Cyfoeth Naturiol Cymru
Natural Resources Wales

Marsh Fritillary Pant Glas landscape assessment 2019

Butterfly Conservation

NRW Evidence Report No. 447

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Mae britheg y gors *Euphydryas aurinia* yn Rhywogaeth a Warchodir gan Ewrop a restrir yn Atodiad II o Gyfarwyddeb Cynefinoedd a Rhywogaethau'r UE. Mae britheg y gors yn brin yng ngogledd Cymru a dim ond 13 o boblogaethau sy'n weddill, a phrin y mae llawer ohonynt yn parhau o ganlyniad i ddulliau anffafriol o reoli tir, ac mae angen cymryd camau gweithredu brys er mwyn diogelu ei dyfodol. Mae'r glaswelltiroedd corsiog sydd ar ochr ddwyreiniol Penrhyn Llŷn yn cynnal y metaboblogaeth o bwys mwyaf yng ngogledd Cymru, o gwmpas Pant Glas.

Mae angen i fetaboblogaethau o frithegion y gors gael rhwydwaith o safleoedd sydd â chysylltiadau da ac sy'n cynnal ardaloedd estynedig o gynefin addas o ansawdd uchel er mwyn sicrhau eu goroesiad i'r hirdymor. Mae gofyn am gynnal asesiadau cyfoes o'r tirweddau lle mae brithegion y gors yn byw er mwyn canfod faint o gynefin *Da* ac mewn *Cyflwr Addas* sy'n bodoli ymhob tirwedd, pa mor dda yw'r cysylltiadau rhwng y darnau hyn o dir, a lle y dylir gwneud ymdrech i wella ansawdd y cynefin er mwyn adeiladu metaboblogaethau cadarn. Bydd hyn yn helpu o safbwynt blaenoriaethu tirweddau ar gyfer gweithrediadau cadwraeth.

Cafodd yr arolwg hwn ei gomisiynu er mwyn mapio cyflwr cynefin brithegion y gors ar gyfer metaboblogaeth Pant Glas a'i rhwydwaith o gynefinoedd cynhaliol. Nid oedd adnoddau ar gael er mwyn mapio'r dirwedd hon yn ei chyfanrwydd, ac felly cyfyngwyd y gwaith mapio i ardal sy'n cynnal pedair o'r saith poblogaeth o frithegion y gors, gan gynnwys dau Safle o Ddiddordeb Gwyddonol Arbennig (SoDdGA) (sef Cors y Wlad a Chors Gyfelog), ac o fewn ffiniau'r dirwedd graidd. Cafodd yr arolwg ei gynnal rhwng 8 a 31 Hydref 2019. Cafodd addasrwydd y cynefin ei gategoreiddio a'i fapio gan ddilyn dulliau safonol Cyfoeth Naturiol Cymru. Cafodd tir ei ddosbarthu'n chwe chategori yn ôl presenoldeb/helaethrwydd y planhigyn tamaid y cythraul *Succisa pratensis*, y mae'r larfau yn bwydo arno, a glaswellt y gweunydd *Molinia caerulea* (neu laswellt arall sy'n ffurfio twmpathau), yn ogystal ag uchder a strwythur llystyfiant. Cafodd dull asesu cyflym (RAM) ei ddilyn lle gwrthodwyd caniatâd, lle nad oedd manylion tirfeddiant ar gael neu lle'r oedd yn amhosib cael mynediad i dir.

Cafodd arwynebedd o 280 hectar ei nodi ar gyfer ei asesu o ganlyniad i astudiaeth ddesg, a chafodd 21.56 hectar ychwanegol o dir ei nodi yn dilyn hynny a oedd â chofnodion diweddar cysylltiedig ar gyfer brithegion y gors. Cafodd cyfanswm o 300.35 hectar o dir ei arolygu, a chafodd 250.94 hectar o hwn ei arolygu'n llawn, cafodd 10.41 hectar ei asesu yn ôl y dull asesu cyflym, ac ni fu'n bosibl gweld 38.99 hectar. Roedd 72.6 hectar (24%) o'r tir a arolygwyd/aseswyd o fewn y ddau SoDdGA a 227.86 hectar yn y dirwedd ehangach.

Cafodd arwynebedd o 52.92 hectar ar draws y dirwedd ei gategoreiddio fel cynefin *Da*, *Addas*, neu â *Photensial (Bras)*, ac roedd 29.35 hectar o hwnnw o fewn y ddau SoDdGA a 23.56 hectar yn y rhwydwaith o gynefinoedd o'u cwmpas. Roedd 16.03 hectar o gynefin mewn *Cyflwr Da* yn ardal y dirwedd, 12.79 hectar yn y ddau SoDdGA a 3.24 hectar yn y dirwedd ehangach. Roedd arwynebedd o 12.67 hectar o'r 30.71 hectar o gynefin *Addas* yn y dirwedd wedi'i leoli o fewn y ddau SoDdGA – roedd 44% o hwn yn gynefin *Addas (Wedi'i Danbori)*, ac roedd symiau tra chyfartal o gynefin *Addas (Wedi'i Orbori)* a chynefin *Addas (Gwasgaredig)*. Roedd y rhan fwyaf (86%) o'r 18 hectar o gynefin *Addas* yn y dirwedd ehangach yn gynefin *Addas (Wedi'i Danbori)*. Roedd cynefin sydd â *Photensial (Bras)* yn brin ar draws y dirwedd gyda dwy ran o dair ohono yn y ddau SoDdGA.

Mae'r 46.74 hectar o gynefin *Da* a chynefin *Cyflwr Addas* yn y dirwedd ychydig yn llai na'r trothwy cyflwr ffafriol o 50 hectar. Fodd bynnag, mae rhagor o gynefin *Addas* yn debygol o fod ar gael yn y dirwedd graidd yn rhan ddeheuol y fetaboblogaeth sydd heb ei mapio, ac yn y dirwedd ehangach o 2km. Drwy reoli mewn ffordd briodol, gan gynnwys adfer cynefin sydd â *Photensial (Bras)*, dylai'r 52.92 hectar o gynefinoedd *Cyflwr Da*, *Addas* ac sydd â *Photensial (Bras)* yn y dirwedd graidd fod yn ddigon i gynnal y rhan hon o'r fetaboblogaeth yn

y tymor byr i ganolig o leiaf. Mae'n debygol y bydd gofyn am agosach at 90 hectar er mwyn sicrhau parhad i'r hirdymor.

Mae'r dull o reoli'r ddau SoDdGA yn ffafriol ar hyn o bryd, fodd bynnag mae'r dirwedd ehangach lawer yn llai addas ar gyfer brithegion y gors. Mae cynefin *Cyflwr Da* yn brin, ac mae i'w weld fel darnau bach gwasgaredig ar draws y dirwedd ac nid oes tir o dan drefn reoli ffafriol o gwbl ar hyn o bryd. Mae'r pori gan wartheg naill ai'n annigonol, yn rhy ddwys neu'n gyfuniad o bori â defaid; mae'r pori gan ferlod yn arwain at swm sylweddol o gynefin *Addas (Wedi'i Danbori)*; ac mae defaid, sy'n bresennol ar bron hanner y tir a borir, yn lleihau *Succisa* ac yn cael gwared ohono o'r glastir yn raddol. Mae'r sefyllfa fwy neu lai'r un peth ar gyfer cynefin *Addas,* ac mae diffyg rheolaeth, ac i ryw raddau torri gwair, yn ffactorau ychwanegol sy'n cyfrannu.

Mae angen cymryd camau gweithredu er mwyn sicrhau bod mwy o gynefin yn cael ei reoli'n briodol ar draws y dirwedd sydd o dan yr amryw fathau o feddiant. Dylai gwaith o'r fath dargedu, o'r cychwyn, y parseli hynny o dir sy'n cynnwys y symiau mwyaf o gynefin *Da* a *Chyflwr Addas* a'r safleoedd hynny sydd heb eu dynodi ond y mae'n hysbys fod brithegion y gors yn bresennol yno, sef Bwlch Derwin. Dylid annog pori gan wartheg, lle bo hynny'n ymarferol, yn arbennig yn ardaloedd allweddol brithegion y gors; a bydd monitro trefniadau pori newydd yn hanfodol er mwyn llywio gwaith pellach. Bydd creu ardaloedd mwy helaeth o gynefin addas, gan gynnwys cynefin *Cyflwr Da*, yn helpu i adfer cyflwr cynefinoedd yn y dirwedd ehangach a lleihau dibyniaeth brithegion y gors ar y ddau SoDdGA, gan greu tirwedd sy'n llawer mwy cadarn a gwydn. Bydd hyn hefyd yn helpu i gynyddu cysylltedd cynefinoedd yn y dirwedd, er efallai y bydd angen ychydig o waith ychwanegol er mwyn goresgyn rhwystrau sylweddol fel y blanhigfa gonwydd ddwys sy'n gyfagos i Gors y Wlad.

Camau gweithredu allweddol sydd eu hangen

1. Sicrhau dull o reoli sy'n fwy ffafriol ar gyfer brithegion y gors ar dir SoDdGA – cynnal deialog da, darparu cyngor/cymorth priodol ac adborth rheolaidd rhwng Cyfoeth Naturiol Cymru a thirfeddianwyr.
2. PG23.01 a PG23.02 – cysylltu â'r tirfeddiannwr er mwyn cytuno ar drefniadau pori gwartheg sy'n fwy ffafriol, a'i weithredu.
3. PG25.01, PG25.02 a PG16.01 - cysylltu â'r tirfeddianwyr er mwyn sefydlu dull o reoli pori sy'n dderbyniol ar gyfer parseli o dir nad ydynt yn cael eu rheoli ar hyn o bryd.
4. PG4 (pob parsel) – cysylltu â'r tirfeddiannwr er mwyn penderfynu ar ddichonoldeb pori gan wartheg, neu fel arall, torri darnau o dir er mwyn hwyluso pori gan ferlod mewn ardaloedd bras.
5. PG6.01 – PG6.05 – cysylltu â'r tirfeddiannwr er mwyn ymchwilio i'r posibilrwydd o bori gan wartheg neu ferlod.
6. PG27.01 a PG27.02 – trefnu ailymweliad yn ystod tymor gwe larfaol brith y gors er mwyn cadarnhau bod bridio'n digwydd. Cysylltu â'r tirfeddiannwr er mwyn adolygu'r trefniadau pori presennol a gweithredu dull o reoli sy'n fwy ffafriol, gan gynnwys atal pori gan ddefaid, ac yn ddelfrydol, sicrhau seibiant o bori.
7. PG 7.01, PG9 (pob parsel), PG13 (parseli nad ydynt mewn SoDdGA) - cysylltu â'r tirfeddianwyr er mwyn penderfynu a fyddai'n bosibl peidio â chynnwys defaid yn y trefniadau pori cymysg presennol.
8. PG28.01 – cysylltu â'r tirfeddiannwr er mwyn adolygu'r trefniadau pori presennol a gweithredu dull o reoli sy'n fwy ffafriol.
9. PG11.01 – cysylltu â'r tirfeddiannwr er mwyn cytuno ar drefniadau pori sy'n llai dwys, a'u gweithredu, yn ddelfrydol gan gynnwys gwartheg a seibiant o unrhyw bori er mwyn caniatáu i *Succisa* adfer a lledaenu.
10. Planhigfa gonwydd i'r dwyrain o Gors y Wlad – archwilio cyfleoedd i greu llwybrau hedfan trwy dynnu coed conwydd.
11. Cwblhau gwaith mapio cyflwr cynefinoedd ar gyfer rhan ddeheuol metaboblogaeth Pant Glas gan ymgorffori poblogaethau presennol brithegion y gors ym Mryn-engan a Rhosgyll a Rhos-ddu.

2. Executive summary

The Marsh Fritillary *Euphydryas aurinia* is a European protected species, listed on Annex II of the EU Habitat and Species Directive. The Marsh Fritillary is scarce in North Wales with just 13 populations remaining, many just clinging on due to unfavourable management and urgent conservation action is needed to secure its future. The marshy grasslands of the eastern Llŷn Peninsula support the most significant metapopulation in North Wales, centred around Pant Glas.

Marsh Fritillary metapopulations need a network of well-connected sites supporting extensive areas of suitable habitat of good quality to ensure their long-term survival. Contemporary assessments of landscapes occupied by marsh fritillaries are required urgently to determine how much *Good* and *Suitable Condition* habitat exists within each landscape, how connected these patches are and where efforts should be made to improve habitat quality in order to build robust metapopulations. This will help prioritise landscapes for conservation action.

This survey was commissioned to map Marsh Fritillary habitat condition for the Pant Glas metapopulation and its supporting habitat network. Resources were unavailable to map this landscape in its entirety, and mapping was therefore confined to an area supporting four of the seven Marsh Fritillary populations, including two SSSIs (Cors y Wlad and Cors Gyfelog), and limited to the core landscape. The survey was carried out between 8th and 31st October 2019. 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 both the larval foodplant Devil's-bit Scabious *Succisa pratensis* and Purple Moor-grass *Molinia caerulea* (or other tussock-forming grasses) as well as vegetation height and structure. A Rapid Assessment Method was used where permission was refused, land ownership details unattainable or land physically impossible to access.

280 hectares were identified in a desk study for assessment with an additional 21.56ha of land with recent Marsh Fritillary records identified subsequently. A total of 300.35ha of land was surveyed, with 250.94ha fully surveyed, 10.41ha assessed via the Rapid Assessment Method and 38.99ha was not viewable. 72.6ha (24%) of surveyed/assessed land was within the two SSSIs and 227.86ha within the wider landscape.

52.92 hectares of habitat across the landscape was categorised as *Good*, *Suitable* or *Potential Rank* habitat, of which 29.35ha was within the two SSSIs and 23.56ha in the surrounding habitat network. There were 16.03ha of *Good Condition* habitat in the landscape area, 12.79ha on the SSSIs and 3.24ha in the wider landscape. 12.67ha of the 30.71ha of *Suitable* habitat found in the landscape was located within the two SSSIs – 44% of this was *Suitable Undergrazed*, with roughly equal amounts of *Suitable Overgrazed* and *Suitable Sparse*. Most (86%) of the 18ha of *Suitable* habitat in the wider landscape was *Suitable Undergrazed*. *Potential Rank* habitat was rare across the landscape with two-thirds found in the SSSIs.

The 46.74ha of *Good* and *Suitable Condition* habitat in the landscape falls just short of 50ha Favourable Condition threshold. However, further *Suitable* habitat is likely to be available in the unmapped core landscape of the southern part of the metapopulation and in the wider 2km landscape. With appropriate management, including the restoration of *Potential Rank* habitat, the 52.92ha of *Good Condition*, *Suitable* and *Potential Rank* habitat within the core landscape should be sufficient to support this part of the metapopulation at least in the short to medium term. Long-term persistence is likely to require closer to 90 hectares.

Management of the two SSSIs is currently favourable, however the wider landscape is much less hospitable for the Marsh Fritillary. *Good Condition* habitat is scarce, occurring as small patches scattered across the landscape with none of the land currently under a favourable management regime. Cattle grazing is either too little, too intensive or in combination with

sheep; pony grazing is resulting in a dominance of *Suitable Undergrazed* habitat; and sheep, present on nearly half of grazed land, is reducing and gradually eliminating *Succisa* from the sward. The situation is largely the same for *Suitable* habitat with lack of any management and, to a small extent mowing, additional contributing factors.

Conservation action is needed to bring more habitat into suitable management across the landscape in the various ownerships. Such work should target, at the outset, those land parcels containing the highest amounts of *Good* and *Suitable Condition* habitat and those undesignated sites known to be occupied by the Marsh Fritillary, namely Bwlch Derwin. Cattle grazing, wherever practical, should be encouraged, particularly in key Marsh Fritillary areas; monitoring any new grazing regimes is crucial to guide further work. Producing more extensive areas of suitable habitat, including sufficient *Good Condition* habitat, will help restore habitat condition to the wider landscape and reduce Marsh Fritillary dependence on the SSSIs, creating a much more robust and resilient landscape. This will also help increase habitat connectivity in the landscape, although some additional work may be needed to overcome substantial barriers such as the dense conifer plantation adjacent to Cors y Wlad.

Key actions required

1. Ensure favourable management for Marsh Fritillary on SSSI land - maintain good dialogue, provision of appropriate advice/support and regular feedback between NRW and landowners.
2. PG23.01 & PG23.02 - liaison with landowner to agree and implement a more favourable cattle-grazing regime.
3. PG25.01, PG25.02 & PG16.01 – liaison with landowners to establish acceptable grazing management for currently unmanaged land parcels.
4. PG4 (all parcels) – landowner liaison to determine the feasibility of cattle grazing or, alternatively, patch cutting to encourage pony grazing of rank areas.
5. PG6.01 – PG6.05 – liaison with landowner to investigate the potential for cattle or pony grazing.
6. PG27.01 & PG27.02 – revisit during Marsh Fritillary larval web season to confirm breeding. Liaison with landowner to review current grazing regime and implement more favourable management, precluding sheep grazing and ideally including a rest from grazing.
7. PG 7.01, PG9 (all parcels), PG13 (non-SSSI parcels) – liaison with landowners to establish whether sheep can be excluded from current mixed grazing regimes.
8. PG28.01 – liaison with landowner to review current grazing regime and implement more favourable management.
9. PG11.01 – landowner liaison to agree and implement a less intensive grazing regime, ideally including cattle and a rest from any grazing to allow *Succisa* to recover and spread.
10. Conifer plantation east of Cors y Wlad – explore opportunities to create flight corridors through conifer removal.
11. Undertake habitat condition mapping for the southern part of the Pant Glas metapopulation incorporating current Marsh Fritillary populations at Bryn-engan and Rhosgyll & Rhos-ddu.

3. Introduction

The Marsh Fritillary *Euphydryas aurinia* is classed as Vulnerable in the UK, is included on Annex II of the EU Habitats and Species Directive and is a feature of thirteen Special Areas of Conservation (SAC) in Wales and 37 SSSIs. In the UK, the butterfly has declined by 79% in its distribution between 1976 and 2014 and by 25% in abundance between 1976 and 2016. In Wales, there are currently 153 populations (based on records from the most recent 5-year period, 2014-2018) but just 8% (13 populations) of these are in the north of the country with many only just clinging on due to unfavourable land management. Conservation action is urgently needed to secure the future of the Marsh Fritillary in North Wales.

The majority of the populations in North Wales are in Caernarvonshire (seven populations), with Merionethshire supporting five populations and only one extant population on Anglesey. Data shows that historically the situation was much better, for example, in Caernarvonshire 29 populations were recorded from the vice county. The current populations in Caernarvonshire are all found in the marshy grasslands that lie along the eastern edge of the Llŷn Peninsula. Significant areas of this marshy grassland are within the Corsydd Efionydd Special Area of Conservation (the butterfly is one of the primary reasons for the SAC), and its four component Sites of Special Scientific Interest (SSSIs); Cors y Wlad, Cors Gyfelog, Cors Graianog and Cors Llanllyfni. These SSSIs, along with a similar number of undesignated sites in the landscape where the larval food plant Devil's-bit Scabious *Succisa pratensis* is abundant, support the most significant metapopulation of Marsh Fritillary in North Wales.

Metapopulation modelling suggests that the Marsh Fritillary requires between 76 and 104ha of suitable habitat within a defined landscape for its long-term survival (Bulman *et al*., 2007) although the current Natural Resources Wales (NRW) Marsh Fritillary landscape model (Fowles, 2004, 2005) regards 50ha of *Good* and *Suitable Condition* habitat, of which 10ha is in *Good Condition*, within a 2km radius as an appropriate target for achieving Favourable Condition. Contemporary assessments of landscapes occupied by marsh fritillaries are required urgently to determine how much *Good* and *Suitable Condition* habitat exists within each landscape, how connected these patches are and where efforts should be made to improve habitat quality and build robust metapopulations. This will help prioritise landscapes for conservation action.

There are currently 38 occupied landscapes in Wales, 14 of which have never been assessed. Some have been assessed only in part and require completion whilst others were surveyed between 2002 and 2009 and should be repeated. The Pant Glas landscape was surveyed in 2002, with some specific subsequent mapping of Cors y Wlad SSSI (Boardman, 2003), and therefore the data is now over 17 years old.

This survey was commissioned to map Marsh Fritillary habitat condition for the Caernarvonshire metapopulation, centred around Pant Glas, a hamlet on the A487 road in the community of Clynnog, approximately 9 miles north west of Porthmadog. Marsh Fritillary landscapes can be divided into the core landscape (the area within a 1km radius of recent Marsh Fritillary records encompassing the typical dispersal distance of a female Marsh Fritillary) and the surrounding functional landscape (the

area within a 2km radius of recent Marsh Fritillary records which covers the average dispersal distance of a male). The Pant Glas metapopulation is spread over a large area and resources were not available to undertake mapping for the entirety of the landscape. Mapping was therefore confined to an area supporting four of the seven Marsh Fritillary populations, including two SSSIs, and limited to the core landscape.

The current Marsh Fritillary populations in this area are on Cors y Wlad SSSI, Cors Gyfelog SSSI, Bwlch Derwin (SH457468) and 450m south of Bwlch Derwin at SH458460 (a recently-discovered site with 3 adults recorded in 2018 although breeding has yet to be confirmed).

A desk study was carried out to determine the 1km combined radius polygons for the landscape area. Phase 1 habitat mapping and aerial photographs were then used to identify land parcels, within the defined landscape area, believed to support vegetation communities with the potential to support the Marsh Fritillary. These land parcels were identified for survey with *Not Suitable* categories excluded. The dominant Phase 1 habitat type is Marshy Grassland although within the Pant Glas landscape there is also a large element of both unimproved neutral grassland and heath (Figure 1). The combined 1km polygons cover a fairly large area, including 14 x 1km grid squares. The combined land parcels identified for field survey totalled roughly 280ha.

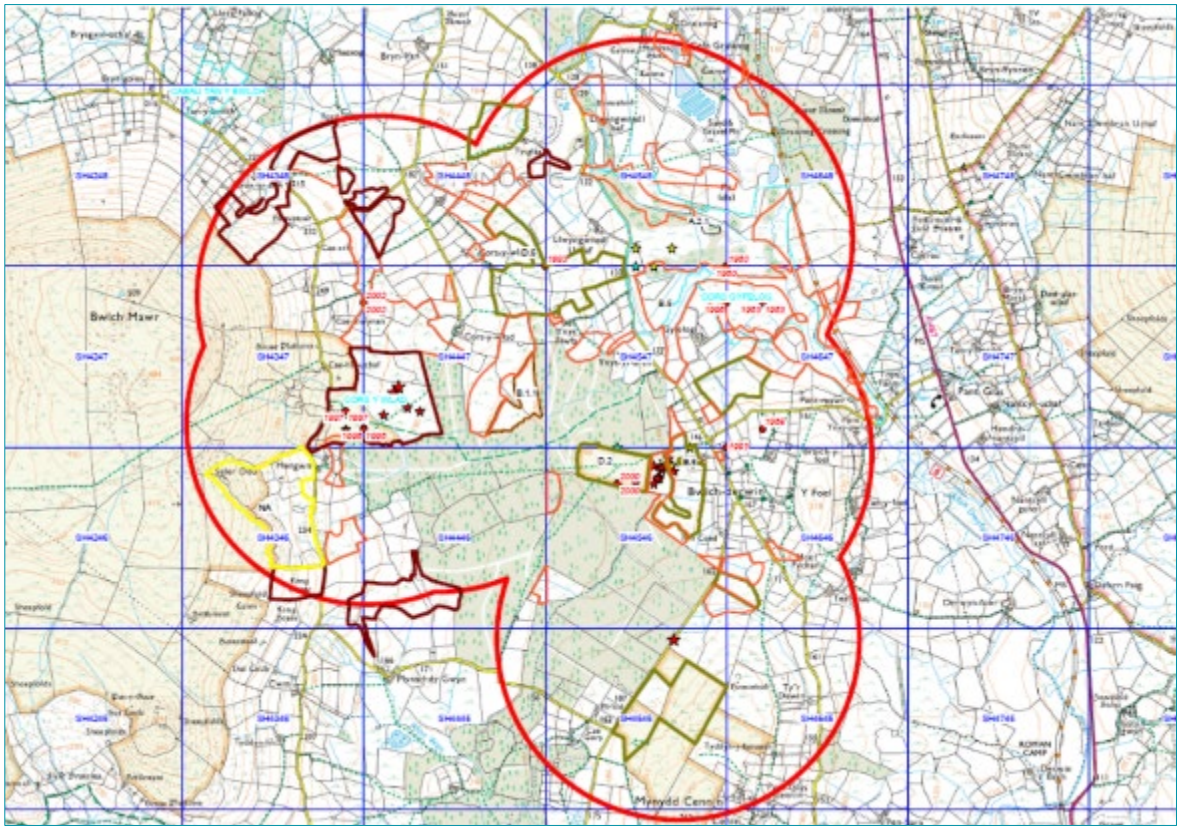

Figure 1. The Pant Glas Landscape defined for survey (red line); land parcels identified for field survey edged in orange (marshy grassland), chestnut (unimproved neutral grassland), heath (pale green) and yellow (no Phase 1 data).

This report assesses the current condition and management of the Pant Glas landscape for the Marsh Fritillary and compares these findings with previous landscape assessments in order to highlight changes over time. It also identifies

opportunities to improve the landscape for Marshy Fritillary with more sympathetic management.

4. Methods

4.1. Maps

NRW supplied Butterfly Conservation with 1:10000 scale OS tiles and aerial mapping (jpeg format) of the Pant Glas area. These were used to generate field maps and in their subsequent digitisation. Two additional areas, not highlighted by the desk study, but with recent Marsh Fritillary records were also surveyed; these large areas were mapped as 'fen' in Phase 1 but are actually a mosaic of mire, grassland and fen. These areas are both located within the Cors Gyfelog SSSI, one on NRW-owned land containing the boardwalk and one on privately owned land to the east of Gyfelog Farm.

4.2. Land ownership

NRW contacted the landowners of the two SSSIs within the landscape area to request access. They also provided landowner names and contact details, where known, for a small number of land parcels not under their ownership. Butterfly Conservation was responsible for obtaining survey permission from these owners and/or managers before undertaking the surveys and tracing the ownership of land parcels where owners had not been identified.

4.3. Field numbers

A unique ID code was assigned to each surveyed land parcel. The format used was PGX.XX - the letters identify the landscape (PG for Pant Glas); the first digit refers to the landowner and the second to the individual land parcel.

4.4. Surveys

The Pant Glas landscape was surveyed by Butterfly Conservation's Senior Conservation Officer for Wales and contractor Alice Smith; the former surveyed the two SSSIs, Cors y Wlad and Cors Gyfelog (including adjacent non-SSSI land), and the second the remainder of the landscape. This approach allowed for continuity with tracing ownership and landowner contact.

The surveys were carried out between 8th October and 31st October 2019. Each land parcel identified for mapping in the desk study, along with the two additional areas known to be suitable, was surveyed (if access was consented and where physically possible) and the suitability of the habitat categorised and mapped following standard NRW methods outlined in Fowles (2005).

Land was classed into six categories (Table 1) according to the presence/amount of both the larval food plant Devil's-bit Scabious *Succisa pratensis* and Purple Moor-grass *Molinia caerulea* (or other tussock-forming grasses) as well as vegetation height and structure.

Table 1. Marsh Fritillary habitat quality mapping codes.

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*

In cases where permission was refused, land ownership details unattainable or land physically impossible to access, a Rapid Assessment Method was used. This approach is based on viewing sites from locations where the surveyor has legitimate rights of access e.g. roads, public rights of way or adjoining fields (where access permission has already been obtained). Binoculars are used to identify the suitability of the land parcel for Marsh Fritillary and place the land parcel in a broad suitability category (Table 2). This helps gain an estimate for inaccessible land that is likely to support *Suitable* or *Potential* habitat.

Table 2. Marsh Fritillary Rapid Assessment categories.

Category	Description
Contains suitable (CS)	*Succisa* present, noted either in flower or vegetative growth. This could include overgrazed fields or scrubby fields.
Potential (P)	Fields which contain significant amounts of *Molinia* but no obvious *Succisa* (usually rank & neglected). It also includes recently mown fields.
No Access (NA)	Fields not viewable.
NOT suitable (NS)	Fields obviously grazed regularly by sheep (very short, dung and/or bits of fleece in field, on hedges or fences) or improved or complete scrub.

The mapping results have been supplied with this report as a MapInfo GIS file, and illustrated in Appendix 1. Land Parcel Identification Codes and Appendix 2. Habitat Condition Mapping. Site descriptions for each surveyed/assessed land parcel are included in Appendix 3.

5. Results

5.1. Survey results

The desk study identified approximately 280ha for survey with an additional 21.56ha of land with recent Marsh Fritillary records identified subsequently. A total of 300.35ha of land was surveyed or assessed. 250.94ha (83.5%) were surveyed and habitat classified according to Fowles (2005); this included land that was not surveyed but which was obviously *Not Suitable* when viewed from locations on the perimeter or bisecting Public Rights of Way. A total of 10.41ha (3.5%) of land was assessed via the Rapid Assessment methodology whilst 38.99ha (13%) were not

viewable. 24% (72.6ha) of surveyed/assessed land was within two SSSIs and 227.86ha in the wider landscape.

Table 3. Land (ha) surveyed and assessed.

Assessed?	Hectares
Surveyed	250.94
Rapid Assessment	10.4
No Access (not viewable)	38.99
Total identified for survey	300.35

5.2. Habitat condition

Within the defined landscape of 300.35ha, 52.92ha of *Suitable* or *Potential Rank* habitat was identified; 16.03ha (31%) of this habitat was in *Good Condition*. If the 'Contains Suitable' Rapid Assessment category is included, this brings the total for '*Suitable*' habitat (including GC) to 60.77ha. The majority of the *Suitable* habitat was *Suitable Undergrazed* (45%), but a reasonable amount of *Good Condition* habitat was also present (34%). *Suitable Overgrazed* and *Suitable Sparse* habitat were present in roughly equal amounts.

Fifty-five percent (29.35ha) of the *Suitable* or *Potential Rank* habitat in the landscape was within the two SSSIs (17.12ha in Cors y Wlad and 12.24ha in Cors Gyfelog). If the 'Contains Suitable' Rapid Assessment category is included, 59% (35.94ha) lies within the two SSSIs. Of the *Suitable* habitat (GC,SU,SO,SS) in the SSSIs, *Good Condition* habitat accounts for 50% with *Suitable Undergrazed* at 22% and *Suitable Overgrazed* and *Suitable Sparse* both in the region of 14%.

44% (23.56ha) of the *Suitable* or *Potential Rank* habitat in the landscape was outside the SSSIs. If the 'Contains Suitable' Rapid Assessment category is included, 40% (24.83ha) lies outside the SSSIs. Most (66%) of the *Suitable* habitat (including GC) outside the SSSIs is concentrated in three ownerships (six land parcels) in the central and southern part of the landscape. The majority of Potential Rank habitat lies within three ownerships (four land parcels), once again in the central and southern part of the landscape and in the east adjacent to the railway line.

Table 4. Habitat condition data for the Pant Glas landscape (figures in hectares).

Condition	Cors y Wlad	Cors Gyfelog	Wider landscape	Total
Good Condition	8.18	4.61	3.24	16.03
Suitable Undergrazed	2.64	2.99	15.52	21.15
Suitable Overgrazed	3.47	0.24	1.42	5.13
Suitable Sparse	1.39	1.94	1.10	4.43
Subtotal 1: Suitable only (excluding GC)	*7.5*	*5.17*	*18.04*	*30.71*
Potential Rank	1.44	2.46	2.28	6.18
Subtotal 2: GC, Suitable and potential	*17.12*	*12.24*	*23.56*	*52.92*
Contains Suitable (CS)	0	6.58	1.27	7.79
Subtotal 3: GC, Suitable, PR and CS	*17.12*	*18.82*	*24.83*	*60.77*
Potential	0	0.36	2.20	2.56
Not Suitable	8.99	14.47	174.56	198.02

Condition	Cors y Wlad	Cors Gyfelog	Wider landscape	Total
Not Accessed	0	12.73	26.27	39.00
Total	**26.11**	**46.49**	**227.86**	**300.35**

5.2.1. Good Condition

There were 16.03ha of *Good Condition* habitat in the landscape area, 12.79ha (80%) of this were within the two SSSIs, 8.18ha on Cors y Wlad and 4.61ha on Cors Gyfelog. On Cors y Wlad, the majority of the *Good Condition* habitat occurred in the southeast compartment (PG7.04 - 6.47ha) with a much smaller amount in the adjoining land parcel to the west (PG7.03 – 1.61ha); both land parcels are under the same ownership. A negligible amount of *Good Condition* habitat was found in the land parcel comprising the remaining northern area of the SSSI (PG4.03 – 0.09ha). This land parcel is under a different ownership and the *Good Condition* habitat occurred as five separate, small patches.

On Cors Gyfelog, the majority of the *Good Condition* habitat was concentrated in a large area of mire/grassland/fen mosaic to the northeast of Gyfelog Farm (PG11.05 – 3.2ha). Much of this area was *Carex rostrata* mire, quite different to typical *Molinia* dominated 'Rhos' pasture, but generally with a good structure although less tussocky. The remainder of this habitat was largely on the adjoining area of similar habitat to the northwest of Gyfelog Farm (PG10.02 & PG10.03 – 0.87ha). Small patches of *Good Condition* habitat were also present in the southeast arm of the SSSI adjacent to the railway line (PG10.04 – 0.8ha, NRW owned) and as a couple of very small patches within mainly fen habitat.

20% of *Good Condition* habitat (3.24ha) was present outside the SSSIs, approximately half of this occurred within six land parcels, under five different ownerships. These land parcels were in the Bwlch Derwin area (PG22.01 & PG23.01), in the north of the landscape (PG7.01 & PG6.02), the west (PG4.02) and the centre (PG4.05).

5.2.2. Suitable Undergrazed, Suitable Overgrazed & Suitable Sparse (SU, SO, SS)

The three '*Suitable*' categories (not including *Good Condition*) amounted to 30.71ha, 12.67ha (41%) of this being within the two SSSIs (7.5ha on Cors y Wlad and 5.17ha on Cors Gyfelog). Outside the SSSIs, just over half (57%) of this habitat condition was located within four land parcels in two ownerships, in the centre of the landscape (PG4.05 & PG4.07) and in the Bwlch Derwin area in the southeast (PG23.02, PG25.01). The remainder of the habitat was scattered throughout the landscape, in particular north of Cors y Wlad (PG4.02), at Bwlch Derwin (PG23.01) and adjacent to the cycle track in the east (PG13.01).

5.2.3. Potential Rank

Six hectares of *Potential Rank* habitat were recorded across the landscape, 3.9ha (63%) within the two SSSIs (Cors y Wlad - 1.44ha, Cors Gyfelog – 2.46) and 2.28ha outside. On Cors y Wlad, the majority of this habitat (86%) was in the northernmost land parcel (PG4.03) whilst on Cors Gyfelog, just over half (1.3ha) was in the southwest arm (PG11.07). Outside the SSSIs, 60% of PR habitat lay within four land parcels: PG 23.01, PG13.01, PG4.02 and PG4.05).

5.2.4. Not Suitable

65% (198ha) of all surveyed and assessed land was recorded as *Not Suitable*. The largest *Not Suitable* land parcel was at the western extent of the landscape (PG17.01), comprising mainly *Festuca ovina/Agrostis* pasture extending into the uplands. Large areas were also present as rush-dominated marshy grassland (some mown), wet heath and fen.

5.2.5. Not Accessed

The condition of 38.99ha of habitat could not be assessed due to a lack of access. 12.72ha of this was on Cors Gyfelog, mainly areas of fen considered unlikely to support much if any suitable habitat. The remaining 26.26ha was in the wider landscape and were not accessed largely due to permission being refused and the areas not viewable for Rapid Assessment.

5.2.6. Rapid Assesment – Contains Suitable (CS) & Potential (P)

A total of 7.85ha of habitat was assessed as 'Contains Suitable', the majority of this (6.58ha) was on Cors Gyfelog, comprising an area of mire and swamp which was too wet to access safely with the exception of an area immediately adjacent to a boardwalk. *Succisa* was clearly visible throughout the majority of this area, although noticeably more abundant in some areas. There are recent larval web records from the area beside the boardwalk, including a small number of webs in 2019.

A total of 2.56ha was assessed as 'Potential' (P) habitat supporting *Molinia* but with no obvious *Succisa* present. The majority of this (86%, 2.20ha) was outside the SSSIs in the wider landscape, and largely (2.14ha) within land parcel PG17.01. This land parcel contained a large area of very rank large tussocky *Molinia* which could not be walked through and, although no *Succisa* was visible when viewed through binoculars, a single *Succisa* plant was present in a depression at the northern edge of the area.

5.2.7. Larval webs

The survey was carried out late in the season, making observation of Marsh Fritillary larval webs, which would be in their over-wintering form, unlikely. No hibernation webs were recorded.

5.3. Habitat management

5.3.1. Cors y Wlad

Cors y Wlad SSSI is under two different ownerships, and the two separate management units are under two separate management agreements. The western and eastern land parcels are cattle grazed (spring to late autumn) as one unit with approximately 29 cattle. The cattle also have access, if the gate is open, to an improved land parcel to the north. The northern land parcel is grazed by a small herd of ponies.

5.3.2. Cors Gyfelog

The majority of Cors Gyfelog is grazed by ponies. A small herd of ponies grazes the NRW-owned land (PG10.01), which was not accessed, and also an area adjacent to the cycle track (PG10.04). A separate small herd of ponies grazes the two areas of mire/grassland/fen mosaic northwest and northeast of Gyfelog Farm (PG10.03 & PG11.05). Away from the two main bog areas, the parcel of marshy grassland

southwest of Gyfelog Farm (PG11.01) is pony-grazed whilst the marshy strip (PG11.02), which extends from here northwards towards the bog, is grazed seasonally by heifers and also part-mown. No management was evident for much of the eastern arm of Gyfelog, west of the river (PG13.02, PG11.06, PG11.07 & PG13.06), whilst there were signs of limited cattle grazing in PG13.03.

5.3.3. Wider landscape

Of the 227ha of land in the wider landscape, management could not be ascertained for 23% (53ha), largely due to these land parcels being inaccessible. 22ha (9%) of land was unmanaged (or no management evident). 139ha (61%) were grazed, 32ha (14%) by ponies, 20ha (9%) by cattle and 30ha (13%) by sheep. The remainder of the grazed land was either grazed by a combination of livestock, or livestock along with a mechanical form of management e.g. cutting (see Table 5). 29% (65ha) of grazed land had sheep grazing solely or in combination with other livestock or management (e.g. mowing).

The majority (96%, 31ha) of the (solely) pony-grazed land occurred within one ownership covering three land parcels, PG4.02, PG4.07 and PG4.05. Ponies also grazed a small area southwest of Gyfelog Farm (PG11.01). Pony grazing also occurred in combination with cattle and/or sheep on two further parcels of land but these were *Not Suitable*.

The majority (99%) of land solely grazed by cattle was concentrated in six land parcels in four ownerships. 30% of this was *Not Suitable*, semi-improved grassland (PG20.3) with the remainder occurring in the Bwlch Derwin area (PG23.01 & 23.02) and in the southeast of the landscape (PG27.01, PG27.02, PG28.01). Cattle grazing also occurred in combination with sheep on two land parcels in the north of the landscape (PG7.01 & PG1.03), multiple land parcels in land ownership PG6, the *Not Suitable* heathland south of Gyfelog Farm (PG11.09) and on four land parcels in one ownership (PG13) adjacent to the cycle track in the east. Cattle grazing occurred in combination with mowing on three land parcels but only one of these (PG5.01) supported suitable habitat.

None of the habitat identified as solely ‘mown’ supported suitable habitat, with the exception of sections of the verge associated with the cycle track in the east (PG14.01).

The majority (73%) of the solely sheep-grazed land occurred in one sizeable land parcel (PG17.01) which was largely *Not Suitable* with the exception of an area of *Potential* habitat in the centre. The remainder occurred within five land parcels in one land ownership (PG6.01 – PG6.05, 7.9ha) and a small land parcel in the southeast of the landscape (PG27.03).

The majority (67%, 15ha) of land classified as unmanaged (or no management evident) was in the Bwlch Derwin area (PG16.01, PG22.01 & PG25.01). Other notable areas include PG1.02 in the northeast, PG15.01 which was inaccessible but classed as ‘Contains Suitable’, and a small triangle of land just south of Bwlch Derwin (PG25.02).

Well-maintained drains, both around the perimeter and bisecting marshy grassland, were observed on a number of land parcels, particularly those with ownership PG3

where survey permission was refused but Rapid Assessment, where possible, noted low-diversity, rush-dominated grassland with no visible *Succisa*.

Table 5. Management on non SSSI land surveyed/assessed.

Management	Hectares
Not known	53.03
No Management	22.26
Grazing - Stock unknown	10.73
Pony Grazing	32.64
Cattle Grazing	20.36
Sheep Grazing	30.77
Cattle & Sheep	28.70
Ponies, sheep, cattle	1.29
Ponies & sheep	0.92
Mowing & Cattle Grazing	10.32
Cattle, sheep & cutting	3.89
Mown	11.37
Forestry	1.57
Total	**227.85ha**

5.4. Habitat Connectivity

The matrix of land between habitat patches in the landscape is important in determining how connected the habitat patches are and its ability to facilitate dispersal. This is hard to quantify or generalise about but we can look at the Pant Glas landscape and identify any barriers that may substantially reduce dispersal, particularly in relation to the known Marsh Fritillary populations on Cors y Wlad SSSI, Cors Gyfelog SSSI, Bwlch Derwin and South of Bwlch Derwin.

Habitat on Cors y Wlad SSSI is connected to a small amount of *Suitable* habitat present to the north but to the east 500m of conifer plantation and *Not Suitable* habitat lie between the SSSI and suitable habitat patches in PG4.07. The central part of the landscape (centred on PG4.05) appears reasonably connected although *Suitable* habitat becomes increasingly patchy to the north and east. Cors Gyfelog SSSI and the central landscape appear well-connected in the region of PG10.2 and PG9.02, with patches less well-connected further to the south. The two populations in the Bwlch Derwin area appear to be the most isolated, both from the other two populations and from *Suitable* habitat in the surrounding landscape. Potential connectivity exists with Cors Gyfelog to the north, although there are reasonable amounts of *Not Suitable* habitat in-between containing only small patches of *Suitable Sparse* and *Suitable Overgrazed* habitat. Approximately 1km of coniferous woodland with no connectivity via rides or Public Rights of Way separates Bwlch Derwin and Cors y Wlad SSSI.

6. Discussion

6.1. Habitat condition

The amount of *Good Condition* habitat (16ha) in the Pant Glas landscape exceeds the 10ha considered necessary to achieve Favourable Condition for Marsh Fritillary. 80% of this habitat category occurred within the two SSSIs with roughly two-thirds on Cors y Wlad and one-third on Cors Gyfelog (less tussocky in structure), occupying relatively large, contiguous areas. Only a small amount of *Good Condition* habitat (3ha) was present in the wider landscape, as small patches spread over six land parcels under five ownerships; notable concentrations occurring in the Bwlch Derwin area, in the north (PG7.01) and in the centre of the landscape (PG4.05 and PG6.02). *Good Condition* habitat patches will constitute the most important breeding areas for Marsh Fritillaries within the landscape; the two SSSIs are therefore vital to the survival of this Marsh Fritillary metapopulation.

Approximately 12.67ha (41%) of the 30.71ha of '*Suitable*' habitat found in the landscape was located within the two SSSIs; 44% of this habitat was *Suitable Undergrazed*, with roughly equal amounts of *Suitable Overgrazed* and *Suitable Sparse*. Most of the *Suitable Sparse* habitat had a good vegetation structure (i.e. was not overgrazed) and was often associated with wet heath. The majority of *Suitable Overgrazed* habitat occurred on the drier areas of Cors y Wlad. Most (86%) of the 18ha of *Suitable* habitat in the wider landscape was *Suitable Undergrazed*, with some fairly sizeable, contiguous patches present particularly in the centre (PG4) and south (Bwlch Derwin area) of the landscape area. *Suitable Undergrazed* habitat is capable of supporting the Marsh Fritillary in its current condition but its significance will decline over time unless action is taken. *Suitable Overgrazed*/mown swards are unlikely to support Marsh Fritillaries in their current condition with short-sward *Succisa* rosettes only utilised where they are adjacent to breeding habitat. *Suitable Sparse* habitat is less favoured by Marsh Fritillary despite good vegetation structure.

There was considerably less *Potential Rank* habitat (6ha) in the landscape than the 30ha of *Good Condition* and *Suitable* habitat. Two-thirds of *Potential Rank* habitat was found in the two SSSIs, with a 60/40% split between Cors Gyfelog and Cors y Wlad respectively. Only 2ha occurred in the wider landscape, once again mainly in the centre (PG4) and south (Bwlch Derwin area) of the landscape. *Potential Rank* habitat is unlikely to support much more than the occasional larval web without management.

In total, 198ha (65%) of land within the Pant Glas Landscape Area was categorised as *Not Suitable* for Marsh Fritillary, including large areas within land parcels supporting *Suitable* habitat and between sites currently occupied by the butterfly.

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). However, Fowles (2004, 2005) regards 50ha of Available habitat (the total of *Good* and *Suitable Condition* habitat in the landscape) of which 10ha is in *Good Condition*, within a 2km radius, as an appropriate target to represent Favourable Condition. The 46.74ha of *Good Condition* and *Suitable* habitat in the mapped landscape falls just short of this. However, this figure is based on habitat present in the core landscape (1km radius) rather than a larger, functional 2km

landscape. Based on the 1km radius mapping, it is likely that further *Suitable* habitat would be present in a 2km landscape and the 50ha threshold exceeded.

In the unlikely event that no further *Suitable* habitat is present in the 2km landscape, it would be necessary to bring just over half of the 6ha of *Potential Rank* habitat under appropriate management in order to consider the metapopulation as viable in the short-medium term. It is also possible that the 6ha of 'Contains Suitable' habitat present on Gyfelog could contribute '*Suitable*' (as opposed to PR) habitat to the landscape. This could bring the *Suitable* habitat total nearer to the desired 50ha or, potentially, slightly exceed it. There may also be small amounts of *Suitable* habitat in the landscape that have not been assessed due to them not being flagged up in the desk study due to inaccurate Phase 1 mapping. This appeared to be the case in the Bwlch Derwin area where *Suitable* habitat was noted directly adjacent and to the east of the area highlighted by the desk study. Part of this habitat was mapped and included in the survey where views from the adjacent land parcel allowed this. Restoring all the CS and PR habitat in the landscape to a *Suitable* condition would provide no more than 60ha of *Suitable* habitat in part of the core landscape. Long-term persistence of this metapopulation is likely to require closer to 90 hectares in the landscape (minimum density of 6.25% in the landscape area; Bulman *et al*., 2007).

6.2. Grazing management

6.2.1. Marsh Fritillary requirements

In terms of breeding habitat, the Marsh Fritillary needs extensive, open, damp grasslands with abundant Devil's-bit Scabious in a sward that is an uneven patchwork of long and short vegetation (average between 12-25cm). It also requires scattered scrub for shelter and that suitable habitat remains throughout the year-on-year. Adults need abundant nectar and dense grass tussocks are needed for larval over-wintering sites.

Prescribed management to achieve these requirements is light grazing by cattle or ponies, generally in spring and summer, although autumn and winter can also work. Sheep grazing is highly detrimental, as they graze out food plants and nectar sources, as is cutting or mowing (unless for restoration purposes) as this leads to an unsuitable, uniform sward. Uncontrolled burning, agricultural improvement (draining, ploughing, re-seeding etc.) and cessation of grazing can all be detrimental.

6.2.2. Cors y Wlad

Grazing management across the two SSSIs was largely favourable. The current cattle grazing regime on Cors y Wlad is resulting in widespread *Good Condition* habitat. There are areas of *Suitable Undergrazed* habitat that would benefit from targeted grazing, particularly in the south-west compartment, but micromanagement on such a large site is difficult to achieve and a mosaic of habitat categories is always going occur. The most important thing is that favourable amounts of *Good Condition* and *Suitable* habitat are present. The northern compartment of Cors y Wlad is pony-grazed. The ponies concentrate on the drier western area with limited *Succisa* resulting in undergrazed and rank wetter areas in the east where *Succisa* is more abundant. This compartment would benefit from cattle grazing to open up the sward or potentially some cutting of small patches to encourage pony grazing in the ranker areas.

6.2.3. Cors Gyfelog

Pony grazing on much of Cors Gyfelog is achieving favourable habitat condition for Marsh Fritillary. The small herds of ponies grazing the two large, privately-owned bog areas appear to range throughout the habitat despite the wetness, maintaining large areas of *Good Condition* and *Suitable* Habitat. The large NRW-owned area of bog in the north of the SSSI (PG10.1 – not accessed) is also pony-grazed but the habitat appears taller than on the other bogs, likely due to the wetness of the site restricting accessibility and hence grazing. The NRW-owned land adjacent to the cycle track (PG10.04) also appears suitably grazed by a small herd of ponies, although the *Good Condition* habitat in the centre of this area is likely to be largely self-maintaining due to the wetness of the area.

6.2.4. Wider landscape

6.2.4.1. Pony grazing

61% (139ha) of land in the wider landscape was grazed by livestock. 32 ha were pony/horse grazed (majority in one ownership, PG4), with *Suitable* habitat largely undergrazed and uniform in structure. The ponies/horses preferentially graze the drier parts of the site, avoiding the wetter flush areas. These land parcels would benefit from cattle-grazing to open up and diversify the sward structure; patch cutting is also an option to encourage grazing if cattle are unfeasible. A small area of marshy grassland adjacent to Gyfelog Farm access (PG11.01) was also pony-grazed but the stocking rate/period had resulted in an overgrazed sward with *Succisa* present as basal rosettes. This land parcel requires less intensive grazing, ideally including a break from grazing to allow *Succisa* to recover and spread, particularly in the *Suitable Sparse* patches.

6.2.4.2. Cattle grazing

20ha of land was solely cattle-grazed. In the Bwlch Derwin area (PG23.01 & PG23.02), suitable habitat was mainly *Suitable Undergrazed* indicating that higher grazing levels or a longer grazing period is required. Bwlch Derwin is a known occupied site with good web numbers (32 webs on a casual walk through part of the site in 2019) and should be a priority for conservation action. To the south of Bwlch Derwin (PG27.01, PG27.02 and PG28.01), only very small, isolated patches of *Suitable* habitat were present. In PG27.01, despite habitat patches being mapped as *Suitable*, *Succisa* occurred as very small plants well below the top of the sward or as basal rosettes; some small very isolated plants were present in the 'Unsuitable area' but too far apart to constitute habitat. The habitat condition indicated overgrazing by cattle and also that sheep may have been present on the site in the past, grazing out *Succisa* in what is now mapped as *Not Suitable* habitat. PG27.02 is noted as being wet heath/acid grassland mosaic, the land parcel is grazed as one unit with PG27.01 resulting in similar small, overgrazed habitat patches. These two land parcels would benefit from a respite from grazing and a review of the current grazing regime, which would need to preclude any sheep grazing.

In contrast to PG27.01 & PG27.02, PG28.01 adjacent and to the south, was drier and less grazed, supporting *Suitable Undergrazed* and *Potential Rank* habitat. Cattle were not present on the site at the time of survey although signs of recent cattle were evident; this land parcel would benefit from a review of the current grazing regime to secure more appropriate grazing levels/period.

6.2.4.3. Sheep grazing

30ha of land were solely sheep-grazed, the majority being *Not Suitable* pasture. The remainder of the sheep-grazed habitat occurred on five land parcels under the same ownership (PG6.01 – PG6.05), totalling 7.9ha. Although not grazed at the time of the survey, sheep had been taken off in August and were due to be put back on imminently. *Succisa* was present in these land parcels but largely as small, discrete patches, including some *Good Condition* within a rank sward. Sheep grazing has likely reduced the presence of *Succisa* in these land parcels and, if continued, will eventually eliminate the foodplant entirely. The potential for these land parcels to be grazed by cattle or ponies needs to be explored, soon, in order to retain the foodplant and restore a suitable sward structure.

Sheep were also present on an additional 35ha, grazing in combination with cattle and/or ponies. In all of these land parcels, and in particular PG7.01, those under PG9 ownership and in PG13 outside the SSSI, *Succisa* was present in a suitable sward but often very patchy, occurring as basal rosettes or unflowering plants. The exclusion of sheep grazing from these areas is required in order to retain current *Succisa*, allow them to grow into large, healthy plants required by the Marsh Fritillary and hopefully to spread into adjacent habitat.

6.2.4.4. Mowing

Succisa was present within a uniform, mown sward either side of the cycle track in the area identified as PG14.01. There is the potential that a change in management regime, such as patch cutting, could produce a more uneven sward, allow *Succisa* plants to grow larger and produce more suitable habitat for the butterfly.

6.2.4.5. Unmanaged land

The majority of unmanaged land was in the Bwlch Derwin area. A large area of wet heath/valley mire, owned by the Community Council (PG22.01), was very rank with *Succisa* largely confined to the areas of pingo. The nearby area PG25.01 had abundant *Succisa* but was also very undergrazed/rank; this site is not grazed as the owners feel that it is unsafe for livestock. The smaller, currently-unmanaged land parcel of PG25.02 is also under their ownership and a further small land parcel to the north (PG16.01) also appeared unmanaged. These areas offer a good opportunity for habitat restoration; this needs to be done sooner rather than later whilst the amount of *Suitable Undergrazed* habitat far outweighs *Potential Rank*, therefore requiring less effort to restore. Dialogue with these landowners needs initiating to determine whether grazing is a feasible and tailored advice provided on suitable management regimes.

6.3. Habitat connectivity

Marsh Fritillary metapopulations need a network of several sites close to one another to ensure their long-term survival. Sites need to support extensive suitable habitat of good quality and be well-connected to the rest of the network. Historically, Marsh Fritillary habitats were larger and more connected allowing the natural processes of local colonisations and extinctions to occur.

Cors Wlad SSSI is connected to a limited amount of *Suitable* habitat to the north but the dense conifer plantation adjacent to the eastern boundary of the SSSI constitutes a likely barrier to dispersal between the SSSI, the central landscape area and the populations at Bwlch Derwin. Opportunities to create better connectivity between this

SSSI and habitat patches to the east needs further study; opening flight corridors within the plantation may be one option. Cors Gyfelog SSSI appears better linked to *Suitable* habitat in the central landscape but connectivity appears very limited between the SSSI and habitat in the Bwlch Derwin area. The habitat mapping indicates that the main Bwlch Derwin population is relatively isolated, having only good connectivity with four land parcels supporting very patchy *Suitable* habitat to the south east, where Marsh Fritillary has recently been recorded.

6.4. Comparison with previous landscape assessments

The Countryside Council for Wales commissioned condition mapping of habitat across the area supporting the Llyn Marsh Fritillary metapopulation in 2002 (Boardman, 2003). The survey covered the whole of the metapopulation landscape from just north of Cors Gyfelog SSSI to south of Rhosgyll. The survey was undertaken prior to the production of the standard definitions of Fowles (2005) but following guidance published in January 2003 (Fowles, 2003), the field data being converted during the reporting process to correspond to the new criteria. These categories were broadly in line with current criteria although *Molinia* was included in the definition of *Suitable* and the category 'Overspill Grassland' was used for habitat where *Molinia* was sparse or absent but *Succisa* was frequent/abundant.

The survey area totalled 1284ha in total. 185.5ha of available habitat was mapped, made up of 43.3ha of *Good Condition* habitat and 142.2ha of *Suitable* habitat. 31.65ha were identified as 'other *Succisa*' habitats - *Potential Rank* habitat of 9.9ha and 'Overspill Grassland' habitat of 21.75ha.

Exact comparison of the 2019 mapping with the 2002 mapping is difficult due to the variation in the landscape boundary and areas surveyed. However, the 2019 survey area roughly falls into four of the 'areas' identified in the 2003 report (Selar Ddu & Cors y Wlad West, Cors y Wlad East, Gyfelog and Bwlch Derwin) and for which land area in each habitat condition category area was provided. Table 6 below shows figures extracted from the 2003 report.

Table 6. Habitat condition data for the Pant Glas landscape extracted from Boardman (2003).

Condition	Selar Ddu & Cors y Wlad West	Cors y Wlad East	Gyfelog	Bwlch Derwin	Total
Good Condition	19.49	0.00	0.00	1.71	21.2
Suitable Undergrazed	0.00	0.00	2.12	4.27	6.39
Suitable Overgrazed	0.00	0.00	0.00	0.00	0.00
Suitable Sparse	0.00	0.00	0.00	4.75	4.75
Subtotal 1: Suitable only (excluding GC)	*0.00*	*0.00*	*2.12*	*9.02*	*11.14*
Potential Rank	0.00	0.00	0.00	0.00	0.00
Subtotal 2: GC, Suitable and potential	*19.49*	*0.00*	*2.12*	*10.73*	*32.34*
Overspill Grassland	0.00	0.00	21.75	0.00	21.75
Subtotal 3: GC, Suitable, PR and OS	*19.49*	*0.00*	*23.87*	*10.73*	*54.09*
Not Suitable	108.28	43.73	48.10	50.54	250.65
Not Accessed	0.00	15.31	24.42	3.42	43.15
Total	**127.77**	**59.04**	**96.39**	**64.69**	**349.89**

The mapping provided in the report indicates that it was done on a much broader scale than in 2019; the majority of the habitat condition categorisation appears to be at the land parcel scale as opposed to the mapping of individual habitat matches within land parcels in 2019. The total area surveyed in 2002, in a similar landscape area to that surveyed in 2019, was approximately 50ha greater but the majority of this extra land was *Not Suitable*. Table 7 provides a comparison of the habitat condition figures from both surveys.

Table 7. Comparison of habitat condition data (ha) for the Pant Glas landscape from 2002 and 2019.

Condition	2002	2019
Good Condition	21.2	16.03
Suitable Undergrazed	6.39	21.12
Suitable Overgrazed	0.00	5.13
Suitable Sparse	4.75	4.43
Subtotal 1: Suitable only (excluding GC)	*11.14*	*30.71*
Potential Rank	0.00	6.18
Subtotal 2: GC, Suitable and potential	*32.34*	*52.92*
Overspill Grassland	21.75	0.00
Subtotal 3: GC, Suitable, PR and OS	*54.09*	*52.92*
Contains Suitable	0.00	7.76
Potential	0.00	2.56
Not Suitable	250.65	198.02
Not Accessed	43.15	39.00
Total	**349.89**	**300.35**

In 2002, 32.34ha of *Suitable* or *Potential Rank* habitat was identified; 21.03ha of this habitat was in *Good Condition*. If 'Overspill Grassland' is included this figure increases to 54.09ha. In 2019, this compares to 52.92ha of Suitable or *Potential Rank* habitat with 16.03ha in *Good Condition*, increasing to 60.77ha is 'Contains Suitable' is included. The amount of *Good Condition* habitat in both surveys is broadly similar, however 2002 mapping shows this habitat condition to cover the entirety of the two southern parcels of Cors y Wlad and around one-third of the southern land parcel of the Bwlch Derwin complex. The biggest difference is in the amount of 'SU, SO and SS' habitat which is nearly two-thirds less than in 2019. No *Potential Rank* habitat was recorded in 2003.

The 2002 mapping shows *Suitable* (including *Good Condition*), *Potential Rank* and Overspill Grassland to be confined to the two SSSIs and Bwlch Derwin; all remaining land parcels are classified as *Not Suitable*. This is considerably different than the 2019 mapping which shows suitable habitat patches to be spread through the landscape. Some of the 2003 site descriptions provide information as to why this may be the case (although management information is only available for some land parcels). Land equating to PG4.05 – PG4,07 was described as having no *Succisa* and that "it would seem that cattle and sheep from an adjacent field are used for summer grazing". The northern field of Cors y Wlad SSSI (PG4.03) was noted as having an almost complete lack of *Succisa* (apart from a few plants) due to heavy sheep grazing. To the north, PG4.02 was noted as heavily sheep-grazed and *Succisa*-free, whilst PG1.03 was cut for silage. In the Bwlch Derwin area, PG22.01, PG23.01 and the lower portion of PG23.02 were all described as *Not Suitable* due to a complete lack of *Succisa*, as were PG27.01, PG27.02 & PG28.01. On Cors

Gyfelog, PG11.05 was noted as too unsafe to access, PG10.01 and PG10.03 as Overspill Grassland with no *Molinia* whilst PG11.01 was classed as improved. NRW-owned land PG10.04 was noted as treacherous with the limited area accessed being *Succisa*-free.

Landowner details from 2002 shows that much of the land has changed ownership and hence management. For example, ownership for PG4 is now different with current pony grazing allowing *Succisa* to re-establish. The 2019 mapping indicates that the current situation in this portion of the Pant Glas Landscape is more favourable than in 2003, both in terms of the amount of *Suitable* habitat available and in terms of connectivity between habitat patches across the landscape, in particular between areas known to be occupied by Marsh Fritillary.

6.4.1. Cors y Wlad SSSI

6.4.1.1. Additonal habitat mapping

Cors y Wlad SSSI was also mapped twice in the intervening years between the 2003 and 2019 surveys. Habitat mapping by Dylan Lloyd in 2005 (Lloyd, 2005) followed published guidance (Fowles, 2005) and suggested that habitat suitability on the SSSI had declined compared with 2002. *Suitable* habitat covered just 8.3ha of the site comprising GC (0.53ha), SO (0.01), SU (0.86), SS (5.5) PR (9.67) NS (14.2). This included the northern parcel which appeared to have recovered some suitability with habitat mapped mainly as *Suitable Sparse* or *Potential Rank*.

Re-mapping of the SSSI again in 2016 by Tom Harrison (NRW) showed an increase in *Suitable* habitat to 10.8ha with a further 6.5ha identified as *Potential Rank*. Only 0.21ha was classed as *Good Condition* with much classed as *Suitable Overgrazed* or in mosaic with *Potential Rank*. Subsequent site visits by Butterfly Conservation and NRW in 2017 noted a noticeably taller sward height than in 2016, with fewer, smaller patches of shorter, open vegetation; there were almost no areas of ‘good quality habitat’ indicating just how quickly habitat quality can change in the absence of a favourable management regime.

6.4.1.2. Historic records

Marsh Fritillary records for Cors y Wlad show that the site historically supported the strongest colony in the area. In 1997, 73 adults and 137 larval webs were recorded with 180 larval webs recorded in 1998. The butterfly has continued to be recorded from the site since then but never in such numbers; within the last ten years, no more than 41 webs have been recorded in any one year and, within the last five years, a maximum of 15 larval webs and four adult butterflies have been recorded. This indicates that Marsh Fritillary abundance at the site has decreased, largely due to an inconsistent supply of *Suitable* habitat and a deterioration in the quality of this habitat, as evidenced by the mapping studies and various site visits.

6.4.1.3. Larval web monitoring

In 2010, a larval web transect was set up at Cors y Wlad by Butterfly Conservation and NRW. This is a permanent route that representatively samples potential breeding habitat in the southwestern section of the site. The route is walked in the autumn each year and the number of larval webs seen within a 1m width each side of the transect is recorded. This allows a better understanding of how the Marsh Fritillary is

faring at the site and how this is changing over time. The results from the larval web monitoring at Cors y Wlad are provided in Table 8 and Figure 2 below.

Table 8. Cors y Wlad larval web counts and index, 2010 to 2019. *Larval webs were recorded 'off-transect' in 2015 (2 webs) and 2016 (4 webs). In 2017, 4 adults were recorded indicating the continued presence at the site.

Year	2010	2011	2012	2013	2014	2015*	2016*	2017*	2018	2019
Larval web count	5	2	3	2	3	0	0	0	7	15
Index (density per ha suitable habitat searched)	15.15	6.06	9.09	6.06	9.09	0	0	0	25	54

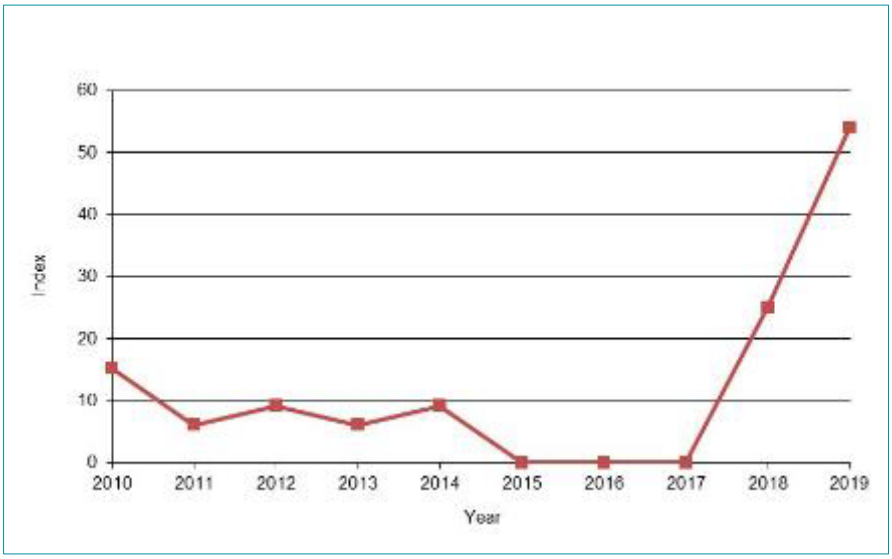

Figure 2. Cors y Wlad Marsh Fritillary Web Index (density per hectare of suitable habitat searched).

The monitoring results highlight that the population is very small in recent years compared with a much larger population indicated by historic records. However, they also demonstrate that, with favourable management, this decline can be reversed and the results seen in a short space of time, particularly when this coincides with good weather during the adult flight period. The 2019 survey indicates that the grazing regime for the SSSI is now producing the favourable habitat required by the Marsh Fritillary.

7. Conclusions

Marsh Fritillary metapopulations require a large, well-connected network of suitable sites to maintain their populations in the long-term. The Pant Glas Marsh Fritillary metapopulation is centred around the Cors y Wlad and Cors Gyfelog SSSIs. The 2019 survey of part of the Pant Glas landscape indicates that the metapopulation is likely to be in Favourable Condition, with *Good Condition* and *Suitable* habitat falling just 4ha short of the 50ha threshold, with over 10ha of *Good Condition* habitat present. Further suitable habitat is likely to be available in the unmapped core (1km) landscape of the southern part of the metapopulation and in the wider functioning (2km) landscape. With appropriate management (including restoration of *Potential Rank* habitat), the 52.92ha of *Good Condition*, *Suitable* and *Potential Rank* habitat within the core landscape should be sufficient to support this part of the

metapopulation at least in the short to medium term. Long-term persistence is likely to require closer to 90 hectares.

One-quarter of surveyed land lies within the two SSSIs and just over half of the *Suitable* or *Potential Rank* habitat lies within these protected areas; the SSSIs also contain 80% of *Good Condition* habitat mapped. The SSSIs are therefore vital to the survival of the Pant Glas Marsh Fritillary metapopulation, containing the majority of the most important breeding areas for the butterfly in the landscape. The current management of the SSSIs is favourable but on-going dialogue with the landowners, evidenced by monitoring, will be key to ensuring continued habitat favourability, year on year, on which the metapopulation heavily depends.

In contrast to the SSSIs, the wider landscape is much less hospitable for the Marsh Fritillary. *Good Condition* habitat is scarce, occurring as small patches scattered across the landscape with none of the land currently under a favourable management regime. Cattle grazing is either too little, too intensive or in combination with sheep; pony grazing is resulting in a dominance of *Suitable Undergrazed* habitat and; sheep, present on nearly half of grazed land, is reducing and gradually eliminating *Succisa* from the sward. The situation is largely the same for '*Suitable*' habitat with lack of any management and, to a small extent mowing, additional contributing factors.

Conservation action is needed to bring more habitat into suitable management across the landscape in the various ownerships. Such work should target, at the outset, those land parcels containing the highest amounts of *Good* and *Suitable* condition habitat and those undesignated sites known to be occupied by the Marsh Fritillary, namely Bwlch Derwin. Cattle grazing, wherever practical, should be encouraged, particularly in key Marsh Fritillary areas; monitoring any new grazing regimes is crucial to guide further work. Producing more extensive areas of *Suitable* habitat, including sufficient *Good Condition* habitat, will help restore habitat condition to the wider landscape and reduce Marsh Fritillary dependence on the SSSIs, creating a much more robust and resilient landscape. This will also help increase habitat connectivity in the landscape, although some additional work may be needed to overcome substantial barriers such as the dense conifer plantation adjacent to Cors y Wlad.

Key actions required

1. Ensure favourable management for Marsh Fritillary on SSSI land - maintain good dialogue, provision of appropriate advice/support and regular feedback between NRW and landowners.
2. PG23.01 & PG23.02 - liaison with landowner to agree and implement a more favourable cattle-grazing regime.
3. PG25.01, PG25.02 & PG16.01 – liaison with landowners to establish acceptable grazing management for currently unmanaged land parcels.
4. PG4 (all parcels) – landowner liaison to determine the feasibility of cattle grazing or, alternatively, patch cutting to encourage pony grazing of rank areas.
5. PG6.01 – PG6.05 – liaison with landowner to investigate the potential for cattle or pony grazing.
6. PG27.01 & PG27.02 – revisit during Marsh Fritillary larval web season to confirm breeding. Liaison with landowner to review current grazing regime and implement

more favourable management, precluding sheep grazing and ideally including a rest from grazing.
7. PG 7.01, PG9 (all parcels), PG13 (non-SSSI parcels) – liaison with landowners to establish whether sheep can be excluded from current mixed grazing regimes.
8. PG28.01 – liaison with landowner to review current grazing regime and implement more favourable management.
9. PG11.01 – landowner liaison to agree and implement a less intensive grazing regime, ideally including cattle and a rest from any grazing to allow *Succisa* to recover and spread.
10. Conifer plantation east of Cors y Wlad – explore opportunities to create flight corridors through conifer removal to facilitate dispersal between the SSSI, the central landscape and Bwlch Derwin.
11. Undertake habitat condition mapping for the southern part of the Pant Glas metapopulation incorporating current Marsh Fritillary populations at Bryn-engan and Rhosgyll & Rhos-ddu.

8. Acknowledgements

All maps included in this report were produced from Ordance Survey Data under licence to Natural Resources Wales: Ordnance Survey Licence Number 100019741. Crown Copyright and Database Right (2020). Mike Howe and Joanna Clark of NRW provided invaluable assistance in the preparation and undertaking of the survey and the preparation of this report. Ecological contractor Alice Smith for liaising with the majority of landowners, obtaining survey consent, undertaking the survey and assisting with the preparation of this report. To the landowners who consented survey access and enabled the successful completion of this important landscape assessment.

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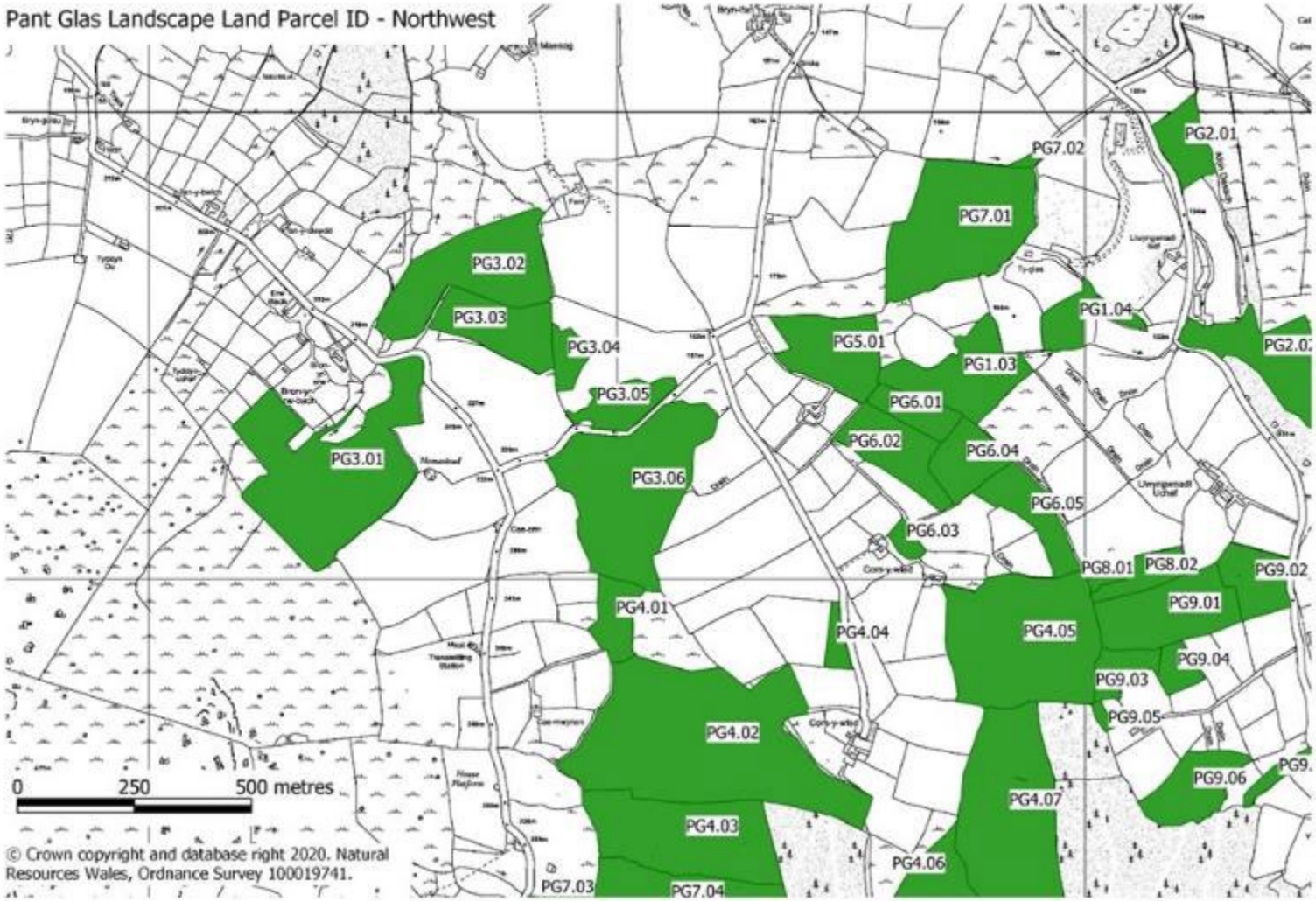
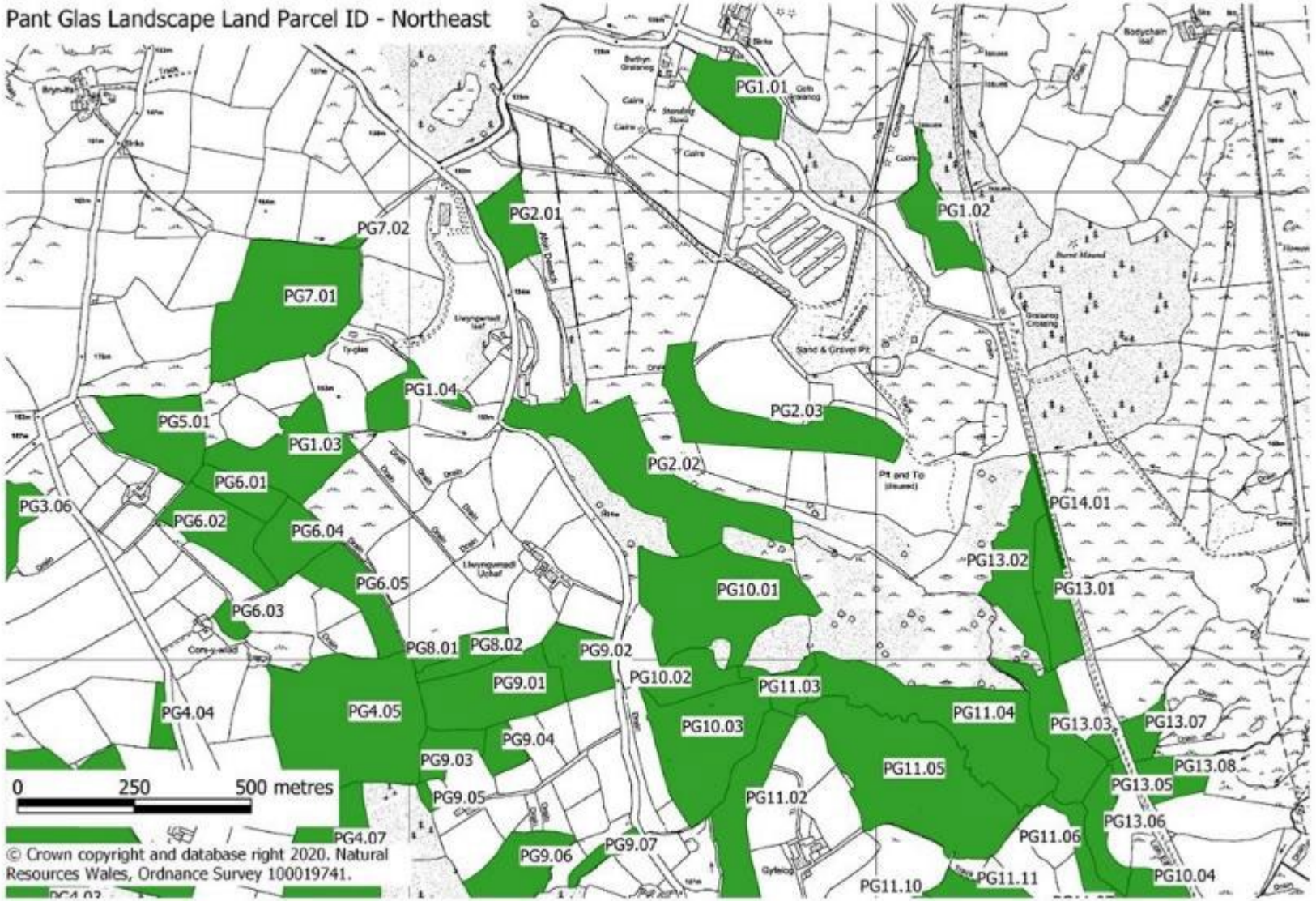
10. Appendix 1. Land parcel identification codes

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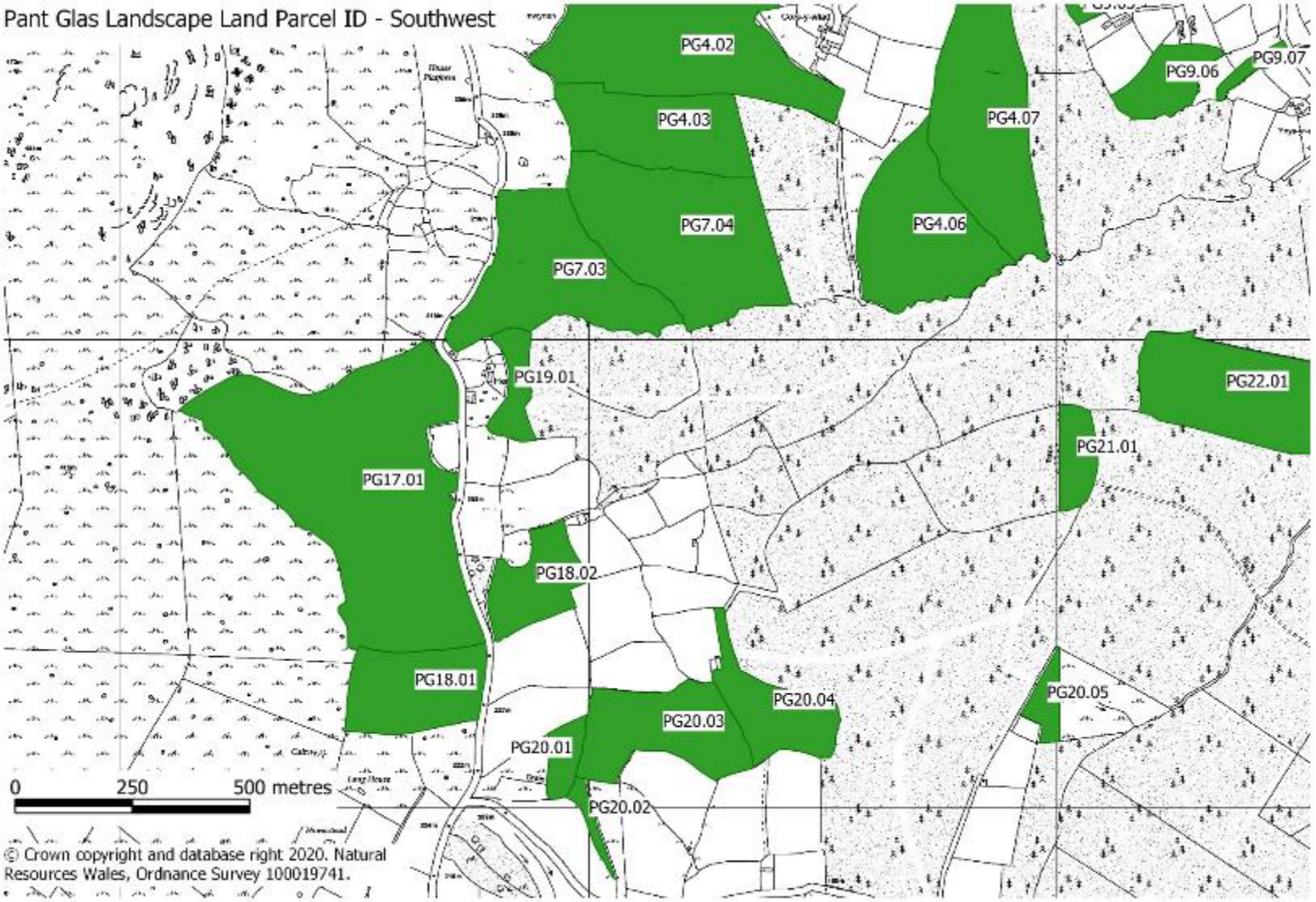
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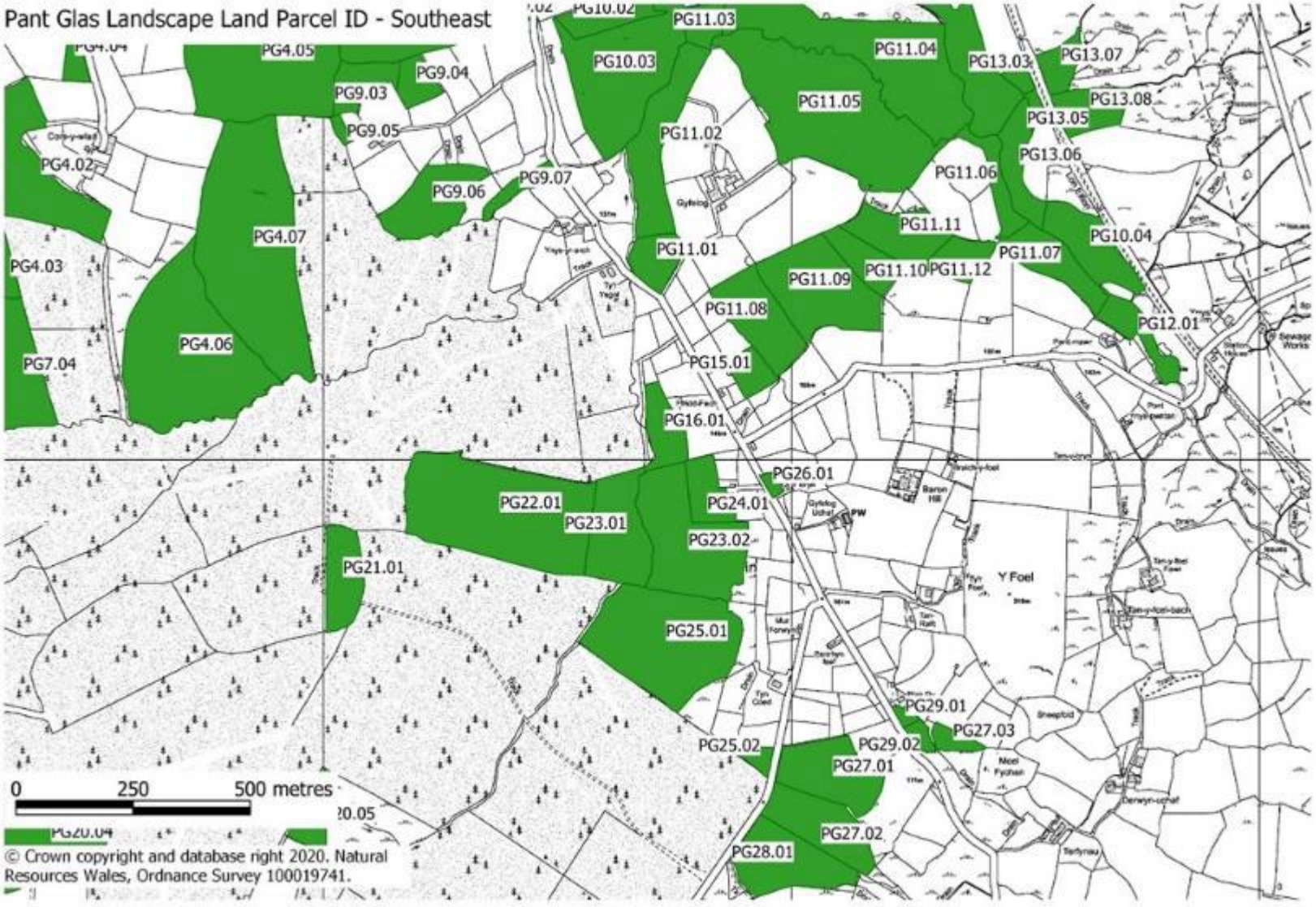
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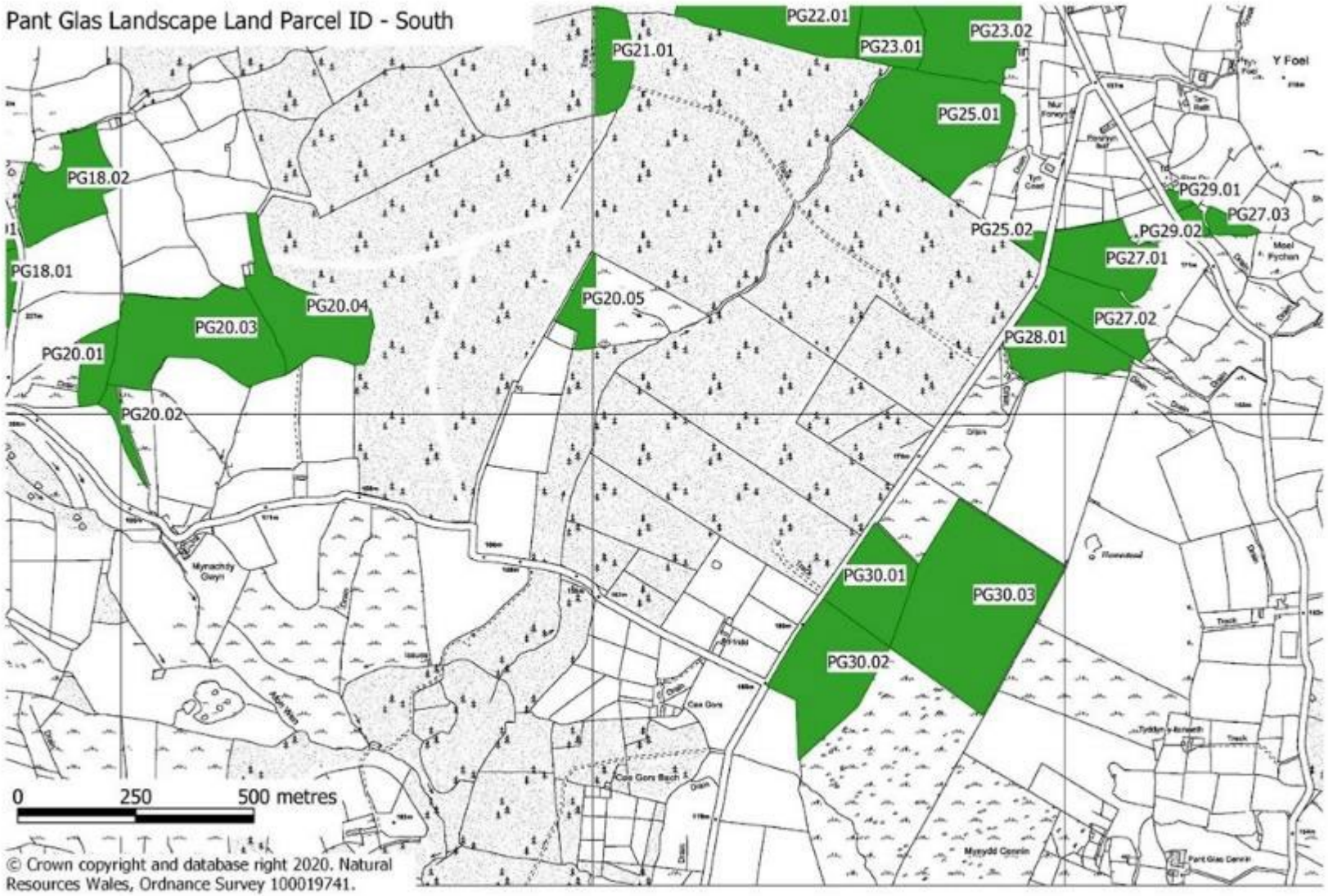
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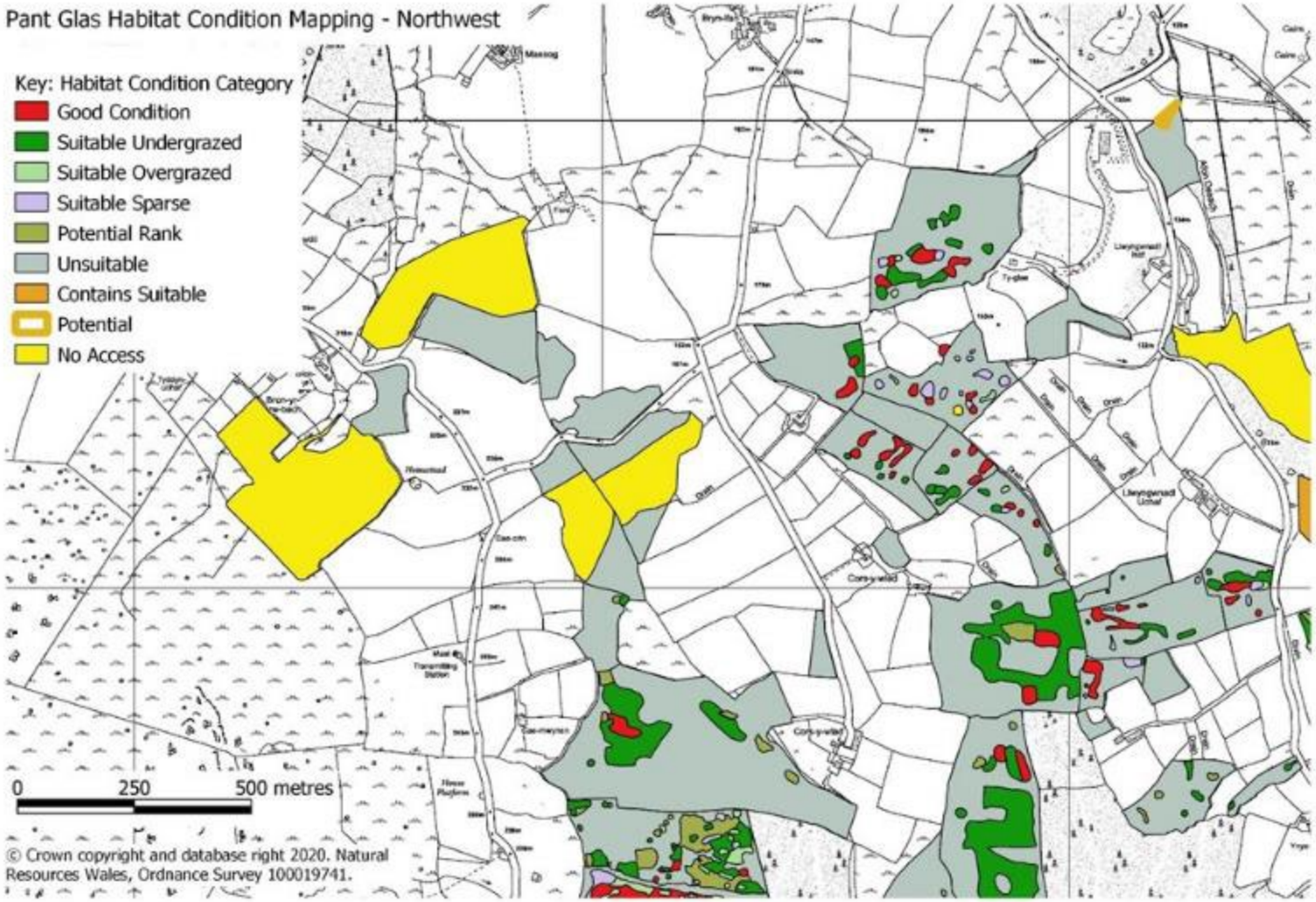
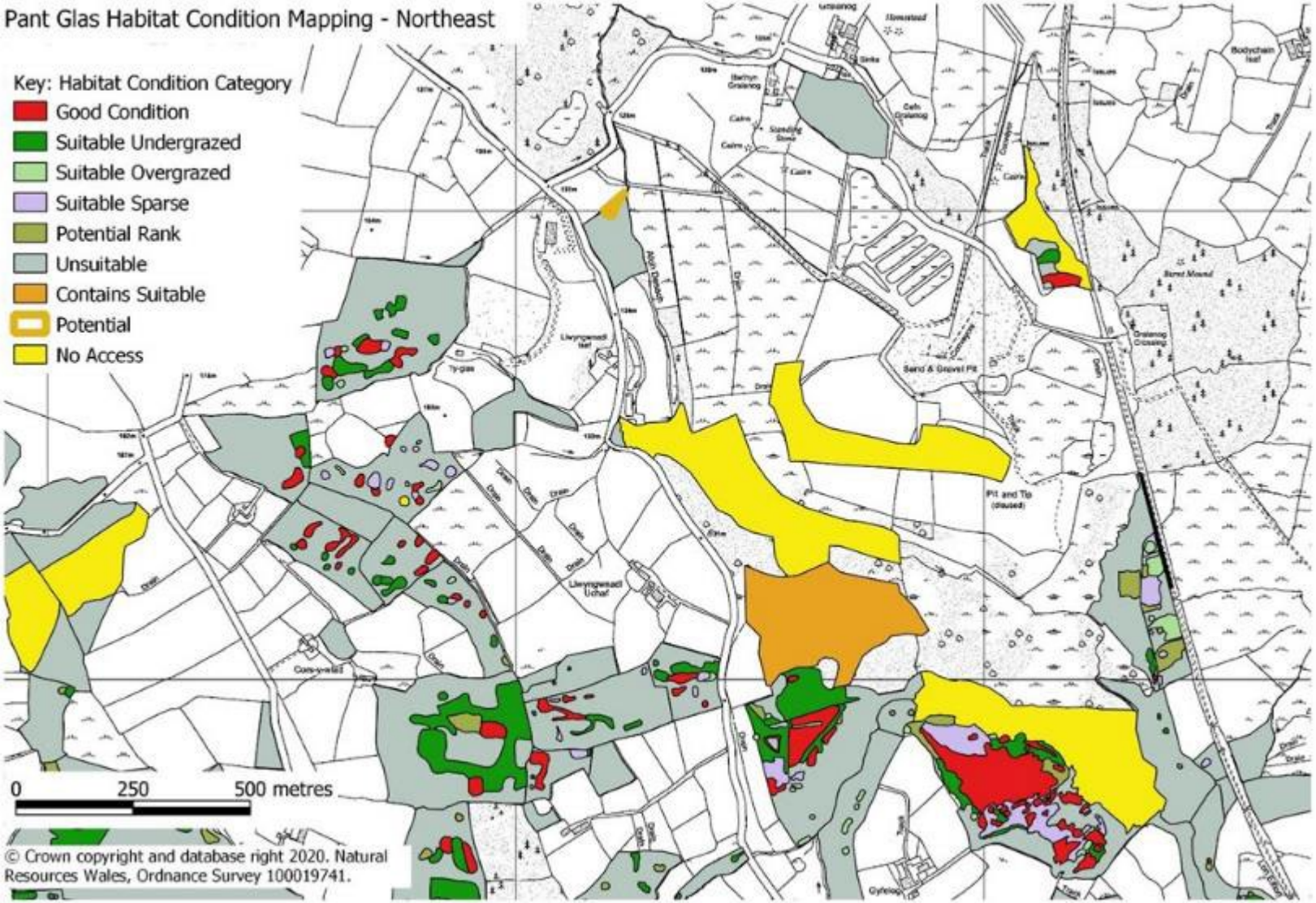
11. Appendix 2. Habitat condition mapping

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No Access
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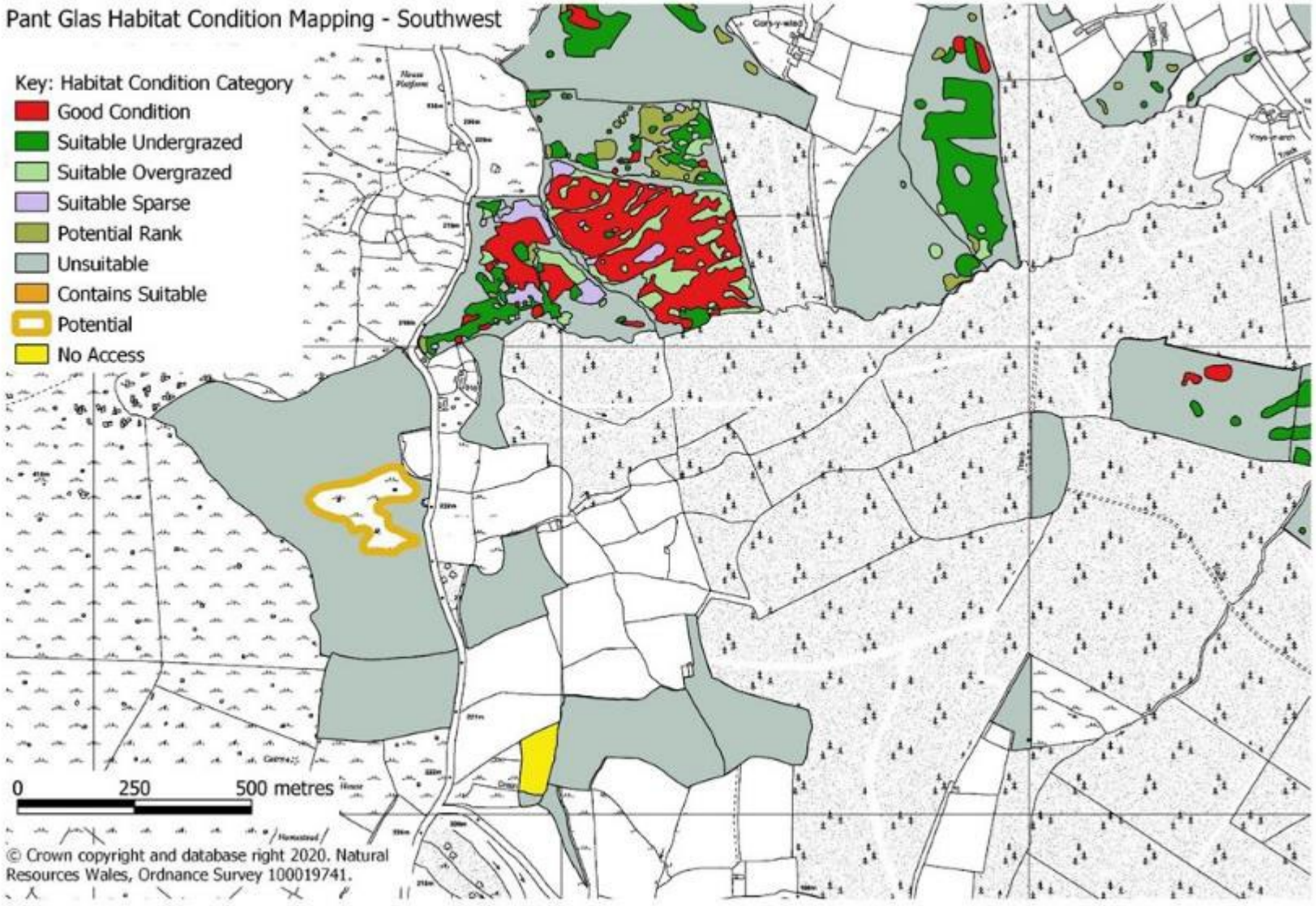
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Suitable Overgrazed
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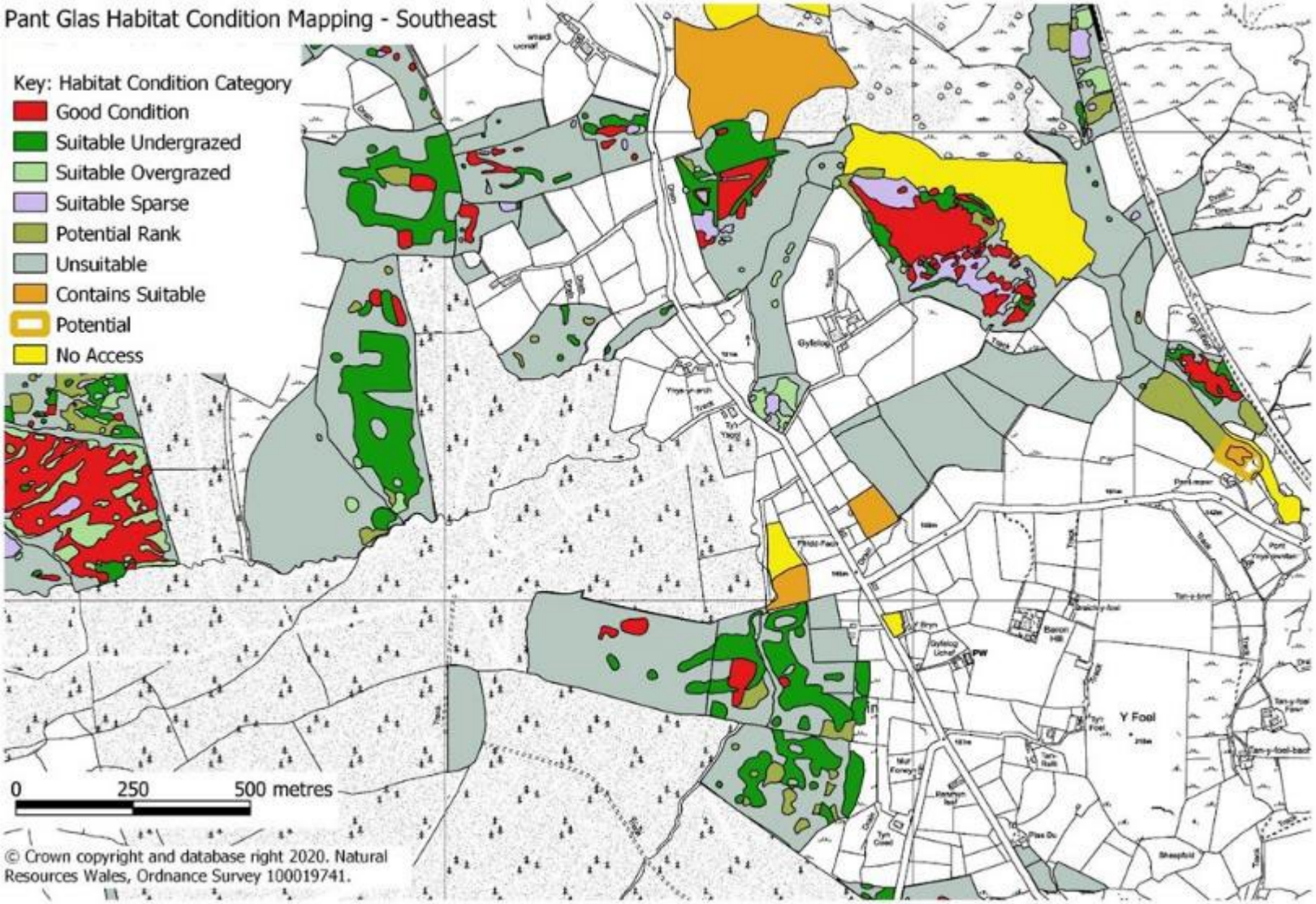
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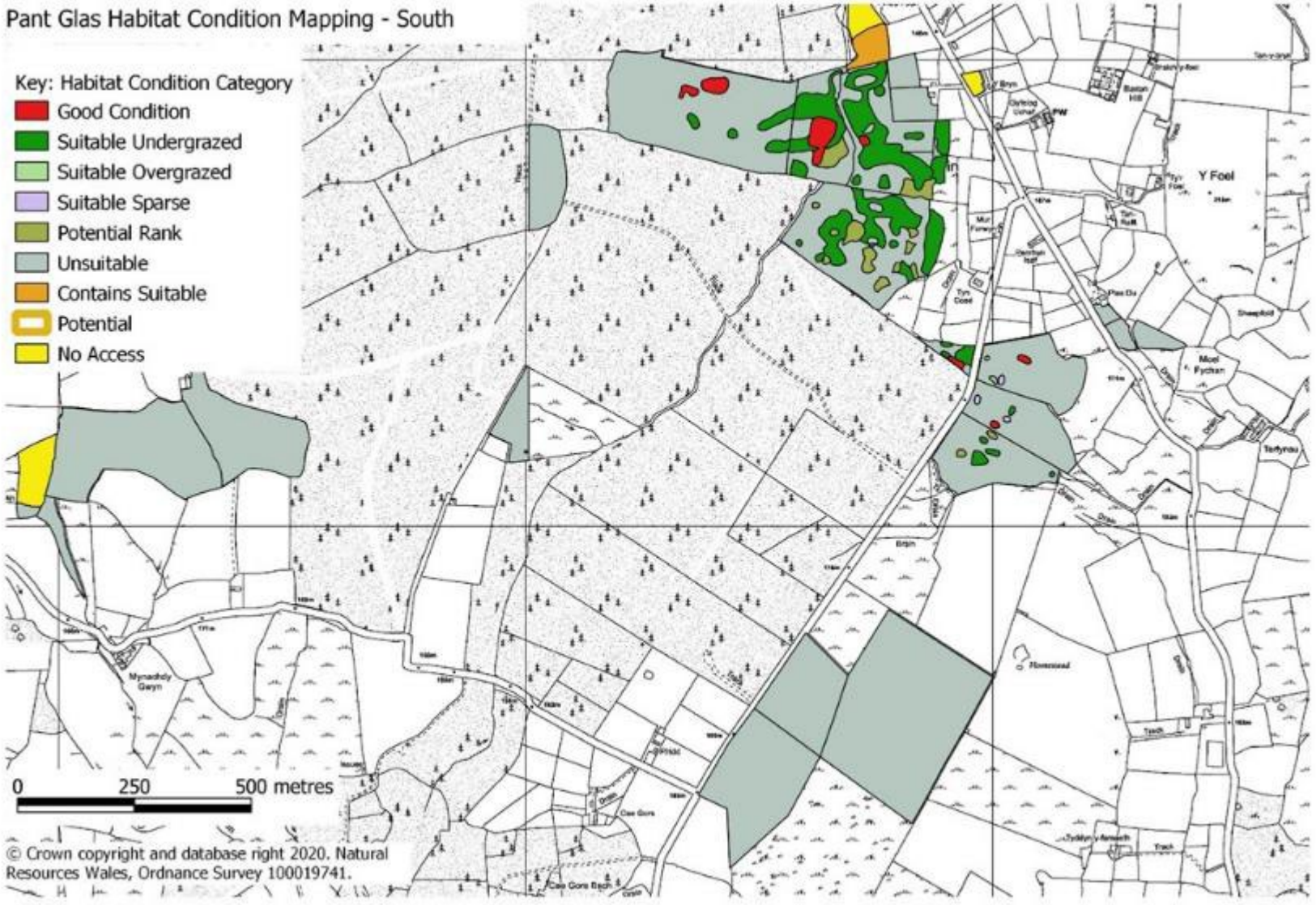
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500 metres
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Y Foel

12. Appendix 3. Site descriptions

Table 9. Marsh Fritillary habitat quality mapping codes.

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 10. Marsh Fritillary Rapid Assessment categories.

Category	Description
Contains suitable (CS)	*Succisa* present, noted either in flower or vegetative growth. This could include overgrazed fields or scrubby fields
Potential (P)	Fields which contain significant amounts of *Molinia* but no obvious *Succisa* (usually rank & neglected). It also includes recently mown fields
No Access (NA)	Fields not viewable
Not Suitable (NS)	Fields obviously grazed regularly by sheep (very short, dung and /or bits of fleece in field, on hedges or fences) or improved or complete scrub

Table 11. Site descriptions.

Field number	Site description
PG1.01	Marshy Grassland habitat - *Unsuitable*. No *Succisa* was present in this wet field of *Juncus* species, *Molinia* and a mosaic of mosses including *Sphagnum* moss species. Management: Not known.
PG1.02	Marshy Grassland habitat. The northern end of the land parcel was very rank and inaccessible consisting of large tussocked *Molinia*, *Rubus fruticosus* and willow scrub. No *Succisa* was visible from the accessible southern end and it was not possible to do a Rapid Assessment from the improved field because of the presence of cattle. The eastern area is raised bog/pingo, some of which was too wet to walk on; this No Access area had no *Succisa* visible from the edge. *Management:* Ungrazed - the farmer receives payment under Glastir not to graze this plot.

Field number	Site description
PG1.03	Marshy Grassland habitat – largely *Not Suitable* with patchy *Succisa* mainly in *Suitable Sparse* and *Good Condition* habitat. *Succisa* was mostly present as basal rosettes. There were a few small flowering plants well below the top of the sward. Sheep were present on the drier pasture to the north of the land parcel and have access to the habitat and the *Molinia* had been grazed fairly recently by cattle. *Management:* cattle and sheep grazing.
PG1.04	Improved pasture – *Not Suitable*.
PG2.01	Marshy grassland habitat east of Biogen. Permission refused therefore surveyed by Rapid Assessment. There was an area of *Potential* habitat in the northeast, it was ungrazed *Molinia* with incursion of C*hamaenerion angustifolium* and *R. fruticans*. No *Succisa* was visible. In the northwest/west of the area grazed *Juncus effusus* pasture is present; no *Succisa* was visible – *Not Suitable*. *Management*: grazing.
PG2.02	Land owned by Graianog quarry. Access permission refused. A small area at the western end was viewed from the road. Dense willow scrub was present with some ungrazed sward adjacent to the road. No *Succisa* was observed – *Not Suitable*. *Management:* Not known.
PG2.03	Land owned by Graianog quarry. Access permission refused. The land parcel was not accessible for a Rapid Assessment to be undertaken. *Management:* Not known.
PG3.01	Semi-improved acid grassland to east of road. Northeast area was surveyed by Rapid Assessment as permission was not granted. Habitat was *Juncus effusus* low diversity pasture; no *Succisa* viewed from the road – *Not Suitable*. No access to view southwest part of area to undertake Rapid Assessment. *Management:* Not known.
PG3.02	Permission refused. No Access. Unable to view to undertake Rapid Assessment. *Management:* Not known.

Field number	Site description
PG3.03	Permission refused. Rapid Assessment from footpath. Marshy grassland habitat bisected by a 15' drain. All areas viewed from the footpath were low diversity *Juncus effusus* interspersed with occasional *Molinia*; no *Succisa* visible – *Not Suitable*. *Management:* Draining.
PG3.04	Permission refused. Rapid Assessment of northern end from footpath. Neutral grassland appears to be low diversity *Juncus effusus* interspersed with occasional *Molinia*; no *Succisa* visible - *Not Suitable*. *Management:* Unknown.
PG3.05	Land parcel north of road. Permission refused. Rapid Assessment undertaken. There were large well-maintained drains on the boundaries of the habitat. No *Succisa* seen when viewed from two separate locations from the road – *Not Suitable*. *Management:* Draining.
PG3.06	The land parcel was viewed from the road and the southern boundary; the central area could not be viewed or assessed. The northern and southern areas were dominated by *Juncus* species interspersed with small quantities of *Molinia*. No *Succisa* was observed; habitat *Not Suitable*. There was a deep, recently enlarged drain along the boundary next to the wall. Management: Draining.
PG4.01	Area of Marshy Grassland largely *Not Suitable* with one small area of *Potential Rank* and *Suitable Undergrazed* habitat in the northeast corner. There are well-maintained drains around the perimeter and an area of *Urtica dioica* in the west indicated nutrient enrichment. *Management:* Draining. No evidence to indicate grazing regime.
PG4.02	Marshy Grassland habitat - the northwest and northeast parts of the land parcel supported *Suitable Undergrazed* habitat with one small area of *Good Condition* and a few small *Potential Rank* areas also present. A large area at the southern extent of the land parcel was *Not Suitable* comprising drier neutral grassland with some patches of *Juncus* but no *Succisa* or *Mollinia*. *Management:* three or four horses were present in this land parcel but not venturing onto the wetter areas.

Field number	Site description
PG4.03	Part of Cors y Wlad SSSI/Corsydd Efionydd SAC. Semi-improved grassland dominates this land parcel. *Molinia* is patchy in occurrence with *Succisa* either absent from (NS) or rare in (PR) large areas in the western half of the parcel. *Succisa* is largely limited to the damper, rushy areas, predominantly on the parcels in southern perimeter, which are principally *Suitable Undergrazed*. *Succisa* is more abundant in the eastern half of the parcel in a *Suitable Undergrazed* rush-dominated sward with many small areas of *Suitable Overgrazed* habitat where pony grazing is more concentrated. Stands of rush-dominated *Potential Rank* habitat make up the remainder and the larger part of this parcel. *Management:* Pony grazing (small herd).
PG4.04	Land parcel *Not Suitable*. Low diversity pasture with deep well-maintained drain around the perimeter. Management: Draining.
PG4.05	Area of wet heath/acid grassland mosaic. Majority of habitat is *Not Suitable* but a good amount of *Suitable Undergrazed* habitat was present in the central and eastern part of the land parcel in association with a couple of small *Good Condition* areas. *Management:* There was evidence that ponies have grazed this compartment but none were present at the time of survey.
PG4.06	This land parcel had a large extent of unsuitable habitat comprising mown rush pasture bordered to the east by a very rank sward. There was a very small area of *Potential Rank* habitat in the northeast corner supporting a single *Succisa* plant. *Management:* mowing.
PG4.07	This land parcel had large areas of *Suitable Undergrazed* habitat where *Succisa* was abundant. The sward was very even and would benefit from grazing by cattle to create more structure. *Management:* Two horses were present but were mostly grazing at the western edge near the fence.
PG5.01	Marshy Grassland habitat - the southwest corner of this land parcel had been mown (25 – 30% of total compartment) and contained Creeping Buttercup. Some other areas were also nitrogen enriched even where there was *Succisa*. *Management:* cattle were on the improved area to the northwest of the land parcel and had access to the land parcel.

Field number	Site description
PG6.01	A drier land parcel supporting *Not Suitable* habitat of *Agrostis* species and fescues. The sward was lower indicating recent grazing although there was no dunging. *Management:* sheep grazing.
PG6.02	Marshy Grassland habitat, very overgrown with little evidence of recent grazing. *Succisa* limited in occurrence with a few patches of *Good Condition* and a few patches of *Suitable Undergrazed* habitat present. *Management:* sheep grazing.
PG6.03	Land parcel *Not Suitable* – habitat dominated by *Molinia*, *Juncus effusus* and *Holcus lanatus*, no *Succisa* present. Owned by the family of Joe Davies who graze the land. It is currently in probate. *Management:* sheep grazing.
PG6.04	Marshy Grassland habitat in the land parcel was very overgrown with little evidence of recent grazing. Some small patches of *Good Condition*, *Suitable Undergrazed* and *Potential Rank* habitat were present. *Management:* fences on this land were very old and in poor condition so that animals are able to move between enclosures.
PG6.05	Marshy Grassland habitat in the land parcel was very overgrown with little evidence of recent grazing. A large ditch, which had not been cleared recently, lies along the western boundary. A few single plants and patches of *Suitable Undergrazed* of less than 5m x 5m lie along the boundary where the ditch is were not mapped. *Management:* fences on this land were very old and in poor condition so that animals are able to move between enclosures. Sheep had been taken off two months ago and were due to be put back on imminently.
PG7.01	Area of wet heath/acid grassland mosaic. 24 cows grazing at the time of survey had created a good sward structure in terms of *Molinia*. However, there were very few flowering *Succisa* plants and most other non-flowering *Succisa* plants were ground level rosettes. A handful of sheep were delivered to the site during the survey. Sheep are grazing out the Succisa and leaving the *Molinia*. *Management*: cattle and sheep grazing.
PG7.02	Small corner of Marshy Grassland in an otherwise Improved field. No *Succisa* – *Not Suitable*.

Field number	Site description
PG7.03	Part of Cors y Wlad SSSI/Corsydd Efionydd SAC. Marshy grassland dominated by *Molinia* and *Juncus* species occupies the majority of this land parcel. The southwest of corner of the site was much wetter with numerous flushes present and an abundance of wet heath. *Succisa* was abundant throughout both the marshy grassland and flush communities; large areas of the marshy grassland were in *Good Condition* whereas the wetter rush-dominated flushes were *Suitable Undergrazed*. *Succisa* was more variable in abundance and somewhat sparser in the wet heath communities with most of this habitat classified as *Suitable Sparse* or *Not Suitable*. Areas of semi-improved acid grassland flank the land parcel to the east along the stream corridor and to the west on the slope running adjacent to the road. *Succisa* was less abundant in these drier areas; in the east the areas are either *Suitable Overgrazed* or *Suitable Sparse* whilst in the west *Succisa* was absent from the majority of the drier grassland, which was classified as *Not Suitable*. Large areas of gorse scrub were present along the western boundary and in the southeast section of the land parcel, where only very small areas supporting *Succisa* remain. The stream corridor along the eastern perimeter was dominated by bracken and willow with no *Succisa* present and was *Not Suitable*. *Management:* Cattle grazed as a single management unit with adjacent land parcel to east (NRW Unit 7). Approximately 29 cattle. Cattle have access to improved land parcel to northwest of SSSI.
PG7.04	Part of Cors y Wlad SSSI/Corsydd Efionydd SAC. Semi-improved acid grassland dominates this land parcel. *Succisa* was widespread with large areas classified as *Good Condition*. The drier nature of the habitat in this land parcel encourages more concentrated cattle grazing resulting in frequent areas of *Suitable Overgrazed* habitat, often in association with raised areas, banks and ridges. *Management:* Cattle grazed as a single management unit with adjacent land parcel to west (NRW Unit 7). Approximately 29 cattle. Cattle have access to improved land parcel to northwest of SSSI.
PG8.01	Area of wet heath/acid grassland mosaic. No *Succisa* – *Not Suitable*. Management: recently grazed by cattle.

Field number	Site description
PG8.02	The main enclosure consisted of very rank *Molinia* and *E.tetralix* with *R.fruticans* encroaching in the centre of the site. *Management:* There were no signs of grazing and no gate to this enclosure i.e. livestock cannot gain access.
PG9.01	Area of wet heath/acid grassland mosaic - part of the central area supports *Erica tetralix* with *Sphagnum* moss species. *Management:* grazed by cattle in summer. Laura Parry of Caerau Farm puts sheep on in the winter.
PG9.02	Area of wet heath/acid grassland mosaic. The *Molinia* had been grazed recently and much of the *Succisa* was in the form of ground level rosettes. The area of *Good Condition* habitat had more full-size plants. The long *Suitable Undergrazed* area had a *Good Condition* sward but followed a line of young willows so classified as *Suitable Undergrazed* - *Sucissa* on this area was small flowering plants and basal rosettes. There were scattered basal rosettes and small plants elsewhere in the land parcel but too far apart to qualify as habitat. *Management:* grazed by cattle in summer. Laura Parry of Caerau Farm puts sheep on in the winter. Sheep were not present at time of survey but they were on other areas of Mr Shelton's land (PG9.06, PG9.07) so had possibly been grazing this plot recently.
PG9.03	Area of wet heath/acid grassland mosaic with dense *Ulex europeaus* and *Molinia* present. *Management:* grazed by cattle in summer. Laura Parry of Caerau Farm puts sheep on in the winter.
PG9.04	Mown sward of *Juncus effusus* and *Holcus lanatus* – *Not Suitable*. Management: Mowing. *Management:* grazed by cattle in summer. Laura Parry of Caerau Farm puts sheep on in the winter.
PG9.05	Land parcel containing Marshy Grassland. No *Succisa* present – *Not Suitable*.

Field number	Site description
PG9.06	Much of the Marshy Grassland habitat in this land parcel was rank *Molinia*, *Deschampsia cespitosa* and *Juncus* species. Small areas of *Suitable Undergrazed* and *Potential Rank* habitat were present. *Management:* the area is cattle grazed in the summer and Laura Parry of Caerau puts sheep on in the winter. Sheep and cattle have access from the adjacent improved fields. Sheep were present at the time of survey.
PG9.07	This land parcel was very rank with some scrub encroachment. There was some evidence that cattle were accessing it. *Management: t*he area is cattle grazed in the summer and Laura Parry of Caerau puts sheep on in the winter. Sheep and cattle have access from the improved fields. Sheep were present at the time of survey.
PG10.01	Part of Cors Gyfelog SSSI/Corsydd Efionydd SAC. NRW owned. Large area comprising a mosaic of mire and swamp habitats. Not accessible for full survey due to wetness of site. Area accessed via boardwalk using binoculars to undertake a Rapid Assessment. *Succisa* clearly visible throughout the majority of the area, although clearly more abundant in some areas than others. The *Succisa* plants appear to be large in quite tall vegetation. There are recent web records from the area from beside the boardwalk, including a small number in 2019. Management: Grazed by a small herd of ponies.
PG10.02	Part of Cors Gyfelog SSSI/Corsydd Efionydd SAC. NRW owned. Area of mire north of the fence line. Rush pasture is present in the western part which was largely *Not Suitable* with the exception of an area flanking the western fence line which supported sparse *Succisa* at the northern end (*Potential Rank*) and frequent *Succisa* in the south in an under grazed sward. To the east, there was a large area of mire with abundant *Succisa* in an under grazed sward with a patch of *Good Condition* habitat present on a drier hummock. *Management*: pony grazing.

Field number	Site description
PG10.03	Part of Cors Gyfelog SSSI/Corsydd Efionydd SAC. NRW owned. Large area dominated by mire habitats with some areas of wet heath and tall herb fen also present. *Succisa* was widespread and abundant throughout the majority of the mire; a large area of *Good Condition* habitat was present with good-sized *Succisa* plants in a sward of variable height. *Succisa* was more sparse in the patches of wet heath habitat, predominately present in the east of the area. To the south the habitat was bounded by a strip of improved grassland on drier, raised ground which was largely *Not Suitable* with the exception of a small area supporting very small *Succisa* basal rosettes in a shortly grazed sward. Adjacent to this was a wide band of rush pasture with no *Succisa* and therefore *Not Suitable*. *Management:* pony grazing (small herd).
PG10.04	Part of Cors Gyfelog SSSI/Corsydd Efionydd SAC. NRW owned. Land parcel dominated by a mosaic of sphagnum-rich mire and wet heath habitats. *Succisa* widespread and abundant across much of the site in a variable height sward comprising *Good Condition* habitat. Around the perimeter of the parcel the habitat was less suitable; in the north west and south *Succisa* was present in *Molinia*-dominated undergrazed vegetation and *Succisa* was absent in the habitat bordering the river, part of which was False-oat grass dominated grassland and part swamp. *Management:* pony grazing.
PG11.01	Land parcel of Marshy Grassland lying between farm track and main road. The habitat was a mosaic of wet *Sphagnum*-rich heath, which was shortly grazed with basal rosettes of *Succisa* just visible, and drier, heavily-grazed grassland supporting rush. *Molinia* was rare and *Succisa* was restricted to the perimeter of these areas. *Management:* 3 ponies were grazing at the time of the survey.
PG11.02	Marshy Grassland strip, very wet, dominated by rush in a *Sphagnum*-rich sward. *Succisa* was present as very patchy, very small plants, occurring in an interrupted band along the eastern side of the strip in slightly drier areas. The sward was very uniform in height indicating it had been cut. The *Succisa* areas were mapped as *Suitable Overgrazed* due to the size of the plants. *Management:* Mowing and grazing - two heifers were grazing at the time of the survey.

Field number	Site description
PG11.03	Marshy Grassland habitat– rush dominated with Creeping Buttercup and Sorrel. Rush was very tall and much more dense than in the land parcel immediately to the south. *Succisa* was present in a couple of patches mapped as *Potential Rank*. Management: Not known.
PG11.04	Part of Cors Gyfelog SSSI/Corsydd Efionydd SAC. Marshy Grassland habitat – not accessible as extremely wet – No Access. Rush pasture was visible with areas of broad-leaved pondweed, tall herb fen and willow scrub. No *Succisa* was visible from the western end and the habitat was considered unlikely to support *Succisa*. Management: Not know.
PG11.05	Part of Cors Gyfelog SSSI/Corsydd Efionydd SAC. Area of mire habitat. The northern half was a large expanse of *Carex rostrata* mire supporting widespread and abundant *Succisa* within a sward with a good structure comprising *Good Condition* habitat. In the north a mosaic of vegetation types was present (mire, rush pasture, swamp and willow) giving rise to a range of habitat suitabilities; in the north west *Succisa* was quite sparse within a suitable sward whereas in the north east, *Succisa* remained abundant in *Juncus*-dominated rush-pasture mapped as *Suitable Undergrazed*; small areas of *Good Condition* habitat were also present. In the southern part of the area habitat condition was much more variable due to the vegetation communities present. In the north of this half, many small areas of *Good Condition* habitat were present on a series of dry heathy mounds comprising raised and blanket mire. In the west, these mounds were surrounded by very wet habitat dominated by St John's-wort and Bog Pondweed. This area was flanked to the west by rush-pasture which was largely *Not Suitable*. The remainder of the habitat was a mosaic of vegetation communities dominated by fen where *Succisa* was absent and rush pasture where *Succisa* was either sparse in the site interior or more abundant in slightly drier areas adjacent to the western and southern perimeter of the area. To the east of the mire was a large area dominated by fen and willow scrub. This area was inaccessible due to the wet nature of the habitat. *Management:* a herd of ponies grazes throughout the mire.
PG11.06	Part of Cors Gyfelog SSSI/Corsydd Efionydd SAC. Linear strip of habitat running on the west side of, and adjacent to, the river. The area comprised grassland dominated by *Holcus lanatus* and *Deschampsia cespitosa* in the north grading into *Juncus*-dominated rush pasture in mosaic with tall herb fen to the south. No *Succisa* was recorded and the habitat classed as *Not Suitable*. *Management:* no management evident.

Field number	Site description
PG11.07	Part of Cors Gyfelog SSSI/Corsydd Efionydd SAC. South east arm of Cors Gyfelog to the west of the river. This land parcel comprised very tall, rank rush pasture in mosaic with Marshy Grassland and some areas of swamp. *Succisa* was rare within the sward and classed as *Potential Rank*. *Management:* no management evident.
PG 11.08	Land parcel supporting wet heath with some *Molinia* and rush-dominated areas also present. The wet heath appeared suitably grazed but no *Succisa* was recorded therefore habitat *Not Suitable*. No grazing animals were noted at the time of survey but sheep and cattle dung was observed. *Management:* sheep and cattle grazing.
PG11.09	Wet heath/acid grassland mosaic. Heath was in good condition with grassland areas dominated by rush and *Molinia* but no *Succisa* was recorded – *Not Suitable*. *Management:* sheep and cattle grazing - no stock were present during the survey; small quantities of sheep and cattle dung were noted.
PG11.10	Wet heath/acid grassland mosaic. Heath was in good condition, rush-dominated areas had been cut and habitat was in general less species-rich than the two land parcels to the west. No *Succisa* present – *Not Suitable*. *Management:* Sheep and cattle grazing, rush cutting.
PG11.11	Marshy Grassland habitat – species poor. Some *Molinia* was present but no *Succisa* – *Not Suitable*. Part of the land parcel had been mown whilst the drier parts were overgrazed. *Management:* Mowing, sheep and cattle grazing.
PG11.12	Marshy Grassland habitat – the higher southern part was quite species-rich but the lower, northern area is dominated by rank *Molinia* and more species poor. No Succisa was present – *Not Suitable*. *Management:* Mowing, sheep and cattle grazing.
PG12.01	Ownership unknown – area surveyed by Rapid Assessment using binoculars from north west boundary. *Succisa* was visible in a rank sward of rush and *Molinia* with invading willow in the north and scrub dominant in the south. The areas were mapped as 'Contains Suitable' where *Succisa* was obvious and 'Potential' were no *Succisa* was visible. *Management:* Not known.

Field number	Site description
PG13.01	Marshy Grassland habitat in mosaic with patches of heath. The heathy areas supported more *Succisa* than the surrounding Marshy Grassland but were drier and shortly grazed. The *Succisa* was present as basal whorls of very small leaves and was mapped as *Suitable Overgrazed*. *Succisa* was absent from some areas of Marshy Grassland whilst in the remainder it was generally Occasional/Rare and therefore mapped as *Suitable Sparse* or *Potential Rank*. *Management:* the land parcel was grazed by sheep and cattle, as one management unit with the two adjoining land parcels to the south.
PG13.02	Part of Cors Gyfelog SSSI/Corsydd Efionydd SAC. Land parcel extends from the cycle track in the north to (and including) the *Phragmites*-dominated Fen in the south. The majority of the habitat was *Not Suitable*; in the north there was a mosaic of Marshy Grassland dominated by *Molinia* with frequent Meadowsweet and Bramble in mosaic with areas dominated by *Deschampsia cespitosa*. In the west where the habitat borders NRW land ownership the grassland was infested with *Phragmites* from the adjacent Fen; this habitat extended to the south of the land parcel. *Succisa* was present in one area of *Molinia*-dominated grassland as Occasional plants in a very rank sward (almost head high) – this area was mapped as *Potential Rank*. Management: Not known – none evident.
PG13.03	Part of Cors Gyfelog SSSI/Corsydd Efionydd SAC. This land parcel lies on the east side of the river, extending from the fence in the north to the stream in the south. The majority of the habitat was *Not Suitable* comprising mire/swamp vegetation with the exception of one area with abundant large *Succisa* plants within a tall sward dominated by Bottle Sedge. This was mapped as a strip of *Suitable Undergrazed* but there was a small patch of *Good Condition* habitat in the south of the area. To the south of this strip there were three more areas supporting *Succisa* but these were very small, two being *Suitable Undergrazed* and one *Potential Rank*. The remainder of the habitat in the south part of the parcel was *Not Suitable* - some, in the west of the area, was species-poor mire infested with Reed Canary-grass with signs of limited cattle grazing, whilst the remainder was *Phragmites* infested mire or *Phragmites* Fen. Management: minimal signs of cattle grazing.

Field number	Site description
PG13.04	Land parcel comprising *Molinia*-dominated, species-poor Marshy Grassland. There was a small area of *Suitable Sparse* habitat in a sphagnum-rich area in the north west. There is the potential for *Succisa* to spread with the cessation of sheep grazing and a review of the cattle grazing regime. The land parcel is grazed as one management unit with the adjacent land parcel to the south/south-east. *Management:* sheep and cattle grazed.
PG13.05	Land parcel comprising *Molinia*-dominated, species-poor Marshy Grassland. No *Succisa* present. Grazed as a single management unit with the adjoining land parcel to the north. *Management:* sheep and cattle grazed.
PG13.06	Linear strip of Marshy Grassland in mosaic with areas of Fen. *Succisa* largely absent with the exception of one very small area of *Good Condition* and a slightly larger area of *Potential Rank* habitat. Management: no signs of grazing or other management observed.
PG13.07	Land parcel supporting rush-dominated, sphagnum-rich Marshy Grassland with *Molinia*. Vegetation very tightly grazed – no *Succisa* recorded – *Not Suitable*. *Management:* sheep and cattle grazing.
PG13.08	Land parcel supporting rush dominated Marshy Grassland with very short grazed grassland in-between. No *Succisa* visible within rush or in grassland but very closely grazed so could have been missed – *Not Suitable*. If *Succisa* is present in the seedbank there is the potential for it to return with a change in the grazing regime. *Management:* ponies grazing at the time of the survey. Also signs of previous grazing by sheep and cattle.
PG14.01	*Succisa* was present in a mown sward either side of the cycle track. There is the potential for the management regime to be changed to create more suitable habitat. *Management:* mowing.
PG 15.01	Land parcel not accessed, no response from door knocking at associated property. Land viewed through binoculars from boundary with adjacent land to the north east. Some flowering *Succisa* visible, land appeared ungrazed. *Management:* no management evident.

Field number	Site description
PG16.01	Permission not obtained. Surveyed by Rapid Assessment from southern boundary. This habitat appeared not to have been grazed for some time; the sward was very rank and willow was encroaching. In the rank *Molinia* there was abundant *Succisa* so mapped as Contains Suitable. Management: Not known – none evident.
PG17.01	Large amounts of bracken were present in the northern section of the land parcel and a large area of gorse in the north west corner. Sheep were grazing the *Festuca ovina/Agrostis* pasture but not the areas of *Molinia* which were becoming very rank. There was a large area in the centre of the land parcel of very rank large tussocked *Molinia* (not accessible) with no *Succisa* around the edge or further in when viewed through binoculars; it was therefore *Potential* habitat. However, a single *Succisa* plant was present in a depression at the northern edge of the main area of *Molinia*. This area of rank *Molinia* might be worth grazing with cattle. *Management:* sheep grazing.
PG18.01	Area of Neutral Grassland - surveyed through rapid assessment as ownership was not known at the time. *Not Suitable*. Management: Not known.
PG18.02	This land parcel was predominantly mown *Juncus effusus* improved pasture with two small areas of *Molinia* but no *Succisa* – *Not Suitable*. Management: Not known.
PG19.01	Land parcel of Marshy Grassland consisting of extremely rank and large tussocked *Molinia* and willow scrub. No *Succisa* was seen viewing around the boundary with binoculars. The northern area of *Molinia* looked more promising but again no *Succisa* was seen through binoculars. *Management:* the owners do not graze this land as they regard it as a wildlife haven.
PG20.01	Semi-improved acid grassland. The western strip of land beyond hedge was not accessible. No *Succisa* was seen amongst the large tussocked *Molinia* and willows. The state of the vegetation indicates that this area is not grazed. *Management:* no management evident.
PG20.02	Semi-improved acid grassland – no *Succisa*, *Not Suitable*. Management: Not known

Field number	Site description
PG20.03	Semi-improved acid grassland. Substantial drains surround most of the boundaries and bisect the land parcel. The drier areas consisted of Fescues, *Agrostis* species, *Holcus lanatus* and *Juncus* species (predominantly *Juncus effusus*) and small amounts of *Molinia* constitute the wetter areas. No *Succisa* was seen. *Management:* The area had been grazed by cattle recently, draining.
PG20.04	Semi-improved acid grassland – no *Succisa*, *Not Suitable*. Management: Not known
PG20.05	Marshy grassland land parcel comprising an area of large tussocked, rank *Molinia* with one small area of *Suitable Undergrazed* at the southern end. *Management:* Horses and sheep had been grazing the improved fields leading to the plot fairly recently and had access to the habitat. It was possible to walk through the *Molinia* sward to survey but there is no evidence that it had been grazed recently.
PG21.01	Habitat patch within forestry; managed by Tilhill Forestry. Surveyed by Rapid Assessment from forest track as permission was not granted. The entire habitat patch was inaccessible dense conifer woodland bordered by willow scrub. No *Succisa* was visible in occasional small patches of *Molinia* between the willow scrub. *Management*: forestry.
PG22.01	Area of Common land owned by the Community Council This land parcel comprises wet heath, valley mire mosaic. It was very rank but it was still possible to walk through it. There were numerous patches of gorse. *Succisa* was confined to pingos apart from around one area of willows where the *Succisa* was present. There was Pine encroachment from the forest plantation at the west end of the land parcel. *Management:* No management was evident.

Field number	Site description
PG23.01	Area of Marshy Grassland habitat. *Succisa* was abundant through a large part of this land parcel with a large area of *Good Condition* habitat present in the central part of the site. This area is managed together with the adjacent land parcel to the east of the river but is not so well grazed. *Management:* Cattle graze this compartment from April to September. The graziers are Mathew and Aled. They also graze Cors Gyfelog with ponies for NRW and the Ty'n-y-gors fields with cattle. The owners' application to have the land classified as agricultural was rejected. Therefore, neither the owners nor the grazier receive any single farm payment or Glastir subsidy.
PG23.02	Area of wet heath acid grassland mosaic. *Succisa* widespread and the trampling and grazing of cattle has created a good sward structure. *Management:* Cattle graze this compartment from April to September. The graziers are Mathew and Aled. They also graze Cors Gyfelog with ponies for NRW and the Ty'n-y-gors fields with cattle. The owners' application to have the land classified as agricultural was rejected. Therefore, neither the owners nor the grazier receive any single farm payment or Glastir subsidy.
PG24.01	Permission not granted. Surveyed by Rapid Assessment from western boundary. *Juncus effusus* dominated grassland with no *Succisa* visible – *Not Suitable*. Management: Not known.
PG25.01	Area of wet heath acid grassland mosaic. An area in the north-west of the compartment between the willows and the plantation forestry was very wet and unsafe to walk on. *Sussica* was abundant or even dominant in the *Suitable Undergrazed* areas but the sward was very rank across the compartment with encroachment in some areas by *Salix* and *Rubus fruticosus* etc. *Management:* The owners do not graze this compartment as they feel that it is unsafe for livestock.
PG25.02	Small triangle of Marshy Grassland habitat to the west of the road. This area has not been grazed for some time although there is a strip of *Good Condition* habitat bordering the conifer plantation. *Management:* None
PG26.01	Ownership unknown – No Access.

Field number	Site description
PG27.01	Marshy Grassland habitat - this was a very wet site with significant areas of *Sphagnum* cover although these were not always the wettest areas. Ditches were wide, boggy at the edges and problematic to cross. In the mapped habitat patches, *Succisa* occurred as very small plants or basal rosettes well below the height of the surrounding sward; inevitably, some plants will have been missed. A small number of isolated plants were also present. *Management:* a handful of cattle were grazing the drier pasture to the north and had access to the survey area which was well grazed.
PG27.02	Wet heath acid grassland mosaic. Largely *Not Suitable* with a couple of small areas supporting *Succisa* across the central section. Managed as a unit with the adjacent land parcel to the north. *Management:* a handful of cattle were grazing the drier pasture to the north and had access to the survey area which is well grazed.
PG27.03	Marshy grassland with *J.effusus/articulatus/acutiflorus, H.lanatus, Agrostis* species and fescues. No *Succisa* was seen – *Not Suitable*. There is a deep drainage channel on the southern boundary of the land parcel. *Management:* sheep have access to the habitat from the adjacent improved field.
PG28.01	Marshy Grassland land parcel, drier than the adjacent ones to the north with no significant *Sphagnum* cover. *Management:* There was evidence of cattle having grazed recently but this field was not as well grazed as the two land parcels to the north.
PG29.01	Land ownership for this land parcel was unknown; it was therefore surveyed by Rapid Assessment from the boundaries. Some *Molinia* was present amongst the willow and bramble scrub in this area but no *Succisa* was observed.
PG29.02	Land ownership for this land parcel was unknown; it was therefore surveyed by Rapid Assessment from the boundaries. The area was dense willow and bramble scrub; no *Succisa* was present – *Not Suitable*. *Management:* this land parcel had not been grazed for some time.

Field number	Site description
PG30.01	Wet heath/acid grassland mosaic. Ownership unknown therefore surveyed by Rapid Assessment from the boundary. No suitable habitat was visible in the *Juncus effusus* low diversity pasture. A large area of rushes in this compartment had been mown. *Not Suitable*. *Management:* mowing.
PG30.02	Wet heath/acid grassland mosaic. Open Access. Ownership unknown. Two cows were grazing this south west corner where rushes had been mown. Livestock in this enclosure had access to a large area of *Trichophorum cespitosum/Erica tetralix* in the north of the enclosure. No *Succisa* was found. Management: cattle grazing, mowing.
PG30.03	Wet heath/acid grassland mosaic. Open Access Land - ownership unknown. Vegetation on the hillside was dominated by *Ulex gallii* interspersed with *Molinia* and Erica species. No *Succisa* was found – *Not Suitable*. Lower down *Molinia* dominated and again no *Succisa* was observed. There was no evidence of recent grazing in this compartment. *Management:* Recent grazing.

13. Appendix 4. Site ownership details.

An Excel spreadsheet of providing details of Landscape Code, Landholding ID, Land Parcel ID, Landowner Name, Address and Contact Details has been provided to NRW.

14. Appendix 5. Pant Glas field parcel images

All photos were taken between 8th October and 31st October 2019 with the exception of a small number, which were taken at Cors Gyfelog and Bwlch Derwin during larval web searches in September of the same year – where this is the case the date is noted under the Field Parcel ID. Not all Field Parcels have photos.

Field parcel ID	Photos
PG1.01	
PG1.01	
PG1.03	

Field parcel ID	Photos
PG2.01	
PG2.01	
PG2.02	

Field parcel ID	Photos
PG2.02	
PG3.03	
PG3.05	

Field parcel ID	Photos
PG3.06	
PG4.01	
PG4.02	

Field parcel ID	Photos
PG4.03	
PG4.06	
PG5.01	

Field parcel ID	Photos
PG6.02	
PG6.02	
PG6.02	

Field parcel ID	Photos
PG6.05	
PG7.04	
PG8.02	

Field parcel ID	Photos
PG8.02	
PG8.02	
PG9.03	

Field parcel ID	Photos
PG9.04	
PG9.06	
PG9.07	

Field parcel ID	Photos
PG10.03	
PG10.03	
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Field parcel ID	Photos
PG10.03 19.09.19	
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Field parcel ID	Photos
PG10.04	
PG10.04	
PG10.04	
PG11.02	

Field parcel ID	Photos
PG11.02	
PG11.02	
PG11.05	

Field parcel ID	Photos
PG11.06	
PG11.06	
PG11.10	
PG11.10	

Field parcel ID	Photos
PG13.02	
PG13.07	
PG13.08	
PG16.01	

Field parcel ID	Photos
PG17.01	
PG17.01	
PG17.01	

Field parcel ID	Photos
PG18.01	
PG18.02	
PG20.03	

Field parcel ID	Photos
PG20.03	
PG21.01	
PG21.01	
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Field parcel ID	Photos
PG22.01	
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PG23.01 19.09.19	
19.09.19	

Field parcel ID	Photos
PG23.02	
PG23.02	
PG25.01	
PG25.01	

Field parcel ID	Photos
PG25.01	
PG26.01	
PG26.01	

Field parcel ID	Photos
PG26.01	
PG27.01	
PG27.02	

Field parcel ID	Photos
PG27.03	
PG27.03	
PG28.01	

Field parcel ID	Photos
PG29.01	
PG29.02	

15. Data Archive Appendix

The data archive contains:

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

[B] GIS landscape assessment layer. This will be added to the Master layer which is currently maintained by Butterfly Conservation under grant-aid from Welsh Government.

~~Metadata for this project is publicly accessible through Natural Resources Wales' Library Catalogue http://libcat.naturalresources.wales or http://catllyfr.cyfoethnaturiol.cymru by searching 'Dataset Titles'. The metadata is held as record no XXXXX~~.