



**Cyfoeth
Naturiol**
Cymru
**Natural
Resources**
Wales

Assessment of Marsh Fritillary Habitat Quality around Cors Erddreiniog SAC, Anglesey

Dr. Deborah Sazer

Evidence Report No. 9



About Natural Resources Wales

Natural Resources Wales is the organisation responsible for the work carried out by the three former organisations, the Countryside Council for Wales, Environment Agency Wales and Forestry Commission Wales. It is also responsible for some functions previously undertaken by Welsh Government.

Our purpose is to ensure that the natural resources of Wales are sustainably maintained, used and enhanced, now and in the future.

We work for the communities of Wales to protect people and their homes as much as possible from environmental incidents like flooding and pollution. We provide opportunities for people to learn, use and benefit from Wales' natural resources.

We work to support Wales' economy by enabling the sustainable use of natural resources to support jobs and enterprise. We help businesses and developers to understand and consider environmental limits when they make important decisions.

We work to maintain and improve the quality of the environment for everyone and we work towards making the environment and our natural resources more resilient to climate change and other pressures.

Evidence at Natural Resources Wales

Natural Resources Wales is an evidence-based organisation. We seek to ensure that our strategy, decisions, operations and advice to Welsh Government and others are underpinned by sound and quality-assured evidence. We recognise that it is critically important to have a good understanding of our changing environment.

We will realise this vision by:

- Maintaining and developing the technical specialist skills of our staff;
- Securing our data and information;
- Having a well-resourced proactive programme of evidence work;
- Continuing to review and add to our evidence to ensure it is fit for the challenges facing us; and
- Communicating our evidence in an open and transparent way.

This Evidence Report series serves as a record of work carried out or commissioned by Natural Resources Wales. It also helps us to share and promote use of our evidence by others and develop future collaborations. However, the views and recommendations presented in this report are not necessarily those of NRW and should, therefore, not be attributed to NRW.

Report series: NRW Evidence Report
Report number: 9
Publication date: February 2014
Contract number: EAS0653
Contractor: Dr. D. Sazer
Contract Manager: A.P. Fowles
Title: **Assessment of Marsh Fritillary Habitat Quality around
Cors Erddreiniog SAC, Anglesey**
Author(s): Dr. D. Sazer
Technical Editor: A.P. Fowles
Restrictions: None

Distribution List (core)

NRW Library, Bangor	2
National Library of Wales	1
British Library	1
Welsh Government Library	1
Scottish Natural Heritage Library	1
Natural England Library (Electronic Only)	1

Distribution List (others)

Senior Invertebrate Ecologist, NRW Bangor
Senior Reserve Manager, Cors Erddreiniog NNR, NRW Bangor
Senior Conservation Officer, Anglesey, NRW Bangor
Conservation Officer, North Wales Wildlife Trust, Bangor

Recommended citation for this volume:

D. Sazer. 2014. Assessment of Marsh Fritillary Habitat Quality around Cors Erddreiniog SAC, Anglesey. NRW Evidence Report No. 9, 37pp, Natural Resources Wales, Bangor.

Contents

1. Crynodeb Gweithredol	6
2. Executive Summary	7
3. Background	8
4. Methods	9
4.1. Maps	9
4.2. Ownership	10
4.3. Field numbers	10
4.4. Terminology	12
4.5. Surveys	13
5. Results	13
5.1. Ownership contact	14
5.2. Survey results	14
5.3. Habitat Condition (Figures 1, 2 and 3; Maps 9 through 16)	15
5.4. Habitat Management	22
6. Discussion	23
6.1. Habitat Condition	23
6.2. Grazing Management	23
6.3. Habitat Condition Categories	24
7. Conclusions	27
8. References	28
9. Appendix 1: Site Descriptions	28
9.1. Cors Erddreiniog (NRW)	28
9.2. Wider landscape (not owned or managed by NRW)	32
10. Appendix 2: Data Archive	37
11. Appendix 3: Acknowledgements	37

List of Figures

Map 1. Marsh Fritillary Records at Cors Erddreiniog	8
Map 2. Cors Erddreiniog Functional Landscape	9
Map 3. Potential Habitat within the Cors Erddreiniog network	10
Map 4. Field Numbers – North	11
Map 5. Field Numbers - Central	11
Map 6. Field Numbers - South	12
Map 7. Cors Erddreiniog NNR and SSSI	12
Map 8. Ownership	13
Figure 1. Habitat condition - Cors Erddreiniog	16
Figure 2. Habitat condition - Private sites	16
Figure 3. Habitat condition - All sites	16
Figure 4. Key - Habitat Condition Maps	17
Map 9. Habitat Condition – North	17

Map 10. Habitat Condition – Northwest	17
Map 11. Habitat Condition - Northeast	18
Map 12. Habitat Condition - East.....	18
Map 13. Habitat Condition – Central.....	19
Map 14. Habitat Condition - Southwest	19
Map 15. Habitat Condition – Southeast and Cors Goch	20
Map 16. Habitat Condition – Far southeast	20
Figure 5. Good Condition marsh fritillary habitat	21
Figure 6. Unsuitable fen and reedbed	22
Figure 7. Juncus-dominated fen at Cors Erddreiniog.....	25
Figure 8. Succisa pratensis under Myrica gale.....	26
Figure 9. Tussock islands	26

List of Tables

Table 1. Field numbers	10
Table 2. Habitat codes	13
Table 3. Access to privately-owned sites.....	15
Table 4. Habitat Condition.....	15
Table 5. Habitat codes	28

1. Crynodeb Gweithredol

Mae britheg y gors *Euphydryas aurinia* yn rhywogaeth dan warchodaeth Ewropeaidd, ar restr Atodiad II Gorchymyn Cynefinoedd a Rhywogaethau yr UE. Mae Cors Erddreiniog, yng ngogledd-ddwyrain Ynys Môn, wedi'i dynodi'n Safle o Ddiddordeb Gwyddonol Arbennig (SoDdGA), yn Warchodfa Natur Genedlaethol (GNG) ac yn Ardal Cadwraeth Arbennig (ACA) yn rhannol oherwydd ei phoblogaeth britheg y gors – un o'r ychydig, neu o bosib, yr unig boblogaeth sy'n bodoli ar yr ynys. Mae britheg y gors yn dangos dynamigau uwchboblogi, gan ddiflannu a phoblogi mewn clytiau addas yn rheolaidd gydag amser. O ganlyniad, mae cael rhwydwaith eang o safleoedd addas yn hanfodol er mwyn cynnal eu poblogaeth yn y tymor hir. Ar hyn o bryd mae Cors Erddreiniog mewn Cyflwr Anffafriol ar gyfer y glöyn byw hwn sydd erbyn 2013, wedi prnhau i un gytref fridio.

Comisiynwyd yr arolwg hwn i fapio cyflwr cynefin britheg y gors ar gyfer uwchboblogi, yn ogystal â rhwydwaith y cynefinoedd cynnal o amgylch Cors Erddreiniog NNT/SSI. Cynhaliwyd yr arolwg rhwng Hydref 21ain a Thachwedd 5ed 2013. Categoriwyd a mapiwyd addasrwydd y cynefin yn ôl dulliau safonol Cyfoeth Naturiol Cymru. Didolwyd y tir yn chwe categori yn ôl presenoldeb/nifer planhigion bwyd larfaol y glöyn byw hwn, sef tamaid y cythraul a glaswellt y gweunydd (neu dwmpathau glaswellt eraill) yn ogystal ag uchder a ffurf y planhigion.

Dynodwyd 349 o hectarau o dir ar gyfer eu hasesu, ac arolygwyd 262 ohonynt; 212 yng Nghors Erddreiniog a 51 yn rhwydwaith y cynefinoedd o'i hamgylch. Ni chafwyd mynediad i 74 hectar o dir preifat, yn bennaf oherwydd ni ellid eu cyrraedd, gwrthodwyd caniatâd neu ni lwyddwyd i ganfod eu perchnogaeth. O'r tir, categoriwyd 60 hectar yn gynefinoedd o Gyflwr Da, Addas neu â Photensial - 50 hectar yng Nghors Erddreiniog a 10 hectar nad oedd o dan reolaeth Cyfoeth Naturiol Cymru. Roedd yna 1.2 hectar o gynefin Cyflwr Da yng Nghors Erddreiniog a 0.001 hectar yn y tir ehangach. Roedd y rhan fwyaf o'r 20.5 hectar o gynefin Cyflwr Addas y tir gweithredol wedi cael eu pori'n rhy dynn i gael eu dynodi'n dir Cyflwr Ffaffriol.

Mae Cors Erddreiniog a'r safleoedd o'i hamgylch yn cynnwys cryn dipyn o gynefin 'annodweddiadol' britheg y gors o'u cymharu â rhostir pori Cymraeg nodweddiadol, gan gynnwys glastiroedd brwyn trwchus, prysgwydd myrtwydd y gors a thwmpathau ynysig mewn dŵr llonydd. Serch hyn, mae'r rhain yn debygol o fod yn gynefin lled orau ar gyfer britheg y gors.

Mae angen gwaith brys i greu mwy o gynefinoedd Cyflwr Da ar gyfer y glöyn byw hwn er mwyn sicrhau y bydd yn goroesi yn ei chynefin Cyflwr Ffaffriol yng Nghors Erddreiniog. Gyda rheoli cymwys, gall y 60 hectar o gynefin Cyflwr Da, Cyflwr Addas a Chyflwr â Photensial fod yn ddigonol i gynnal yr uwchboblogi yn y tymor canolig. Byddai goroesi yn y tymor hir yn golygu bod angen gwaith rheoli pellach er mwyn dwyn darnau sylweddol o dir i safon cynefin Cyflwr Da.

2. Executive Summary

The marsh fritillary *Euphydryas aurinia* is a European protected species, listed on Annex II of the EU Habitats & Species Directive. Cors Erddreiniog, in northeast Anglesey, is designated as a Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR), and Special Area of Conservation (SAC) in part due to its marsh fritillary population - one of the few, or possibly the only, extant population on the island. Marsh fritillaries exhibit metapopulation dynamics, experiencing regular extinctions and colonisations of suitable patches over time. Therefore, a large network of suitable sites is essential to maintain their populations in the long term. Cors Erddreiniog is currently in Unfavourable Condition for the butterfly, which has declined to only one small breeding colony in 2013.

This survey was commissioned to map marsh fritillary habitat condition for the metapopulation and its supporting habitat network around Cors Erddreiniog NNR/SSSI. The survey was carried out between 21 October and 5 November 2013. The suitability of the habitat was categorised and mapped following standard NRW methods. Land was classed into six categories according to the presence/amount of the butterfly's larval foodplant devil's-bit scabious *Succisa pratensis* and purple moor-grass *Molinia caerulea* (or other tussock-forming grasses), as well as the vegetation height and structure.

349 hectares were identified on the ground for assessment, and 262ha were surveyed: 212ha on Cors Erddreiniog and 51ha in the surrounding habitat network. Seventy-four hectares of private land could not be accessed, primarily because they were physically inaccessible, survey permission was refused or the ownership could not be traced.

Sixty hectares of habitat across the landscape was categorised as Good, Suitable or Potential habitat - 50ha on Cors Erddreiniog and 10ha outside NRW's management. There were 1.2 hectares of Good Condition habitat on Cors Erddreiniog and 0.001ha in the wider landscape. Most of the 20.5ha of Suitable habitat throughout the functional landscape was grazed too tightly to achieve Favourable Condition. Cors Erddreiniog and the surrounding sites contain a great deal of 'atypical' marsh fritillary habitat, compared to more typical Welsh rhos pasture, including ungrazed dense *Juncus* swards, bog myrtle scrub *Myrica gale*, and isolated tussocks in standing water. However, these are likely to be sub-optimal for marsh fritillaries.

Urgent work is needed to create more Good Condition habitat for the butterfly to ensure its survival and its Favourable Condition on Cors Erddreiniog. With appropriate management, the 60 hectares of Good Condition, Suitable and Potential Rank habitat could be sufficient to support the metapopulation in the medium term. Long-term survival would require management to bring substantially more habitat into Good Condition.

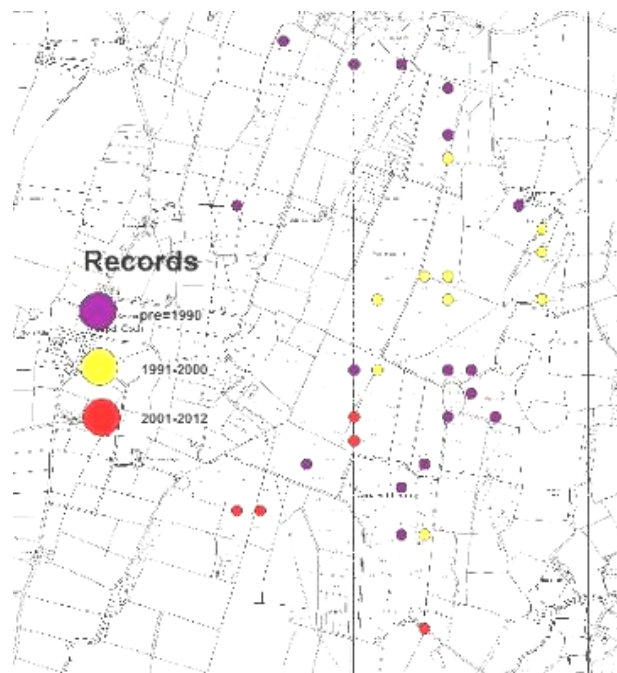
3. Background

The marsh fritillary *Euphydryas aurinia* is a European protected species, listed on Annex II of the EU Habitats & Species Directive. Cors Erddreiniog in northeast Anglesey has been identified by Natural Resources Wales as a Site of Special Scientific Interest (SSSI) and National Nature Reserve (NNR), and as part of the Anglesey Corsydd Môn/Anglesey Fens Special Area of Conservation (SAC), in part due to its population of marsh fritillaries. It now holds one of the few, or possibly the only, extant Anglesey population.

NRW is required to ensure that Favourable Conservation Status (FCS) applies to Annex II species and the SACs that have been designated to protect them. FCS is defined as a combination of the Favourable Condition of the species and the means to ensure its secure future on the site.

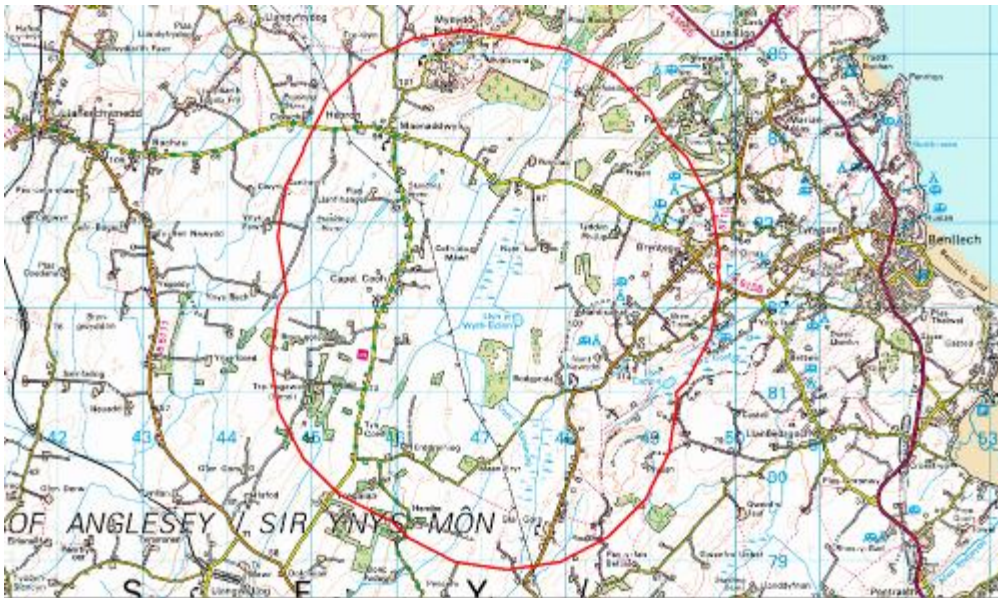
Marsh fritillaries experience regular extinctions and colonisations of suitable patches over time, exhibiting classic metapopulation dynamics. That is why they require a large network of suitable sites to maintain their populations in the long term. The restriction of Cors Erddreiniog's marsh fritillaries to one or a few patches indicates the currently unfavourable condition of this site for the butterfly.

The marsh fritillary was first recorded on Cors Erddreiniog in 1971, although undoubtedly it has been present for much longer. The butterfly's breeding sites have shifted across the site over time, with no evidence of a stable 'core' area (Map 1). In the 1970s and 80s larval webs were found mainly in the northern and southeastern parts of the reserve. Since 2000 webs have only been found in the south/southwest. The single breeding site recorded in 2013 was in compartment CE007a/b, southwest of Llyn yr Wyth-eidion (Les Colley, pers. comm.).



Map 1. Marsh Fritillary Records at Cors Erddreiniog

This survey was commissioned to map marsh fritillary habitat condition for the metapopulation (in the core landscape) and its supporting habitat network around Cors Erddreiniog NNR/SSSI (the functional landscape), as part of the process to report on Favourable Condition and Favourable Conservation Status for Natura 2000 features. The core landscape is the area within a 1km radius of recent marsh fritillary records (encompassing the typical dispersal distance of a female marsh fritillary), while the surrounding 2km radius is the functional landscape, which covers the average dispersal distance of the males (Fowles, 2005). This report assesses the condition and management of the landscape for its potential to support the marsh fritillary, and is not intended to address the condition or management of the other priority species and habitats on Cors Erddreiniog NNR/SSSI.



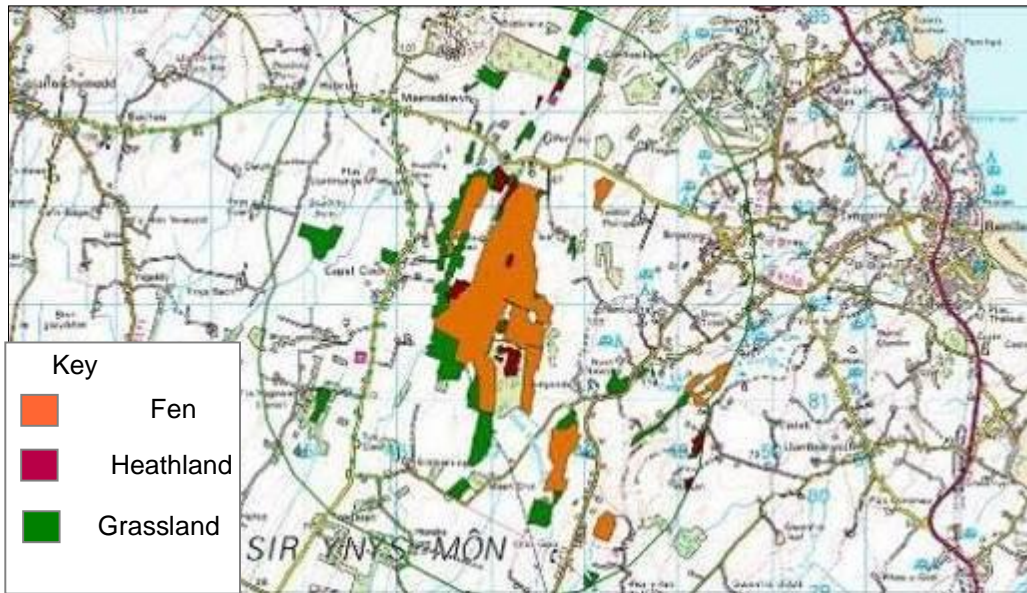
Map 2. Cors Erddreiniog Functional Landscape

4. Methods

4.1. Maps

NRW supplied the contractor with digital GIS maps identifying the core and functional landscapes of the Cors Erddreiniog marsh fritillary metapopulation. NRW Phase One and Phase Two vegetation data were used to identify 250 hectares of pasture, fen and heath on Cors Erddreiniog NNR/SSSI, with another 53 hectares in the surrounding neighbourhood (Map 3). These habitat maps were believed to include all vegetation communities with the potential to support marsh fritillaries.

When undertaking the surveys, some inaccuracies were found in the Phase 1 and Phase 2 vegetation surveys, and additional unmapped areas were surveyed where they appeared to have potential for the marsh fritillary.



Map 3. Potential Habitat within the Cors Erddreiniog network

4.2. Ownership

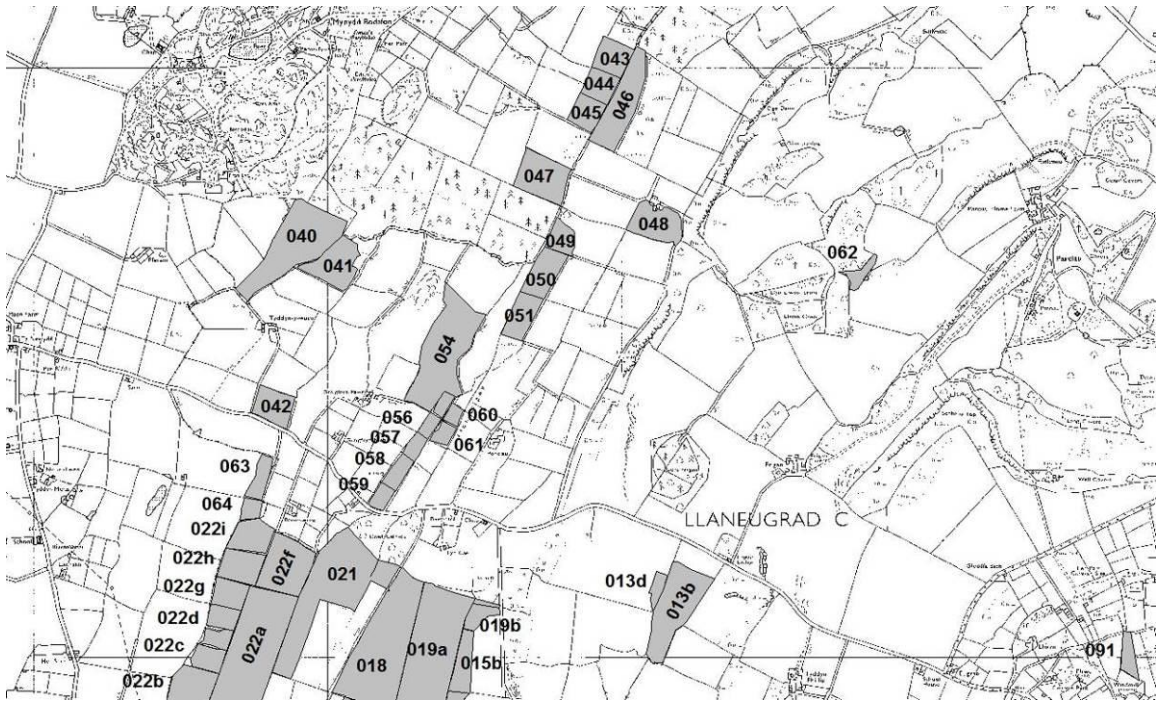
NRW provided landowner names and contact details, where available, for the land parcels not under their ownership. The contractor was responsible for obtaining survey permission from these owners and/or managers before undertaking the surveys, and tracing the ownership of fields where the owners had not been identified. Cors Erddreiniog Reserve staff also helped obtain survey permission from several private owners.

4.3. Field numbers

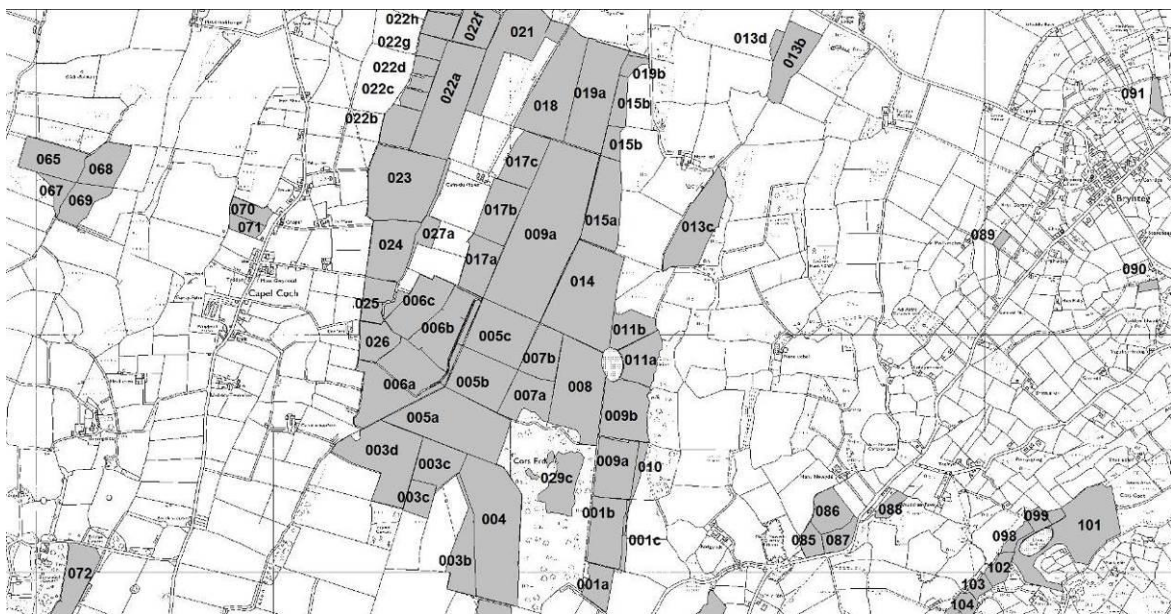
NRW's Cors Erddreiniog management unit numbers were used to identify land parcels within NRW's management. New numbers were allocated in one field where no number appeared on the map (CE0027c). NRW's field numbers range from CE001a to CE0027c, but CE013b to d and CE027 are actually in private ownership. All fields numbered CE029 and greater are privately-owned. Any other private fields with NRW management numbers have been re-numbered, to avoid confusion (see Table1 and Maps 4, 5 and 6).

Field numbers	Ownership	
	NRW	Private
CE001 to CE012	√	
CE013b, c, d		√
CE014 to CE026	√	
CE027a		√
CE027b, c	√	
CE029 to CE104		√

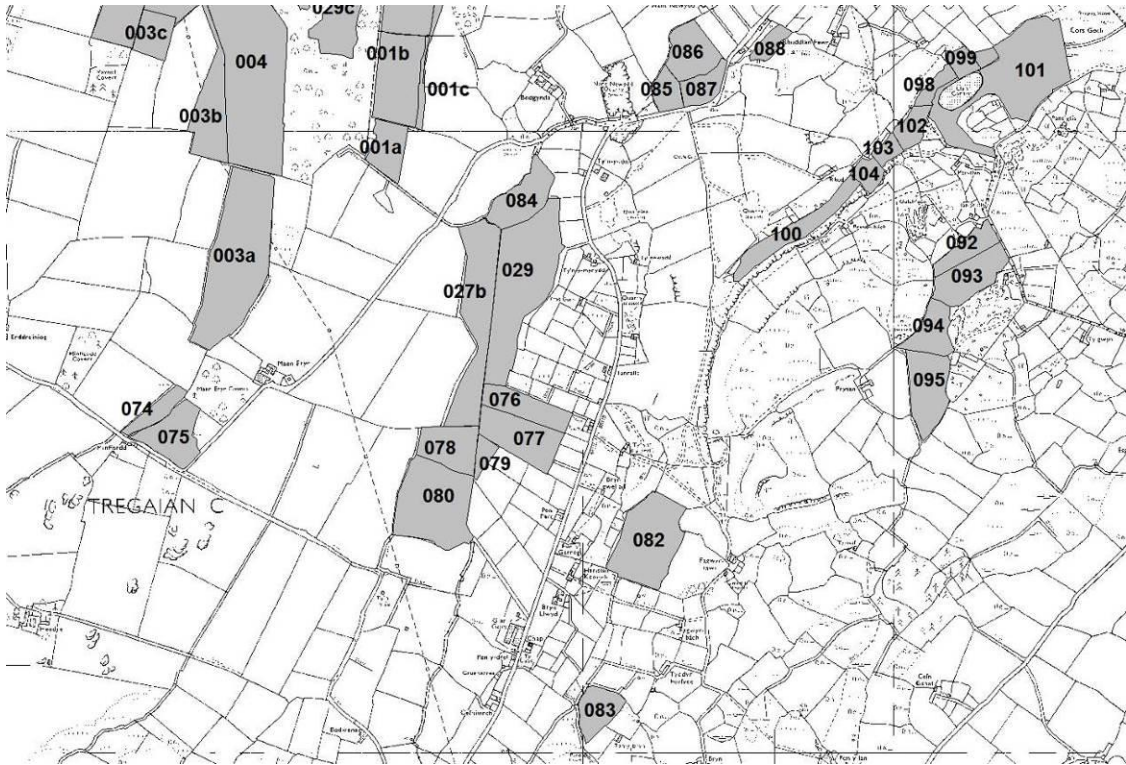
Table 1. Field numbers



Map 4. Field Numbers – North



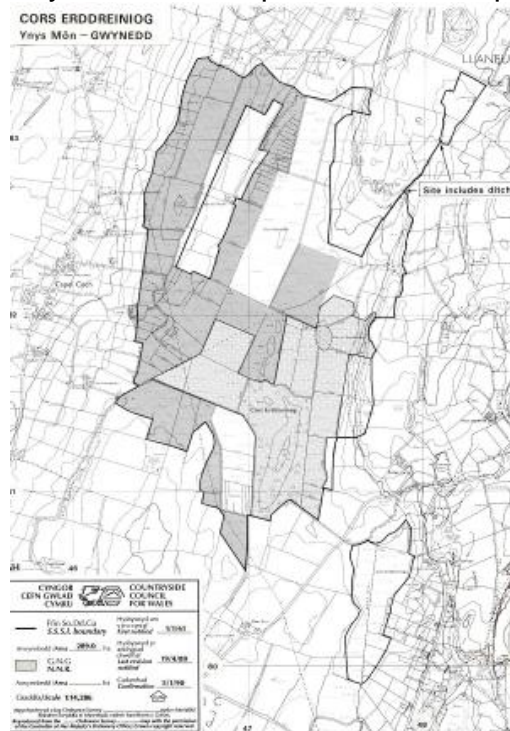
Map 5. Field Numbers - Central



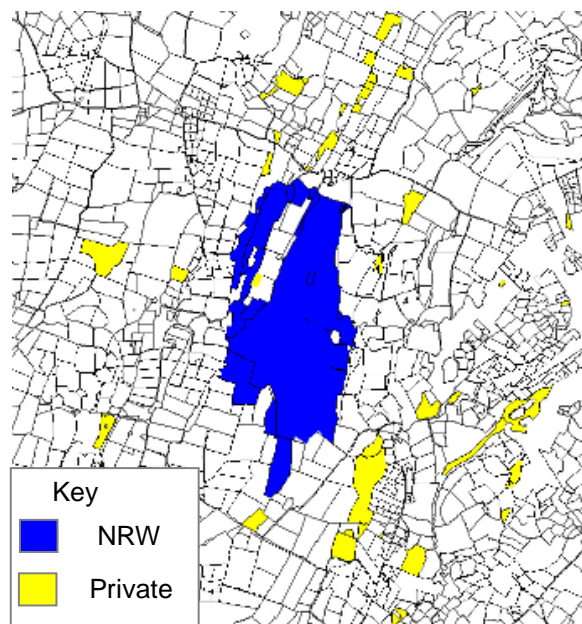
Map 6. Field Numbers - South

4.4. Terminology

Cors Erddreiniog NNR lies within the larger Cors Erddreiniog SSSI, most of which is owned and managed by NRW (Map 7). However, parts of the SSSI, mainly to the east of the NNR, are in private ownership. In this report, the terms 'Cors Erddreiniog' or 'the reserve' refer to all of the land that is managed by NRW. All other land, including privately-owned fields within the SSSI, is described as 'privately-owned' or 'in private ownership' (Map 8).



Map 7. Cors Erddreiniog NNR and SSSI



Map 8. Ownership

4.5. Surveys

The contractor visited Cors Erddreiniog with the Senior Reserves Manager (Emyr Humphreys) and the previous Site Manager (Les Colley) before undertaking the surveys. They both provided additional support and information during and following the survey. The contractor surveyed all of the enclosures or parts of fields at Cors Erddreiniog that they identified as worth assessing for marsh fritillary habitat.

The survey was carried out between 21 October and 5 November 2013. Each enclosure was surveyed (where physically possible) and the suitability of the habitat was categorised and mapped following the standard NRW methods outlined in Fowles 2005. Land was classed into six categories (Table 2), according to the presence/amount of the butterfly's larval foodplant devil's-bit scabious *Succisa pratensis* and purple moor-grass *Molinia caerulea* (or other tussock-forming grasses), as well as the vegetation height and structure. The mapping results have been supplied with this report as a Mapinfo GIS file, and are illustrated in Maps 9 to 16.

Habitat code	Habitat Classification
GC	Good Condition
SU	Suitable Undergrazed
SO	Suitable Overgrazed
SS	Suitable Sparse
PR	Potential Rank
NS	Not Suitable
NA	Not Accessed

Table 2. Habitat codes

5. Results

5.1. Ownership contact

Land was surveyed only after obtaining permission from the owner and/or manager. Some of the landowner details provided by NRW were incorrect (either incorrect contact details or attribution of fields to the wrong owner), and any new information obtained by the contractor was passed back to John Ratcliffe, NRW Senior Conservation Officer/Team Leader, Anglesey. It was impractical to visit all of these owners, especially those who do not reside on Anglesey. Permission was usually obtained by phone – it is possible that owner attribution of a few of these fields was incorrect, due to the difficulty of accurately identifying locations over the phone.

5.2. Survey results

A total of 349 hectares were identified for survey across the core and functional landscapes – land previously mapped by NRW with some additional habitat identified on the ground by the contractor, and 262ha were surveyed.

212ha of the reserve were surveyed or assessed (not including the 12.5ha previously identified by NRW staff as unsuitable).

125ha of fen, heathland and grassland in private ownership was identified for survey. Forty-one percent (nearly 51ha) was surveyed (11 owners).

Seventy-four hectares across the wider landscape could not be accessed for survey – see Table 3 for the details.

Five owners of 23% of all privately-owned land refused permission. One owner only denied access for one large tenanted field, granting permission for the four other fields in the family's ownership. Three of the other owners cited differences with NRW as their reason for refusal. Ownership could not be established for just under 10ha (9 fields).

Twenty-one percent of private land with survey permission was physically inaccessible. Several were extremely wet, dense fen or thick scrub/woodland. Four were inaccessible because the only access was across the Afon Lligwy or across fields with unknown ownerships.

	Number of fields	Hectares	Number of owners
Total identified by NRW	65	123.62	19 known
Surveyed	28	50.7	11
Not accessed			
Permission but physically inaccessible	8 [±]	26.19 [±]	6 [±]
Unable to complete in time	3	5.03	2
Refused permission	12	29.47	5
Unable to obtain permission*	5	2.54	1

Owner unknown	9	9.71	unknown
Total not accessed		72.92	

Table 3. Access to privately-owned sites

± Two entire fields, only parts of the other four fields were inaccessible.

* Incorrect contact details were provided by NRW. By the time the contractor obtained the correct address (but no phone number) the owner was not contactable, despite several attempts.

5.3. Habitat Condition (Figures 1, 2 and 3; Maps 9 through 16)

Within the entire Core and Functional Landscape of 349ha, 60ha of Suitable or potential habitat was identified. Eighty-three percent of this (50ha) was on Cors Erddreiniog.

Most of the ten hectares of privately-owned Suitable/Potential habitat were within no further than 550m from the reserve, or on Cors Goch NNR/SSSI (less than 2km from the core landscape), which is owned and managed by the North Wales Wildlife Trust (NWWT). There were just over 5ha of Suitable habitat and 5ha of Potential Rank on the private sites. Nearly all Suitable habitat was either Overgrazed (SO) or Suitable Sparse (SS) habitat – most of the SS habitat was also overgrazed. Eighty-two percent all of the Suitable/Potential habitat is designated as a SSSI, and most of it is also within a SAC. It is concentrated in five ownerships – two to the north and north-west, three to the southeast (including the NWWT).

	Cors Erddreiniog	Private sites	Total
Good Condition	1.19	0.01	1.19
Suitable Undergrazed	2.02	0.14	2.16
Suitable Overgrazed	9.32	1.21	10.53
Suitable Sparse	4.03	3.75	7.79
<i>Subtotal 1: Suitable only (excluding GC)</i>	<i>15.37</i>	<i>5.10</i>	<i>20.47</i>
Potential Rank	32.84	5.30	38.14
<i>Subtotal 2: Good Condition, Suitable and Potential</i>	<i>49.40</i>	<i>10.40</i>	<i>59.80</i>
Not Suitable (NS)	162.31	40.30	202.61
<i>Subtotal 3: Area Surveyed</i>	<i>211.71</i>	<i>50.70</i>	<i>262.41</i>
Not Accessed (NA)	13.96	74.35	86.88
Total	225.67	123.62	349.29

Table 4. Habitat Condition

Habitat Condition: Cors Erddreiniog

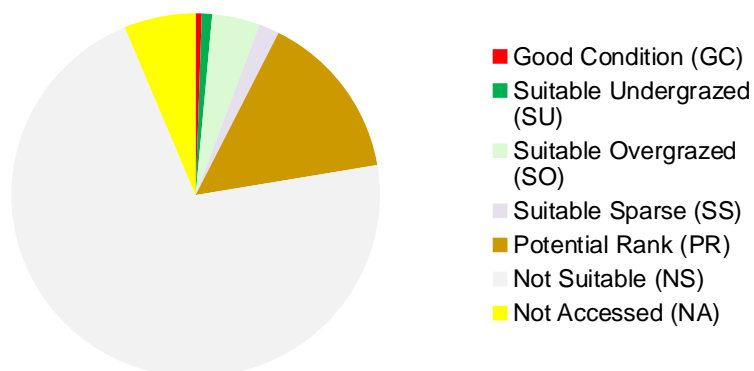


Figure 1. Habitat condition - Cors Erddreiniog

Habitat Condition: Privately-owned Sites

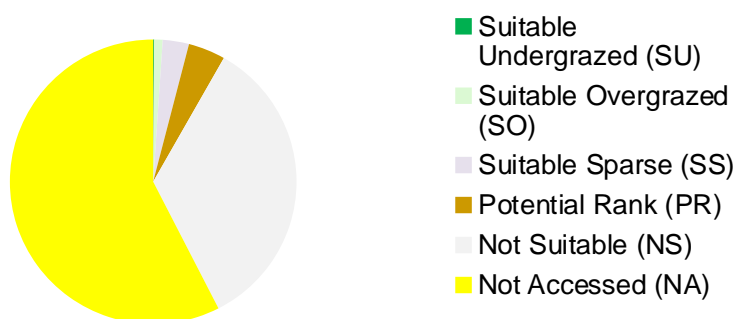


Figure 2. Habitat condition - Private sites

Habitat Condition: All Sites

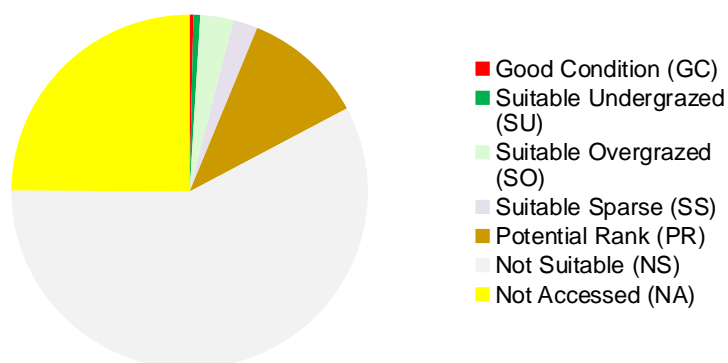


Figure 3. Habitat condition - All sites








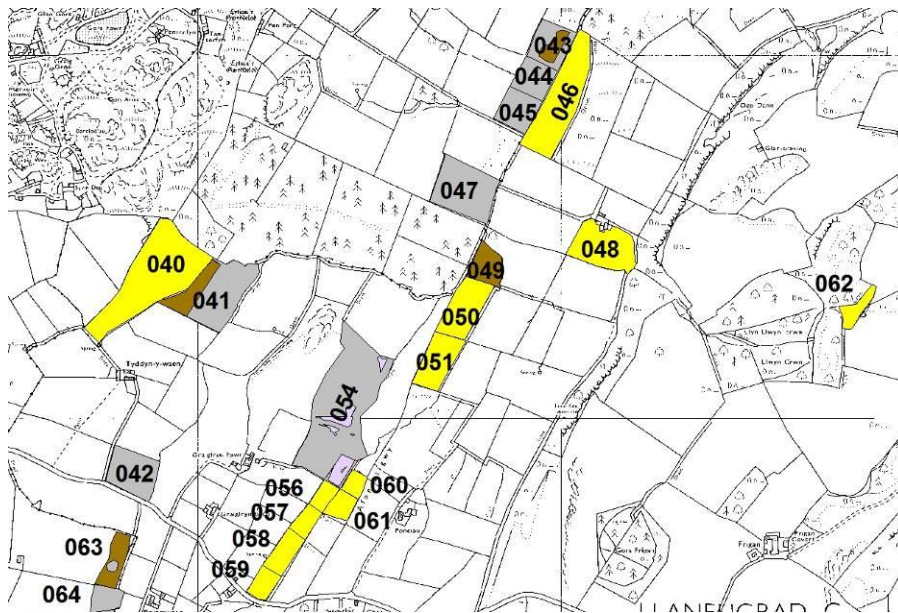
	Good condition
	Suitable undergrazed
	Suitable overgrazed
	Suitable sparse
	Potential rank
	Not suitable
	Not accessed

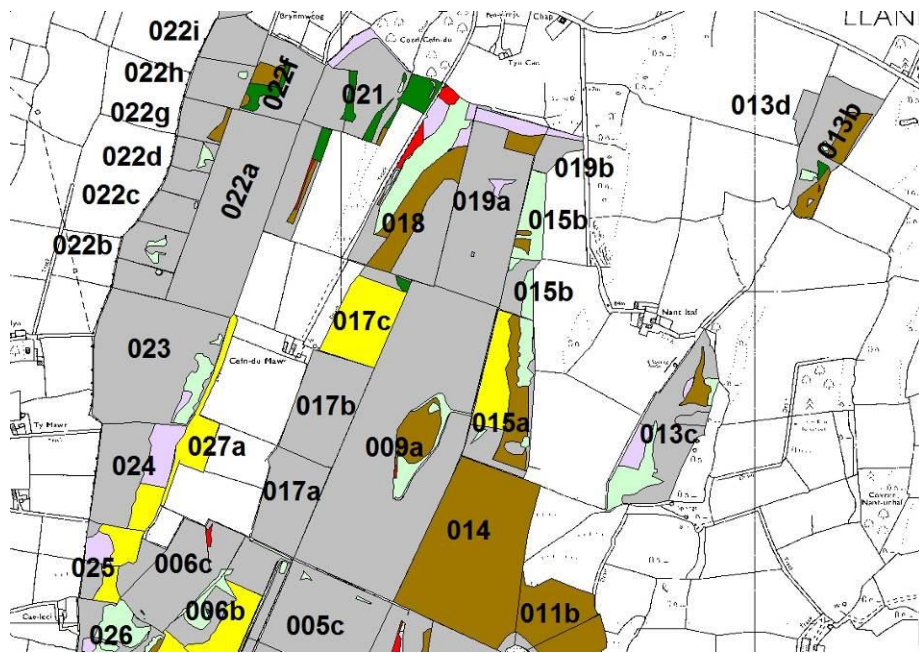
Figure 4. Key - Habitat Condition Maps



Map 9. Habitat Condition – North



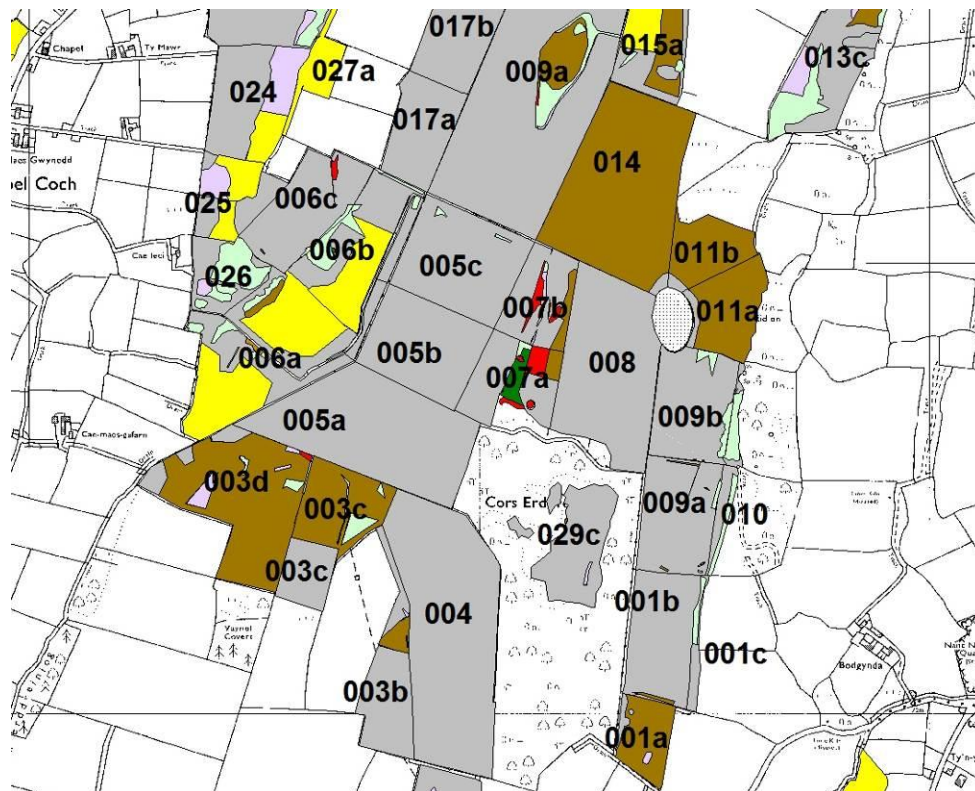
Map 10. Habitat Condition – Northwest



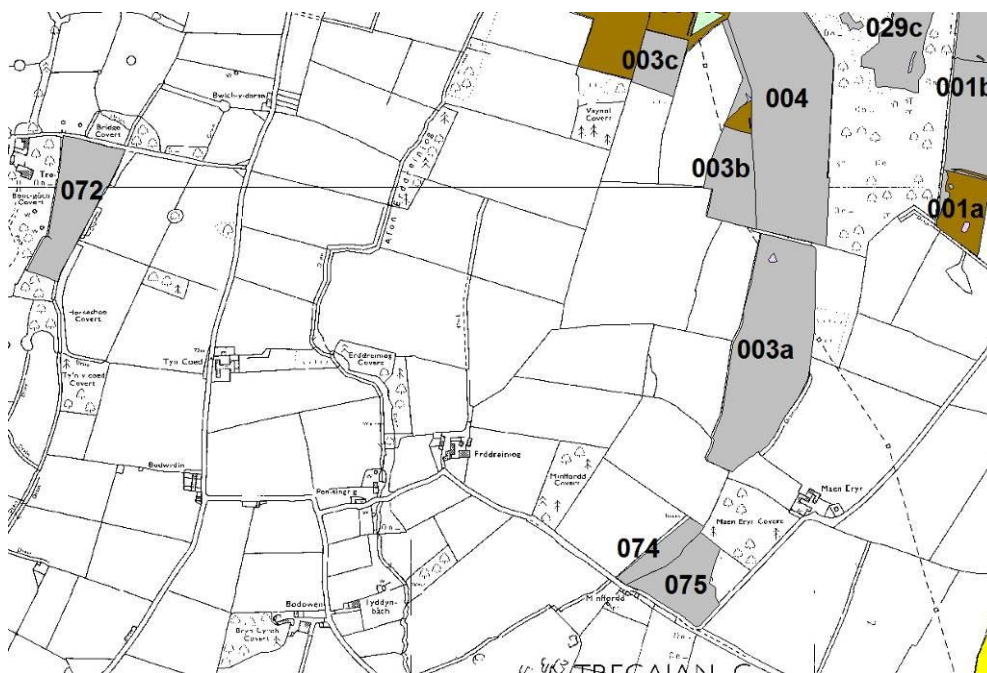
Map 11. Habitat Condition - Northeast



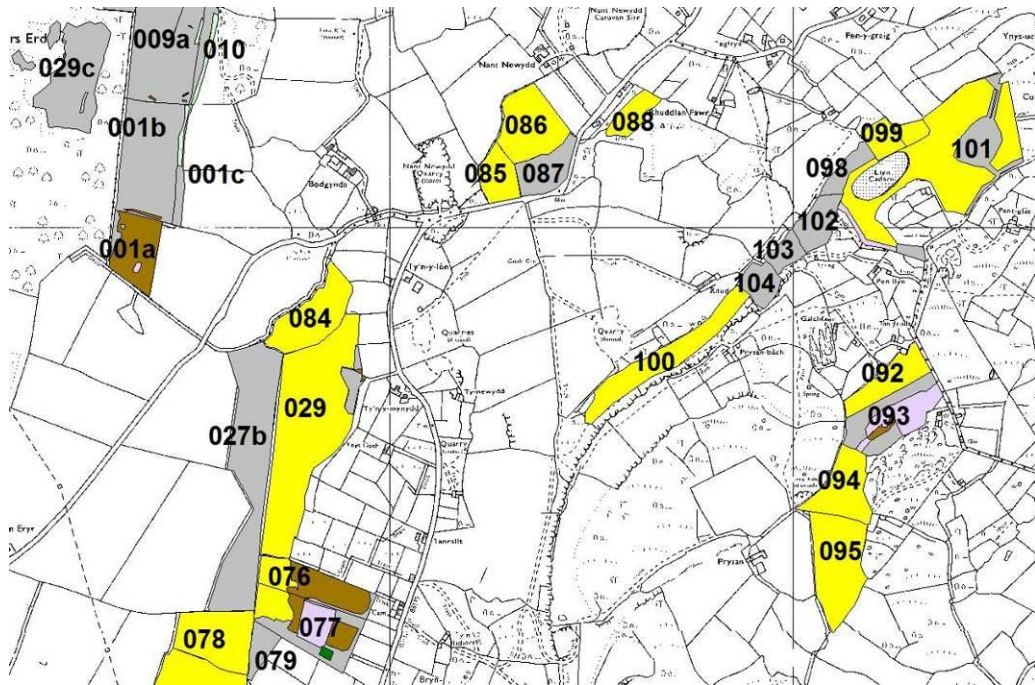
Map 12. Habitat Condition - East



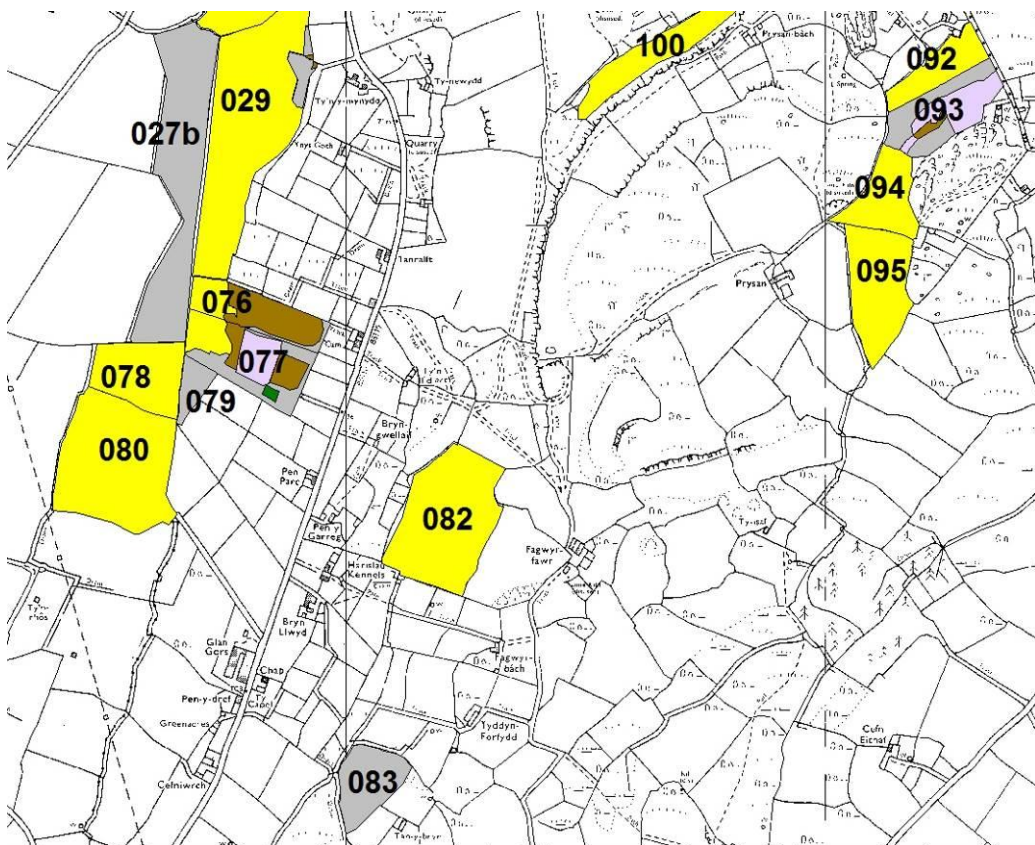
Map 13. Habitat Condition – Central



Map 14. Habitat Condition - Southwest



Map 15. Habitat Condition – Southeast and Cors Goch



Map 16. Habitat Condition – Far southeast

Good Condition

There were 1.2 hectares of Good Condition habitat on Cors Erddreiniog and 0.001ha just outside. The greatest amount of GC habitat occurred in compartments CE007a and b, south of Llyn yr Wyth-Eiddion (the only area with recorded larval webs in 2013) and in the north, in compartment CE018. Patches of GC habitat too small to map (less than 25m²) were found within some of the fens on Cors Erddreiniog, and in the neighbouring private field CE013c. However, added together these amounted to a negligible area. These small patches have been noted in the 'comments' column of the GIS table.



Figure 5. Good Condition marsh fritillary habitat

Suitable Undergrazed, Suitable Overgrazed and Suitable Sparse (SU, SO and SS)

The three 'Suitable' categories (not including Good Condition) amounted to 20.5ha, with 75% on the reserve. The only sizeable amounts of habitat outside the reserve were to the north (CE054 and 055), the northeast (CE013b and c), an ungrazed field (CE076) adjacent to Cors Cefn Iwrch (the southern extension of the reserve) and on the heathland at Cors Goch (CE093).

Potential Rank

Thirty-eight hectares of Potential Rank habitat were recorded, 33ha (86%) of this on the reserve.

Not Suitable

Fifty-eight percent (203ha) of all assessed land was recorded as Not Suitable. This broke down as 162ha of mostly fen and reedbed on the reserve and 51ha of various habitats in the wider landscape.



Figure 6. Unsuitable fen and reedbed

Not Accessed

The condition of a total of 87 hectares could not be assessed, with 74ha of these in the wider functional landscape. Those inaccessible sites that could be partially viewed from neighbouring land did not appear to be suitable for the marsh fritillary (CE056-059, CE061, CE085, CE086 and CE092). The one exception was SSSI heathland (CE094) extending southwest from the NWWT's Cors Goch SSSI heathland. The Suitable Sparse habitat found on Wildlife Trust land appeared to continue along the stream that flowed onto the neighbouring field (permission refused). It is likely that the physically inaccessible sites are unmanaged and thus only PR at best.

Larval webs

The survey was carried out too late in the season to observe marsh fritillary larval webs.

5.4. Habitat Management

Cors Erddreiniog

Most of the reserve is grazed by cattle and/or ponies. Some rushy areas along the western edge and a few sections of CE007b were mown. This latter compartment, along with CE007a, was the only larval web site on the reserve in 2013, but it is not known whether the mown areas included the breeding patches. The heathland areas (CE006c and CE027c) are rotationally burnt. Parts of the reedbeds have been managed by the Cors Erddreiniog LIFE project.

Privately-owned sites

Management was assessed on nearly 65ha of private land, including areas that were judged not suitable or could not be physically accessed (but the management could be ascertained). Twenty-three hectares (36%) were unmanaged. Forty hectares (62%) were grazed by cattle, or, on Cors Goch (NWWT) by cattle and Welsh cobs. 1.5ha (2%) appeared to have been cut and/or burnt in the recent past.

6. Discussion

6.1. Habitat Condition

There was a negligible amount of Good Condition habitat on Cors Erddreiniog, and so the marsh fritillary population here cannot be judged to be in Favourable Condition. In 2013, marsh fritillaries were only found in the compartment with the greatest amount of GC habitat in the landscape network (CE007a and b), with frequent to abundant *Succisa* and appropriately grazed tussocky grassland on a west-facing bank. There were a few other GC patches in CE003d, just over 500m southwest of this bank (where larval webs were recorded in 2012), and over 1km to the north, in CE018 (with only pre-1990 larval records).

Most of the 20.5ha of Suitable habitat found throughout the entire landscape was grazed too tightly (Suitable Overgrazed or close-grazed Suitable Sparse) to provide favourable condition habitat for the marsh fritillary. There was considerably more Potential Rank (33ha) than the 21.5 ha of Good Condition and Suitable habitat on Cors Erddreiniog, with the 10ha of habitat outside the reserve split evenly between Suitable and Potential Rank.

Metapopulation modelling has suggested that marsh fritillary metapopulations require between 76 and 104ha of suitable habitat for their long-term survival (Bulman, et.al. 2007), although Fowles (2004) regards 50ha of Available habitat (the total of Good and Suitable Condition habitat in the landscape) as an appropriate target to represent Favourable Condition. The 21.7ha of Good and Suitable habitat in the landscape falls short of this and it will be necessary to bring the 38.1ha of Potential Rank habitat under appropriate management in order to consider the metapopulation as viable in the medium to long-term.

6.2. Grazing Management

Cors Erddreiniog

The prescribed management for the marsh fritillary is light grazing, by cattle or ponies, to create a 10-25cm tussocky mosaic with frequent to abundant *Succisa pratensis*. This provides warm, sheltered pockets where the eggs and larvae have the greatest chance of survival, particularly on south- and west-facing banks and slopes.

Nearly all of the grazing at Cors Erddreiniog and the suitable areas outside the reserve was found to be too intensive for marsh fritillaries, with short, even swards and few tussocks. A few patches of land within the 2013 breeding site compartment, but not necessarily in larval web patches, had been mown. Management guidance for the marsh fritillaries on the reserve has been produced (Fowles 2012), recommending low levels of cattle and/or pony grazing. Sheep have grazed some areas of marsh fritillary habitat on Cors Erddreiniog in the past (CCW, undated) and this may have contributed to the loss of *Succisa* in habitat with otherwise suitable structure, as sheep use their small mouths to target *Succisa* and other favourite herbs.

Several of the post-1970 marsh fritillary breeding records were in compartments with suitable dry banks bordering wet PR fen, e.g. CE015a and 019a. Although the exact web locations were not identified, it is likely they were on these banks, highlighting the importance of ensuring appropriate grazing of these areas. There is no easy solution to the uneven grazing of the large, wet, Potential Rank fens with overgrazed dry banks. It is tricky to persuade livestock to graze a large grazing unit evenly, especially when most of it is wet and the drier banks are understandably more attractive for grazing and resting. In addition, it is not clear whether even intense grazing would significantly reduce the dominance of *Juncus*, nor would it be desirable to change the natural character of these fens.

Electric fencing might be a practical means to prevent stock from overgrazing the drier slopes, banks and other areas with the greatest potential for marsh fritillaries. If the ground is dry enough, paths could be mown through the fens with the greatest amount of *Succisa*, to encourage stock to move through the fens and create more suitable patches.

There is barely any *Succisa* in the heathland areas (CE006c, 027c and parts of 021), which are managed by rotational burning. There are pre-1990 records of marsh fritillaries on these heathlands. It is possible that burning led to a reduction of *Succisa* in the past, possibly exacerbated by sheep grazing. The one exception is a small, well-structured patch of GC in the northwest of CE006c, which might serve as a small 'stepping stone'. Therefore, burning is not recommended in this area.

The Good Condition and Suitable Sparse habitat in compartment CE018 occurred in an open heathland/grassy sward, and the grazing just bordered on too intensive with some poaching. Grazing levels should be closely controlled if this suitable habitat is to be maintained and expanded.

Privately-owned sites

While NRW have no direct control over grazing regimes on land outside its ownership, most of the Suitable/Potential habitat is on protected sites where there is potential to work with the landowners to modify the grazing pressure. Compartment CE013c immediately to the east of the reserve was reasonably well grazed.

6.3. Habitat Condition Categories

Much of Cors Erddreiniog and surrounding sites contain 'atypical' marsh fritillary habitat, compared to the usual Welsh rhos pasture habitat on less alkaline soils. *Succisa pratensis*, the marsh fritillary's larval foodplant, is widespread across the Cors Erddreiniog landscape. There is also a great deal of the tussocky grass *Molinia caerulea*, which provides the structure required by the larvae. However, *Molinia* is much less dominant in the Cors Erddreiniog landscape than it is in rhos pasture. Much of Cors Erddreiniog's habitat lies in wet, *Juncus*-dominated fens, beneath bog myrtle *Myrica gale*, or on tussocks above flooded pools.

Potential Rank or Not Suitable fens?

Potential Rank is defined as grassland with rare *Succisa* in a tall sward (above 25cm on average), which needs extensive habitat restoration before it can be brought into a sufficiently suitable state to allow the introduction of grazing (Fowles 2005).

Some PR areas do meet this definition, with plentiful *Molinia* (e.g. CE003d) and thus the potential to become tussocky under a suitable grazing regime. However, extensive areas of fen on Cors Erddreiniog and Cors Goch were dominated by tall, dense *Juncus*, which initially appeared unsuitable for marsh fritillaries due to their dense (not tussocky) structure, in which *Succisa* was difficult to find. In fact, the presence of *Succisa* and *Molinia* was revealed where livestock had grazed small patches within many of these fens – usually along paths, edges and on the drier banks and hummocks. These patches were usually grazed too tightly to provide suitable marsh fritillary habitat. However, they indicated that *Succisa* and *Molinia* are likely to be present through much of these fields, and so they were classed as Potential Rank.

If no *Succisa* was found, fens were categorised as Not Suitable. It is possible that some of the dense, ungrazed sward in these NS fens does contain small amounts of unseen *Succisa* and, thus, the amount of PR could have been underestimated.



Figure 7. *Juncus*-dominated fen at Cors Erddreiniog

Succisa pratensis under Bog myrtle *Myrica gale*

Suitable patches of *Succisa* were identified near or next to stands of bog myrtle *Myrica gale*. Most scrub shades out *Succisa*, but larval webs have been recorded under *Myrica* at Cors Erddreiniog (Colley, pers. comm.). Open stands of *Myrica* cast much less shade than gorse and other scrub. At Cors Erddreiniog, *Succisa* successfully grows beneath and next to the *Myrica*, frequently in a suitable or good sward structure where grazing was less intensive than on the more open areas. Stands of *Myrica* were categorised as Not Suitable where they were extensive or dense, or no *Succisa* was found.



Figure 8. *Succisa pratensis* under *Myrica gale*

Flooded land: Tussock Islands

Tussocks with Suitable Overgrazed or overgrazed Suitable Sparse habitat were found in large patches surrounded by standing water, mainly in compartments CE024 to 026 along the western edge of the reserve. These areas were difficult to assess accurately because they could only be surveyed from the edges (attempts to access them were eventually abandoned because they were too time consuming and unsafe).

The survey period coincided with the first extended spell of autumn rain in 2013, following a relatively dry summer and early autumn. However, much of the standing water appeared to be permanent or frequent, judging from the presence of aquatic plants and deep mud.



Figure 9. Tussock islands

Marsh fritillary larvae feed in a group in the autumn and (following hibernation) in late winter/early spring. They feed together on successive leaves of a *Succisa* plant, where they spin a web to protect themselves. Once they have

eaten all the leaves on a plant, they move as a group to a neighbouring plant. In the 'tussock islands' fields, larvae would have to cross open water to find additional food resources. Although there is anecdotal evidence that marsh fritillary larvae can survive periods of inundation (Fowles, pers. comm.), it is doubtful whether a colony could persist in these conditions. Only one of the post 1970 records of marsh fritillary was in one of these fields - the records are not detailed enough to show whether they were actually in these flooded areas. These areas have been identified as Suitable (SO or SS), but they may be incapable of sustaining marsh fritillary colonies.

7. Conclusions

Marsh fritillary metapopulations require a large network of suitable sites to maintain their populations in the long term. The Cors Erddreiniog marsh fritillary population is very small and vulnerable. Urgent work is required to provide more Good Condition habitat for the butterfly to ensure its survival in northeast Anglesey and to achieve Favourable Condition for the marsh fritillary SAC feature.

With appropriate management, the 60 hectares of Good Condition, Suitable and Potential Rank habitat within the Functional Landscape could be sufficient to support the Cors Erddreiniog metapopulation in the short- to medium-term.

The grazing pressure on the reserve is currently too intensive to produce sufficient habitat. A grazing strategy integrating the needs of the marsh fritillary and the other key species and habitats is recommended. The first target would be a reduction in stocking levels and/or the length of the grazing season on the key areas: dry banks, slopes and hummocks, particularly those with southerly or westerly aspects. Electric fencing may also be useful to control grazing levels, while mown paths would encourage more even grazing.

Grazing key marsh fritillary areas with cattle only may also help. Cattle tend to create a tussocky mosaic, while ponies and horses can severely overgraze their favourite patches and neglect latrine areas (although this varies with individual ponies and their previous grazing experiences). On the sites with the greatest marsh fritillary potential, it may be worth limiting grazing to cattle only on an experimental basis.

Mowing destroys the sward structure and the availability of the foodplant for marsh fritillaries. It is only suitable as a restoration tool in rank habitat prior to the introduction of a suitable grazing regime, and possibly to reduce the dominance of the invasive rush *Juncus effusus*.

Monitoring of the new grazing regime would be crucial to guide future work.

Subsequently, management to create more Good Condition habitat within the Potential Rank areas on Cors Erddreiniog would be required. It would also be important to work with the small number of neighbouring landowners with potential habitat on their sites, to persuade owners who refused access to begin to work with NRW, and to trace the owners of the fields where ownership could not be established.

8. References

Bulman, C.R., Wilson, R.J., Holt, A.R., Galvez Bravo, L., Early, R.I., Warren, M.S., Thomas, C.D. 2007. *Minimum viable metapopulation size, extinction debt and the conservation of a declining species*. Ecological Applications. **17(5)**: 1460-1473. Ecological Society of America.

CCW (undated) *Cors Erddreiniog Site of Special Scientific Interest. Your special site and its future*. Countryside Council for Wales.

Fowles, A.P. 2004. *Conservation objective for marsh fritillary metapopulations on marshy grassland*. Countryside Council for Wales, unpublished file note.

Fowles, A.P. 2005. *Habitat quality mapping for marsh fritillary populations*. Staff Science Report. **05/5/1**. Countryside Council for Wales.

Fowles, A.P. 2012. *Marsh Fritillary Conservation on Cors Erddreiniog*. Countryside Council for Wales, unpublished file note.

9. Appendix 1: Site Descriptions

Habitat code	Habitat Classification
GC	Good Condition
SU	Suitable Undergrazed
SO	Suitable Overgrazed
SS	Suitable Sparse
PR	Potential Rank
NS	Not Suitable
NA	Not Accessed

Table 5. Habitat codes

9.1. Cors Erddreiniog (NRW)

CE001a. Other than a small patch of shorter SS in the southern section and several ponds, the field was PR or NS fen, with occasional devil's-bit scabious *Succisa pratensis* between and among large patches of bog myrtle *Myrica gale*.

Management: Cattle grazing

CE001b. Mainly non-suitable fen, with one small patch of *Succisa* too small to map (<25m²).

Management: Cattle grazing

CE001c. Dry bank with very short-grazed SO.

Management: Cattle grazing

CE003a. Small patch of overgrazed SS, in NS *Juncus*-dominated sward or tall neutral grassland.

Management: Pony grazing

CE003b. Small patches of SS and SU in PR sward toward the north, with the northernmost and southern sections NS tall, *Juncus*-dominated, and very wet in the south.

Management: Cattle grazing

CE003c. One large and two small patches of SO habitat in the northern part of this field of either open wet heathland vegetation or ranker *Molinia* and *Juncus*. There are recent records of marsh fritillary larval webs here.

Management: Cattle grazing

CE003d. Patches of GC, SS and SO habitat in the drier north and west of a large PR field of *Molinia* and *Juncus*. Much of the habitat was on drier south and west-facing banks. The southern 'extension' contains no *Succisa* and so was NS. There are recent records of marsh fritillary larval webs here.

Management: Cattle grazing

CE004. NA (scrubbed up) and NS reedbed, according to NRW staff.

Management: Ungrazed

CE005a. Not Suitable reedbed and fen, according to NRW staff.

Management: Ungrazed

CE005b. Not Suitable reedbed and fen, according to NRW staff.

Management: Pony grazing

CE005c. Not Suitable reedbed and fen, according to NRW staff.

Management: Pony grazing

CE006a. The bulk of 6a was fen edged by ponds and too wet to access. There were small areas of SO and PR habitat south of the track, and larger patches of SO and PR along the western edge. Small patches of *Succisa* too small to map occur in amongst the ponds and patches of *Myrica* along the path bordering the eastern edge.

Management: Cattle grazing

CE006b. Much of 6b was fen that was either too wet to access or Not Suitable. There was a patch of SO along the western edge, with a tiny amount of SU, consisting of *Succisa* in a tall almost semi-improved sward. There was also a strip of SO along the northern path edge, with patches of *Succisa* too small to map in amongst the ponds and patches of *Myrica* along the path bordering the eastern edge.

Management: Cattle grazing

CE006c. There was a small patch of GC near the track along the northern edge, but other than a small strip of SU near the southwestern edge, the rest of the field was NS heathland with suitable structure but no *Succisa*, and marshy grassland along the southeastern boundary.

Management: Pony grazing and rotational burning

CE007a. The west-facing slope of this field and CE007b (managed as one unit) contains the greatest concentration of GC habitat in the entire survey area, and the only marsh fritillary breeding site found in 2013. There were also patches of SU, a

few areas which had been recently mown and a large patch of scrub. Some PR habitat lay immediately to the east of this habitat. The western part of the field was a separately fenced NS fen.

Management: Pony grazing and mowing

CE007b. See CE007a.

Management: Pony grazing and mowing

CE008. NS reedbed and fen.

Management: Ungrazed

CE009a. Mostly NS fen, with small patches of SO, SU, PR and a tiny patch of GC along the edges.

Management: Cattle grazing

CE009b. Mostly NS fen with reedbeds fringing the lake. There were a few small patches of SO and a narrow strip of SS next to the boardwalk.

Management: Cattle grazing

CE010. The dry bank contained a considerable length of very short-grazed SO habitat. The lower, wetter rushy section was NS, with no *Succisa* found. Grazed as one unit with CE009a and CE009b.

Management: Cattle grazing

CE011a. PR field of *Juncus* and *Molinia*, with occasional *Succisa*, and reedbeds fringing the lake. Marsh fritillaries were recorded here prior to 1990.

Management: Pony grazing

CE011b. PR field of *Juncus* and *Molinia*, with occasional *Succisa* and reedbeds fringing the lake. Marsh fritillaries were recorded here prior to 1990.

Management: Pony grazing

CE011c. This field has been stripped to expose the peat, as part of the LIFE Project.

Management: Ungrazed

CE014. This fen was been categorised as PR. It consists of tall *Juncus* and *Molinia* fen with very wet patches, and small scattered patches of SO (too small to map). The areas that have been grazed by ponies reveal that *Succisa* is probably widespread. Marsh fritillaries were recorded here prior to 1990.

Management: Pony grazing

CE015a. Most of this field was NA (too wet) or NS fen with *Juncus* and plentiful *Myrica gale* and little or no *Succisa*. This was edged with PR fen with occasional *Succisa*. One large and several small patches of very close-grazed SO were on the drier eastern bank. Marsh fritillaries were recorded in this field in the 1990s.

Management: Cattle and pony grazing

CE015b. The northern two-thirds was very short SO with a few patches of PR fen. The southern third was NS fen with a small patch of 'tussock islands' in the north-west corner.

Management: Cattle and pony grazing

- CE016. The bulk of CE016 was NS fen, with a drier raised oval of PR, SO and SS habitat in the centre (former heathland) and SO along the path to CE015. Marsh fritillaries were recorded here in the 1990s.
Management: Pony grazing
- CE017a. Not Suitable fen, according to NRW staff.
Management: Cattle grazing
- CE017b. Not Suitable fen, according to NRW staff.
Management: Cattle grazing
- CE017c. Most of this field was Not Accessible (too wet) or Not Suitable fen. A small patch of SU habitat was found in the northeast corner.
Management: Cattle grazing
- CE018. This field contained one of the largest amounts of Good Condition habitat in the survey area (although only 0.35ha), along with SS and SO, in the drier heathland strip along the western boundary (by the track), and a patch of SS and SO in the drier northeastern corner. The rest of the field was either PR or NS tall fen dominated by flattened *Juncus*. Marsh fritillaries were recorded here prior to 1990.
Management: Cattle grazing
- CE019a/b. Most of this field was NS very wet fen with extensive stands of *Juncus*-dominated sward. Patches of very short-grazed *Juncus* and *Molinia* lay along the northern bank and at a few points on a slightly raised ridge running roughly north-south, where the ponies have been grazing. A less-grazed area of SU and scrub was found in the northeastern corner. Marsh fritillaries were recorded here prior to 2001.
Management: Cattle and pony grazing
- CE021. This field covers a range of habitats. The almost square sloping field to the east (next to the track) was SU with a strip of scrub. The larger area to the west was mostly NS heathland – the structure was suitable but no *Succisa* was found. There were narrow strips of SS along the northwest and north edges, with SU, a small amount of SO, and a patch of PR along the eastern edge of the heathy field. The western side was dominated by *Myrica gale*, with *Succisa* beneath the myrtle, at least along the edge (which was categorised as SU).
Management: Pony grazing
- CE022a. Not Suitable reedbed.
Management: Ungrazed
- CE022b. Patches of SO in otherwise NS field. The southeastern corner of the field was too wet to access.
Management: Cattle grazing
- CE022c. Patch of SS in very wet NS field.
Management: Cattle grazing
- CE022d. Not Suitable pasture.
Management: Cattle grazing and mowing

CE022e. Most of this field was mown *Juncus*, with a patch of SO habitat in very wet ground with *Juncus* and *Myrica*.

Management: Cattle grazing and mowing

CE022f. The northern third was short-grazed semi-improved grassland. The southwestern third was a mix of PR and SU, with a small reedbed in the southern section. The rest of the field was scrub or too wet to access.

Management: Pony grazing

CE022g. The eastern side was PR, the rushy western section (approximately two-thirds of the field) had been cut.

Management: Cattle grazing and mowing

CE022h. There was a small patch of SO in the northeastern corner. The rushy western section (approximately two-thirds of the field) had been cut.

Management: Cattle grazing and mowing

CE022i. Not Suitable pasture.

Management: Cattle grazing

CE023. There was a large patch of SO, with some SS at the eastern end of the field. The western two-thirds was either mown pasture or reedbed (NS), with an area of scrub in the centre. Marsh fritillaries were recorded here prior to 1990.

Management: Cattle grazing and mowing

CE024. The eastern third was flooded, with 'tussock islands' with *Succisa* occasional to frequent, but separated from each other by standing water. The rest was NS.

Management: Cattle grazing

CE025. The northern half of this field featured SS to the west, and Suitable Sparse 'tussock islands' to the east. The southern half was divided into NS in the west and NA in the east – too wet to survey and no *Succisa* evident from the edges.

Management: Cattle grazing

CE026. The western third was NS: scrub surrounding damp grassland with no *Succisa*. The eastern two-thirds were very wet and SO, with some 'tussock islands'.

Management: Cattle grazing

CE027a. Could not find the access to this field, which appears to be part of the farm lying in the centre of the NNR (not owned by NRW).

Management: Edge of improved, cattle-grazed fields

CE027b. Not Suitable, according to NRW staff.

Management: Cattle grazing

CE027c. Extensive heathland with a good structure but barely any *Succisa* – only a tiny patch of PR along the western edge of the main heathland block, and scattered *Succisa* (SS) along the track in the southeast. Marsh fritillaries were recorded here prior to 2001.

Management: Rotational burning

9.2. Wider landscape (not owned or managed by NRW)

CE013b/13d. This field was a mix of *Molinia* and *Juncus*: the western strip was mostly PR. The rest (including all of CE013d) was NS, with patches of Suitable Overgrazed, Suitable Undergrazed and Suitable Sparse. The rectangular strip at the northern edge of the field, to the north of the ditch, was Not Suitable grassland.

Management: Cattle grazing

CE013c. This field contained a good amount of suitable habitat bordering on well grazed. The mix of Good Condition, Suitable Overgrazed and Suitable Sparse habitat was found on the drier areas in the southwest of the field, with more small patches of Good Condition too small to be mapped. The northwest of the field was semi-improved with no *Succisa*, and the wetter eastern side was dominated by *Juncus*, with a large patch of PR and a smaller SU section; the rest was NS wet fen. Several areas had recently been cut. Marsh fritillaries were recorded here in the 1990s.

Management: Cattle grazing

CE028. See CE0078.

CE029. Most of this large field was physically inaccessible or Not Suitable dense *Juncus* and/or saw-sedge *Cladium mariscus* fen. The small accessible section near the northern end was PR, dominated by *Cladium* with some *Succisa* around the edges. A small strip of Suitable Sparse was also accessed along the eastern boundary. Nb. There was an area of Japanese knotweed *Fallopia japonica* on raised ground at SH47926 80608, near the entrance to the site from Tyn y Mynydd.

Management: Unmanaged

CE030. See CE076, 077 and 079

CE040. Permission refused

CE041. The fen to the west of the ditch was Potential Rank *Juncus*-dominated, with rare *Succisa*. There were very small patches of Suitable Sparse habitat along the western boundary, where cattle had grazed. No *Succisa* was found on the NS fen to the east of the ditch.

Management: The field was open to cattle but they had only grazed a narrow strip near the gate, along the western boundary.

CE042. Not Suitable – marshy grassland with no *Succisa*

Management: Cattle grazing

CE043. Potential Rank *Molinia* and *Juncus* and rare *Succisa*, with scrub/ woodland edges.

Management: Unmanaged

CE044. There is a small patch of tall PR with a few patches of *Succisa* in this field. Most is NS scrub/woodland or rank marshy grassland with no *Succisa*.

Management: Unmanaged

CE045. Not Suitable – marshy grassland with no *Succisa*

Management: Cattle grazing

- CE046. Not Accessed – physically inaccessible, across the river from the other fields in the same ownership.
- CE047. Not Suitable – marshy grassland with no *Succisa*.
Management: Cattle grazing
- CE048. Not Accessed – permission refused
- CE049. Not Accessed – permission refused
- CE050. Not Accessed – permission refused
- CE051. Not Accessed – permission refused
- CE052. Not Accessed – permission refused
- CE053. Not Accessed – permission refused
- CE054. Most of this large field was NS scrub or fen with patches of overgrazed SS habitat in the north and a large amount of very short SS between gorse patches on the sloping drier western side of the field, with a tiny patch of SO. These areas had not been identified as potential habitat on NRW's habitat maps. There may also be more potential habitat to the north of this field (ownership uncertain).
Management: The east-facing slope where most of the SS habitat occurred was heavily grazed by cattle. The wetter, rushier areas were also open to the cattle, but they had made less of an impact.
- CE055. This wet field was mainly SS with a small patch of SO in the centre.
Management: Cattle grazing
- CE056. Not Accessed – unable to contact landowner
- CE057. Not Accessed – unable to contact landowner
- CE058. Not Accessed – unable to contact landowner
- CE059. Not Accessed – unable to contact landowner
- CE060. Not Accessed – physically inaccessible, across the river from the other fields in the same ownership.
Management: Unmanaged
- CE061. Not Accessed – unable to contact landowner
- CE062. Not Accessed – time ran out
- CE063. Only the lower, eastern section of this otherwise improved field was surveyed. There was a large patch of PR with a small amount of SU habitat (too small to map) north of the pond. The southern part of the field was species-rich wet grassland, but no *Succisa* was found.
Management: Cattle grazing

- CE064. Not Suitable: As with CE063, only the lower, eastern section of this otherwise improved field was surveyed. The species-rich wet grassland in CE063 continued into this field, but no *Succisa* was found.
Management: Cattle grazing
- CE065. Not Accessed – time ran out
- CE067. Not Accessed – time ran out
- CE068. Not Accessed – permission refused
- CE069. Not Accessed – ownership unknown
- CE070. Not Accessed – ownership unknown
- CE071. Not Accessed – ownership unknown
- CE072. NS – Overgrown semi-improved damp grassland, with wetter areas dominated by Meadowsweet *Filipendula ulmaria* and *Juncus*. No *Succisa* was found.
Management: Unmanaged
- CE074. Not Accessed, but viewed from adjacent field and was Not Suitable – this field has been improved.
- CE075. Not Suitable – Mix of semi-improved grassland and rush pasture with no *Succisa*.
Management: Cattle grazing
- CE076. The eastern two-thirds of this field was mostly PR with scattered *Succisa*. Scrub has developed along the southern and eastern boundaries. Much of the western section was inaccessible (too wet, across a deep ditch). The areas that could be accessed were Not Suitable with no *Succisa*.
Management: Unmanaged
- CE077. This heathy field contains an open sward with one large patch of SS in the western half of the main field, a small SU patch in the southeast and PR to the north of that. Much of the far western section was inaccessible wet fen grading to scrub/woodland. The fringe between this section and the heathland was PR with occasional patches of *Succisa*.
Management: This field appears to have been cut earlier in the year and has not been grazed. There was evidence of past scrub burning.
- CE078. Not Accessed – could not find access into the field.
- CE079. Not Suitable. There was a stand of *Molinia* within this densely vegetated swamp dominated by *Cladium*, *Juncus* and *Filipendula*, but no *Succisa* could be found.
Management: Unmanaged
- CE080. Not Accessed – could not find access into the field.

- CE082. Not Accessed – permission refused
- CE083. Not Suitable – Overgrown damp neutral grassland with *Filipendula* and common knapweed *Centaurea nigra*, *Juncus* and an area of reedbed. No *Succisa* was found.
Management: Unmanaged
- CE084. Not Accessed – permission refused
- CE085. Not Accessed – ownership unknown
- CE086. Not Accessed – ownership unknown
- CE087. Not Suitable – A small patch of *Molinia* with no *Succisa* in the north-west corner, and the rest was flattened tall *Juncus*.
Management: Unmanaged
- CE088. Not Accessed – ownership unknown
- CE089. Not Accessed – ownership unknown
- CE090. Not Accessed – ownership unknown
- CE091. Not Accessed – ownership unknown
- CE092. Not Accessed – permission refused
- CE093. Heathland with a large patch of SS either side of the stream, and some PR to the south. The rest of the field was heathland with no *Succisa* found.
Management: Cattle and Welsh cob grazing
- CE094. Not Accessed – permission refused
- CE095. Not Accessed – permission refused
- CE096. Not Accessed – physically inaccessible, across the river from the other fields in the same ownership.
- CE098. Not Suitable *Juncus*-dominated fen with no *Succisa*.
Management: Unmanaged
- CE099. Not Suitable *Juncus*-dominated fen with no *Succisa*.
Management: Unmanaged
- CE100. Not Accessed – permission refused
- CE101. This is a large, wet, most inaccessible fen to the west, south and east of the lake at Cors Goch NNR / North Wales Wildlife Trust (NWWT) Reserve. There is a SS strip along the accessible western fringes (SS) and alongside a short path to the north of the hill (indicating that *Succisa* may occur within the tall fen).
Management: Cattle and Welsh cob grazing

CE102. Not Suitable marshy grassland with no *Succisa* found, at the western end of Cors Goch NNR / NWWT Reserve.

Management: Cattle and Welsh cob grazing

CE103. Not Suitable marshy grassland with no *Succisa* found, at the western end of Cors Goch NNR / NWWT Reserve.

Management: Cattle and Welsh cob grazing

CE104. Not Suitable marshy grassland with no *Succisa* found, at the western end of Cors Goch NNR / NWWT Reserve.

Management: Cattle and Welsh cob grazing

10. Appendix 2: Data Archive

Data outputs associated with this project are archived on Ffynnon at 13/1723: NRW Research Reports and at *M:\GIS_Users\Adrian_f\APF\Marsh Fritillary\Habitat Quality Surveys\All Wales\Surveys* on server-based storage at Natural Resources Wales.

The data archive contains:

[A] The final report in Microsoft Word and Adobe PDF formats.

[B] A full set of images produced in .jpg format.

[C] A series of GIS layers on which the maps in the report are based

Metadata for this project is publicly accessible through Natural Resources Wales' Library Catalogue <http://194.83.155.90/olibcgi> by searching 'Dataset Titles'.

11. Appendix 3: Acknowledgements

All maps included this report were produced from Ordnance Survey Data under licence to Natural Resources Wales: Ordnance Survey Licence number 100019741. Crown Copyright and Database Right (2014).

All photographs by Deborah Sazer.

Adrian Fowles, Emyr Humphreys, Les Colley and John Ratcliffe of NRW, along with John Anderton, provided invaluable assistance in the preparation and undertaking of the survey and the preparation of this report.

NRW Neath-Port Talbot provided access to MapInfo mapping software for printing survey maps, and Butterfly Conservation Wales provided generous access to MapInfo for mapping the survey results.



**Cyfoeth
Naturiol**
Cymru
**Natural
Resources**
Wales

Published by:
Natural Resources Wales

© Natural Resources Wales 2014

All rights reserved. This document may be reproduced with prior permission of
Natural Resources Wales

Further copies of this report are available from:

Email: library@cyfoethnaturiolcymru.gov.uk