Mynydd Mawr Marsh Fritillary Project

Mynydd Mawr Final Report

Dr Deborah Sazer

Butterfly Conservation Report No. S10 – 06

Butterfly Conservation **Wales**
Gwarchod Glöynnod Byw **Cymru**

Prosiect Brith y Gors Corstir Mynydd Mawr

Mynydd Mawr Marsh Fritillary Final Report

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Executive summary

- The Mynydd Mawr Marsh Fritillary Project Partnership between Butterfly Conservation Wales and the Countryside Council for Wales (CCW) ran from April 2004 to March 2010. It was the first landscape-scale invertebrate conservation project in Wales and was established to address the decline of the Marsh Fritillary *Euphydryas aurinia* and its rhos pasture habitat, both of which are protected by UK and European legislation. The Project's ultimate aspiration was a large, connected area of well-managed Marsh Fritillary habitat, to ensure the butterfly's long term viability.

- The Project covered 24km^2 containing over 250ha of fields with suitable or potential Marsh Fritillary habitat. The landscape features small land parcels in numerous ownerships, which can be difficult and relatively expensive to manage. Much has been overgrazed or abandoned.

- The Project aimed to learn lessons through the use of simple five-year management agreements. These were offered to all owners and occupiers of suitable or potential Marsh Fritillary habitat who were willing to manage their land by extensive cattle or pony grazing. The grants were delivered through CCW Section 15 agreements if the land was a Site of Special Scientific Interest (SSSI) or Section 39 if on non-designated land.

- Forty-nine owners were contacted, and nearly 80 meetings and/or site visits were held with 26 interested owners of 157ha. All owners not already in another agreement were offered Mynydd Mawr agreements.

- Five owners of 54ha signed up to Mynydd Mawr agreements, and owners of 3 SSSIs (15ha) were entered into Section 15 agreements and/or managed by the Project Officer. Informal agreements on another 9ha were funded by the National Grid. Agreements have been in place for less than a year to three years.

- Owners were paid £90 per hectare a year for management, and capital works were usually funded in full by the Project, using local contractors. Works included 2347m of fencing, 5.5ha scrub clearance and the removal of 8.7ha of rank *Molinia* and rush.

- Management has improved on agreement sites. The suitably grazed area increased from 6.3ha to 8.0ha and the amount of overgrazed land dramatically decreased from 5.1ha to 0.8ha. The amount of undergrazed land remained stable overall, although it declined on many individual sites.

- Cattle grazing increased from zero to nearly 25ha, and pony grazing was extended by 7ha. The mown area was reduced by 75%, and most of the remaining cut area was mown as part of an informal Project agreement.

- Marsh Fritillary habitat quality was mapped on just under 95 hectares at the beginning (2004/5) and end (2008/9) of the Project. Marsh Fritillary larval web numbers were monitored annually on 5 key sites encompassing 45ha, and on all Mynydd Mawr management agreement sites. An additional 44ha of non-agreement sites were also surveyed at the project's beginning and end.

- Marsh Fritillary numbers fell during the life of the Project, due to the legacy of inappropriate grazing levels and a series of wet winters and cool, wet summers. The population increased slightly in 2009, a trend which was replicated throughout much of the UK.

- The extensive surveys provided a detailed picture of the state of the butterfly, its habitat resource, and the extent of management required to further improve conditions in Mynydd Mawr. However, it is too early to assess the biological outcome of the Project, as there will inevitably be a lag between the improvement in habitat and the butterfly's response. Continued monitoring is essential, to accurately assess the long-term impact of the Mynydd Mawr Project on the Marsh Fritillary and its habitat.

- The Project identified and improved the management of 8 UKBAP habitats and recorded 34 UKBAP species as well as 12 bird species included in the Wales Red and Amber Lists.

- Nearly 500 hours of volunteer time were amassed. Almost 400 people attended 25 events, including training and education days, surveys, habitat management work and the Devil's-bit Scabious Volunteer Group. Many more people are now aware of the importance of the Marsh Fritillary and rhos pasture in Mynydd Mawr.

- The Project received radio, TV and press coverage, and over 25 articles written by the Project Officer appeared in a range of publications. The Project newsletter served as publicity for the project and as an advice sheet on Marsh Fritillary management. The Project poster was displayed at six large international, UK and Welsh conferences.

- Partnerships with CCW, Carmarthenshire County Council (CCC) and many other members of the Local Biodiversity Action Plan partnership were critical to the Mynydd Mawr Project. The Project worked closely with CCC and CCW to deal with the many development threats to the area, particularly to the Caeau Mynydd Mawr Special Area of Conservation. The Project was constrained by these growing development pressures and the consequent lack of interest by many owners in managing their land.

- The main lessons learnt from the project were:
  1) The need for a dedicated Project Officer to achieve habitat improvements on the ground, especially on small land parcels owned by non-farmers;
  2) The value of simple and flexible management agreements;
  3) The need for a prior assessment of the socio-economic needs of the owners;
  4) A combination of agreements, land purchase and SSSI designation may be a better approach in rural fringe areas with planning pressures.

- There is plenty of scope to extend Mynydd Mawr Project into the wider landscape occupied by the Marsh Fritillary, where owners of larger landholdings have already expressed interest in joining such a scheme. Along with continued habitat and butterfly monitoring, there are many more events and activities that could further involve the local community and thus help secure the future for the Marsh Fritillary in Mynydd Mawr.

Crynodeb gweithredol

- Gweithredwyd Partneriaeth Prosiect Brithion y Gors ym Mynydd Mawr rhwng sefydliad Gwarchod Glöynnod Byw Cymru a Chyngor Cefn Gwlad Cymru (CCGC) o fis Ebrill 2004 tan fis Mawrth 2010. Hwn oedd y prosiect cadwraeth cyntaf yng Nghymru i'w gyflawni ar raddfa tirwedd er lles infertebrata, a chafodd ei sefydlu â'r nod o fynd i'r afael â dirywiad Brith y Gors *Euphydryas aurinia* a'i gynefin ar borfeydd rhostir, a amddiffynir ill dau gan ddeddfwriaeth y DU a'r Undeb Ewropeaidd. Uchelgais y Prosiect yn y pen draw oedd creu ardal eang, gysylltiedig o gynefin rheoledig i Frith y Gors, gyda golwg ar sicrhau hyfywedd y glöyn byw hwn yn y tymor hir.

- Cwmpasai'r Prosiect 24km^2 sydd yn cynnwys mwy na 250ha o gaeau â chynefin addas neu ddichonol ar gyfer Brith y Gors. Mae'r dirwedd yn cynnwys lleiniau bach o dir â nifer fawr o berchnogion, a all fod yn anodd ac yn gymharol ddrud i'w rheoli. Mae rhannau helaeth o'r tir wedi cael eu gor-bori neu'u gadael heb eu defnyddio.

- Nod y Prosiect oedd dysgu gwersi trwy ddefnyddio cytundebau rheolaeth syml am gyfnod o bum mlynedd. Cynigiwyd y rhain i'r holl berchnogion a meddianwyr lleiniau tir lle roedd cynefin addas neu ddichonol ar gyfer Brith y Gors, a fyddai'n fodlon rheoli eu tir trwy bori gwartheg neu ferlod ar raddfa eang. Dyfarnwyd y grantiau trwy gytundebau Adran 15 CCGC os oedd y tir yn Safle o Ddiddordeb Gwyddonol Arbennig (SSSI) neu Adran 39 os nad oedd y tir wedi'i ddynodi felly.

- Cysylltwyd â pedwar-deg naw o berchnogion, a chynhaliwyd yn agos i wyth-deg o gyfarfodydd a/neu ymweliadau â safleoedd â 26 o berchnogion 157ha o dir. Cynigiwyd cytundeb Mynydd Mawr i bob perchennog nad oedd mewn cytundeb arall yn barod.

- Llofnododd pum perchennog â 54ha o dir rhyngddynt gytundebau Mynydd Mawr, a chafodd perchnogion 3 SSSI (15ha) eu derbyn i gytundebau Adran 15 a/neu eu rheoli gan Swyddog y Prosiect. Ariannwyd cytundebau anffurfiol ynghylch 9ha arall gan y Grid Cenedlaethol. Mae'r cytundebau wedi bod mewn grym am gyfnodau rhwng llai na blwyddyn a thair blynedd.

- Talwyd £90 yr hectar y flwyddyn i berchnogion am eu rheolaeth, ac ariannwyd gweithiau cyfalaf yn llawn fel rheol gan y Prosiect, gan ddefnyddio contractwyr lleol. Yr oedd y gweithiau'n cynnwys 2347m o ffensys, clirio 5.5ha o brysgwydd a dileu 8.7ha o *Molinia* a brwyn gordyfol.

- Mae rheolaeth wedi gwella ar y safleoedd cytundeb. Cynyddodd yr ardal a oedd yn cael ei phori'n addas o 6.3ha i 8.0ha, a syrthiodd arwyneb y tir gor-boredig yn aruthrol o 5.1ha i 0.8ha. At ei gilydd fe arhosodd maint y tir is-boredig yn sefydlog, er iddo leihau ar lawer o safleoedd unigol.

- Cynyddodd y tir lle porai gwartheg o ddim i 25ha bron, a bu cynnydd o 7ha yn y tir lle porai merlod. Bu gostyngiad o 75% yn y maint o dir a bladuriwyd, ac ar y rhan fwyaf o weddill y tir a bladuriwyd fe wnaed hyn fel rhan o gytundeb Prosiect anffurfiol.

- Mapiwyd ansawdd cynefin Brith y Gors ar ychydig yn llai na 95 o hectarau ar ddechrau (2004/5) a diwedd (2008/9) y Prosiect. Monitrwyd nifer gweoedd larfâu Brithion y Gors bob blwyddyn ar 5 safle allweddol a gwmpasai 45ha, ac ar bob safle lle yr oedd cytundeb rheolaeth Mynydd Mawr mewn grym. Yn ogystal fe arolygwyd 44ha arall o safleoedd heb gytundebau ar ddechrau ac ar ddiwedd y prosiect.

- Fe syrthiodd niferoedd Brith y Gors yn ystod cyfnod y Prosiect, o ganlyniad i hanes maith o lefelau pori amhriodol a chyfres o aeafau gwlyb a hafau oer gwlyb. Cynyddodd y boblogaeth ychydig yn 2009, a gwelwyd yr un duedd ar hyd rhannau helaeth o wledydd Prydain.

- Rhoddodd yr arolygon eang a gynhaliwyd ddarlun manwl o gyflwr y glöyn byw a'i gynefin, ynghyd â syniad o'r math o reolaeth sydd ei hangen er mwyn parhau i wella'r amgylchiadau ym Mynydd Mawr. Mae'n rhy gynnar, serch hynny, i asesu deilliant biolegol y Prosiect, gan fod oediad yn anochel rhwng y gwelliant yn y cynefin ac ymateb y glöyn byw. Mae monitro parhaus yn hanfodol bwysig, fel y gellir asesu'n fanwl gywir effaith Prosiect Mynydd Mawr dros y tymor hir ar Frith y Gors a'i gynefin.

- Nododd y Prosiect 8 o gynefinoedd UKBAP (Cynllun Gweithredu Bioamrywiaeth y DU) a gwella eu rheolaeth, a chofnododd 34 o rywogaethau UKBAP yn ogystal â 12 o rywogaethau adar sydd ar Restrau Coch a Melyn Cymru.

- Fe weithiodd gwirfoddolwyr am yn agos i 500 o oriau. Daeth bron 400 o bobl i 25 o ddigwyddiadau, gan gynnwys diwrnodau hyfforddiant ac addysg, arolygon, gwaith rheoli cynefin a Grŵp Gwirfoddolwyr Bara'r Cythraul (Botwm yr Ysbryd Drwg). Mae llawer mwy o bobl yn ymwybodol bellach o bwysigrwydd Brith y Gors a phorfeydd rhostir ym Mynydd Mawr.

- Derbyniodd y Prosiect sylw gan y radio, y teledu a'r wasg, ac mae mwy na 25 o erthyglau gan Swyddog y Prosiect wedi ymddangos mewn rhychwant o gyhoeddiadau. Gweithredodd cylchlythyr y Prosiect fel cyfrwng cyhoeddusrwydd i'n gwaith yn ogystal â thaflen gyngor ynghylch rheoli Brith y Gors. Arddangoswyd poster y Prosiect yn ystod chwe chynhadledd fawr yng Nghymru, gwledydd Prydain a thramor.

- Yr oedd partneriaethau â CCGC, Cyngor Sir Caerfyrddin (CSC) a llu o aelodau eraill o bartneriaeth y Cynllun Gweithredu Bioamrywiaeth lleol yn allweddol bwysig i Brosiect Mynydd Mawr. Fe gydweithiodd y Prosiect yn glòs â CSC a CCGC i wynebu'r llu o ddatblygiadau dichonol a fygythiai'r ardal, ac yn enwedig Ardal Cadwraeth Arbennig Caeau Mynydd Mawr. Llesteiriwyd y Prosiect gan bwysedd cynyddol y cynlluniau datblygu hyn, ynghyd â'r diffyg diddordeb a fynegodd llawer o berchnogion o ganlyniad mewn rheoli eu tir.

- Y prif wersi a ddysgwyd trwy'r Prosiect oedd:
  1) Yr angen am Swyddog Prosiect ymroddedig, fel y gellir cyflawni gwelliannau ymarferol yn y cynefin, ac yn enwedig ar leiniau bach o dir nad yw eu perchnogion yn ffermwyr;
  2) Gwerth cytundebau rheolaeth syml a hyblyg;
  3) Yr angen i gynnal asesiad ymlaen llaw o anghenion cymdeithasol-economaidd y perchnogion;
  4) Y gallai cyfuniad o gytundebau, pwrcasau tir a dynodi safleoedd yn SSSI fod yn ffordd well o fynd ati mewn ardaloedd gwledig ymylol lle mae pwysedd gan ddatblygwyr.

- Fe ellid estyn Prosiect Mynydd Mawr yn hawdd i'r dirwedd ehangach a ddefnyddir gan Frith y Gors, lle mae perchnogion tiroedd ehangach wedi mynegi diddordeb eisoes mewn ymuno â chynllun o'r fath. Yn ogystal â pharhau i fonitro'r glöyn byw a'i gynefin, mae yna gyfoeth dichonol o ddigwyddiadau a gweithgareddau eraill a allai ennyn cefnogaeth y gymuned leol a thrwy hynny helpu i ddiogelu dyfodol Brith y Gors ym Mynydd Mawr.

1.0 Introduction

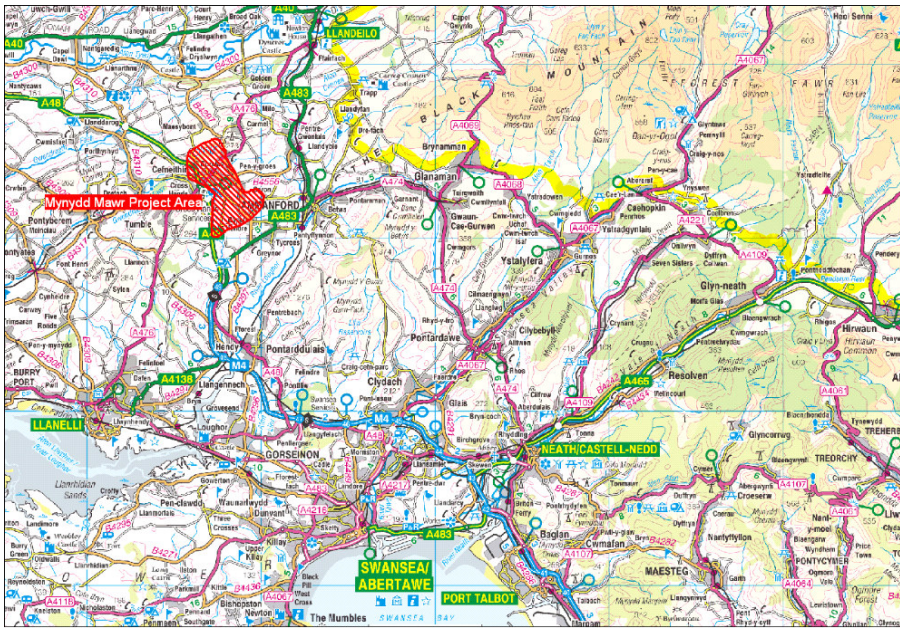
1.1 Background

The Mynydd Mawr Marsh Fritillary Project Partnership between Butterfly Conservation Wales (BCW) and the Countryside Council for Wales (CCW) was the first landscape-scale invertebrate conservation project in Wales. It ran from April 2004 to March 2010. This innovative project was established to address the decline of the Marsh Fritillary *Euphydryas aurinia* and its habitat. The key aims were to learn lessons by developing a new approach to habitat management through the use of management agreements with owners and occupiers. The ultimate aspiration was a large, connected area of well-managed Marsh Fritillary habitat throughout Mynydd Mawr.

Mynydd Mawr has been identified as a core landscape for the Marsh Fritillary, one of a handful in Wales with enough habitat to sustain its population in the long term (see Fowles and Smith 2006 and Early 2008). The Caeau Mynydd Mawr Special Area of Conservation (SAC) was designated for the Marsh Fritillary and *Molinia* meadows. It consists of three Sites of Special Scientific Interest (SSSI). There are another 5 other SSSIs in the Project area which have also been designated for their *Molinia* meadows.

The Project area is centred around Cross Hands in south-eastern Carmarthenshire, on the former Mynydd Mawr (Great Mountain) Common (see Maps 1 and 2 for location). It was traditionally summer cattle-grazed by commoners (Owen 1961), which would have been ideal management for the Marsh Fritillary. The present landscape of small fields partitioned by hedgerows and ditches was created following the Enclosure Act of 1811. Coal mining, along with quarrying and other industries, provided the main source of income until the 1970s. The small fields served to supplement the workers' incomes, leaving the poorly-drained land free from intensification (Pryce 2005). This extensive management would have varied over space and time, reflecting changing economic conditions and annual weather variations. It featured an irregular mix of cattle or pony grazing, hay cutting, topping and neglect. This lack of intensification explains why Mynydd Mawr still contains one of the largest concentrations of rhos pasture in Wales.

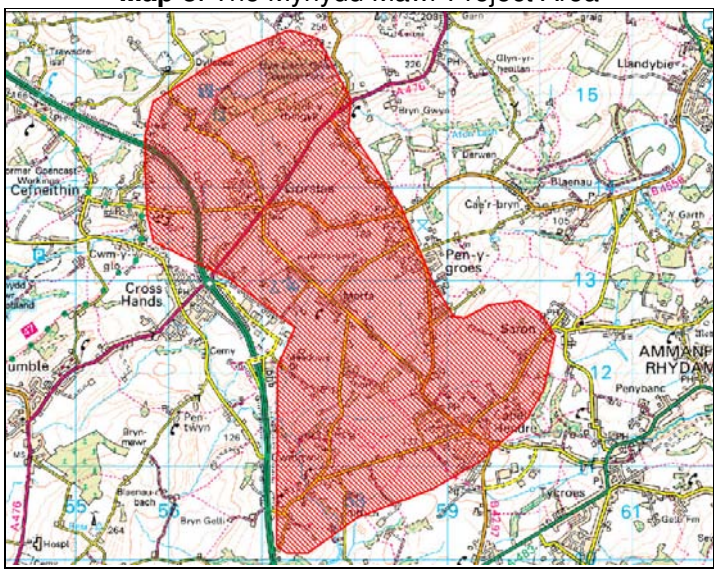
Map 1 and Map 2. The Mynydd Mawr Project Area Location



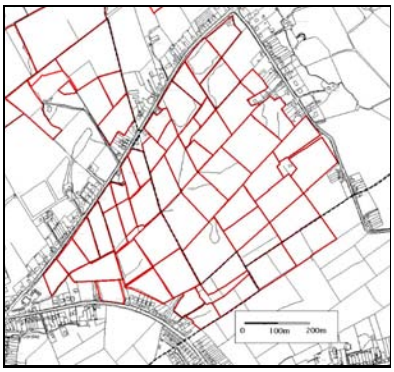
The sites targeted by the Project were identified following an extensive habitat survey in 2001 (Smith *et al* 2001). It was decided to exclude two outlying groups of fields identified in 2001, to concentrate on the core area around Cross Hands. A number of additional fields were discovered during the life of the project, while a few of the fields identified in 2001 were found to have lost their ecological value.

The Project covered a landscape of 24km^2 containing over 250ha of fields considered to have current or potential value for the Marsh Fritillary (see Map 3). The pattern of small land parcels in numerous ownerships still holds, with182 habitat fields belonging to nearly 60 different owners; Map 4 shows a typical example.

Map 3. The Mynydd Mawr Project Area



Map 4. Typical pattern of small fields separated by hedgerows and ditches



The average field size is 1.43ha, with fields ranging from only 0.13ha to 4.86ha. These small parcels can be difficult to manage, since livestock need frequent checking and moving to prevent overgrazing. The infrastructure is relatively more expensive than on larger parcels (e.g. more boundary fences and multiple water supplies).

Mynydd Mawr now features a range of small industrial ventures dotted between ribbons of houses and fragments of open land. One of the Project's aims was to open local people's eyes to the rich wildlife hidden in the rhos pasture behind the bungalows, small industrial units and business parks.

1.2 The Marsh Fritillary

The Marsh Fritillary *Euphydryas aurinia* has suffered a dramatic and continuing decline in Britain and throughout its European range over the past century. It is classified as vulnerable in the latest Butterfly Red List for Great Britain (Fox *et al* 2010), because of a population size reduction of 30-49% over the last 10 years (estimated from a 46% decline in area of occupancy between the survey periods 1970-1982 and 1995-2004). It is protected under Schedule 5 of the Wildlife & Countryside Act 1981, and is a Section 42 (of the Natural Environment & Rural Communities Act 2006) Species of Principle Importance in Wales, a UK Biodiversity Action Plan (BAP) species and an Annex II species in the EC Habitats Directive (Council Directive 92/43/EEC). In the UK the Marsh Fritillary is now restricted to damp grasslands in south and west Wales, southwest England and southwest Scotland, and chalk grasslands in southern England.

Devil's-bit Scabious *Succisa pratensis*, the Marsh Fritillary larval foodplant

Tussocky grasses with Devil's-bit Scabious provide warm sheltered pockets in which Marsh Fritillary eggs and larvae can develop

1.3 Rhos pasture

Rhos pasture, or purple moor-grass *Molinia caerulea* and rush *Juncus* pasture, occurs only along Europe's Atlantic edge. These damp *Molinia* meadows form in areas of high rainfall on poorly drained clay and peat soils. Roughly 24,000ha of rhos pasture are believed to remain in Wales, 43% of the UK total (UK BAP); 20% of that is found in Carmarthenshire (Carmarthenshire Local BAP). It is a Section 42 (of the Natural Environment & Rural Communities Act 2006) Habitat of Principle Importance in Wales, a UK BAP priority habitat and is listed in the EC Habitats Directive.

In addition to Devil's-bit Scabious *Succisa pratensis*, which is the Marsh Fritillary's chief larval foodplant, rhos pasture can be rich in plants such as sedges, orchids, the locally important Whorled Caraway *Carum verticillatum* and, on less acid soils, Meadow Thistle *Cirsium dissectum*. Rhos pastures are home to many other threatened BAP species, such as Cuckoo *Cuculus canorus*, Reed Bunting *Emberiza schoeniclus* and Grass Snake *Natrix natrix*, while Dormice *Muscardinus avellanarius* live in the intervening hedgerows and scrub. The grasslands are rich in moths, spiders, beetles and many other invertebrates.

The combined effects of agricultural improvement, drainage, inappropriate management and urbanisation have destroyed and degraded rhos pasture across Wales. Much of the remaining habitat is in small, isolated fragments. Yet the Marsh Fritillary requires very large, continuous or closely connected patches of habitat to persist in the long term (ideally at least 80ha), due to the large fluctuations in their numbers at any one location over time (Bulman *et al* 2007). Therefore, Marsh Fritillary conservation demands a landscape approach - the butterfly is unlikely to survive unless owners and managers of rhos pasture spread across the landscape manage the habitat sympathetically.

2.0 Project delivery

2.1 Aims

The primary aim of the Project was to increase and connect the amount of habitat under sustainable, appropriate management for the Marsh Fritillary and other priority species, to ensure the long term viability of Mynydd Mawr's Marsh Fritillary metapopulation.

The second priority was to raise awareness of the importance of rhos pasture and the butterfly in the local community.

This Project was set the following specific priorities:

- Deliver actions in the Carmarthenshire LBAP for the Marsh Fritillary and rhos pasture, along with other species associated with this habitat.
- Develop and deliver an innovative biodiversity landscape project for a flagship invertebrate species.
- Disseminate best practice during and at the end of the project.
- Raise awareness in the local community and provide opportunities to enjoy their local environment and contribute to the Project.

This report focuses on how these aims and objectives have been achieved between 2004 and 2010, and the lessons learnt that have wider implications for other landscape-scale conservation projects. Appendix 11.1 shows a summary of the Project outputs.

2.2 Management agreements

The main tools for achieving the Project's aims were purpose-built land management agreements. These offered payments to owners of all suitable or potential Marsh Fritillary habitat who were willing to manage their land with appropriate grazing. The management payments were delivered through CCW Section 15 (Countryside Act 1965) agreements if the land was a SSSI, or through Section 39 (Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way Act 2000) agreements if on non-designated land, and featured:

- A five-year agreement between the owner and CCW
- £90 per hectare annual payment for management
- The full cost of capital works (usually)
- In most cases, capital works were coordinated by the Project Officer, and contractors were paid by CCW or Butterfly Conservation Wales
- A few owners undertook the capital work themselves, or used their own contractors, and were paid an agreed fee following the satisfactory completion of the work

Due to unforeseen circumstances, the funding for the management agreements was not delivered until the third year of the project. The first agreement was signed in late 2006 and the last in 2008. Some sites required fencing and water supplies before grazing could commence. Therefore, there were only a maximum of three grazing seasons in which to influence grazing regimes. Table 1 shows details of the agreements. £10,667 has been spent by CCW in annual payments so far. These

payments will continue for the life of each 5-year agreement, as long as the owner continues with sympathetic management. This will amount to an additional £20,000. See Section 7.1 for the discussion of the Project's progress with agreements.

Table 1. Summary of Management Agreements and Advice

Type of Agreement	Hectares	No. of owners
*** Mynydd Mawr on non-SSSIs**	**54**	**5**
± SSSI agreements initiated and/or managed by Mynydd Mawr Project	15	3
SSSI agreements managed by CCW	8	1
† Informal Project agreements	9	2
‡ Tir Gofal	21	2
Total agreements	**106**	**13**
Management and wildlife advice given (without management agreement)	29	8
** Mynydd Mawr agreement which ran for 2½ years, cancelled 2009 (see section 3.2)*	*5*	*1*
Total influenced	**141**	**22**

* Section 39 CCW management agreements on non-designated sites
± Section 15 CCW management agreements on designated sites
† Informal agreements between the Project and the landowners, funded by the National Grid
‡ Welsh Assembly Government agri-environment scheme

2.3 Capital works

The following capital works were funded by the Mynydd Mawr Project.

Table 2. Capital works 2007-2009

Fencing	Water piping	Scrub clearance	Rush/ *Molinia* cutting	Ragwort pulling	Gates	Water troughs	Culverts
2347m	570 m	5.5 ha	8.7 ha	10 ha	8	6	2

In nearly all cases, the work was organised and managed by the Project Officer. This included tendering three quotes for all jobs over £1000 (most instances), writing a detailed job specification, supervising the contractor and inspecting the job on completion before approving payments. Local Carmarthenshire contractors and suppliers were used whenever possible, in order to contribute to the local economy and strengthen local businesses.

Nearly £22,000 was spent on capital works by CCW, and a further £10,000 for works on informal agreements came from the National Grid ('Felindre to Tirley Pipeline Butterfly Habitat Restoration Enhancement Project').

New fences and scrub clearance at one of the Mynydd Mawr Agreement sites

2.4 Working with landowners

Unlike other landscape scale conservation projects, most of the Mynydd Mawr landowners are not farmers and have no agricultural background. They have never been dependent on their land for any income and are outside the agri-environment scheme loop. Therefore, one of the key points of this Project was to make the scheme as simple, clear and easy as possible to join. The scheme was designed by the Project Officer and CCW, with the aim of keeping all paperwork straightforward and to a minimum, and the process of joining the scheme was rapid (see Appendix 11.2 for a sample management agreement). After careful discussions with owners about what they wanted or needed from their land, the Project Officer prepared the agreement, including devising the estimated grazing level to create the desired tussocky sward and identifying necessary capital works. The scheme was not competitive; all fields with suitable or potential Marsh Fritillary habitat were eligible. Intervening non-habitat fields in the same ownership were also considered. This contrasts with the more complicated and competitive application procedures of most agri-environment schemes. Many Mynydd Mawr owners would not have qualified for Tir Gofal (the Welsh 'higher-level' agri-environment scheme) as their land is not classed as an agricultural holding or is too small to qualify. Furthermore, the opportunities to join Tir Gofal and Tir Cynnal (the 'entry-level' scheme) have been very limited in recent years.

The Project's first task was to contact all owners of suitable land. CCW only held contact details for the owners of protected sites, some of which were out of date. The 2001 habitat survey had also identified a few owners. All of these were approached in 2004. The Project Officer tracked down many other owners by knocking on doors, writing letters and speaking to neighbours, Country Park staff, County Councillors, Community Councils and other local people. The Land Registry was consulted several times, which yielded some results, although a sizeable proportion of fields are not yet formally registered. At least 75 individuals were contacted during this process, many of whom turned out not to own the relevant fields. Eventually the owners of all but a couple of fields were found and contacted. In the end, a total of 49 owners were contacted, including 38 newly-found ones.

The Project Officer visited or spoke to 26 owners (representing 157 ha of grassland), initially to explain the project. Nine of these, owning 60ha, were already in other management agreements, and the project went on to work with five of them. This included owners of Tir Gofal sites that, despite being in the scheme, were not managing their land sympathetically for the Marsh Fritillary. Another owner joined the Mynydd Mawr scheme after his Tir Cymen (the predecessor to Tir Gofal) agreement expired. All of the rest of the owners were offered Mynydd Mawr agreements. A further 10 owners of 38ha had no interest in speaking to the Project Officer, and 10 more (17.7ha) did not reply to any attempts to contact them.

The Project Officer met with the interested owners several times, to explain the Project and discuss the owners' needs and aims for their land. CCW's Regional Land Agent assisted on some of these early visits. Grazing regimes and capital works requirements (fences, gates, water supplies, and scrub encroachment) were assessed on all eligible fields. In total, nearly 80 meetings and/or site visits were held with owners. Amenable owners who were not interested in signing up at the beginning of the Project were contacted a second time, after a suitable interval, to offer them another opportunity to join.

2.5 Tools to inform landowners

The Project developed several tools to inform landowners and other interested members of the community about the Marsh Fritillary and its habitat.

- A newsletter was produced in 2007 and distributed to all landowners in the Project area, as well as all Butterfly Conservation Wales members and all of the Project's partners, supporters and volunteers. It was also distributed via local

shops, libraries, country parks, the National Botanic Garden of Wales, etc. The newsletter served as publicity for the project, explaining how the Project worked and highlighting the wildlife value of the area, and also acted as an advice sheet on Marsh Fritillary management.

- A free, laminated identification sheet was produced and given to all interested landowners. It featured local butterflies and day-flying moths on one side and local meadow wildflowers on the other.

- Illustrated survey reports detailing the key species found on their land were produced for interested landowners.

3.0 Implementing management

3.1 Grazing

The ideal tussocky habitat for the Marsh Fritillary can only be maintained by light pony or cattle grazing – not necessarily every year, but frequently enough to prevent the sward from becoming rank and scrubby. The precise number of grazing animals varies between sites and seasons, but the Project advised a grazing level of 0.3 livestock units (LU) per hectare, averaged over a year. Grazing was generally only allowed between May and October (but not necessarily for this entire period, dependant on the size of the site, number and type of animals).

Mowing is generally not an appropriate tool, since it creates a uniform sward. However, it can be useful to freshen up rank sites, as long as the arisings are cleared away (to prevent them smothering the vegetation beneath) and it is followed by grazing. Carefully controlled winter burns can be successfully used to clear dead thatch and scrub quickly and inexpensively. However, the Project did not practice burning since there was no local expertise available to carry it out safely. Additionally, the Project did not want to send out the message that burning is acceptable, because arson is such a serious problem on grassland throughout Wales.

The Project directly influenced grazing on 79ha of land (see Figure 1 and Table 3), adjusting the grazing level as needed. This included 54ha in Mynydd Mawr Section 39 agreements, 15ha in Section 15 agreements, 9ha in informal agreements and 1.4ha in Tir Gofal. Graziers were introduced to Caeau Ffos Fach SSSI, the formerly undergrazed Butterfly Conservation Wales Reserve, which is now grazed by Welsh Black cattle, and an ungrazed site which has been managed with a local grazier's Welsh mountain ponies.

Once the stock were on site, it was necessary to monitor and adjust grazing throughout the season, to ensure areas were not over- or undergrazed. Sixty-two grazing check visits were made between 2007 and 2009.

Figure 1. Management Changes on Mynydd Mawr Agreement Sites

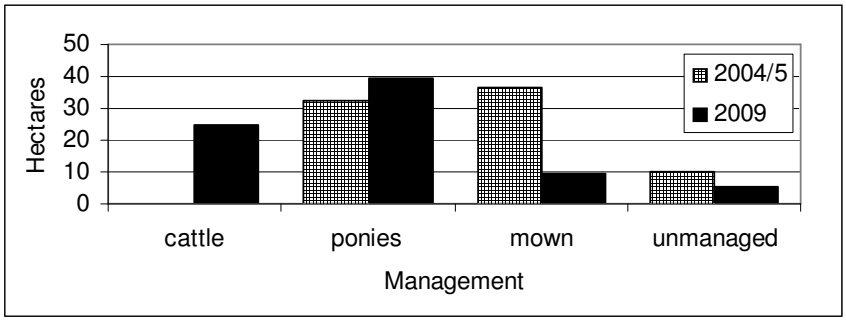


Table 3. Management Changes on Mynydd Mawr Agreement Sites

Management	**2004/5** (hectares)	**2009** (hectares)
cattle	0	24.6
ponies	32.5	39.7
cut	36.4	9.2
unmanaged	10.1	5.5

Cattle grazing increased on agreement sites from zero to nearly 25ha, and pony grazing was extended by 7ha. Grass cutting had been a problem on some sites, but the mown area was reduced on Mynydd Mawr sites by 75%. Nearly 7ha of the remaining cut area was carefully cut and arisings removed as part of an informal Project agreement (see Case Study 2), since grazing was impossible on this site. The rest of the mown fields (2ha) had very little Marsh Fritillary habitat and were aftermath grazed. The Project Officer has also worked to dissuade people from unnecessarily topping their land in September, a popular practice in the area.

Pony ownership is traditional in South and West Wales and the majority of grazed sites in the Project area (48 fields, 72ha, 17 owners) were grazed by ponies or horses. Some of these animals were ideal at creating the tussocky mosaic needed by the Marsh Fritillary, while others produced overgrazed lawns and rank latrine areas. In general, smaller hardier ponies such as Welsh mountain ponies are better at creating tussocky sward than large horses. However, the type of grassland on which an animal has been reared is the most important factor. See Case Study 1 for an example of how large Welsh cobs can sensitively graze Marsh Fritillary habitat.

Ponies and horses may create short lawns and rank latrine areas

Welsh Black cattle are ideal at creating tussocky Marsh Fritillary habitat

Deborah Sazer, the Project Officer, plans capital works with the owner/grazier and contractor

Prize winning Welsh cobs thrive on and improve rhos pasture for the Marsh Fritillary

Case Study 1: Prize-winning Welsh cobs manage rhos pasture: a successful partnership between 3 landowners and a grazier

The Mynydd Mawr Project developed a grazing scheme with three landowners and one owner/grazier. The grazier's Welsh cob mares and foals have been sensitively grazing 10 ha on three agreement sites: Caeau Lotwen SSSI (part of the Caeau Mynydd Mawr SAC), Brown Hill Farm (owned by the grazier) and Caeau Capel Hendre SSSI. The Project also found winter grazing for some of the mares at the Grasslands Trust Reserve (Carmel National Nature Reserve) which adjoins the Project area. The Project commissioned, supervised and paid for 100% of the costs of new boundary fences, gates, water supplies and bramble clearance at both Caeau Lotwen and Brown Hill, and regular ragwort pulling at Caeau Capel Hendre. A hedgerow at Caeau Lotwen was also fenced, to encourage regeneration after being damaged in the past by winter pony grazing. All fields are now being summer grazed to produce a tussocky sward for the Marsh Fritillary and a wide range of other wildlife.

This grazier/owner is a renowned breeder of prize-winning Welsh cobs. His stud won a Progeny award at the 2009 Royal Welsh Show - its offspring won the greatest number of prizes in their category that year. Rhos pasture is perceived as poor grazing land by many livestock owners, but these healthy ponies illustrate how well livestock can thrive when grazed on *Molinia* grassland, and how well the grassland fares under a sensitive grazing regime, whatever the pony breed.

An additional 0.6ha of suitable habitat has been created on these agreement sites (between 2004/5 and 2008/9), while rank area has declined by the same amount. Caeau Lotwen is the only one of the 3 sites that has been occupied by Marsh Fritillaries during the life of the project, and the numbers have declined in the past few years (as they have throughout Wales). One egg-laying female was seen in 2008 and no adults or larval webs were recorded in 2009. Nonetheless, the Project has expanded and linked up suitable habitat in the surrounding landscape, to enhance the Marsh Fritillary metapopulation and increase the potential for future re-colonisation.

Nearly 25ha, including the three largest blocks in single ownerships, are cattle-grazed. Cattle, particularly hardy breeds such as Welsh Blacks, are generally better than ponies at creating a tussocky sward suitable for Marsh Fritillaries. Again, the animal's background is most important and most breeds of cattle can do a good job if they are accustomed to rough grazing. Unfortunately, there are not many cattle in the Mynydd Mawr area and the Project had to employ a local stock-checker to look after the cattle at Caeau Ffos Fach since the owner lives too far away to check them regularly. While most landowners without stock are happy to have ponies on their land, they are less comfortable with cattle. An even more crucial point is that cattle are not practical on the numerous small holdings in Mynydd Mawr, because even small herds require too much micro-management. Cattle also come with their own issues, due to disease control restrictions and potential movement bans.

Sheep are not ideal grazers of Marsh Fritillary habitat, since they preferentially graze out Devil's-bit Scabious, the larval foodplant. Fortunately, none of the Mynydd Mawr sites with suitable or potential habitat are currently sheep-grazed, although it is likely that some fields were damaged by high sheep-stocking levels in the past.

3.2 Problems and solutions

Some owners consider their fields as extensions of their gardens, or as a buffer to give them privacy. It was difficult to overcome a few owners' wish for a manicured garden extension, rather than a wildlife habitat. The Project had to admit failure and cancel one agreement because the owner broke its terms by repeatedly mowing an area where Marsh Fritillary larval webs had been recorded, because he wanted it to look 'neat and tidy'.

The most difficult problem to solve has been the overgrazing of pony paddocks. The paddock owners range from people with one or a few pet ponies, to pony breeders, show horse trainers and a livery stable – all on an insufficient amount of land. Few of them are willing or able to reduce their livestock numbers. Many owners use their paddocks merely as somewhere to park their ponies, frequently throughout the year. Large areas are grazed down to centimetre-high lawns, while latrine areas become tall and rank and hay-feeding areas become enriched. The owners do not consider the land or vegetation as having intrinsic wildlife value or in need of any special management.

The Project had hoped to find additional grazing for some of these ponies, but this rarely proved possible. Owners understandably want their valuable horses/ponies close by, in order to keep an eye on them and to be able to look after them when they get home from work. Their neighbours did not always need additional grazing, and neighbours did not always want to enter into grazing arrangements with each other.

Seventy hectares in 24 ownerships outside of agreement sites are not managed at all. Many of these sites are in blocks of land that have been designated for future development. However, a short-term solution was found to improve the habitat structure on one site that had been unmanaged for many years - see Case Study 2.

Case Study 2: Alternative Management Solutions

One of the best Marsh Fritillary sites, and the only occupied site in the north of the Project area, had not been grazed for years. The butterflies survived on small flushed *Sphagnum* patches, the only remaining open spots in nearly 7ha of dense *Molinia* sward. The plant and invertebrate interest was still high, but this biodiversity was under threat without management. After many years of trying to agree a suitable grazing arrangement, it was clear that the owners would never be comfortable with livestock on their land.

Therefore, the Project reached an informal agreement with the owners in winter 2009/10, to carefully cut and remove the dense *Molinia* stands and clear encroaching bramble, away from Marsh Fritillary larval web areas. Small, light-weight machinery was used to minimise damage to the sensitive vegetation and soil structure. The cut was designed to create as much 'edge' as possible, to provide ideal microhabitats for the butterfly's eggs and larvae. It is hoped that this will ensure a future for the butterfly in the short term. It would be ideal to cut the rest of the site (away from areas with larval webs) in 2011. However, without follow-up grazing or long-term funding for rotational cutting, this significant colony will remain vulnerable.

4.0 Planning

Carmarthenshire County Council (CCC) has begun to take its responsibilities to have regard for the conservation of biodiversity seriously, under the Natural Environment and Rural Communities Act 2006. All plans and projects within and adjoining the Caeau Mynydd Mawr SAC are subject EC Habitats Regulations Assessments, which requires CCC to avoid adverse impacts on the SAC and to adopt the 'precautionary principle' when potential effects cannot be known.

Cross Hands was understandably targeted for regeneration following the decline of the mining industry. It was identified as a key growth area in Carmarthenshire County Council's Unitary Development Plan (UDP) 2006 (before the NERC responsibilities were in place) and the Carmarthenshire Local Development Plan Pre-Deposit Preferred Strategy 2009. For many years before this, the Council had allowed ribbon development throughout the Mynydd Mawr area, which accelerated the fragmentation and isolation of Marsh Fritillary populations. In association with the Welsh Assembly Government, CCC encouraged the development of several large business parks, not only on former mining sites but also on rhos pasture.

Map 5. Developed areas amidst Marsh Fritillary habitat enclosures (in red)

Current plans include numerous sites designated for housing, including a number of small to medium-sized estates, as well as a doubling in size of the business park associated with a new bypass (the Cross Hands Economic Relief Road). Parts of original proposals for the business park and road infringe not just on the Caeau Mynydd Mawr SAC but also on a number of other sites containing suitable and potential Marsh Fritillary habitat, several with recent Marsh Fritillary records. Meanwhile, despite the recession, developers have been pressing ahead with planning applications in 2009/10. All of these developments in combination are likely to further fragment and isolate habitat and reduce permeability of the landscape for the butterfly even further.

The Project has worked closely with CCW and Carmarthenshire County Council's Conservation Section to develop strategies for dealing with the many development threats to the SAC and other land. This has included coming to grips with planning and habitat protection legislation and the 'in-combination' effects of continual development. Mitigation and compensation strategies are being considered, including plans to avoid damage to the SAC by the proposed business park and link road. The Project delivered a presentation in 2008 to a meeting with CCC's Forward Planners, Transport

Department and Conservation Section, the Welsh Assembly Government and CCW. Following this meeting, the Council agreed to fund a Marsh Fritillary habitat survey of the entire metapopulation landscape surrounding Mynydd Mawr in 2009 (see 7.2.1, 7.2.2 and 8.5 for results). CCC also imposed a moratorium on any planning consents in the area pending the outcome of this survey.

However, the previous pattern of development has created an expectation among many owners that they will be allowed to develop their land. Even some owners who have been denied permission in the past believe that they will gain approval once the road and subsequent developments are in place. This development atmosphere has had a detrimental and not entirely expected effect on the Project's progress. The plans for Cross Hands have been interpreted as a threat by some local landowners, but as a promise by many others who hope to exploit their land. Land values are relatively high, due to the business parks and the potential for future growth, as well as good transport links to Swansea and Cardiff. The £90 per hectare that the Project offers is no compensation to someone planning to fund their retirement by constructing a couple of bungalows on their fields, let alone to a commercial developer who has bought the land precisely to develop it. At the very least, it has made quite a few owners reluctant to commit themselves to a five-year management plan. One site near the proposed link road route, on which Marsh Fritillary larval webs were recorded in 2005, was ploughed in 2009 with the aim of reseeding it for sheep grazing. The owners had previously been denied planning permission for housing on this site. They were ordered to reinstate the land under the Environment Impact Assessment Regulations, but the damage had already been done.

5.0 Working in Partnership

5.1 Countryside Council for Wales

The Mynydd Mawr partnership between Butterfly Conservation Wales and Countryside Council for Wales has been very successful. CCW provided 75% of the Project funding, with the rest funded by Butterfly Conservation (11%), the National Grid (5%) and volunteers (9% 'in kind'). CCW also generously shared GIS and other data. Unfortunately, funding for the management agreements was delayed until 2006, which held back progress. The Project Officer worked closely with CCW's Land Agents to design and develop the management agreements and with CCW's Senior Invertebrate Ecologist to identify a candidate area for an enlarged Mynydd Mawr SSSI. CCW also provided significant formal and informal training. A secondment to CCW was arranged for the Project Officer in 2007, to write the Core Management Plan for the Caeau Mynydd Mawr Special Area of Conservation (SAC).

5.2 Other Partners

A close working relationship was established with the Conservation Section of Carmarthenshire County Council. This included joint activities such as a stand at the 2005 Biodiversity Fair and a Project talk and site visit with the County planners.

The Project was an active member of the Local Biodiversity Action Plan partnership and worked closely with other members, e.g. joint walks with and talks to the East Carmarthenshire Wildlife Trust group and the Llanelli Naturalists. The exchange of ideas with and the support of LBAP members were vital to the success of the Project. See Appendix 11.3 for full details of all Mynydd Mawr Project Partners.

Case Study 3: Key partnership

A key partnership was established with the Carmarthenshire County Council Ranger Team at Llyn Llech Owain Country Park (LLO) in the north of the Project area. They worked closely together throughout the life of the Mynydd Mawr Project, as grazing schemes were established by both projects. The LLO staff shared their grazing experience and organised pony handling training for the Project Officer, who in turn provided advice about management for the Marsh Fritillary as well as butterfly and water shrew surveys in the Park.

The Mynydd Mawr Project was consulted on the Park's conifer removal scheme under a Heritage Lottery Grant – this led to a partnership project between the Park, the Project and Coed Cymru to remove a 1.5ha block of conifers to facilitate movement of Marsh Fritillaries between habitat patches to the north/northwest of the Park and patches to the south. Using an informal agreement funded by the National Grid, the Mynydd Mawr Project paid for and arranged the installation of fencing, gates and culverts on this new habitat, to allow grazing by the Park's Exmoor ponies. The Park and Project then organised a Devil's-bit Scabious Volunteer Group to grow plants for this new grassland, with help from Flora Locale's Wild Meadows Project – (see 6.3 for details).

Conifers have been cleared to provide a fly-way and potential new habitat for the Marsh Fritillary

The two projects assisted each other at many events, including the Project Celebration (See 6.1). A joint event was held with Awaydays, a charity that organises days out for adults with mental health issues. The visitors created a 3-D Mynydd Mawr Project display for use with school groups who visit the park.

6.0 Engaging the local community

6.1 Events

Nearly 400 people participated in 25 events to inform and engage the public. These included wildlife walks, talks to local groups and volunteer training events (e.g. Marsh Fritillary and reptile survey training). See Appendix 11.4 for a full list of events.

A large Project Celebration was held in 2007. Landowners, contractors, volunteers, CCW and many other partners gathered at Llyn Llech Owain Country Park to learn about the Project and then visit one of the key management agreement sites at Caeau Lotwen SSSI (part of Caeau Mynydd Mawr SAC). This visit was in partnership with Dyfed Archaeological Trust, who showed guests the 3 standing stones that remained of Y Naw Carreg (The Nine Stones) Ancient Monument.

The Mynydd Mawr Celebration at Caeau Mynydd Mawr SAC

The Project Officer also attended numerous events held by other organisations to inform them about Marsh Fritillary management and assist the organisers.

6.2 Publicity

The Mynydd Mawr Project Celebration received radio, TV and press coverage in both the English and Welsh language (See Appendix 11.5.1). The Project received further coverage in several South Wales newspapers and in the CCW newsletter Adain y Ddraig, and over 25 articles written by the Project Officer appeared in a range of publications. See Appendix 11.5.2 for full details.

The Project poster was displayed at six large Welsh, UK and international conferences, where a Project leaflet was also distributed (see Appendix 11.5.3). In addition to a number of leaflets written specifically for the Project, the Mynydd Mawr Project Newsletter served both to publicise the Project's work with local landowners and as an advisory leaflet on Marsh Fritillary management. See Appendix 11.5.4 for details of all publicity materials produced by the Project.

6.3 Volunteers

The Mynydd Mawr Project generated nearly 500 hours of volunteer time. This ranged from training and education events to volunteer surveys of Marsh Fritillaries, birds and reptiles, and habitat management work at Butterfly Conservation Wales' Caeau Ffos Fach Reserve.

The Devil's-bit Scabious Volunteer Group was established in 2009, in partnership with CCC Llyn Llech Owain Country Park and the Wild Meadows Project (see Case Study 3). The group collected fresh Scabious seed from the neighbouring Rhyd y Gwiail SSSI. Ten individuals along with the Mencap Cymru Conservation Group and Gower Wildflower Centre have grown the seed over the winter and will plant them out into the Park's newly cleared grassland in summer 2010. Despite the end of the Mynydd Mawr Project, it is hoped that this volunteer group will continue to monitor the Scabious, as well as grow other locally-sourced wildflowers for the Park, other wildlife sites and their own gardens.

7.0 Outcomes

7.1 Management agreements

The Project offered agreements to all owners of suitable or potential Marsh Fritillary habitat in Mynydd Mawr. Other than one prepared agreement which is on hold at the owners' request, no other owners within the current Project area are likely to sign up in the near future. However, 5 owners of 54ha signed up to Mynydd Mawr agreements, and owners of another 3 SSSIs (15ha) were entered into Section 15 agreements and/or managed by the Project Officer. The Project Officer worked with another owner

in a Mynydd Mawr agreement for 2½ years before reluctantly deciding to cancel the agreement (see Section 3.2). The Project also entered into informal agreements with 2 owners on another 9ha. Management and/or wildlife advice was given to a further 8 owners (29 ha) who did not enter into any formal agreement (see Table 1). The owners and managers of many other Marsh Fritillary sites outside of the Project area were also influenced through talks, articles and site visits.

Most of the agreement holders have significantly improved the management of Marsh Fritillary habitat, and several have developed an interest in the butterflies and other species found on their land, such as dormice and moths. Other owners outside of agreements are also doing their best to maintain and improve wildlife habitats, although overgrazing remains widespread.

However, some owners are unlikely to ever be interested in the scheme, and are content to carry on intensively grazing their land or leaving it unmanaged. A number of them do not want or are unable to commit to an extensive grazing regime. Many own too many ponies or horses for the size of their land. Some, such as the livery stable owners and pony breeders, cannot afford to restrict their businesses by limiting their stocking levels. Others do not want to make a 5 year commitment, due to uncertainty over the future or concern that their children or potential purchasers would be burdened with the commitment.

A proportion of owners are planning to develop their land, or do not want to jeopardise the potential for developing their land in the future. They will not consider joining the scheme, even when they have already been turned down for planning permission and/or are outside of the development limits. Not all agreement holders understood or cooperated with the Project aims, despite great efforts to enthuse them through meetings and site visits. A few people signed up merely for the money, or because they wanted ‘to do their bit for the environment’, but they had no interest in understanding the needs of the Marsh Fritillary or any other wildlife.

7.2 Biological outcomes

7.2.1. Habitat quality

Marsh Fritillary habitat quality was mapped on all accessible fields using CCW’s Habitat Quality Mapping guidance (Fowles 2005). Habitat patches were mapped using the definitions in Table 4. See Maps 5 and 6, below, for examples of maps showing habitat change on one Mynydd Mawr Agreement site.

Table 4. Habitat condition categories (Fowles 2005)

GOOD QUALITY (GC): For at least 80% of sampling points, *Succisa* present within a 1m radius & the vegetation height is 12-25 cm. Scrub (>0.5 metres tall) covers no > than 5% of area.
SUITABLE (UNDER-GRAZED) (SU): *Succisa* occasional/frequent/abundant & vegetation height is >25cms. **Or** sward height is between 12-25 cms, but scrub (>0.5 metres tall) covers > 5%.
SUITABLE (OVER-GRAZED) (SO): Frequent/abundant *Succisa* but which is currently over-grazed such that the sward is below 12cm on average. Can include mown swards.
SUITABLE (SPARSE) (SS): Rare/occasional *Succisa* & vegetation height <25cm on average.
POTENTIAL (RANK) (PR): Scattered *Succisa* plants, but currently under-grazed or neglected so the sward is > 25cm on average, rank & tussocky.
UNSUITABLE (NS): All other habitat types, including ones that could potentially be restored for marsh fritillaries, but only with considerable resource input

The fields were originally identified and mapped in 2001, using the simpler method of habitat categorisation that was in use at the time (Smith *et al* 2001). Therefore, these early results are not directly comparable to the Mynydd Mawr Project surveys. See Appendix 11.6 for 2001 methods and results.

The Project surveyed just under 95 hectares twice – once at the beginning of the Project in 2004/5 and once at the end (2008/9). An additional 129ha of fields were surveyed only once. This was primarily due to limited access – either lack of permission from the landowner or lack of physical access due to dense bramble and other scrub. A few sites had been damaged (mown or ploughed), or were identified in the first survey as so marginal that they were not prioritised for re-survey. The 2009 Carmarthenshire County Council survey of the wider Marsh Fritillary metapopulation landscape mapped a number of fields within Mynydd Mawr to which the Project Officer was denied access. They found 4.6 hectares of suitable or potential Marsh Fritillary habitat, which have been included in Table 6 if they were also mapped in the earlier survey.

Table 5. Habitat Condition on Mynydd Mawr Agreement Sites (S39, S15 and informal agreement sites managed by the Project): 2004/5 to 2008/9 (hectares).

	2004/5	2008/9
Good condition	5.9	2.4
Suitable sparse	0.4	5.6
Suitable overgrazed	5.1	0.8
Suitable undergrazed	9.6	10.0
Potential rank	3.9	7.2
Not suitable	10.5	8.0
Total	35.4 ha*	34.0 ha*

* The subjective nature of the mapping and recorder variation leads to small differences in the total amount of habitat mapped

Figure 2. Habitat condition changes on Mynydd Mawr Agreement sites: 2004/5 to 2008/9.

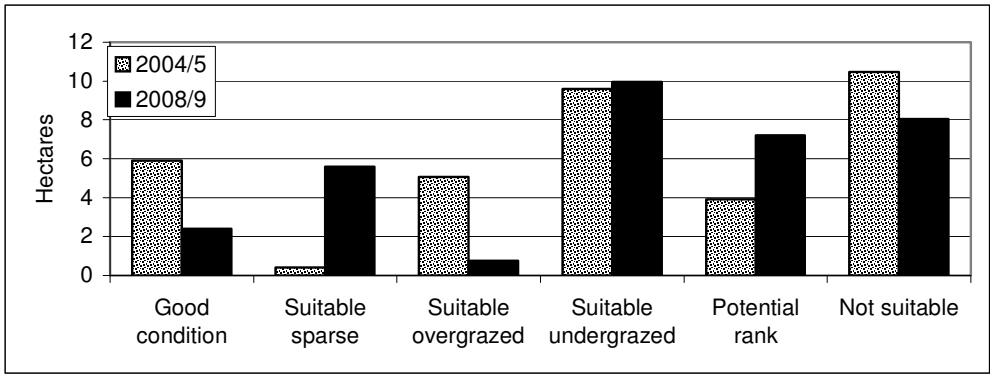


Table 5 includes only those fields that were managed by the Mynydd Mawr Project (Section 39, S15 and informal agreements), and which were mapped in both survey periods. Unfortunately, only 3.3ha of the largest agreement site (36ha) were surveyed in 2005 (since the rest had been identified as not suitable in 2001), so this site is under-represented in the data. All fields were surveyed in 2008 and any notable changes were mapped in 2009, after only a few months of grazing. Only the fields that were surveyed in both 2005 and 2008 have been included in the analysis.

It is too early to assess the biological outcome of the Project over the short period that management agreements have been in place. Different owners entered agreements at different times, so the management of their land has been influenced by the Project for at most 3 years to less than a year. However, initial results indicate that the grazing pressure and habitat condition of *Molinia* grassland and other BAP habitats have improved on many sites.

It can take several years to work out the best grazing levels for an individual site, as they vary annually. It has taken time and patience to work through problems with owners (e.g. continued overgrazing), and management is not yet perfect on all agreement sites. For example, light grazing was introduced on the largest agreement site (36ha) in 2009. While the small number of cattle made a noticeable impact, further work needs to be done to enable appropriate grazing by a larger herd throughout this site, since fencing, hedgerows and/or ditches prevent the cattle from easily accessing the entire holding. Therefore it is much too early for the mapping exercise to illustrate much habitat change. In another case, the introduction of cattle was delayed on a Tir Gofal agreement field which contains one of the key Marsh Fritillary colonies because the owner was ill; she had been topping the field, but has agreed to stop this and begin grazing with cattle in 2010. These types of problems can only be understood and solved by working with the owners and their livestock over time.

The Project had to assess whether to take a hard line and cancel agreements on two sites where owners did not fulfil their obligations, as this would risk losing any influence on the habitat. Thus, the Project agreed to install additional fencing on one site to prevent ponies accessing the field in winter. This, in combination with the owners' agreement to reduce the number of ponies, should solve the perpetual overgrazing. On the other hand, as discussed in 3.2, one agreement was terminated because the owner repeatedly broke its terms.

There is often a time lag between alterations in management and changes in habitat quality. In one instance, scrub was cleared from a field that still contained patches of *Molinia* and Devil's-bit Scabious, with the intention of quickly introducing ponies to graze the re-growth. However, grazing was delayed by many weeks because the neighbouring owners had not installed fencing, as promised. By the time the fence was in place, the vegetation had grown too rank to be eaten by the stock. The owner has now agreed to periodically cut the bramble and rush re-growth herself, but it will take several years for the follow-on grazing to have a measurable effect on the habitat. Case study 2 details the cutting and scrub clearance work on one of the key Marsh Fritillary sites which was only completed in March 2010. The biological results will not be known for some time.

While the majority of surveys were done by the Project Officer, a contractor was used in 2005 and 2008 to help complete the survey work. Both surveyors had extensive experience in using the standardised Marsh Fritillary habitat condition methodology, which was designed precisely to produce comparable data (Fowles 2005). However, on examination of the data, it became clear that there were some disparities in their interpretation of the methodology (regarding the scale at which habitat patches were mapped), which has made it difficult to interpret the some of the results. These habitat mapping methods have been designed pragmatically, to enable accurate recording/mapping within a realistic time frame; thus they are necessarily subjective (Fowles 2005). This inconsistency between interpretations suggests that further clarification may be required in the methodology to limit the room for misinterpretation.

It is important to remember that these surveys are only snapshots of a dynamic habitat that changes and moves each year. Grazing will never be perfect. For example, if a field is grazed hard enough to eliminate all undergrazed patches, there will be a great

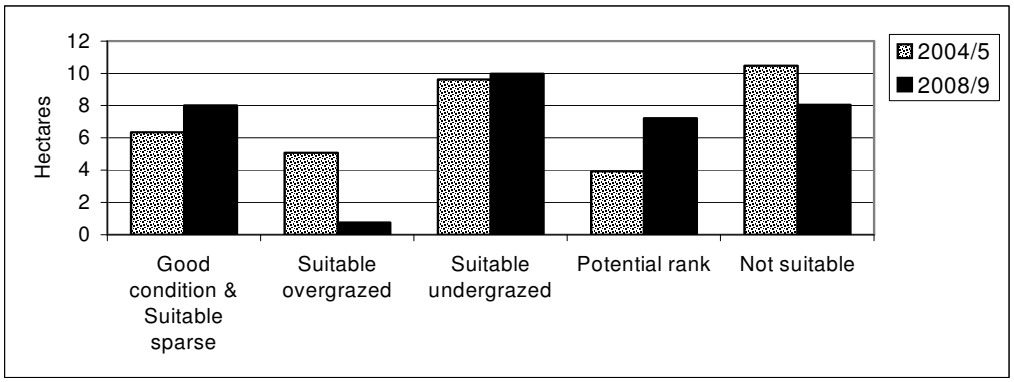
risk of other areas becoming overgrazed. Small fields are particularly difficult to manage, and risk becoming 'over-managed'.

Therefore, for all of the factors discussed above, the figures do not show an increase in the area of good quality and other suitable habitats on agreement sites (Table 5, Figure 2). However, the suitable sparse category was not in use in 2004. Therefore, the apparent decline in good condition and increase in suitable sparse habitat is misleading, and hides much improvement in the level and spread of grazing pressure across sites. The real measure of the Project's success is the improvement in grazing, which is the chief management tool. If the good quality and suitable sparse categories are combined to show the area that is being properly grazed for the Marsh Fritillary (Table 6 and Figure 3), it can be seen that the well-grazed area has increased from 6.3ha to 8.0ha and the amount of overgrazed land has dramatically decreased during the life of the Project. It obviously is not possible to train the animals to concentrate on grazing the spots with plentiful Devil's-bit Scabious (good condition), rather than the areas where Scabious is sparse.

Table 6. Habitat condition changes on Mynydd Mawr Agreement sites, combining Good Condition and Suitable Sparse categories: 2004/05 to 2008/09

	2004/5	2008/9
Good condition and suitable sparse categories	6.3ha	8.0ha

Figure 3. Habitat condition changes on Mynydd Mawr Agreement sites, combining Good Condition and Suitable Sparse categories: 2004/05 to 2008/09



While further monitoring over a longer time period is clearly necessary to gauge the true impact of the Project, these results show that the Project has already had a positive impact on most agreement sites and has clearly improved grazing regimes.

Undergrazed land has remained stable overall, although it has declined on many individual sites. The series of wet years encouraged lush grass growth, which is likely to have increased the amount of sward exceeding the 25cm maximum height which is

suggested for good quality Marsh Fritillary habitat. The wet conditions also meant that some sites could not be managed without causing serious poaching and compaction from machinery. This seriously delayed progress on several sites, such as a rotational rush cut which had to be abandoned.

The apparent increase in potential rank habitat and the decrease in not suitable habitat may highlight the difficulty in distinguishing between potential rank sward (>25cm with scattered Scabious) and rank *Molinia* grassland judged not suitable because no Scabious can be seen. Following the introduction of grazing, Scabious plants smothered by rank *Molinia* may be revealed, thus changing the status from not suitable to potential rank.

Table 7. Habitat Condition on all other sites in the Mynydd Mawr Project Area that were surveyed twice: 2004/5 to 2008/9

	2004/5	2008/9
	hectares	hectares
Good condition	1.52	1.49
Suitable sparse	1.61	1.24
Suitable overgrazed	14.73	11.27
Suitable undergrazed	16.19	12.84
Potential rank	13.72	7.95
Not suitable	9.56	25.18
Total	57.34*	59.97*

* The subjective nature of the mapping and recorder variation leads to small differences in the total amount of habitat mapped

Figure 4. Habitat condition changes on all other sites that were surveyed twice: 2004/05 to 2008/09 (n.b. different scale from Figures 5 and 6)

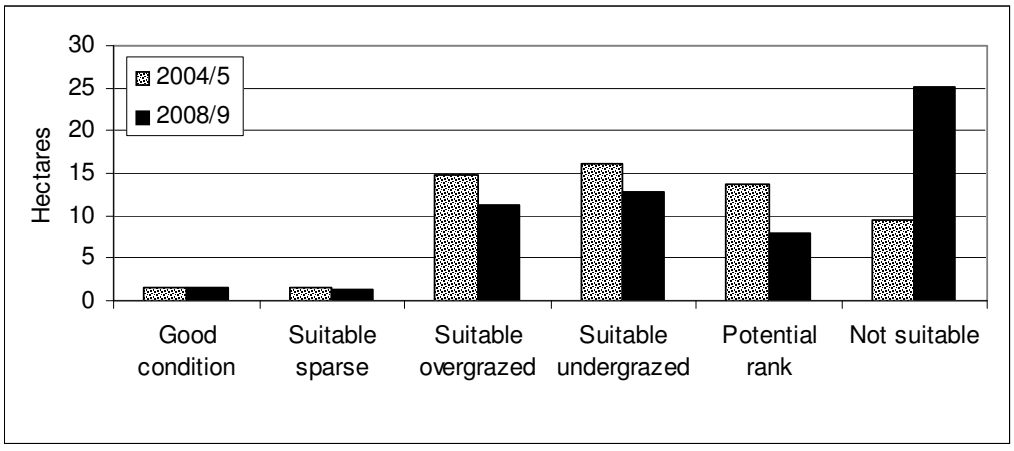


Table 7 and Figure 4 show the changes over the same time period on non-Mynydd Mawr agreement sites. This shows that the amount of good condition and suitable

sparse habitat has remained fairly stable, but the amount of not suitable habitat has increased considerably. This probably reflects both the inconsistencies in recorder interpretation of the mapping guidance and increasing encroachment by scrub and rank vegetation through a lack of management.

Habitat change can be seen and understood better by examining each site independently. Figures 5 through 7 illustrate the improvement in habitat condition on two agreement sites.

Figure 5 shows the positive results of the management changes at Caeau Capel Hendre SSSI under the Project Officer's guidance. Most importantly, the grazing was spread much more evenly throughout the site. All of the area that was judged not suitable in 2004/5 (grassland that appeared to have no Devil's-bit Scabious) was revealed to indeed contain Scabious following light grazing, and most of this was re-categorised as suitable sparse. Overgrazing has ceased, and most of the undergrazed area is in a field which the pony tends to avoid because of the dog walkers using the footpath.

Figure 5. Habitat condition changes at Caeau Capel Hendre SSSI: 2004 and 2008

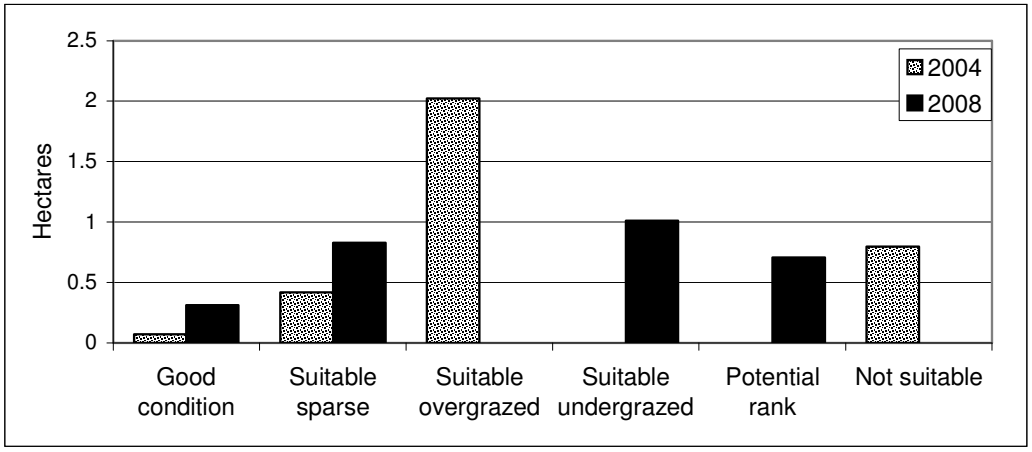
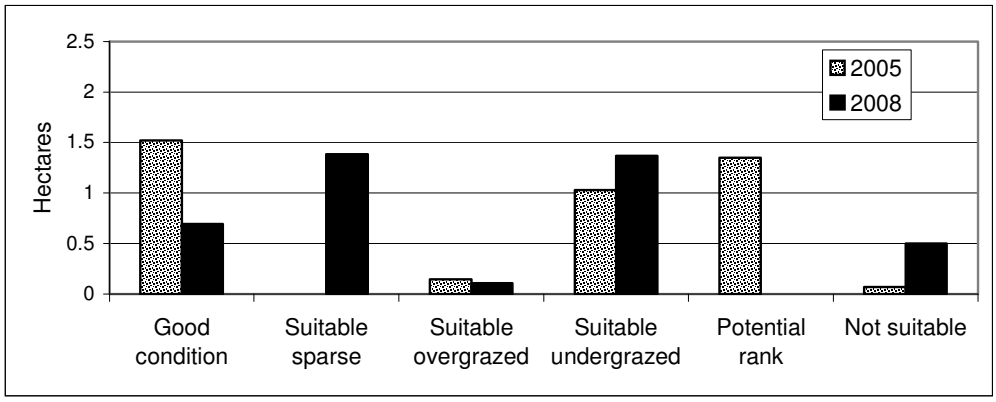
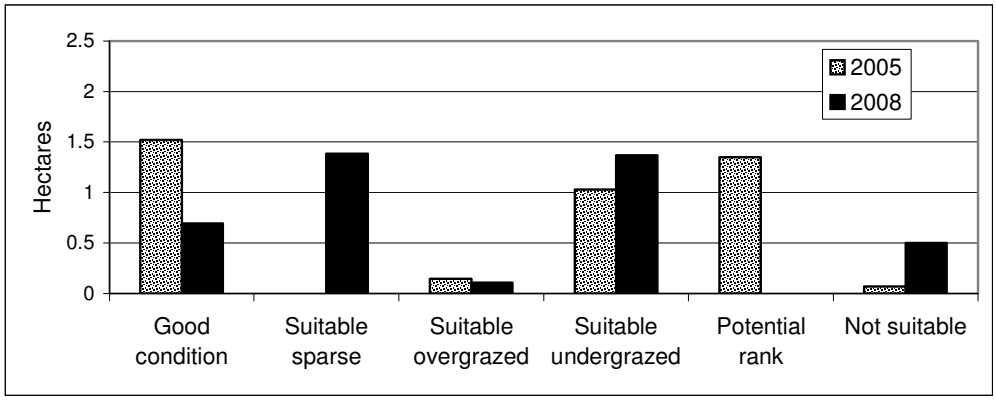


Figure 6. Habitat condition changes at Caeau Lotwen SSSI between 2005 and 2008



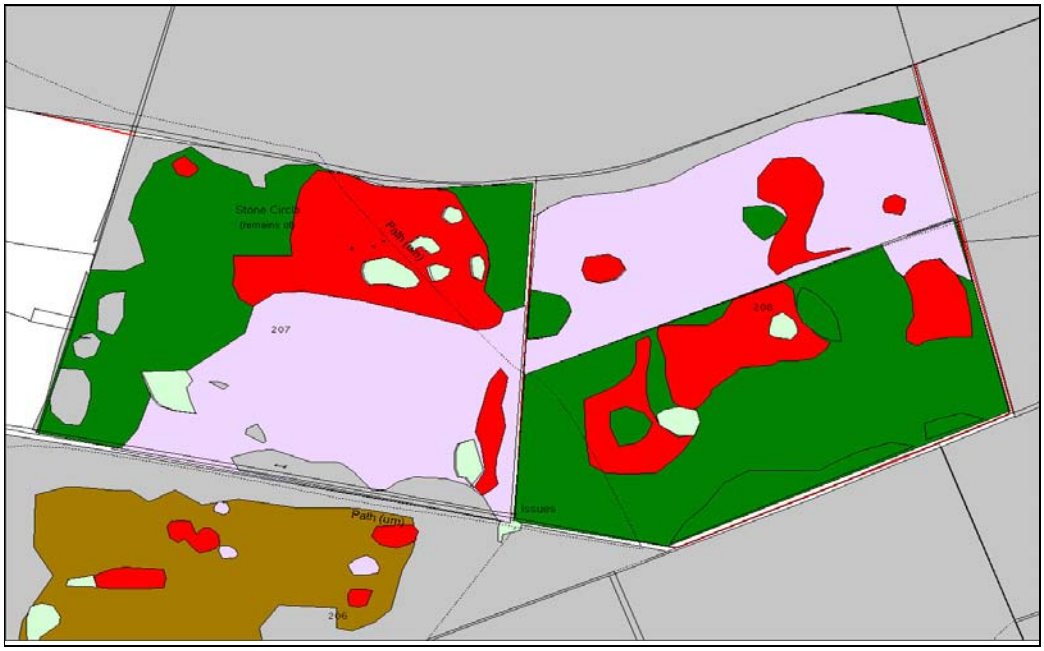
Caeau Lotwen includes two SSSI fields and two non-designated fields. Figure 7 appears to show a decline in good condition habitat on this holding, but in fact management has greatly improved under the Project's influence. The site is being grazed more evenly than it was in 2005, when large latrine areas (potential rank) were not being grazed at all (see Map 6). The Project installed a gate between the 2 fields, to enable better control of the grazing pressure. Figure 8 and Map 7 show that, by combining the good quality and suitable sparse categories, much of the area that was judged potential rank and not suitable in 2005 has been grazed to a good structure for Marsh Fritillary, although the frequency of Devil's-bit Scabious over parts of the site is low. The impact of improved management can be seen by comparing Maps 6 and 7.

Figure 7. Habitat condition changes at Caeau Lotwen SSSI between 2005 and 2008, combining good quality and suitable sparse categories



Map 6. Caeau Lotwen SSSI 2005

Map 7. Caeau Lotwen SSSI 2008



Key for Maps 6 and 7

- Good quality
- Suitable undergrazed
- Suitable overgrazed
- Suitable sparse
- Potential rank
- Not suitable

7.2.2 Marsh Fritillary larval web surveys

Marsh Fritillary larval web numbers were monitored annually on 5 key sites encompassing 45ha. All sites with Mynydd Mawr management agreements were added to the annual monitoring programme as soon as they joined the Project. An additional 44ha of non-agreement sites were surveyed at the beginning and end of the project. Seventy-nine further hectares were surveyed only once during the life of the project, mainly due to limited access.

Table 8. All larval web surveys 2004-2009

	2004	2005	2006	2007	2008	2009
Hectares surveyed	68	54	47	44*	54	103
No. fields surveyed	31	53	25	21*	34	71
No. fields occupied	12	14	15	7*	2	5
No. larval webs	**60**	**205**	**116**	**9**	**2**	**23**
% fields occupied	39%	26%	60%	33%	6%	7%
Webs per hectare	0.88	3.80	2.47	0.28	0.04	0.22

*Four fields that supported larval webs in all other years were surveyed only for adults in 2007. The 16 adults seen are not included in this table.

Each of the two major surveys was undertaken over 2 years: 2004/5 and 2008/9. The survey area was larger in 2008/9 because of increased access to sites not surveyed in 2004/5. In 2006 and 2007 only the 5 key sites and agreement sites were surveyed.

Table 9. Larval web surveys on the 5 monitored key sites

Key Site	2004/5	2006	2007	2008	2009
Caeau Ffos Fach SSSI	154	46	2	0	1
Church Road	24	9	no access	1	11
Black Lion Road	41	48	*	1	8
Caeau Lotwen SSSI	2	1	3	0	0
Felin Fach SSSI	11	5	4	0	1
Total	**232**	**109**	**9**	**2**	**21**

* only adult Marsh Fritillary surveys were done in 2007 (16 adults)

The wet winters and cool, wet summers through the life of the project were detrimental to both the butterflies. It is thought that adult Marsh Fritillary flight periods were restricted, and that larval growth and survival rates were poor, partially through an increased risk of fungal infection and parasitoid attack. Therefore, it is no surprise that numbers fell during this period, with 2008 experiencing particularly low figures. Figure 10 illustrates how the population increased slightly in 2009, due to reasonably warm and dry conditions during the adult flight season in late May and June. This trend was replicated throughout much of the UK, as seen when comparing Figures 11 and 12. Note that these graphs are shown only to compare trends; Figure 11 shows the calculated UK Butterfly Monitoring Scheme Marsh Fritillary Index, while Figure 12 shows actual larval web numbers in Mynydd Mawr. Note that the y axes are on

different scales and that larval web counts for years 2004 and 2005 are combined, since it took 2 years to survey all the sites.

Figure 8. UK Butterfly Monitoring Scheme Marsh Fritillary Index: 2004 - 2009

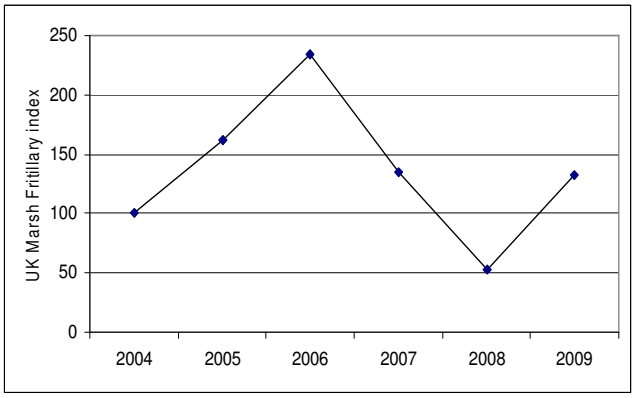
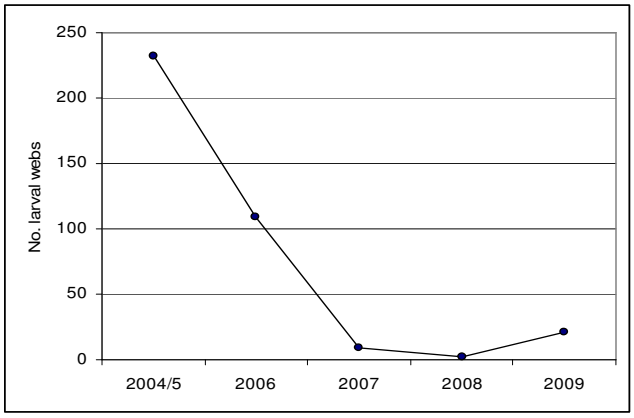


Figure 9. Mynydd Mawr 5 Key Sites Marsh Fritillary larval web numbers: 2004/5 - 2009



It is thought that the Mynydd Mawr Marsh Fritillary population was in steady decline by the time the Project began, due to neglect, unsympathetic management and habitat destruction. Not only is there often a time lag between changes in management and improvements of habitats, there can also be a lag between the change in habitat and Marsh Fritillary numbers (Bulman *et al* 2007). On some sites, the introduction of grazing can have a negative effect on butterfly numbers (A. Fowles, pers. comm.). This is one of the challenges of Marsh Fritillary management – the butterfly needs grazing to create and maintain its habitat, but the sudden change from ungrazed to grazed can be too abrupt in some cases. It is sometimes found that the best habitat develops on sites a year or two after grazing has ceased (R. Smith, pers. comm.). Possibly the management prescriptions need re-evaluation, to prevent 'over-management'. However, intermittent grazing is extremely impractical, without having complete control over stock movements and sufficient alternative land on which to rotate the stock annually. This would be impossible on most of the small Mynydd Mawr grazing units in multiple ownerships with a relatively large number of ponies.

Marsh Fritillary populations are known to fluctuate dramatically, experiencing periodic peaks and troughs. This is thought to be driven by the parasitoid *Cotesia bignellii* (a small wasp which lays it eggs in the butterfly's larvae) (Porter 1983, but see Klapwijk *et al* 2009), along with poor weather and, possibly, other unknown factors. The decline in numbers through the life of the Project was undoubtedly influenced by the series of cool wet summers, but it may well have coincided with a low point in the metapopulation's cycle.

The many steps to improve Marsh Fritillary habitat on agreement sites were also diluted by the unsympathetic actions of neighbouring owners. Declines in butterfly abundance on any individual sites within the metapopulation landscape are likely to affect other sites, due to reduced immigration. For example, one large area with a great deal of potential habitat was completely mown at least once and probably several times between 2004 and 2007, destroying any eggs or larvae that may have been present. Thus a potential large source of colonists was lost. Fortunately, most of this site is now managed with cattle grazing under a Mynydd Mawr agreement, and it is hoped that the butterfly will recolonise what is potentially the largest block of suitable habitat in the Project area. However, adjoining fields which had larval webs in 2005 were ploughed in 2009 (see 4.0 Planning), reducing the chances of such a recolonisation.

The extensive larval web and habitat surveys at the beginning and end of the project, as well as annual larval web monitoring on key and agreement sites, have provided a detailed picture of the state of the butterfly, its habitat resource, and the extent of management still required to improve the conditions for the Marsh Fritillary in Mynydd Mawr. The Carmarthenshire County Council 2009 survey also found a number of previously unknown Marsh Fritillary colonies and habitat patches in the surrounding landscape. However, continued monitoring of this Marsh Fritillary metapopulation is essential, to accurately assess the long-term impact of the Mynydd Mawr Project on Marsh Fritillary numbers and habitat.

7.2.3. Other biodiversity outcomes

The Project has worked to identify and improve the management of 8 UKBAP habitats – not only purple moor-grass and rush pasture, which is the dominant habitat in Mynydd Mawr, but also

- lowland dry acid grassland
- lowland meadow
- lowland heathland (wet heath)

- hedgerows
- wet woodland
- brownfield ('open mosaic habitats on previously developed land')
- and even a small reedbed.

The Project Officer and volunteers have recorded 34 UKBAP species as well as 12 bird species included in the Wales Red and Amber Lists (See Appendix 11.7 for details).

Many other European protected species and UKBAP species are also resident in these rhos pastures. For example, the European Otter *Lutra lutra* has been recorded on the Afon Gwili within the project area, and there have been several unconfirmed reports of Water Vole *Arvicola amphibious* and Harvest Mouse *Micromys minutus*.

Many more people are now aware of the importance of the Marsh Fritillary and rhos pasture in the Mynydd Mawr area. Many have also become interested in and actively involved with the other wildlife of the area, such as moths, birds, reptiles and dormice.

Dormouse nest woven from purple moor-grass at a Mynydd Mawr agreement site

8.0 Summary of lessons learnt and questions for the future

8.1 Developing relationships with owners requires a dedicated Project Officer

Working cooperatively with landowners works better than a top-down prescription-based approach. It is vital that owners are not made to feel as if they are being told what to do. This all takes time; it can take many visits to 'sell' the scheme, set up an agreement and carry out capital works. Project Officers and funders must understand that owners have busy and sometimes stressful lives in which managing their land for wildlife is often not a priority.

Signing a management agreement is only the first step in implementing a desired grazing regime. Each site and owner, each grazing animal and each grazing season is different. Therefore grazing must be carefully monitored throughout the season. Some landowners' grazing systems were ideal, but others required a large investment of Project Officer time.

That is why one of the key elements of the Project was the employment of a full-time Project Officer, with the time to develop good relationships with owners, and to tailor agreements to suit each one. CCW and Tir Gofal staff do not have the time or flexibility required to micro-manage owners and their small grazing units.

8.2 Design of agreements

Simplicity

It is vital to make it as easy as possible for landowners to join the scheme. It is highly unlikely that most of the agreement holders would have joined if they had been faced with the extensive paperwork and long delays that some agri-environment scheme applicants have faced.

100% capital costs

The project's commitment to pay 100% of capital costs was key to signing up several of the owners. Many of them could not afford or would not be willing to pay for a proportion of the costs (as is required by most agri-environment schemes). Without secure fencing or a water supply there can be no grazing.

Flexibility

The Project was able to work out and adjust grazing plans with each owner, and even to develop alternative methods when grazing was impractical. This creates a much better working relationship between the owners and the project, and produces a better result on the ground.

Informal agreements

Informal agreements for one-off works are useful when owners are unwilling or unable to make a five-year commitment to a formal agreement. As a body funded by the Welsh Assembly Government, CCW is unable to pay for work without a formal agreement. Therefore, the Project's additional funding from the National Grid enabled one-off works on two extra sites, including one of the key Marsh Fritillary sites in Mynydd Mawr.

Act local

As part of the commitment to the community, it is important to use local contractors and suppliers wherever possible, to put money back into the local economy. Several of the contractors were subsequently hired by Project landowners to do additional work on their holdings. Local partners are also key, as a route into the community as well as a source of practical support for the project.

8.3 Preparatory Work

It is crucial to evaluate the needs and wants of the local community and its landowners before embarking on such a scheme, including understanding and involving the local social, economic and cultural networks. A pilot study would have identified some of the major problems that the Mynydd Mawr Project encountered, particularly the huge planning pressures. This may have led to a different strategy, with more realistic aims for the numbers of agreements, the habitat targets and the time needed to implement and refine the Project.

Partnerships between different organisations need careful coordination. The delay in funding by CCW for management agreements created great uncertainty and hindered the Project's progress with landowners. It is imperative that all partners clarify project priorities and build lines of communication and support from the outset.

8.4 Landscape project, land purchase or designation?

The Mynydd Mawr Project was an experiment, to discover whether a 'carrot' approach offering payments to encourage suitable management for the Marsh Fritillary would be more successful than a 'stick' approach using SSSI designation legislation. Over the four years when the payments were available and offered to all owners of suitable land, only 6 landowners signed agreements, and one of these was cancelled in 2009. This does not mean that this type of approach is a failure, but it does raise the question of whether this type of scheme is the most suitable or effective tool for achieving sympathetic wildlife management in every region. Socio-economic and cultural factors will have a strong effect on any project's success. The pattern of multiple ownerships of small fields in Mynydd Mawr presented the greatest difficulties for the Project. It necessitated more time in which to contact and develop relationships with the numerous owners, and presented a few difficult-to-solve problems, particularly overgrazing by ponies and horses on small holdings. Such a Project is possibly better suited to a more rural, agricultural setting, where owners have relatively larger landholdings and are also more likely to be looking for ways to earn income from their land. The Project would fill a very important gap for rural smallholders who may

struggle to qualify for a standard agri-environment scheme, or who may not have the time or resources to complete lengthy paperwork with no guarantee of success. While they may be able to join the new Glastir 'entry-level' scheme when it begins in several years' time, this is unlikely to provide sufficient incentive or guidance to create enough good quality Marsh Fritillary habitat.

Land purchase and/or designation as an SSSI might be more appropriate or effective in a 'rural fringe' area like Mynydd Mawr. Land purchase (by CCW or a non-governmental organisation) is expensive, but it is the only way to guarantee appropriate and ongoing management in the long term (if there is additional funding for ongoing management). It also requires that owners must be willing to sell their land. Research carried out by the Mynydd Mawr Project in 2009 revealed that few owners wanted to sell, and those who might have sold were only interested in the high rates paid by developers.

Designation could protect land that would otherwise be destined for development. On the other hand, it will cause conflict with some owners, and may lose the cooperation of those who are not particularly interested in wildlife conservation but might be persuaded to join a management scheme. It may even upset some keen owners who are happy to cooperate voluntarily but resent the lack of choice imposed by designation.

Designation also requires resources for officer time; not just for the designation process itself, but to regularly monitor and advise landowners. Designation alone does not guarantee good management. CCW does have legal tools to define and regulate management of designated sites, including the ultimate power of Compulsory Purchase. However, CCW's culture is one of building relationships with owners and occupiers, and working with them on a 'voluntary' basis to ensure appropriate management. However, in light of the problems discussed in this report, CCW accepts that there is room for improvement in respect of the management of some existing SSSIs in Mynydd Mawr.

A project employing a combination of these methods may offer the greatest chance of positively influencing habitat management and habitat quality for the Marsh Fritillary (or any other target species or habitat), by tailoring the approach towards different groups of landowners.

8.5 Future Project work

The Mynydd Mawr Project area covered only a portion of the area occupied by the Marsh Fritillary metapopulation. There is great scope for an extension of the Project into the wider metapopulation landscape. The 2009 Carmarthenshire County Council survey on the surrounding area found 264 grazing units amounting to 573 hectares that contained some suitable Marsh Fritillary habitat (Smith pers. comm.), particularly to the west and southwest of Mynydd Mawr. Many owners in this area enquired whether any grant scheme was available for them. Landholdings in this more rural landscape tend to be larger than those in Mynydd Mawr, and so may be easier and relatively less expensive to manage sympathetically. It is essential that as much of the entire metapopulation area as possible is connected, protected and managed for the Marsh Fritillary, particularly in view of the current and future development pressure. Any delay is likely to see more habitat lost and damaged, further reducing the permeability of this critical Marsh Fritillary landscape.

Some Mynydd Mawr agreement owners will continue to carefully manage their rhos pasture. Others, however, require continuing monitoring and guidance, to ensure that the Project's past efforts do not go to waste. While Butterfly Conservation Wales and CCW staff will keep an eye on agreement sites, their time will be limited. A repeat Marsh Fritillary habitat mapping survey is essential in the next few years, to monitor the ongoing management and to show the effects of management changes after a more realistic period of time.

There is a clear need to provide pony owners with more opportunities to learn about land management that benefits both ponies and wildlife. The Wild Meadows Project (Flora Locale) has successfully run such courses in other locations and a series of these courses run by a new project would be very useful and welcome in the Mynydd Mawr area.

The project could be expanded by linking with more partners, targeting a wider range of species (e.g. water vole and reptiles) and habitats (such as heathland). This would widen the funding opportunities and would appeal to a broader spectrum of the local community.

There are many more activities that could be incorporated into a new project. For example, it could set up and train a 'burning task-force' of volunteers and conservation managers, to sensitively use this tool on neglected rhos pasture throughout Carmarthenshire.

There are a wealth of community and volunteer projects that could increase participation in a future project, such as working with schools, women's institutes and other local organisations. The Devil's-bit Scabious Volunteer Group could be expanded to attract more gardening enthusiasts. A Welsh language volunteer group could attract a new audience. A focus on local history would draw in another sector of the community, focussing on Mynydd Mawr's traditional agricultural management through an oral history project. This would also help develop our understanding of how the Marsh Fritillary and its habitat have survived for so long at Mynydd Mawr and could provide valuable lessons for the ongoing management of rhos pastures across Wales.

9. Acknowledgements

We are extremely grateful to our partners at Countryside Council for Wales, particularly Adrian Fowles, Rhian Jardine, George Johnson, Neil Matthew, Huw Williams, Charlotte Gjerling and Tracey Lovering, not just for funding the Project but for all of their assistance, guidance and support. John Evans, the Regional Land Agent, was key to setting up and establishing the agreements, administering all CCW capital works projects and providing essential support and training for the Project Officer. We also thank the National Grid for the 'Felindre to Tirley Pipeline Butterfly Habitat Restoration Enhancement Project' funding. Likewise, thanks to the many Butterfly Conservation staff who supported and enhanced the Project.

We give a huge thanks to all of the Mynydd Mawr landowners who have been involved in the Project – particularly those who are helping to secure the future of the Marsh Fritillary in Mynydd Mawr by grazing their land appropriately, but also the many others who allowed us to survey their fields and welcomed advice.

We also would like to give many thanks to all of the volunteers without whom we would know much less about the status and range of the Marsh Fritillary and the many other species that live in these rhos pastures.

We thank our many LBAP partners who supported and enriched the project, particularly Judith Weatherburn and Simon Morris at CCC Llyn Llech Owain Country Park and Isabel Macho, Rosie Carmichael and Lindsey Rendle at Carmarthenshire Country Council Conservation Section.

Finally, we are indebted to Richard Smith and John Anderton for the many hours of surveys and other work, discussion and support throughout the life of the Mynydd Mawr Project.

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11. Appendices

Appendix 11.1. Summary of outputs achieved

Management agreements					
	Total	Mynydd Mawr S39 agreements	Informal agreements	Section 15 (SSSI) agreements	Tir Gofal
180 hectares of potential and intervening land entered into management agreements	108.5	60ha	9 ha	11 ha	28.5 ha
Advice given	29ha				
Agreement cancelled or on hold	9ha				

Habitat condition						
	Total habitat	Good quality	Suitable sparse	Suitable overgrazed	Suitable under-grazed	Potential Rank
50 hectares to be in good condition for the Marsh Fritillary	71.15ha suitable	6.78	16.03	21.02	27.32	36.13

Capital works		
Original output	*Output achieved*	*Notes*
1km of overgrown hedgerows laid or coppiced	2165 m fencing	Fencing includes both sides of a 120m hedgerow to prevent pony grazing and allow regeneration. Hedgerow work usually inappropriate – most hedgerows are lines of trees, few benefits for cost in laying/coppicing them.
5 hectares of dense scrub coppiced/cleared	5.5 ha scrub	And 8.7 ha Molinia & rush cut

Surveys, monitoring and mapping	
Output	*Completed*
Larval web survey of all enclosures with potential breeding habitat including previously unsurveyed land	Year 1 and 2
Map habitat quality according to standard protocols	Year 1 and 2 repeated Year 4 & 5
Management requirements for each enclosure assessed and costed	Year 1 and 2
Re-survey of larval webs and habitat quality in enclosures containing potential habitat in Year 1	Year 5 & 6
5 key breeding areas monitored	Annually
Management agreement fields monitored	Annually
Surveys of other key species	Annually (see appendix 11.7 for details)

Community and other outcomes	*Completed*
Local Liaison Group established	Year 1
'Friends of Mynydd Mawr' volunteer group established	No formal group, nearly 500 hours of volunteer time. Devil's-bit Scabious Volunteer Group established in year 6
Open Day/Training Day for local residents/land owners	1 in 2005, 2 in 2007
Newsletter for local residents/land owners	2007
Progress report/Steering Group	Quarterly and annually
Best practice seminar	Best practice was disseminated at Marsh Fritillary Workshop 2006, in numerous site visits, in this report and in subsequent publications

Appendix 11.2: Mynydd Mawr Management Agreement proformas

Appendix 11.2.1 Agreed Management Policy

Mynydd Mawr Marsh Fritillary Project

AGREED MANAGEMENT POLICY

1. As from the commencement of the Agreement the land shall be managed in accordance with the policy set below.

2. BACKGROUND INFORMATION - Marsh Fritillary Butterfly

   Populations of the Marsh Fritillary have been declining throughout Europe and the UK for decades. Wales is one of the last remaining homes for this rare butterfly, but even here its future is precarious. Marsh fritillaries have disappeared from over half of their previous sites, even nature reserves and Sites of Special Scientific Interest (SSSIs).

   This decline is due mainly to habitat loss or inappropriate management (no grazing, over/undergrazing and cutting). Marsh Fritillaries need large areas of connected fields of damp grassland to survive in the long term. A very high proportion of our Marsh Fritillary populations are small and isolated, which leaves them susceptible to extinction - any sites that are lost will not be re-colonised if there are no other populations in the neighbourhood.

   All of these factors have led to the establishment of the Mynydd Mawr Marsh Fritillary Project. The former Mynydd Mawr Common around Cross Hands still supports many small Marsh Fritillary populations, as well as a large amount of damp grassland that could be made suitable for the butterfly with appropriate management. The intervening fields are also important, helping the butterflies move from one suitable patch to another.

   The Project aims to improve the management of the entire area, which will benefit not only the resident marsh fritillaries but also the many other important species that live in these damp grasslands.

3. MANAGEMENT OBJECTIVES

   The management of the land shall aim to achieve the following:

   - To maintain the habitat in the best possible condition to support viable populations of Marsh Fritillary.
   - To make adequate records of butterfly populations.
   - To maintain traditional agricultural use and management of the land.

4. GENERAL PRINCIPLES

   The aim is to create the best possible habitat for the Marsh Fritillary through appropriate land management. The butterfly is found in grasslands with a mix of devil's-bit scabious and purple moor grass (and other tussocky grasses). Devil's-bit scabious is virtually the only plant that the caterpillars will feed on, and the grass tufts provide shelter and warmth where the butterfly's eggs and caterpillars can develop. Tussocky grasses should be abundant and you should aim for a vegetation height between 12 and 25cms at the end of the grazing period (see grazing guide). Ideally, devil's-bit scabious should be abundant - the restoration of suitable management should help the scabious to increase and spread.

   Hedgerows and mature trees are also important, providing shelter from the elements.

5. MANAGEMENT REGIME

Grazing

Grazing is key to the survival of the Marsh Fritillary. Light cattle or pony/horse grazing between April and October is appropriate. This roughly equates to 1 cow or pony/horse per hectare for 3 months during this period (approximately 0.3 'livestock units' per hectare). Sheep grazing is to be avoided, as they eat the scabious and other flowers rather than tackle the coarser grasses and scrub, and produce a very short, even sward. Winter pony grazing may occasionally be appropriate – this will need to be agreed in advance with the project officer.

The key point is to achieve the vegetation height between 12 and 25cm by the end of the grazing period as shown on the enclosed grazing guide.

For this agreement area the suggested grazing regime likely to achieve this height is:

_____

Fencing

Details of any fencing as agreed

If the owner wishes to arrange for or carry out this work her/himself, contributions to any agreed works will be made at the published standard rates on satisfactory completion of the work. Alternatively, the council will arrange for the erection of the fencing, and will pay the contractor for the work on its satisfactory completion. Details of the work to include specification and cost will be agreed in advance with the contractor.

Gates

Details of any gates to be installed, as agreed

If the owner wishes to arrange for or carry out this work her/himself, contributions to any agreed works will be made at the published standard rates on satisfactory completion of the work. Alternatively, the council will arrange for the erection of the fencing, and will pay the contractor for the work on its satisfactory completion. Details of the work to include specification and cost will be agreed in advance with the contractor.

Water supply

Details of any troughs/piping to be installed, as agreed

If the owner wishes to arrange for or carry out this work hir/himself, contributions to any agreed works will be made at the published standard rates on satisfactory completion of the work. Alternatively, the council will arrange for the erection of the fencing, and will pay the contractor for the work on its satisfactory completion. Details of the work to include specification and cost will be agreed in advance with the contractor.

Burning

Burning is not generally a sympathetic management tool for maintaining the habitat, as it can kill the caterpillars and encourage growth of the tougher grasses. Burning can sometimes be a useful way to restore neglected grassland which is currently unoccupied by the butterfly, but should only be undertaken with great care. CCW staff, the Project Officer and the local Fire Department should be consulted before any burning takes place. Burning should only take place between January and March and no more than a third of the field

should be burnt in any one year. It needs to be followed by suitable grazing to restore the sward structure.

Cutting

As with burning, cutting can be a useful tool to open up overgrown grassland and reduce domination by rushes. Like burning, it should only be looked at as a kick-start to grazing on long under-grazed sites, rather than as an alternative, since cutting creates an even sward with little structure for the butterfly.

The project officer will advise on suitable machinery and cutting patterns. Areas known to support Marsh Fritillaries should be avoided, and no more than half of the field should be cut in any one year. It needs to be followed by suitable grazing to restore the sward structure.

If the owner wishes to arrange for or carry out this work hir/himself, contributions to any agreed works will be made at the published standard rates on satisfactory completion of the work. Alternatively, the council will arrange for the erection of the fencing, and will pay the contractor for the work on its satisfactory completion. Details of the work to include specification and cost will be agreed in advance with the contractor.

Scrub Control

Scrub is a valuable source of shelter and nectar, but shouldn't be allowed to take over the open areas. Cutting may be needed if it covers more than about 5-10% of the habitat. This should only take place in the winter months, between November and February (after any berries have been eaten by birds and small mammals) and the brash should ideally be piled in designated areas to be agreed with the Project Officer. In some situations it may be possible to for burn or chip the wood, again as agreed with the Project Officer.

If the owner wishes to arrange for or carry out this work her/himself, contributions to any agreed works will be made at the published standard rates on satisfactory completion of the work. Alternatively, the council will arrange for the erection of the fencing, and will pay the contractor for the work on its satisfactory completion. Details of the work to include specification and cost will be agreed in advance with the contractor.

Hedgerows and Trees

Hedgerows, woodland and mature trees in and around the site provide sheltered conditions for the Marsh Fritillary and many other insects, birds and small mammals, so they should be retained and managed. Hedgerows can be allowed to grow up as linear features or laid and coppiced as appropriate, with gapping up and fencing also considered. Hedgerows should be cut on rotation, with no more than 1/3 cut in any one year.

Providing that funds allow, the council may agree to hedgerow work in future years during the term of this agreement. Again, if the owner wishes to arrange for or carry out this work her/himself, contributions to any agreed works will be made at the published standard rates on satisfactory completion of the work. Alternatively, the council may agree to arrange and pay for this work by a contractor. This work will need to be agreed with the Project Officer before its commencement.

Water Levels

The damp grassland relies on springs and watercourses to feed and drain the site. No new drains should be opened, but existing drains may be maintained following prior consultation with the Project Officer, who will provide advice on a suitable approach for each site.

Agricultural Operations

Fertilisers, including manures, should not be used on the site. These cause damage by encouraging agricultural grasses and weeds, rather than the finer, more varied native grasses and herbs. Other activities that could lead to enrichment problems, such as supplementary stock feeding or storage of cut vegetation, should not take place on the land. Pesticides must not be used, and herbicides should only be used in exceptional circumstances. Any use of herbicides (such as glyphosate to control scrub regrowth) must be agreed by the Project Officer beforehand.

6. KEEPING RECORDS

The Owner will keep and provide the Council with an annual record of the management carried out on the land.

7. OPERATIONS LIKELY TO DAMAGE

The Owner will not carry out (and will not permit to be carried out) any of the operations likely to damage the special interest of the land.

8. WRITE OFF OF EXPENDITURE

Expenditure incurred by the Council towards the costs of works detailed above shall be written off over a period of 10 years from the date of payment. If this agreement is terminated as a result of breach or if the owner declines to enter into further agreements (if offered) on similar terms during the write off period then the written down sum at the date of termination of this or subsequent agreement shall be repaid to the Council.

SIGNED by the said)
)
in the presence of:)
)

SIGNED by the said)
)
for and on behalf of the)
COUNTRYSIDE COUNCIL FOR WALES)
in the presence of:)
)

Cyngor Cefn Gwlad Cymru
Countryside Council for Wales

Mynydd Mawr Marsh Fritillary Project

DATED **2009**

and

COUNTRYSIDE COUNCIL FOR WALES

MANAGEMENT AGREEMENT
UNDER SECTION 39 OF THE
WILDLIFE AND COUNTRYSIDE ACT 1981
AS AMENDED BY
SECTION 96 OF THE COUNTRYSIDE AND RIGHTS OF WAY ACT 2000

---

relating to land at

in the community of
in the County of Carmarthenshire

THIS A G R E E M E N T is made the day of 2009

B E T W E E N : NAME (the "Owner") of **ADDRESS**
and the

COUNTRYSIDE COUNCIL FOR WALES (the "Council") of Welsh Assembly Government, Rhodfa Padarn, Llanbadarn Fawr, Aberystwyth SY23 3UR

1. DEFINITIONS

In this agreement the following words and expressions have the following meanings:

1.1	"**Land**"	the land at **name** shown edged red on the attached Plan containing **x hectares/ acres** or thereabouts
1.2	"**Policy"**	the agreed management policy attached to this agreement
1.3	"**Term"**	the term of **five (5)** years commencing on the **1st** day of **month 2009** (subject to the provisions of clause 5.1 of this agreement)
1.4	"**Payment"**	the sum of **£** per year payable by the Council to the Owner in each year of the agreement on the **1st day** of **month 2010** (12 months after commencement date)

2. INTERPRETATION

In this agreement:

2.1 an obligation not to do anything includes an obligation to prevent others from doing it; and

2.2 any inconsistency between the terms of this agreement and those of the Policy will be resolved in favour of the terms of this agreement

3. OWNER'S OBLIGATIONS

In consideration of the payments to be made by the Council, the Owner agrees (so as to bind the Land and all future owners and occupiers of it (so far as the law allows) with the Council as follows:

3.1 MANAGEMENT

3.1.1 To manage the Land in accordance with the Policy

3.1.2 Where the Land forms part of the Owner's holding, to manage the remainder of that holding to at least the standard of usual good farming practice (in accordance with guidelines produced by the Welsh Assembly Government)

3.2 ACCESS FOR COUNCIL

3.2.1 To allow Council staff and other persons authorized by the Council to visit the land on foot and by vehicle for research, monitoring and management purposes.

3.3 STATUTORY OBLIGATIONS

3.3.1 To obtain at his own cost (save where stated otherwise in the Policy) all consents, licences and permissions required to carry out any work which the Owner is obliged to carry out under the terms of this agreement or the Policy

3.4 DEALINGS

3.4.1 Not to sell, transfer or part with occupation any of the Land without ensuring that all new occupiers will abide by the provisions of this agreement

3.5 INDEMNITY

To indemnify the Council against all actions, proceedings, costs, claims and demands (howsoever arising) as a result of the Owner complying with the terms of this agreement or the Policy

3.6 PAYMENTS AND AGREEMENTS

To give details to the Council of any sums received or due from any other government department or public body in relation to the management of the Land.

3.7 REFUND OF PAYMENTS

In the event that this agreement is terminated in accordance with Clause 5.1 to repay any sums made by the Council under this agreement or a proportion of the sums as determined by the Council

4. PAYMENTS BY COUNCIL

4.1 The Council agrees to pay to the Owner the payment on the payment date and to make such further payments as may be set out in the Policy

5. PROVISOS

5.1 TERMINATION

The Council may serve notice on the Owner terminating this agreement with immediate effect if:

5.1.1 the Owner breaches any of his obligations contained in this agreement or the Policy

5.1.2 at the same time that this agreement is terminated, the Owner enters into an alternative environmental land management scheme agreement which is approved of by the Council and which serves the nature conservation objectives of the Council equally well or better than this agreement

5.2 REDUCTION IN PAYMENTS

The Council may withhold or reduce the payments payable pursuant to clause 4 of this agreement if:

5.2.1 the Owner breaches any of his obligation

5.3 INFORMATION

The Council reserves the right to publish information about this agreement

Signed by the said

_____

in the presence of: _____

Signed on behalf of the Council
by the said

_____

in the presence of: _____

Appendix 11.3. Partnerships

- **Carmarthenshire County Council**
  - Biodiversity Fair stand
  - Twp dragonfly surveys at Council-owned farm
  - Planning consultations, presentation to planners, and meetings with planner
  - Mynydd Mawr Country Park site visit
  - Millennium Coastal Park grazing advice
  - Rights of Way Department: liaison re: blocked footpaths
  - Roads Department
    - consultation on new field access
    - meeting about Cross Hands Economic Relief Road
  - **Llyn Llech Owain Country Park** – see Case Study 3

- **Dyfed Archaeological Trust**
  - Site inspection and advice given to Project on a Mynydd Mawr agreement site SSSI with ancient monument, before capital works undertaken
  - Trust staff spoke at Mynydd Mawr Project Celebration

- **Grasslands Trust Carmel**
  - Regular advice and liaison
  - National Moth Night joint event 2009
  - Grazing provided by Grasslands Trust for Mynydd Mawr owner/grazier

- **Llanelli Naturalists**
  - Project talk to Llanelli Naturalists
  - Joint visit to Caeau Ffos Fach Butterfly Conservation Reserve
  - Visit to Saron Primary School in Mynydd Mawr

- **Local Biodiversity Action Plan Partnership**
  - Active member
  - Assisted with the writing of the Marsh Fritillary and rhos pasture Action Plans

- **PONT**
  - Attended PONT meetings and site visits
  - Assisted with PONT cattle-owner questionnaire at Royal Welsh Show

- **South & West Wales Wildlife Trust**
  - Talk to East Carmarthenshire branch
  - Joint visit for members and general public to Caeau Ffos Fach Butterfly Conservation Reserve
  - Joint management advice visit to Rhos Cefn Bryn and Caeau Ffos Fach Reserves

- **Wild Meadows Project** / **Flora Locale**
  - Mutual advice and support
  - Events

- **Visits to and advice exchange with other grazing projects**
  - Pembrokeshire Coast National Park grazing project
  - CCW Pembrokeshire and Cardiff
  - Tonyrefail Project (CCW/BC project)
  - Bridgend Council

- **ADAS**
- **Coed Cymru** – see Case Study 3
- **Environment Agency**
- **Forestry Commission**
- **Gower Wildflower Centre**
- **RSPB**

Appendix 11.4 Events

Event	Year	Audience	Lead	Other orgs	attendees
Talk to BC South Wales AGM	2004	BC members & volunteers	BC		50
Presentation & site visit to CCC planners	2004	CCC planners	CCC	BC	14
Butterfly & Plant **walk**	2005	Llanelli Naturalists & BC members, general public	Llanelli Naturalists & BC	CCC	18
Talk to Llanelli Naturalists	2005	Llanelli Naturalists members & general public	Llanelli Naturalists		16
Talk to East Carms Wildlife Trust Group	2006	WT members & public	South & West Wales Wildlife Trust (SWWWT)		20
Talk at Marsh Fritillary workshop	2006	Conservation staff from all UK Marsh Fritillary landscape projects	BC/Natural England	Wildlife Trusts	30
Marsh Fritillary **Survey Training**	2006	Survey volunteers	BC		5
Visit to Saron School Wildlife Garden	2006	Llanelli Naturalists	Llanelli Naturalists		12
Royal Welsh Show – **PONT questionnaire**	2006	Cattle owners	PONT		8
FWAG **Farm Visit**	2006	FWAG members	FWAG		~25
Mynydd Mawr Celebration: **talks and site visit**	2007	CCW, landowners, contractors, other partners, volunteers & supporters	BC	CCW, CCC, SWWWT, Community Councils, Llanelli Nats, PONT, Tir Gofal, NBGW, Cambria Archaeology	45
National Moth Night - **moth trapping**	2007	General public	BC	CCC, Carms Bat Group	8
National Moth Night - **moth id event**	2007	General public	BC		13
Marsh Fritillary **Walk**	2007	BC & Wildlife Trust members & general public	BC/SWWWT East Carms Group		12
Marsh Fritillary **Management visit**	2007	Welsh and Southwest England Marsh Fritillary workers	BC		6
Marsh Fritillary **Management visit**	2007	BC staff	BC		5
Marsh Fritillary **Management visit**	2007	Caerphilly County Council staff	BC		1
Reptile **survey training day**	2007	Volunteers	BC	S & W Wales Amphibian & Reptile Group	5
Talk at BC Wales Volunteer Seminar	2007	BC Members & Volunteers	BC		59
Marsh Fritillary **Management visit**	2007	SWW Wildlife Trust	BC/SWWWT		2
Talk, walk and 3-D poster making with Awaydays	2008	Awaydays charity	BC/LLO		6
Marsh Fritillary **Management visit**	2009	European Forum on Nature Conservation and Pastoralism	BC		1
Marsh Fritillary	2009	Carmarthenshire	CCC	CCW	9

Management visit to Rhos Llawr Cwrt		Marsh Fritillary Workers	Conservation Section		
National Moth Night – **2 moth trapping events**	2009	General public & landowners	BC/Grassland s Trust Carmel		6
Talk and seed collection - Devil's-bit Scabious Volunteer Group	2009	Volunteers & Landowners	BC/LLO		6
Total attendance					**382**

Appendix 11.5. Publicity

Appendix 11.5.1 Media coverage

Radio Wales	Mynydd Mawr Project celebration	2007
Radio Cymru	Mynydd Mawr Project celebration	2007
S4C Newyddion (Wales Channel 4 Evening News)	Mynydd Mawr Project celebration	2007

Appendix 11.5.2 Articles

Publication	*Title*	*Year*
Carmarthenshire Marsh Fritillary LBAP	Contributed to LBAP document	2004
Carmarthenshire Rhos Pasture Poster	Contributed to poster text	2004
Natur Cymru	'Connecting the Dots'	2004
BC South Wales Branch newsletter	'The Mynydd Mawr Marsh Fritillary Project'	2005
BC Wales Newsletter	'The Mynydd Mawr Marsh Fritillary Project'	2005
Lepidoptera Conservation Bulletin	'The Mynydd Mawr Marsh Fritillary Project'	2005
BC Wales e-Newsletter	'The Mynydd Mawr Marsh Fritillary Project'	2006
Butterfly	'Putting Words Into Action: The Mynydd Mawr Marsh Fritillary Project'	2006
Carmarthenshire Bird Club newsletter	'Bird surveyors wanted in Cross Hands'	2006
Lepidoptera Conservation Bulletin	'The Mynydd Mawr Marsh Fritillary Project'	2006
Adain y Draig (CCW Newsletter)	'Project shows the way to save butterfly habitat'	2007
BC website	'The Mynydd Mawr Marsh Fritillary Project'	2007
BC Wales Newsletter	'The Mynydd Mawr Marsh Fritillary Project'	2007
Carmarthen Journal	'Mynydd Mawr Marsh Fritillary Project is Looking for Lookers'	2007
CCC Biodiversity website	'Mynydd Mawr'	2007
CCC Biodiversity website	'National Moth Night'	2007
Lepidoptera Conservation Bulletin	'The Mynydd Mawr Marsh Fritillary Project'	2007
Wales Grassland Report (Grasslands Trust)	'The Mynydd Mawr Marsh Fritillary Project'	2007
Western Mail	'Butterfly Project to Mark its Success'	2007
Western Mail	'Mynydd Mawr Marsh Fritillary Project is Looking for Lookers'	2007
BC Wales Newsletter	'Celebrating Mynydd Mawr'	2008
Butterfly	'Ponies save the Marsh Fritillary'	2008
Grazing Animals Project Newsletter	'The Mynydd Mawr Marsh Fritillary Project'	2008
BC Conservation Review	'Ponies save the Marsh Fritillary in a Post-industrial Landscape'	2009
BC South Wales Branch newsletter	'The Mynydd Mawr Marsh Fritillary Project'	2009
BC North Wales Branch newsletter	'The Mynydd Mawr Marsh Fritillary Project'	2009
BC Wales Newsletter	'The Mynydd Mawr Marsh Fritillary Project'	2009
Lepidoptera Conservation Bulletin	'The Mynydd Mawr Marsh Fritillary Project'	2009

Butterfly	tba	2010
Carmarthenshire Biodiversity website	tba	2010
Lepidoptera Conservation Bulletin	'The Mynydd Mawr Marsh Fritillary Project'	2010
Natur Cymru	tba	2010

Appendix 11.5.3. The Mynydd Mawr Project Poster was displayed & leaflets were distributed at the following conferences, reaching many 100s of conservationists

Conference	Audience	Year
Butterfly Conservation Symposium	International	2005
FACT/GAP Conference	UK	2005
BC North Wales Branch AGM	North Wales	2005
Wales Conservation Management Conference	Wales	2006
England LBAP conference	England	2007

Appendix 11.5.4. Publicity material produced by the Project

Media		*Year*
Project leaflet	Distributed to landowners & locally via libraries, Country Parks, etc	2004
Grazing Guide	Included in all management agreements and given to all interested landowners	From 2005
ID card	Butterflies, Day-Flying Moths & Plants of Carmarthenshire Meadows' Distributed to all interested landowners	From 2006
National Moth Night poster	Shops, libraries, Country Parks, post offices, etc.	2007
Mynydd Mawr Newsletter	All landowners, BC Wales members, all partners, supporters & volunteers. Locally via libraries, Country Parks, NBGW, etc	2007
3-D Project Display	Displayed at Llyn Llech Owain Country Park (made by Awaydays volunteers)	2008

Appendix 11.6. 2001 Mynydd Mawr survey (Smith *et al* 2002)

Appendix 11.6.1 2001 Habitat condition categories

Optimal Marsh Fritillary Habitat:
Molinia-dominated grassland where the vegetation height is within the range of 10cm to 20cm, and where *Succisa pratensis* is present within a 1m radius of any point, such that:

1) *Succisa pratensis* is present throughout at high frequency
2) The sward structure is such that there is a mosaic of tall, often tussocky, grasses and litter formation, with shorter vegetation and no or little litter build up.

Potential Marsh Fritillary Habitat
Molinia-dominated grassland where the vegetation height is outside the range of 10cm to 20cm, and where *Succisa pratensis* is present at lower frequencies but still widely distributed throughout the patch. Alternatively, *Succisa* may be present at high density in close-cropped swards.

Other Suitable:
Where grassland meets either of the definitions above, except not *Molinia* dominated.

Appendix 11.6.2 2001 Mynydd Mawr Survey Results

Habitat category	**Hectares**
Optimal	10.7
Potential	105.6
Other suitable	14.9
Not suitable	576.9
Total surveyed*	708

* includes 2 outlying areas that were excluded from Mynydd Mawr Project area

Appendix 11.7. Other species recorded by the Mynydd Mawr Project Officer and volunteers

Appendix 11.7.1 UK Biodiversity Action Plan Species

Butterflies	**Moths**	**Reptiles**	**Mammals**	**Birds**
Dingy skipper	Autumnal Rustic	Common lizard	Dormouse	Common bullfinch
Marsh Fritillary	Broom	Common toad	West European hedgehog	Common cuckoo
Small heath	Centre-barred sallow	Grass snake		Common grasshopper warbler
	Dot Moth			Common linnet
	Dusky Thorn			Common starling
	Green-brindled Crescent			Herring gull
	Grey Dagger			House sparrow
	Knot Grass			Marsh tit
	Small Phoenix			Northern lapwing
	Small square spot			Reed bunting
	The sallow			Skylark
	White Ermine			Song thrush
				Spotted flycatcher
				Tree pipit
				Barn owl*

* Carmarthenshire LBAP-listed species only

Appendix 11.7.2 Birds of Conservation Concern in Wales

Red List	**Amber List**
Common bullfinch	Black-headed gull
Common grasshopper warbler	Common linnet
Northern lapwing	Herring gull
Marsh tit	House sparrow
Starling	Reed bunting
	Skylark
	Song thrush