemeyer, A., Evans, C., Moxley, J. (2016) WP3: Emission factors applicable to UK Peatlands. Report to the Department of Energy and Climate Change.

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Blackstock, T.H., Howe, E.A., Stevens, J.P., Burrows, C.R. & Jones, P.S. (2010). Habitats of Wales: a comprehensive field survey, 1979-1997. University of Wales Press, Cardiff. 229 pp.

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Jones, P.S. & Birch, K.S. (in prep.). A New Inventory of Raised Bogs in Wales. Draft.
Jones, P.S., Stevens, D.P., Blackstock, T.H., Burrows, C.R. & Howe, E.A. (2003). Priority Habitats of Wales - a Technical Guide. Countryside Council for Wales, Bangor.
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Limpens, J., Berendse, F. & Klees, H. (2003). N deposition affects N availability in interstitial water, growth of Sphagnum and invasion of vascular plants in bog vegetation. New Phytologist, 157, 339-347.
Lindsay, R. (2010) Peatlands and carbon: a critical synthesis to inform policy development in peatland conservation and restoration in the context of climate change. Report to RSPB Scotland, Scottish Natural Heritage, Natural England, Forestry Commission, Countryside Council for Wales, IUCN UK Peatlands.
Lindsay, R.A & Immirzi, P. (1996). An inventory of lowland raised bogs in Great Britain. SNH Research, Survey and Monitoring Report No. 78, Scottish Natural Heritage, Edinburgh.
Lindsay, R.A., Birnie, R. & Clough, J. (2014). Peat Bogs, Climate and Climate Change. IUCN UK Committee Peatland Programme Briefing Note No. 10.
Milner, R. (2018). H7110*_area_results_R-Millner_final. Excel s/s. Natural Resources Wales, Bangor.
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Wheeler, B.D. & Shaw, S.C. (1995). Restoration of Damaged Peatlands. Department of the Environment, London. 211 pp.
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4. Range

4.1 Surface area (in km²)		
4.2 Short-term trend Period		
4.3 Short-term trend Direction	Stable (0)	
4.4 Short-term trend Magnitude	a) Minimum	b) Maximum
4.5 Short-term trend Method used		
4.6 Long-term trend Period		
4.7 Long-term trend Direction		
4.8 Long-term trend Magnitude	a) Minimum	b) Maximum
4.9 Long-term trend Method used		
4.10 Favourable reference range	a) Area (km²) b) Operator c) Unknown No d) Method	
4.11 Change and reason for change in surface area of range	Improved knowledge/more accurate data The change is mainly due to: Improved knowledge/more accurate data	
4.12 Additional information		

5. Area covered by habitat

5.1 Year or period	1979-2018		
5.2 Surface area (in km²)	a) Minimum	b) Maximum	c) Best single value 15.89
5.3 Type of estimate	Best estimate		
5.4 Surface area Method used	Based mainly on extrapolation from a limited amount of data		
5.5 Short-term trend Period	2007-2018		
5.6 Short-term trend Direction	Uncertain (u)		
5.7 Short-term trend Magnitude	a) Minimum	b) Maximum	c) Confidence interval
5.8 Short-term trend Method used	Insufficient or no data available		
5.9 Long-term trend Period	1994-2018		
5.10 Long-term trend Direction	Increasing (+)		
5.11 Long-term trend Magnitude	a) Minimum	b) Maximum	c) Confidence interval
5.12 Long-term trend Method used	Based mainly on expert opinion with very limited data		
5.13 Favourable reference area	a) Area (km²) b) Operator c) Unknown No d) Method		

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5.14 Change and reason for change in surface area of range	Improved knowledge/more accurate data The change is mainly due to: Improved knowledge/more accurate data
5.15 Additional information	

6. Structure and functions

6.1 Condition of habitat	a) Area in good condition (km^2)	Minimum	2.86	Maximum 2.86
	b) Area in not-good condition (km^2)	Minimum	10.49	Maximum 10.49
	c) Area where condition is not known (km^2)	Minimum	2.59	Maximum 2.59
6.2 Condition of habitat Method used	Based mainly on extrapolation from a limited amount of data			
6.3 Short-term trend of habitat area in good condition Period	2007-2018			
6.4 Short-term trend of habitat area in good condition Direction	Increasing (+)			
6.5 Short-term trend of habitat area in good condition Method used	Based mainly on expert opinion with very limited data			
6.6 Typical species	Has the list of typical species changed in comparison to the previous reporting period?		No	
6.7 Typical species Method used				
6.8 Additional information				

7. Main pressures and threats

7.1 Characterisation of pressures/threats

Pressure	Ranking
Drainage (K02)	H
Problematic native species (I04)	H
Extensive grazing or undergrazing by livestock (A10)	H
Mixed source air pollution, air-borne pollutants (J03)	H
Modification of flooding regimes, flood protection for residential or recreational development (F28)	H
Conversion into agricultural land (excluding drainage and burning) (A01)	M
Sea-level and wave exposure changes due to climate change (N04)	M
Conversion to forest from other land uses, or afforestation (excluding drainage) (B01)	M
Modification of hydrological conditions, or physical alteration of water bodies and drainage for forestry (including dams) (B27)	M
Other invasive alien species (other then species of Union concern) (I02)	M

Threat	Ranking
Drainage (K02)	H

Problematic native species (I04)	H
Extensive grazing or undergrazing by livestock (A10)	H
Mixed source air pollution, air-borne pollutants (J03)	H
Modification of flooding regimes, flood protection for residential or recreational development (F28)	H
Conversion into agricultural land (excluding drainage and burning) (A01)	M
Sea-level and wave exposure changes due to climate change (N04)	M
Conversion to forest from other land uses, or afforestation (excluding drainage) (B01)	M
Modification of hydrological conditions, or physical alteration of water bodies and drainage for forestry (including dams) (B27)	M
Other invasive alien species (other then species of Union concern) (I02)	M

7.2 Sources of information

7.3 Additional information

8. Conservation measures

8.1 Status of measures

a) Are measures needed? Yes

b) Indicate the status of measures Measures identified, but none yet taken

8.2 Main purpose of the measures taken

8.3 Location of the measures taken

8.4 Response to the measures

8.5 List of main conservation measures

Restore habitats impacted by multi-purpose hydrological changes (CJ03)
Manage drainage and irrigation operations and infrastructures in agriculture (CA15)
Reinstate appropriate agricultural practices to address abandonment, including mowing, grazing, burning or equivalent measures (CA04)
Manage changes in hydrological and coastal systems and regimes for construction and development (CF10)
Reduce/eliminate air pollution from agricultural activities (CA12)
Reduce impact of mixed source pollution (CJ01)
Adapt mowing, grazing and other equivalent agricultural activities (CA05)
Management of habitats (others than agriculture and forest) to slow, stop or reverse natural processes (CL01)
Manage drainage and irrigation operations and infrastructures (CB14)
Implement climate change adaptation measures (CN02)

8.6 Additional information

9. Future prospects

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9.1 Future prospects of parameters	a) Range b) Area c) Structure and functions
9.2 Additional information	

10. Conclusions

10.1. Range	
10.2. Area	
10.3. Specific structure and functions (incl. typical species)	
10.4. Future prospects	
10.5 Overall assessment of Conservation Status	
10.6 Overall trend in Conservation Status	
10.7 Change and reasons for change in conservation status and conservation status trend	a) Overall assessment of conservation status No change The change is mainly due to: b) Overall trend in conservation status No change The change is mainly due to:
10.8 Additional information	

11. Natura 2000 (pSCIs, SCIs, SACs) coverage for Annex I habitat types

11.1 Surface area of the habitat type inside the pSCIs, SCIs and SACs network (in km² in biogeographical/ marine region)	a) Minimum b) Maximum c) Best single value 13.92
11.2 Type of estimate	Best estimate
11.3 Surface area of the habitat type inside the network Method used	Based mainly on extrapolation from a limited amount of data
11.4 Short-term trend of habitat area in good condition within the network Direction	Increasing (+)
11.5 Short-term trend of habitat area in good condition within network Method used	Based mainly on expert opinion with very limited data
11.6 Additional information	

12. Complementary information

12.1 Justification of % thresholds for trends	
12.2 Other relevant information	

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Distribution Map

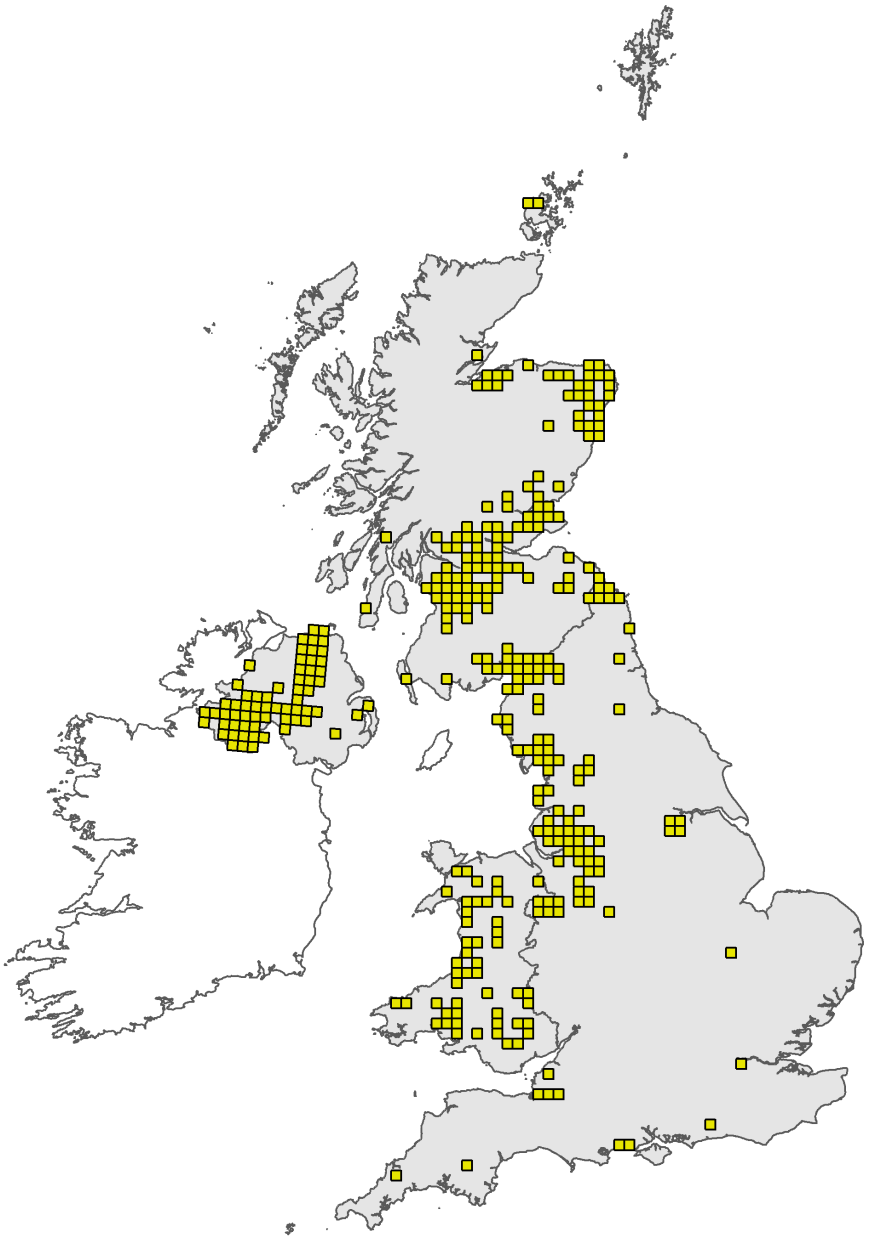

Figure 1: UK distribution map for H7110 - Active raised bogs. Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

The 10km grid square distribution map is based on available habitat records which are considered to be representative of the distribution within the current reporting period. For further details see the 2019 Article17 UK Approach document.

Range Map

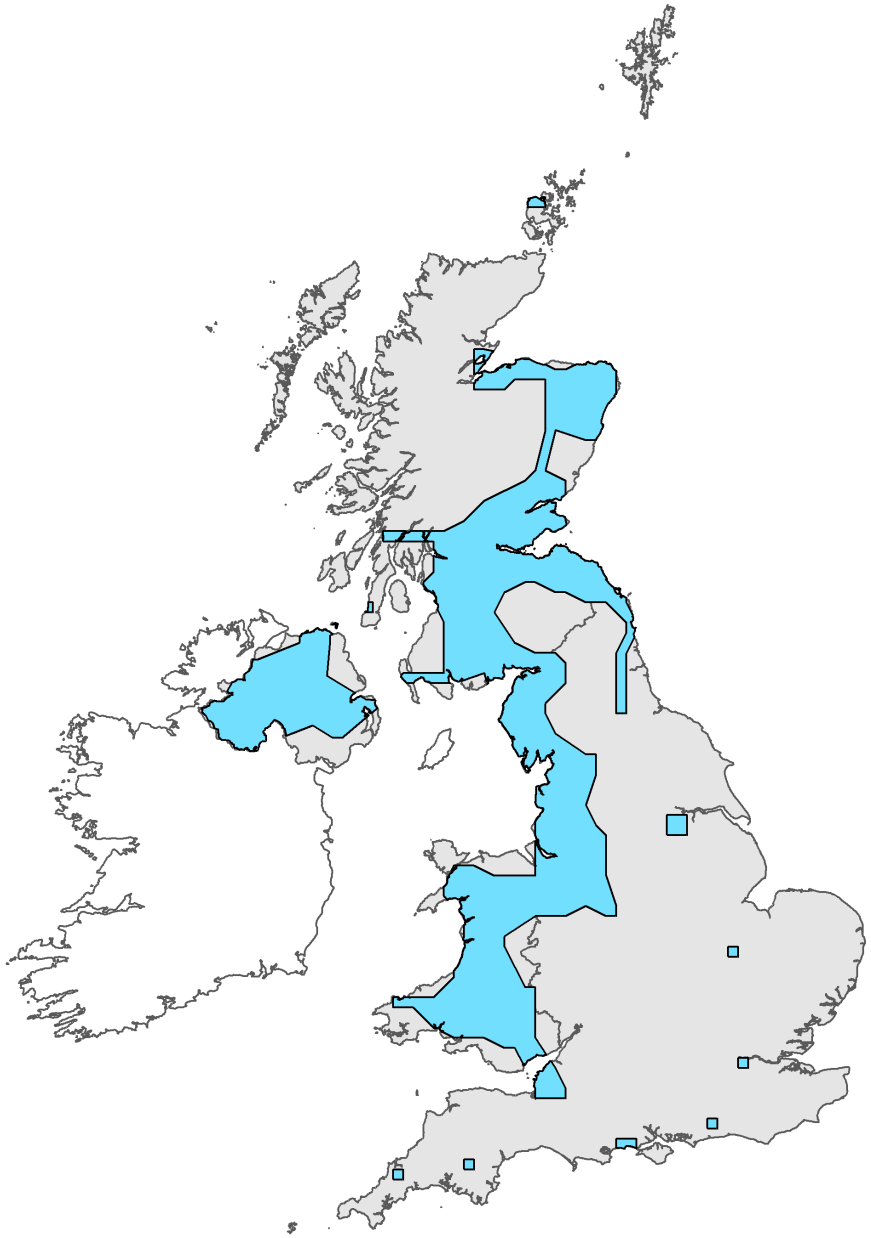

Figure 2: UK range map for H7110 - Active raised bogs. Coastline boundary derived from the Oil and Gas Authority's OGA and Lloyd's Register SNS Regional Geological Maps (Open Source). Open Government Licence v3 (OGL). Contains data © 2017 Oil and Gas Authority.

The range map has been produced by applying a bespoke range mapping tool for Article 17 reporting (produced by JNCC) to the 10km grid square distribution map presented in Figure 1. The alpha value for this habitat was 25km. For further details see the 2019 Article 17 UK Approach document.

Explanatory Notes

Habitat code: 7110

Field label	Note
2.3 Distribution map; Method used	The distribution map is based primarily on GIS analysis of Phase 2 (plant community level) and Phase 1 data contained in an Arc GIS database (Jones et al., 2018a). Phase 2 mapping yields polygon records assigned to NVC communities/sub-communities and non-NVC units mapped to 1:2500 and transferred to a Mapinfo and then subsequently an ArcGIS platform. Polygons (whether relating to individual vegetation types or mosaics) for plant communities/sub-communities judged as conforming to this habitat have been selected and used to create a GIS inventory for this habitat. The definition of this habitat is considered in more detail in Stevens (2012) and Jones et al. (2012). The distribution map provided for this habitat is a revised version of that used for the 2013 Article 17 reporting round. The new map contains the following groups of records ('records' in this context refer to individual pure or mixed polygons containing this habitat and based on field mapping evidence). 1.Data resulting from NRWs Lowland Peatland Survey of Wales (Jones et al., 2011), amounting to 7746 records for 41 sites surveyed between 2004 and 2017. 2.Data from the Habitat Survey of Wales (Blackstock et al., 2010) for 12 records.3.Data from NVC survey of Migneint-Arenig-Dduallt SAC (Averis, 2002); 10 records. 4.Data for the Welsh SAC sites included in the New LIFE for Welsh Raised Bogs LIFE Project (namely Cors Caron, Cors Fochno, Cors Goch Trawsfynydd, Cernydd Carmel, Waun Ddu and Esgyrn Bottom). 5.Data provided by Natural England for Fenns', Whixall, Bettisfield, Wem & Cadney Mosses SAC. Phase 1 data was only used where NVC survey information was lacking and the overwhelming majority of records are based on high quality Phase 2 (plant community [NVC] level) survey, mostly undertaken in-house as part of the LPSW programme. The LPSW is still ongoing and further significant lowland records for this habitat will arise leading up to completion of the Lowland Peatland Survey of Wales programme. Together these sources provide records for 50 hectads in Wales and a reasonable impression of the distribution of this habitat, but for the reasons identified here the overall dataset is not regarded as comprehensive.

Habitat code: 7110 Region code: ATL

Field label	Note
4.11 Change and reason for change in surface area of range	The change is due to further records for this habitat resulting from the Lowland Peatland Survey of Wales coupled with re-evaluation and in some cases deletion or earlier records used in the 2012 reporting round. These new hectad records still lie within the overall distribution envelope of this habitat in Wales so the overall change is relatively insignificant.

5.2 Surface area	15.89 km2 The extent estimate for H7110* is a new estimate prepared for the 2018 (3rd) reporting round. This figure has a complex derivation based on the following sources. 1.Revised estimates for H7110* extent on SAC sites included within the New LIFE for Welsh Raised Bogs project (NRW, 2016b). During preparation of the bid the opportunity was taken to re-examine the H7110 and H7120 extent figures for the project sites, resulting in revised H7110* figures of 445.03 ha for Cernydd Carmel, Cors Fochno, Cors Goch, Trawsfynydd, Esgyrn Bottom, Rhosgoch and Waun Ddu. Data for all of these sites with the exception of Cors Fochno are based on recent high quality NVC survey undertaken since 2004 by the Lowland Peatland Survey of Wales (LPSW, Jones et al., 2011). 2.Phase 2 upland survey. Data for Rhyd y Fen (47.2 ha) are based on the NVC survey of Migneint-Arenig-Dduallt SAC undertaken in 2001 (Averis, 2002). This site has now been surveyed by the Lowland Peatland Survey of Wales but these data were not finalised in time for the current reporting round. 3.Data from the Habitat Survey of Wales (Blackstock et al., 2010), totalling 61.2 ha. 4.Lowland Peatland Survey of Wales sites (167.8 ha) additional to those include in the LIFE project. These data cover 41 sites surveyed since 2004. 5.Extent data for H7110* at Fenn`s, Whixall, Bettisfield, Wem and Cadney Mosses SAC (507 ha). These data were supplied by Natural England in 2018 and relate to the Welsh resource of the cross-border site only. These data appear collectively in the revised inventory for H7110* (Jones et al., 2018a) and amount to a total area of 1228.2 ha. This figure excludes the estimate of 360.4 ha of H7110* at Cors Caron (category 2 above) which was not initially added to the main inventory because of data formatting issues. Adding this figure to the 1228 ha yields a grand total of 1588.6 ha, this representing the current best estimate for the extent of H7110* in Wales. Inevitable uncertainty surrounds the extent estimate of 15.89 km2.- this is summarised below. -The derivation of the Natural England figure for Fenn`s, Whixall, Bettisfield, Wem and Cadney Mosses SAC is unclear and may not have used the same criteria used for the SAC sites wholly in Wales: this figure needs critical re-examination. It may include areas which would have been regarded elsewhere in Wales as conforming to H7120. -Data for the two large wholly Welsh SAC sites (Cors Fochno and Cors Caron) require critical examination, being based currently on a mixture of expert judgement and out-sourced NVC survey. -At least 9 further sites known to or suspected to support H7110* occur in Wales (Jones & Birch, 2018a) but are not included in the inventory of Jones et al (2018): Phase 2 data for some of these still await formal release whilst others of these sites remain un-surveyed.
5.6 Short term trend; Direction	There is no quantitative evidence on which to assess changes in range or surface area over the short term.
5.10 Long term trend; Direction	This assessment reflects the impact of long-standing restoration projects at the three largest SAC sites (Cors Caron, Cors Fochno, and Fenn`s, Whixall, Bettisfield, Wem and Cadney Mosses) which commenced prior to 1994. However, there are insufficient data to be able to assess the magnitude of this trend. This increase is likely to exceed any loss of H7110* over this period.
5.14 Change and reason for change in surface area	The extent estimate used for the 2013 round was 16.45 km2; the current estimate is 0.57 km2 less than this figure. This difference is probably due to the use of revised figures for the larger SACs.

6.1 Condition of habitat	Good - 2.86 - 2.86 km2 Not good - 10.49 -10.49 km2 Unknown - 2.59 - 2.59 km2 The derivation of these figures in based on Jones (2018a). The area judged as being in good condition is based on expert judgement, with 280 ha estimated to be in good condition at Cors Fochno (M. Bailey, pers.comm) and 6.5 ha at Cors Caron (P.S. Jones, based on a conservative estimate of the area of H7110* in good condition on the North-east bog component of Cors Caron. SAC monitoring undertaken by NRW has actually recorded overall assessments of unfavourable for the active raised bog feature at both these sites, so the area in favourable condition has been subtracted from these figures. Judgements of condition have been made for a further 6 SSSI sites supporting this feature, with a total area of unfavourable habitat of 26.97 ha noted across these sites (and no habitat in good condition). The difference between the area of habitat in good and unfavourable condition and the total resource has to be regarded as being in unknown condition due to lack of data.
6.2 Condition of habitat; Method used	Assessment of structure and function within SACs is based on the results of common standards monitoring visits undertaken between 2007 and 2012 (NRW, 2018a). The spreadsheet cited as NRW (2018a) has been analysed to extract monitoring data for SAC sites for H7110*. The related spreadsheet NRW (2018b) has then been checked to see if any monitoring results have been reported which do not figure in NRW (2018b). SAC monitoring data indicates this feature is in unfavourable condition on the 7 Welsh SACs where it occurs as a B-C graded feature: these sites are as follows (with the most recent condition assessment date given in brackets): Afon Eden - Cors Goch Trawsfynydd (September 2015), Afonydd Cleddau [Esgyrn Bottom] (October 2012), Cernydd Carmel (July 2016), Cors Caron (October 2011), Cors Fochno (December 2009), Rhosgoch Common (August 2015), Fenn`s, Whixall, Bettisfield, Wem and Cadney Mosses (August 2007). Only three of these sites have been monitored since the 2012 reporting round. In each case it is assumed that the SAC monitoring assessment relates to the whole H7110 resource. Condition for the non-SAC sites is based on a combination of experience of the sites gained during the survey, expert specialist judgement, and the expert judgement of local NRM team officers: all assessments are based on site visits undertaken since the last (2nd) reporting round. The assessment of the area of this habitat in good condition is based on the rationale given above under 6.1.
6.4 Short term trend of habitat area in good condition; Direction	This is based on same rationale as 5.10 above and reflects the impact of long-standing restoration projects at the SAC sites (Cors Caron, Cors Fochno, Rhosgoch and Fenn`s, Whixall, Bettisfield, Wem and Cadney Mosses) which commenced prior to 1994. However, there are insufficient data to quantify this trend.

7.1 Characterisation of pressures/ threats

Overview Analysis of Pressures and Threats has utilised a number of data sources, with NRWs Action Database (NRW, 2018c) serving as a critical resource. This provides information on 'issues' affecting habitats and species within the protected sites series in Wales and contains a total of 92 management issue entries against the Active Raised Bog feature description, of which 74 remain categorised as 'C' and requiring ongoing control. These apply across a total of 18 management units (many units have more than one management issue recorded) on 7 SSSI, including all of the SACs for which this habitat is a feature. Restricting the search term to 'Active Raised Bog' means that only data for SAC are reported here - these data are thus not wholly representative of the wider resource as it is to be expected that conservation measures would better mitigate pressures and threats inside the SAC series. Data for the more general SSSI feature of 'raised bog' has also been extracted from the Actions Database: this yields a total of 395 management issue entries against the Raised Bog feature description, of which 303 remain categorised as 'C' and requiring ongoing control. These apply across a total of 91 management units (many units have more than one management issue recorded) on 22 SSSI. However, 2 of these sites (Ffrondeg and Rhos Cilcennin) are unlikely to support raised bog, while other raised bogs on SSSI are not formally recognised as features (e.g. the Nant Ffrancon mires of Eryri [Gwynedd] and Cors Caranod [Ceredigion]). NRWs Prioritised Implementation Plans for SAC sites (NRW, 2016a) have also been consulted. Pressures: K02 Drainage (including some A31. Drainage for use as agricultural land) Adverse hydrological regimes remain the key pressure and threat for H7110* in Wales. NRWs Actions Database has three categories relevant to this pressure/threat. For H7110*, 'Drainage' is noted as a current issue for 4 units on 3 SSSI, with 'Ditch management' affected 6 units on 3 SSSI and 'Water levels' 8 units on 3 SSSI. Taken together, these pressures affect 8 units on 3 SSSI. For the wider Raised Bog SSSI feature, the equivalent figures are 17 units and 3 SSSI for drainage, 20 units on 5 SSSI for ditch management, and 21 units on 6 SSSI for water levels. Water levels figure as a high or medium priority pressure and threat in the Prioritised Improvement Plans (PIPs) for 5 SACs, with ditch management cited as a high priority and urgency issue for 3 SAC and drainage as a high priority and urgency issue for 2 sites. In dealing with figures on the number of units affected by hydrological pressures, it is sometimes difficult to disentangle the root cause of (i.e. the original requirement for) drainage, though the primary driver is likely to be drainage for agricultural purposes. Drainage impacts resulting from past or ongoing drainage for agriculture (i.e. A31) is estimated to affect a minimum of 25 (55%) of the 45 sites assessed to-date as supporting H7110* in Wales (Jones & Birch, in prep.), with drainage for other purposes also affecting 9 of these sites together with a further 6 sites with no or un-diagnosed agricultural drainage pressures. Drainage pressures are judged as likely to have been under-recorded in the Actions Database and PIPs. A10 Extensive grazing or undergrazing by livestock H7110* in good condition should require no or only the lightest of grazing regimes. However, past peat cutting and drainage coupled with atmospheric deposition mean that grazing often is warranted. Management neglect is a locally important issue for this habitat and relates chiefly to areas with a significant cover of Molinia caerulea; this is often a symptom of past or ongoing drainage and/or peat cutting, with atmospheric deposition as likely to be reinforcing its dominance (Limpens et al., 2003;, Tomassen et al., 2003, 2004). The issue of insufficient grazing was recorded in NRWs Actions Database (NRW, 2018c) as a current issue for H7110* on 6 units for 2 SSSI: the equivalent figures for the wider raised bog feature is 14 units on 9 sites (note though that this includes 2 of the SSSI where raised bog is actually unlikely to occur). Insufficient grazing may have been under-recorded in the Prioritised Implementation Plans (NRW, 2016a), being recorded as a high priority/high urgency issue for just one site (Cernydd Carmel). This is reflected in the fact that grazing actions (namely its restoration and/or or modification of existing practices) features as an action for four of the seven project sites (NRW, 2016b). The closely related issue of 'grazing type and/or timing' is cited as a current issue for H7110* for 3 units on 2 SSSI

and for raised bog for 20 units on 6 SSSI (including the dubious Frondeg site). This issue seems again to be under-represented in the PIPs for the raised bog sites, being cited as a low and high priority issue for Cors Caron and Cors Goch, Trawsfynydd respectively. This is likely to be a more widespread and pressing problem for non-statutory sites supporting H7110*. I04 Problematic native species This pressure is closely linked to A10 and is often a case of drainage coupled with under-management and atmospheric nutrient deposition (Tomassen et al., 2003). Scrub invasion is noted as a current issue for H7110* for 4 units on 3 SSSI and for raised bog on 37 units on 11 SSSI (including Frondeg). It is noted as a low priority issue for Cors Caron and Cors Fochno but a High Priority issues at Fenn's & Whixall Mosses; urgency is classed as medium or high for all three sites. This is likely to be a more widespread and pressing problem for non-statutory sites supporting H7110*. The related NRW Actions Database pressure of 'Terrestrial [species] - native and archaeophyte' is also considered here as this appears to relate to scrub encroachment in some instances - chiefly due to under-grazing; this was cited as a current issue for H7110* for 3 units on 2 SSSI, and for raised bog 13 units on 5 SSSI, with characterising as a medium priority/medium urgency issue in the Prioritised Implementation Plans (NRW, 2016a), in this case for Rhosgoch common. JO3 Mixed source air pollution, air-borne pollutants Air pollution is cited as a current issue for H7110* for only 10 units across 3 SSSI in NRWs Actions Database (NRW, 2018c). Searching for this issue in NRW (2018c) for the more generic SSSI feature of raised bog reveals it has been recorded as a current issue on 12 units on four SSSI. Air pollution is cited as a high priority and high or medium urgency issue for H7110* in NRWs Prioritised Improvement Plans (NRW, 2016a) for the seven SACs on which this habitat occurs as a feature. The extent of the H7110* resource in Wales subject to N deposition in excess of the critical load for this habitat (5 kg N/ha/yr) has been assessed using the approach of Guest (2012) and using updated deposition data based on the updated extent estimate of 15.88 km2. Using a data overlay method in ARC GIS (Kay, 2018), 100% of the habitat by area (polygon data) was recorded at or above the relevant lower Critical Load limit. NRWs Actions Database needs to be updated to ensure this issue is correctly recorded as a current issue for all SAC and SSSI units. A01. Conversion into agricultural land (excluding drainage and burning) The context of this pressure is the ongoing legacy of impacts relating to the past conversion of H7110* to agricultural land, rather than the ongoing or future loss of H7110* to this pressure. The extent of this issue is demonstrated by comparing the sum total area of H7110* and H7120 (2485 ha) with the estimated original extent of raised bog ecosystems in Wales (4123 ha) based on the analysis by Jones & Birch (in prep.). Much of the difference (1638 ha) consists of modified but sometimes semi-natural habitats on deep peat, as well as semi-improved and improved grassland. The significant modification of peat bodies which this figure represents constrains the long-term resilience of these ecosystems and represents an ongoing pressure. F28. Modification of flooding regimes, flood protection for residential or recreational development - linked to N04. Sea-level and wave exposure changes due to climate change. This pressure concerns modification to the hydrological regime of Cors Fochno SAC as a result of flood defence infrastructure and its ongoing maintenance. This largely affects the Cors Fochno resource only (403.7 ha), though the raised bog at Arthog is also subject to these pressures to some extent. B01 Conversion to forest from other land uses, or afforestation (excluding drainage) & B27 Modification of hydrological conditions, or physical alternation of water bodies and drainage for forestry (including dams). These two pressures are closely linked and relate to ongoing impacts resulting from the past afforestation of a number of raised bogs, with at least three sites included (two sites at Llanbrynmair and Fenn's & Whixall Mosses). The need to remove trees from the peat body of raised mire sites, and the need to remove conifer seedlings from unafforested bog flanked by conifer plantations, is captured to some extent in the issue category 'insufficient tree management' which is noted as a current issue for 3 units on 2 SAC in NRW (2018c). I02 Other invasive alien species (other than species of Union concern) Terrestrial non-native species are a

current issue for H7110* on 3 units on 3 SAC: the species concerned include conifers, and Rhododendron. More widely, for the raised bog feature, this is reported as a current issue for 13 units on 7 SSSI. This issue is only recorded as a low priority pressure in the relevant PIPs. A26 Agricultural activities generating diffuse pollution to surface or ground waters. For H7110*, this only affects 2 units on 2 SAC, but may be an under-reported pressure. F14 Other residential and recreational activities and structures generating point pollution to surface or ground waters This is listed as a low priority pressure for Cors Fochno in NRWs PIPs (NRW, 2016). C05 Peat extraction Extant permission for peat extraction exists for a handful of sites and past extraction has significantly damaged many, with its after effects in terms of drainage impacts ongoing. N02 - Droughts and decreases in precipitation due to climate change N01 - Temperature changes (e.g. rise of temperature & extremes) due to climate change There is little specific evidence indicating impacts due to these pressures at the present time; any such impacts would, in any case, be difficult to disentangle from current drainage mediated impacts. Threats: These were assessed in a similar way to pressures. K02 Drainage (including some A31. Drainage for use as agricultural land) The New LIFE for Welsh Raised Bogs Project (NRW, 2016b) will deal with a significant range of drainage issues affecting the H7110* resource on the 7 project sites. The rather modest number of units for which drainage related issues have been resolved to-date (a single unit of a single SAC each for drainage and water levels and none for ditch management) underlines how difficult it is to effectively eliminate drainage pressures, particularly where these present at the edges or even beyond the boundary of protected sites. This argues for a new and more holistic ecosystems approach to defining and then managing hydrological protection zones around the margins of protected peatland sites. Non-statutory sites remain at significant risk from drainage, with a key existing mechanism (Glastir Advanced) showing no uptake of the rewetting option (403) at present (Milner, 2018). The Environmental Impact Assessment Regulations (Welsh Government, 2017), provide some protection against this pressure for all sites. Threats related to insufficient management or management neglect (A07 & I04) will continue for the foreseeable future due to the following principal factors: (i) lack of resources for promoting and funding management agreements on statutory sites under third party management, and (ii) the inadequacy of current mechanisms for promoting and where necessary enforcing the sustainable management of examples outside the protected sites series, particularly where these occur as small elements within otherwise intensively farmed contexts, and (iii) insufficient resources for bringing the whole NNR resource under restoration management. The New LIFE for Welsh Raised Bogs project should deliver sustainable grazing where needed on the project, though this will need to be maintained in the after-LIFE phase. JO3 Mixed source air pollution, air-borne pollutants Despite modest projected reductions in the overall deposition rates for atmospheric nitrogen in the UK, air pollution is expected to remain a High pressure (threat) to the habitat in Wales. A provisional analysis using projected exceedance data for 2030 indicates that the area of SAC (on which H7110* is a feature) which falls in areas where deposition is above the relevant critical load will not fall at all from the 2013-2015 estimate of 100% by 2030 (JNCC, 2018). A01. Conversion into agricultural land (excluding drainage and burning) Further losses of H7110* to agricultural improvement are expected to be very minor, largely due to EIA regs (Welsh Government, 2017) and other mechanisms. The threat posed by the ongoing intensive agricultural management of deep peat resources contiguous to existing areas of H7110 * and H7120 will continue for the foreseeable future until a financially realistic mechanism is developed to allow the restoration of whole peat bodies at an ecosystem scale. This threat resolves as reduced long-term resilience and ongoing peat loss and shrinkage caused by artificially steep marginal hydraulic gradients. F28. Modification of flooding regimes, flood protection for residential or recreational development - linked to N04. Sea-level and wave exposure changes due to climate change. This pressure is likely to continue at least throughout he next reporting round, though both the New

	LIFE for Welsh Raised Bogs project (NRW, 2016b) and current work to develop a strategy for flood-risk management within the Dyfi, will both help mitigate the effect to a degree. B01 Conversion to forest from other land uses, or afforestation (excluding drainage) & B27 Modification of hydrological conditions, or physical alternation of water bodies and drainage for forestry (including dams). This pressure will continue as a future threat, particularly for the two non-statutory sites affected. This is because there is at present no financial mechanism for making peatland restoration after afforestation an attractive prospect relative to replanting. Whilst NRW has a programme of peatland restoration for afforested sites on land under its own management, limitations in funding restrict this restoration to a small number of priority sites (Vanguelova et al., 2012). I04 Problematic native species The issue of scrub invasion should reduce as implementation of NRWs New LIFE for Welsh Raised Bogs project progresses, though this will remain a threat across non-SAC SSSI and non-statutory sites. A26 Agricultural activities generating diffuse pollution to surface or ground waters Given the localised nature of this pressure its resolution should be feasible in the next two reporting rounds. C05 Peat extraction Extant permission for peat extraction exists for a handful of sites and may be exercised in the next two reporting rounds. The effects of past peat extraction will be ongoing and can only be partially mitigated by hydrological restoration because of the impact on surface profiles of sites. N02 - Droughts and decreases in precipitation due to climate change Modelling predicts that water table draw-down in peat bogs during summer will become more marked (Lindsay et al., 2014). Increased temperatures may lead to increased decomposition of peat-forming material in active, healthy bogs, although this is still an issue of debate. However, the resilience of ombrogenous bogs to climate change has been convincingly linked to the living surface (acrotelm) of 'active' bogs; thus restoration to sustain or restore this critical feature is the best approach for mitigating the effects of climate change.
8.1 Status of measures	While the majority of the most important measures required to restore/maintain this habitat to FCS in Wales have been identified, the bulk have not yet been fully implemented.

8.5 List of main conservation measures	The majority of measures are not fully implemented. A total of 1391.8 ha of this habitat is included within this SAC series (this figure is based on overlap of the GIS habitat layer on the SAC series and not the N2K data-forms areas), (Milner, 2018), with 1177 ha being NNR. CJ03 and CA15, hydrological interventions. A significant number of hydrological pressures remain to be addressed, with many of those within the SACs being subject to planned actions as part of the two current LIFE projects. However, better mechanisms are needed to address drainage at the margins of or beyond the boundaries of protected sites. Hydrological restoration is a key element of the New LIFE for Welsh Raised Bogs project and the expertise developed needs to be applied to other Welsh H7110* sites to ensure hydrological restoration yields a more sustainably managed suite of raised bog ecosystems, thus minimising or even preventing the need for repeated future interventions aimed at tackling recurring problems such as scrub invasion (Rhosgoch Common and Covert Coch being prime examples). Better resourcing of NNRs will be required to both enable maintenance of hydrological restoration infrastructure in the after-LIFE phase for the two projects, and also enable this work on non-SAC NNRs, such as Cors Goch, Llanllwch. Land management actions relating to grazing (CA03, CA05, CL01). Only 8.3 ha of this habitat are included under NRW land management agreements (Milner, 2018), which is a key mechanism for promoting effective sustainable grazing, and this appears to represent a drop in activity since 2012 when the area of H7110* in SSSI with 'raised bog' as a feature and under a Land Agency agreement was 38 ha. This is likely to reflect financial and staff resource pressures on management agreements. Section 9.1c. demonstrates the rather restricted areas of this habitat under agri-environment agreements. Further effort is clearly needed to expand sustainable grazing across the resource (where needed) and the New LIFE for Welsh Raised Bogs project will generate important experience and demonstration sites for this purpose. Actions under CA05 should include the restoration of peat-forming conditions on land currently under purely agricultural management: this relates to substantial areas of deep peat under semi-improved and improved grassland (and other land-cover types) peripheral to many of our lowland raised bog sites. This action is essential in order to secure long-term ecosystem resilience. CC10 Manage/reduce/eliminate air pollution from resource exploitation and energy production, & CA12 Reduce/eliminate air pollution from agricultural activities. National regulations are in place but have been insufficient to prevent continued high levels of N deposition nationally (CC10) and locally increasing ammonia pollution from expansion of poultry units (CA12). The area of this habitat subject to critical load exceedance is not expected to reduce between now and 2030. Addressing forestry impacts - CB05. Resolution of this threat demands a new approach for afforested peatlands, with a more explicit focus on the restoration of Annex 1 habitats. CF10 Manage changes in hydrological and coastal systems and regimes for construction and development This requires a significant ecosystem-based initiative making full use of NRWs new remit and the legislative powers in Wales to support the sustainable management of natural resources, the aim being to create more sustainable natural solutions to managing flood-risk which also create more natural marginal hydrological regimes for raised bog sites, with a strong focus at Cors Fochno but also Arthog Bog. CA11 Reduce diffuse pollution to surface or ground waters from agricultural activities & CJ01 Reduce impact of mixed source pollution. Only localised action is required to address both diffuse and point-source nutrient impacts. CA01 Prevent conversion of natural and semi-natural habitats, and habitats of species into agricultural land. This is not thought to be a major threat but ongoing vigilance by NRW and WG EIA staff is essential to prevent further losses of this already diminished resource. CN02 Implement climate change adaptation measures A national action plan for achieve the restoration of this habitat has been proposed (Jones, 2018c) as part of a proposed national action plan for Welsh peatlands, with action LRB.1 stating \'Implement a national conservation/restoration programme to ensure all 55 Welsh raised bogs are resilient to future change and support the characteristic ecosystems of active raised bog, thus maximising the security of carbon stocks and enhancing the

	provision of core ecosystem services such as greenhouse gas regulation and natural flood management.\'. This plan needs to be implemented across the suite of H7110* sites in Wales.
9.1 Future prospects of parameters	9.1a Future prospects of -range.No significant change in range is expected, though the fragmented distribution and limited size of examples outside the core SACs make this habitat particularly vulnerable to changes in range. 9.1b Future prospects of -area This assessment is based largely on (i) the ongoing and long-running restoration programmes on the raised bog NNR SACs (notably Cors Fochno, Cors Caron, Rhosgoch Common and Fenns's and Whixall Mosses), and (ii) the predicted outcome of the New LIFE for Welsh raised bogs project (NRW, 2016b) and the Marches & Mosses LIFE project which covers the Fenns & Whixall site complex. Increases in the area of H7110* will chiefly be 'at the expense' of H7120. This change is expected to exceed any losses of H7110* across the Welsh site series; these are, however, likely to occur (not least given the significant number of non-statutory sites supporting H7110*) and at the present time there is no system in place for tracking what may be small-scale but nevertheless significant losses. 9.1c Future prospects of -structure and function This reflects the (i) the ongoing and long-running restoration programmes on the raised bog NNR SACs (notably Cors Fochno, Cors Caron, Rhosgoch Common and Fenns's and Whixall Mosses), and (ii) the predicted outcome of the New LIFE for Welsh raised bogs project (NRW, 2016b) and the Marches & Mosses LIFE project which covers the Fenns & Whixall site complex. However, the situation away from these sites is less positive. Glastir Advanced agreements only cover a maximum possible area of 169.5 ha (Milner, 2018 - this figure assumes no overlap in prescriptions and is the sum total of all prescriptions), with Glastir Entry covering a maximum possible area of 14.2 ha and Glastir Commons 30.7 ha; NRW management agreements extend to just 8.3 ha. Thus, despite the high proportion of this habitat included within the SSSI series, some decline in quality is quite possible, although in the short term this is likely to be outweighed by the gains achieved by the two LIFE project mentioned above.
11.1 Surface area of the habitat type inside the pSCIs, SCIs and SACs network	13.92 km2 best value This estimate is derived from digital overlay of SAC boundaries (see Milner, 2018) on the revised habitat inventory for H7110* described under section 5.2 above. The area is different to the figure used in 2012 (14.56 km2) due to recalculation of the area included within the New LIFE for Welsh Raised Bogs LIFE project - see 5.2.
11.4 Short term trend of habitat area in good condition within the network; Direction	This reflects the impact of long-standing restoration projects at the SAC sites (Cors Caron, Cors Fochno, Rhosgoch and Fenn`s, Whixall, Bettisfield, Wem and Cadney Mosses) which commenced prior to 1994. However, there are insufficient data to quantify this trend. This assessment is somewhat challenging due to the lack of condition data for large parts of the habitat resource across the SAC series. Current SAC monitoring infers broader condition based on plot assessments at a limited number of stands and a more systematic assessment of all key stands of H7230 is required.