Species Action Plan

HIGH BROWN FRITILLARY
Argynnis adippe

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This species action plan is an unpublished working document produced to focus and co-ordinate the conservation of the High Brown Fritillary butterfly in the UK over the next five to ten years. It has been prepared under the *Action for Butterflies* project which is funded by WWF-UK, English Nature, the Countryside Council for Wales and Scottish Natural Heritage. The Action Plan was prepared in consultation with the following organisations in the hope that they will participate in the actions outlined; English Nature, Countryside Council for Wales, ITE, Dartmoor National Park, Exmoor National Park, the Forestry Authority, Forest Enterprise, MAFF/ADAS, WOAD, WWF-UK, and the National Trust.

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Butterfly Conservation (the British Butterfly Conservation Society) has an overriding objective to ensure a future for butterflies, moths and their habitats. In order to achieve this objective its aims are to:

- raise public awareness of the plight of our butterflies and moths and encourage public involvement in conservation.
- halt the decline of butterflies and moths and maintain or improve the present status of threatened species.
- improve the extent and suitability of key lepidoptera habitats and the environmental quality of the countryside as a whole for all lepidoptera species.
- work with and advise other conservation groups, local bodies and agencies on techniques of land management which favour butterflies and moths and related wildlife.
- acquire and manage habitats for butterflies and moths.
- encourage the research (both at amateur and professional levels) on butterflies and moths.
- support and encourage butterfly and moth conservation world-wide.

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Summary

• The High Brown Fritillary**,** *Argynnis adippe* is listed in the UK Red Data Book as a vulnerable species. It is protected under the Wildlife and Countryside Act 1981. Due to its rarity and high recent rate of decline, the implementation of this plan is given a **high** priority.

• The High Brown Fritillary has suffered a severe contraction in range (94%) and decline in numbers mainly over the last forty years and is now found in only 51 definite colonies. The bulk of the decline has taken place in woodland and is due to a cessation in dynamic broadleaf woodland management.

• The High Brown Fritillary currently occurs in two main habitat types: 1) Bracken-dominated habitats (throughout its range); and recently coppiced woodland (or cleared scrub) over limestone outcrops (NW England only).

• The major threats to the butterfly are abandonment of/or changing patterns of management in grassland/Bracken habitats (e.g. cessation of/or reduction in grazing), inappropriate Bracken eradication measures, and potentially a minor threat from collectors. The development and implementation of appropriate management is needed for the future survival of most colonies.

• The major objectives of the Plan are to maintain all existing populations at or above present levels, including some large populations in each region (as defined in Appendix 1) and to encourage the expansion of the butterfly both within occupied regions and within its former range .

• The objectives of the Plan will be achieved by maintaining or reintroducing sympathetic grazing regimes on existing Bracken habitats; preventing or limiting Bracken eradication measures in existing and potential High Brown Fritillary Bracken habitats and maintaining and restoring coppicing/scrub management in existing woodland habitats. In order to take into account the metapopulation structure of this species, networks of habitats should be developed and maintained in all occupied regions. Research into the development and implementation of appropriate management, especially in Bracken habitats will be encouraged. The Action Plan and the conservation of the High Brown Fritillary will be publicised and funds sought to ensure that the proposed strategy can be accomplished.

• The Action Plan covers the next ten years, will be monitored annually and reviewed in the year 2000 or such earlier time as the situation demands.

Part 1 Overview

1.1 PRIORITY STATEMENT

The High Brown Fritillary *Argynnis adippe* is listed in the British Red Data Book as a vulnerable species (Shirt 1987) and as a priority species in the Biodiversity: The Uk Steering Group Report (DOE, 1995). Nationally its range has declined by 94%, most rapidly in the last 50 years, with the bulk of its decline taking place in woodland (Warren 1991, 1995). In recent years its fortunes have been mixed; it is still declining in several areas and populations have been reduced to dangerously low levels on many remaining sites. On the other hand some other populations have increased over recent years where traditional management has been maintained due to conservation effort. The High Brown Fritillary is becoming conservation dependent in the UK and is probably Britain's most endangered resident butterfly. **High** priority should therefore be afforded to its conservation and recovery as outlined in this plan.

1.2 BROAD OBJECTIVES

1. Maintain all existing populations including some large populations (>200 adults at peak flight period) in each stronghold.

2. Maintain all large populations at or above present levels.

3. Encourage expansion of the High Brown Fritillary by maintaining an extensive network of suitable habitats in all occupied regions.

4. Encourage restoration of suitable habitat within its former range and examine opportunities for reintroducing the species.

1.3 LEGAL STATUS

The High Brown is listed on Schedule 5 of the Wildlife and Countryside Act. Implications of this legislation in the UK are given in Appendix 2.

Table 1 The Status and Level of Biological Knowledge

Population	**-size**	**In 1994, 51 definite colonies of the butterfly were known, plus another 34 possible colonies (with either occasional adult sightings or older records).**
	-trend, numbers	**Many of the existing colonies are very small and may not be viable in isolation.**
	-trend, range	**Nationally its range has declined by 94%.**
Knowledge of	**-status**	**Reasonable in England; number of colonies in Wales probably remain to be discovered.**
	-trends, numbers	**Good in Morecambe Bay area and W.Midlands. Fair in SW where colonies are known.**
	-conservation requirements	**Fair, although applying this knowledge to practical management has only been attempted in the last few years. Experience and knowledge of how to manage Bracken habitats is in its pioneering stage.**

Definition of a Colony

A colony is defined as a group of individuals that occur in a discrete area of land (a site) which is separated from other colonies by a strip of at least 0.5km of completely unsuitable land (e.g. arable or improved fields) or 1km of semi-natural vegetation which is unsuitable for breeding (from Warren 1991). Although marking experiments have shown that the species is fairly colonial, there is often some interchange of individuals between nearby colonies (Warren, 1994).

Part 2 Biological Assessment

2.1 INTRODUCTION

The High Brown Fritillary *Argynnis adippe* breeds in sunny sheltered areas containing a warm sparse ground flora in which violets are a prominent species. In common with other violet-feeding Fritillaries, its survival appears to be dependent on warm conditions for larval development but it seems to be the most specialised of all, requiring an especially hot local microclimate.

2.2 ECOLOGY

Habitats
The High Brown Fritillary breeds in two main habitats in Britain; 1) Bracken *(Pteridium aquilinum*)-dominated habitats (throughout its range) and 2) limestone rock outcrops, usually where scrub or woodland has recently been cleared (currently north-west England only). The larval food plant in both habitats is normally Common Dog-violet (*Viola riviniana*), although Hairy Violet (*Viola hirta*) is also used regularly in limestone areas (Warren 1995). Some other violet species may be utilised e.g. Pale Dog-violet (*V. lactea),* Heath Dog-violet *(V. canina).*

1) Bracken-dominated Habitats
The Bracken-dominated habitats are usually at low altitudes (up to 200-300m) on open but sheltered slopes, often facing south. They have a simple, spring woodland flora e.g. Ground Ivy (*Glechoma hederacea*), Tormentil (*Potentilla erecta*), Wood Anemone (*Anemone nemorosa*) and violets. Although breeding areas are dominated by Bracken, and have abundant Bracken litter and sparse grass, this is often interspersed with more open grassy areas (Warren, 1995).

2) Woodland or Scrub Clearings With Rock Outcrops
The rock outcrops used in Britain are all on Carboniferous Limestone of the Morecambe Bay area in north-west England. Here, breeding occurs on freely drained limestone soils, typically in sheltered clearings where woodland or scrub has recently been cleared, or where there are early successional stages in the colonisation of bare rock, or amongst sparse sward growth or along Bracken edges.

Away from the Morecambe Bay stronghold, all surviving colonies in the UK breed in dense stands of Bracken, where the eggs are laid in small canopy gaps with abundent larval food plant and a high percentage ground cover of dead Bracken present (50-100%). The butterfly appears to be confined to these habitats because the larvae have high thermal requirements and the dead bracken litter provides an extremely warm micro-climate when larvae are developing during the spring (see below).

Life Cycle

The adult butterfly is univoltine, flying from late June to late August or even early September in the Morecambe Bay area, but having a shorter season (mid June-early August) elsewhere. The adults are highly active in warm weather and fly rapidly just above Bracken or other low vegetation. Both sexes feed especially on Bramble (*Rubus fruticosus*) blossom and Common Knapweed (*Centaurea nigra*) but also on Thistle species (*Cirsium* spp.), Ragwort (*Senecio jacobaea*) and Betony (*Stachys officinalis*), and occasionally visit nearby gardens to feed on Buddleia.

Due to the necessary interest in the conservation requirements of this butterfly detailed studies on the egg laying position of the females have been carried out by Dr Martin Warren and co-workers (Warren 1991, 1992, 1995). Information is hard to obtain in the wild as females are highly mobile and difficult to observe whilst egg-laying. In Bracken habitats they fly low over the tops of the fronds and suddenly drop down to search the ground. Once on the ground, females crawl around for several minutes repeatedly probing the vegetation with their abdomens. Egg-laying usually occurs after they have crawled over a leaf of the food-plant, but not always. Sometimes eggs are laid within seconds of the female landing, before touching any violet plants.

During the extensive bouts of abdomen probing, eggs often appear to have been laid when subsequent searches prove otherwise. This problem arises because the tip of the ovipositor is the same pale brown colour as the egg and the two are difficult to separate unless observed within a few centimetres, which risks disturbance. From lengthy observations on egg-laying it seems clear that many egg sites are rejected and that 'false' egg laying behaviour is common, making it even more difficult to obtain egg data. Information on habitat selection has consequently been obtained partly from a small number of direct observations on egg-laying and partly by searching for larvae during the spring when they can be found basking on dead vegetation. This data shows that eggs were laid near the food plant (within 50cm) on firm substrates which are unlikely to rot down as the eggs overwinter. In woodland clearings, they were laid in very short vegetation (mostly 1-5cm), often next to small outcrops of limestone rock, where there was a good cover of mosses (usually overlying rock) and where there was only a sparse cover of grass. In Bracken habitats, they were laid in small groups in otherwise dense Bracken stands, where the ground was largely covered by dead litter and where there was again a little grass. Substrates chosen were typically dead Bracken litter and moss, small twigs or dead leaves in woodland. Vegetation with fragmented, loose plant debris was usually rejected for egg-laying as females seemed unable to find a firm substrate which would be suitable for eggs to overwinter.

After hatching, the larva leaves the egg shell uneaten and having found a violet seedling, starts to feed on the margins of young leaves and the cotyledons; when not feeding it hides away at the base of the food plant or amongst dead leaves. The larvae are diurnal and, whenever the weather is cool, they bask on the upper surface of leaves or bare ground, apparently warming themselves in any weak sunshine. The basking behaviour is thought to allow the larvae to raise their body temperature greatly above ambient temperature, thereby allowing rapid development during cool spring weather. In Bracken habitats, the dead litter where larvae bask and where eggs were laid was 2-5^{o}C warmer than short, grassy vegetation (5cm tall) early on a sunny day, and 7-10^{o}C warmer than the ambient vegetation. In woodland clearings, the 3cm deep moss and leaf litter where larvae often bask was 10-17^{o}C

warmer than surrounding vegetation early on a sunny day, about 4°C warmer by mid-morning when the latter was dry. The moss over rock, where most eggs were laid was the warmest place measured under dry, sunny conditions, being 27°C warmer than ambient, 2°C warmer than the leaf litter, and 6°C warmer than fairly short vegetation. Thus the High Brown Fritillary seems to breed in the warmest microhabitats in some of the warmest and most sheltered habitats where violet species grow in Britain. However, during hot weather the larvae do not bask but hide under dense vegetation where they remain still for long periods between frantic bouts of feeding. Throughout its development the larva is solitary. High Brown Fritillary larvae hatch in March and become fully grown by the end of May or beginning of June, when they pupate amongst the leaf litter.

Prior to pupation the larva spins several leaves together to form a loose 'tent'. On the roof of this structure it spins a white silken pad from which it suspends itself, the prepupal period lasting c.30 hours depending on the temperature. The pupal stage lasts 2-3 weeks (Emmet & Heath, 1990), although this has not been studied in detail; the length of this stage is probably also very variable with temperature.

2.3 DISTRIBUTION AND POPULATION

Distribution

The High Brown Fritillary is represented by several subspecies from north Africa across Europe and temperate Asia to Japan. The species is still common in the central and southern parts of Europe, but has declined throughout northern Europe (Emmet and Heath, 1990).

In the 18th and 19th centuries, and up to the middle of the present century, the High Brown Fritillary was widely distributed in England and Wales, although it always tended to be scarcer in the eastern counties. Records from Scotland are doubtful (Thomson, 1980) and it has never been recorded from Ireland.

In common with many butterflies which utilise woodland clearings it enjoyed a period of relative abundance from the late 1930s until the early 1950s, but thereafter has suffered one of the most severe contractions of range and decline in numbers of any British butterfly (Warren, 1991, 1992, 1995). By 1980 it had virtually disappeared from the eastern half of Britain and most woodland colonies had become extinct. Even in the New Forest, where it had been locally abundant into the early 1970s, it had declined to the point of apparent extinction, due to the demise of the continuity of supply of clearings from broad-leaved woodland, and the lack of open forest Bracken stands (Oates, pers.comm.). Further west, scattered colonies still existed, mainly in Wiltshire, to the west of the Malvern Hills in Herefordshire, in the Wyre Forest, Worcestershire, and in parts of Wales. It was rather more frequent in south Cumbria, Somerset, Devon and north Lancashire, particularly in the woodland fringes around and on Exmoor and Dartmoor.

However, the male High Brown Fritillary appears very similar to the Dark Green Fritillary in the field especially when fresh (they are the same size and only distinguishable by the pattern and colour of the underside of the wings - females are somewhat more easily separated than

males). This may have lead to confusion in the recording of the historical and present distribution of the High Brown Fritillary.

The butterfly has declined most severely in woodland habitats. The primary causes of colony loss are the cessation of coppicing; regrowth of ancient woodland which had been felled in the post-war period; and the replanting of deciduous woodland with alien conifer species. These changes would have shaded the ground flora and reduced the ground temperature below the threshold necessary for successful breeding. The loss from other habitats is less well documented but the butterfly was undoubtedly once present on many heathy commons as well as in woodland (Frohawk, 1934). It seems likely that such colonies bred in Bracken stands and not in woodland. These habitats have also suffered from changing land use and the abandonment of traditional practices in ways that are harmful to the High Brown Fritillary (e.g. most common land was formerly grazed by livestock and Bracken litter was gathered in large quantities for animal bedding). The latter practice has now almost entirely ceased throughout Britain and, due to economic pressures, many commons in lowland areas have not been grazed since the 1940s (Warren & Oates, 1995).

Although the High Brown Fritillary seems to require fairly dense Bracken for breeding, unmanaged stands can become unsuitable due to the build-up of very dense litter which eventually suppresses all other plant growth. There is a delicate balance between grazing and neglect in these habitats. Most existing colonies occur in areas still being grazed by cattle and/or ponies and sometimes sheep, such as Dartmoor in the south-west. These animals rarely eat Bracken because it is toxic and unpalatable, but their trampling prevents total domination because it damages new fronds and helps break up the litter. Stock pushing into the Bracken stands when grass is in short supply (e.g. early spring and during summer drought) is also thought to be beneficial. There is strong evidence from Herefordshire, where management has ceased more recently, that the local extinction of the High Brown Fritillary on commons has been a direct consequence of abandonment (Warren, 1995).

Thus the decline of the High Brown Fritillary in Britain appears to be linked to the changing management of both woodland and common land, which became particularly severe in the post-war period.

Today the butterfly has three UK strongholds. These are the Morecambe Bay Limestone hills (S.Cumbria / N. Lancashire) and on Dartmoor and Exmoor. The only other definite populations are a few in the south-west Midlands (Herefordshire, Worcs and Shropshire) and four small ones in Wales. On the whole the colonies on limestone woodland and scrub in Cumbria and north Lancashire are faring better than those in the south, and are showing little sign of decline. Details of current colonies are shown in Table 2 overleaf and in Appendix 1..

Population Dynamics

Little detailed research has been carried out on the population dynamics and mobility of this species. However recent mark-release-recapture studies have shown that the High Brown Fritillary is fairly mobile, with individuals occasionally moving 2km between colonies and occasional sightings 5km from breeding areas (Warren 1994, 1995). It is thus likely that the High Brown Fritillary exists as metapopulations* which rely on networks of breeding habitats. Some habitat patches will be highly suitable and used every year, some will be sub-optimal and used sporadically, while others will be marginal and used only in hot summer periods of abundance (e.g. during sequences of hot summers). These marginal and sub-optimal areas are probably important in ensuring the long term viability of the whole metatpopulation. They may also be important in maintaining genetic diversity and may provide stepping stones for the colonisation of new habitats.

Table 2. Location of definite High Brown Fritillary colonies in the UK, 1990-94
(Source: Warren, Baker & Oates, 1995).

	Definite	**Possible**
ENGLAND		
Cornwall	-	3
Devon (Dartmoor)	16	15
Devon (Exmoor)	6	5
Somerset (Exmoor)	6	2
Hereford	4	1
Worcs/Salop	-	1
Glos	1	-
Wilts	-	2
Lancs	5	-
Cumbria	10	4
ENGLAND TOTAL	**48**	**33**
WALES		
Mid-Glam	2	-
Powys	1	-
Gwent	-	1
WALES TOTAL	**3**	**1**
GB GRAND TOTAL	**51**	**34**

* A metapopulation is a collection of local populations, connected by occasional dispersal, in which there are local extinctions and colonisations (Gilpin & Hanski, 1991).

2.4 LIMITING FACTORS

Historical Causes of Decline

Changes in wood management (especially decline in coppicing and replanting with conifers).

Loss of grassland/Bracken habitats and abandonment of grazing and land management (especially on common land).

Bracken control/eradication measures (now being regulated in most High Brown Fritillary areas).

Possible Current and Future Limiting Factors

Continuation of nature conservation management is vital to the continued survival of many colonies.

Abandonment and changing patterns of grassland/Bracken habitat management (e.g. changing stock management - this can be changing from cows to sheep or even from hardy upland sheep to modern soft mouthed/lowland sheep; cessation or reduction of grazing or changes in wintering practices).

Breaks in continuity of felling or dynamic management in broadleaved woodland.

Afforestation on Bracken sites.

A threat on a few sites from inappropriate Bracken eradication measures (e.g. spraying, extensive burning).

Potentially a minor threat from collecting.

Breakdown of metapopulation structures as a result of habitat fragmentation, leading to isolated populations with limited long term viability.

2.5 RESUME OF CONSERVATION TO DATE

Status of the High Brown Fritillary

Recent regional surveys were conducted by Matthew Oates on behalf of the Nature Conservancy Council, Butterfly Conservation and the National Trust during 1983-1991. In addition a national survey was carried out by the Joint Committee for the Conservation of Insects and WWF to determine for the first time the national status of the High Brown Fritillary (see Appendix 3 for details). Results from the surveys described above showed that by 1992 the butterfly's range had declined by 94% since recording began (mostly in the last 30 years), and that since 1970 the High Brown Fritillary has become extinct in at least 13 counties (Warren 1991, 1995). As a result of survey findings, the High Brown Fritillary was added to schedule 5 of the Wildlife and Countryside Act 1981 during 1989.

Of the 51 High Brown Fritillary breeding areas known in Britain in 1990-94, a large proportion are protected in some way (Warren, Baker & Oates, 1995). About 64% are notified as SSSIs, and many are nature reserves. The latter include five NNRs (one with a very large colony) and nine County Trust Reserves. In addition, some twenty colonies occur on land that is owned (or part owned) by the National Trust (Oates 1995) and several are managed under agreements with the Dartmoor National Park or Butterfly Conservation. This situation on the surface thus seems relatively promising; the future of the High Brown Fritillary in Britain does not depend on new conservation designations, but on how many sites can be brought into favourable management. Many organisations have shown a strong interest in conserving the species. The future success of High Brown Fritillary conservation thus depends on 1) the development and implementation of appropriate management, and 2) maintenance of beneficial aspects of traditional regimes.

Conservation Requirements of the Species

The first detailed study of the conservation requirements of the High Brown Fritillary was carried out between 1990-1994: the Nature Conservancy Council (and subsequently English Nature) commissioned research to examine the requirements of the High Brown Fritillary and identify measures needed to conserve its remaining breeding habitats. Some of the results from these studies have already been published and others soon will be (Warren, 1991-5; Warren and Oates, 1995; Warren, Baker & Oates, 1995). The research showed that the butterfly is confined to certain habitats because the larvae have high thermal requirements, especially during the spring. The study also demonstrated that certain Bracken communities can have considerable conservation value, contrary to the prevailing opinion amongst land owners and many conservationists who tend to regard Bracken as a weed.

The future of the High Brown Fritillary is thus tied closely to the conservation and management of Bracken habitats (up to 80% of the existing colonies breed in these). The dynamics of these crucial habitats are extremely complex and our knowledge of how to manage them for the butterfly is still at an extremely experimental and pioneering stage. Traditional extensive agricultural management of these habitats has ceased in many cases, forcing conservation bodies to develop and implement new techniques which produce the required conditions. Bracken management has been implemented on only a few sites and the majority of sites have not been assessed with regard to their suitability and management needs

(notably in the south west where many colonies have only recently been discovered). The exceptions to this are a few National Trust properties where new Bracken management has been initiated, and on some sites involving Butterfly Conservation volunteers. For example, at Bircher Common, the National Trust has introduced a programme of patchy Bracken litter clearance during the winter and seasonal summer path cutting. In limestone habitats, management recommendations have been easier to define and implement. New management has been initiated on numerous sites which are owned by conservation bodies such as English Nature, County Wildlife Trusts, RSPB and National Trust (e.g. Oates, 1995). Indeed, many populations are responding well to rotational cutting of woodland or scrub in the limestone habitats of north-west England (Warren, 1995). For example, at Gait Barrows NNR, the butterfly has increased substantially following the instigation of a coppice rotation, whereby 0.5ha is cut every 1-2 years.

Additional potential problem areas concerning the High Brown Fritillary Bracken habitats are the threats from the inappropriate use/implementation of new grants attempting to eradicate Bracken within areas such as the recently declared Dartmoor, Exmoor and Lake District ESAs, and changing land use such as reduced stocking in Bracken areas within large common land grazing units.

The conservation of the High Brown Fritillary remains one of Butterfly Conservation's top priority projects. The current Action Plan seeks to capitalise on the results and interest gained from previous research and ensure that its findings are used to effect practical recovery. The most recent project, which has been funded by English Nature's Recovery Programme for 1995, will allow Butterfly Conservation to continue collating and monitoring data, record experimental plots, and provide advice to site owners and managers. This project thus fulfils some of the key targets defined within this Action Plan.

Part 3 Actions and Work Programme
(see Appendix 1 for areas defined in the actions)

This section has been divided into the standard headings Policy and Legislative; Site Safeguard and Acquisition; Land Management; Species Protection and Licensing; Advisory; International; Future Research and Monitoring; Communications and Publicity; Review. Actions appear under one heading according to their major role and/or aim, and are given a low, medium or high priority. The lead organisation(s) concerned for each action is/are named.

Notes
Definition of colony size: Large = >200 adults at peak; Medium = 50-200 adults at peak (after Warren *et al*., 1995).
For key to abbreviations see page 20.

3.1 POLICY AND LEGISLATIVE

	Lead organisations concerned
Action 1 PRIORITY: HIGH	
Include habitat requirements of the High Brown Fritillary when drawing up or revising prescriptions in ESAs, Countryside Stewardship and other agri-envronment schemes (to promote appropriate Bracken and grazing management in areas where the species occurs or could be restored).	**MAFF/ ADAS, WOAD, CoCo, EN, CCW, NPs**
Action 2 PRIORITY: MEDIUM	
Review grant applications for Bracken control in regions where the High Brown Fritillary survives and refuse or ammend control programmes on existing and potential sites (e.g. Dartmoor, Exmoor, Hereford, S.Wales, S.Cumbria, N.Lancashire).	**NPs, EN, CCW,FA**
Action 3 PRIORITY: HIGH	
Improve financial incentives for coppice restoration and management in regions where High Brown Fritillary survives (e.g. S.Cumbria / N.Lancashire) - see figure1 for areas identified in the actions.	**FA, LAs, EN**
Action 4 PRIORITY: LOW	
Refuse planting grants on any definite or possible High Brown Fritillary sites.	**FA, EN**

3.2 SITE SAFEGUARD AND ACQUISITION

Action 5 PRIORITY: MEDIUM

Designate as SSSIs all breeding habitats with large or medium colonies, where this will help improve habitat management.	**EN, CCW**

Action 6 PRIORITY: MEDIUM

Protect all known colonies through appropriate management agreements and/or other appropriate management provisions (e.g. Tir Cymen).	**EN, NPs, CCW, LAs, MAFF**

Action 7 PRIORITY: LOW

Protect all known colonies through reserve acquisition where appropriate, possible or necessary.	**BC *etc*.**

3.3 LAND MANAGEMENT

Action 8 PRIORITY: HIGH

Continue appropriate management on existing, protected colonies and extend so that all colonies are managed.	**All**

Action 9 PRIORITY: HIGH

Maintain or encourage some large populations within each regional stronghold and increase population size.	**All**

Action 10 PRIORITY: HIGH

Implement appropriate management near to former colonies if there is a possibility of recreating suitable breeding habitat, concentrating on existing regional strongholds.	**EN, CCW, BC, WTs, NT**

Action 11 PRIORITY: LOW

Implement appropriate management on new sites if there is the possibility of recreating suitable breeding habitat within former range.	**EN, CCW, BC, WTs, NT**

3.4 SPECIES MANAGEMENT AND PROTECTION

Action 12 PRIORITY: LOW

Enforce legislation to prevent collection of this species.	**EN, CCW**

Action 13 PRIORITY: MEDIUM

Actively discourage unauthorised releases of the species into the wild.	**EN, CCW, BC**

Action 14 PRIORITY: LOW

Conduct strategically placed reintroductions into networks of suitable habitats if/when restored, with appropriate licences having been obtained.	**BC, EN *etc*.**

3.5 ADVISORY

Action 15 PRIORITY: LOW

Produce a simple advisory guide on how to manage land for the High Brown Fritillary for circulation to landowners and managers in target areas.	**BC, EN *etc*.**

Action 16 PRIORITY: HIGH

Advise land management agencies and site owners/managers on practical habitat management for the High Brown Fritillary.	**BC *etc*.**

3.6 INTERNATIONAL

Action 17 PRIORITY: LOW

Disseminate and promote exchange of information on conservation requirements of the High Brown Fritillary in the UK to other European countries especially those where the species is declining.	**BC, JNCC**

3.7 FUTURE RESEARCH, SURVEY AND MONITORING

Action 18 PRIORITY: HIGH

Survey habitat on all known sites and identify precise and potential breeding areas.	**BC, EN, CCW**

Action 19 PRIORITY: MEDIUM

Survey potential habitat in all areas with definite colonies and produce habitat suitability maps. Priority effort should be made in those areas with limited survey coverage.	**BC, NPs, EN, CCW**

Action 20 PRIORITY: HIGH

Identify habitat management and conservation needs on all sites.	**BC, EN, CCW**

Action 21 PRIORITY: HIGH

Continue research on habitat management techniques (especially in Bracken habitats), with appropriate monitoring of habitat and butterflies.	**BC, EN, MAFF.**

Action 22 PRIORITY: HIGH

Continue existing butterfly monitoring transects on High Brown Fritillary sites and ensure annual monitoring (e.g. by standard timed counts) of all large or medium colonies, (and occasional monitoring of small colonies (every 2-5 years)).	**BC, EN, CCW, NT, NPs, WT**

Action 23 PRIORITY: HIGH

Collate transect data annually and calculate annual index to compare trends on individual sites.	**BC, EN, CCW**

Action 24 PRIORITY: LOW

Survey for potential reintroduction sites within former range and encourage the restoration of suitable breeding habitats.	**EN, CCW, BC, WTs**

Action 25 PRIORITY: LOW

Investigate the effect of habitat loss and isolation of colonies on population viability.	**EN, CCW, BC, Universities**

3.8 COMMUNICATIONS AND PUBLICITY

Action 26 PRIORITY: MEDIUM

Publicise this Action Plan, the decline of the High Brown Fritillary and measures needed to conserve it.	**BC and All**

Action 27 PRIORITY: MEDIUM

Make information on existing colonies, the ecology of the High Brown Fritillary and the management of its habitat available to all those that play a role in its conservation and recovery (e.g. information to MAFF on ESAs where the butterfly is known to occur).	**BC, NPs, EN, CCW**

3.9 REVIEW

Action 28 PRIORITY: HIGH

To monitor progress of the Action Plan annually and review in five years time.	**BC, EN, CCW**

Key to Abbreviations

All - All organisations listed
BC - Butterfly Conservation
CCW - Countryside Council for Wales
CoCo - Countryside Commission
EN - English Nature
FA - Forestry Authority
LA - Local Authority
MAFF - Ministry of Agriculture, Food and Fisheries
NPs - National Parks (Dartmoor, Exmoor, Lake District)
NT - National Trust
WTs - Wildlife Trusts

References

Emmet, A.M. & Heath, J. (1990) The butterflies of Great Britain and Ireland. Vol 7, Part 1, Harley Books , London.

Frohawk, F.W. (1934) A complete book of British butterflies, Ward Lock.

Gilpin, M & Hanski, I. (Eds) (1991) Metapopulation dynamics: Empirical and theoretical investigations. Academic Press, London.

Oates, M. R. (1995) The role of the National Trust in the conservation of British butterflies. In: Bullock, D.J. & Harvey, H.J. (Eds) The National Trust and nature conservation: One hundred years on. *Biological Journal Of the Linnean Society* **56** (Suppl.), 73-93, London.

Shirt, D.B. (ed.) (1987) British Red Data Books: 2. Insects, Nature Conservancy Council, Peterborough.

Thomson, G. (1980) The butterflies of Scotland: A natural history. Croom Helm, London.

Warren, M.S. (1991) Conservation research on the High Brown Fritillary 1990-91. Unpublished report to NCC.

Warren, M.S. (1992) The High Brown Fritillary - Britain's most endangered butterfly. Butterfly Conservation News **50**, 26-30.

Warren, M.S. (1994) Autecology and conservation needs of the High Brown Fritillary: Annual report for 1993/1994. English Nature Contract report. Butterfly Conservation, Wareham.

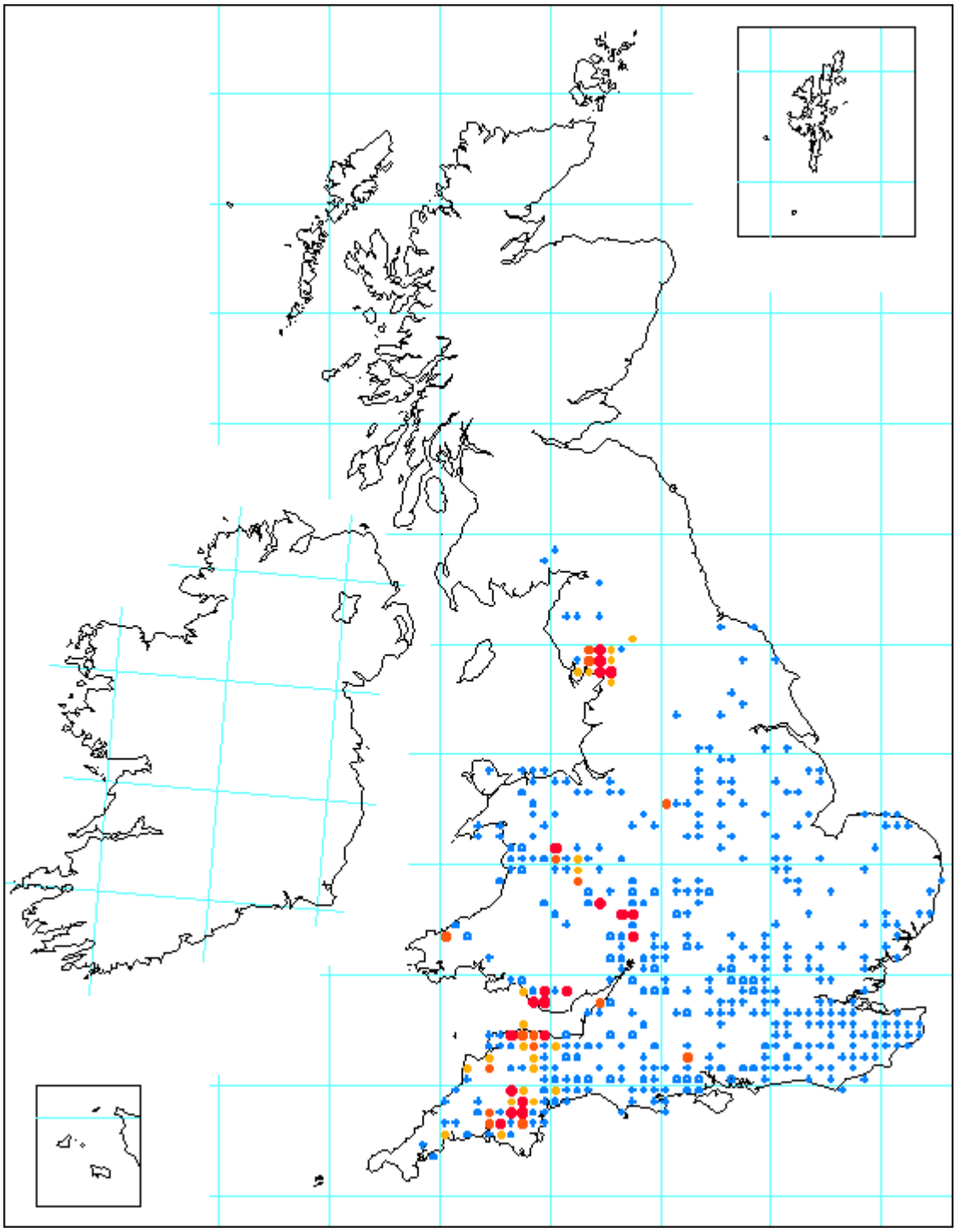
Warren, M.S. (1995). Managing local micro-climates for the High Brown Fritillary, *Argynnis adippe*. In: Pullin, A.S. (Ed.) Ecology and conservation of butterflies, 198-210. Chapman & Hall, London.

Warren, M.S., Baker, N.R. & Oates, M.R. (1995) High Brown Fritillary: site dossier for Britain, 1990-94. Confidential Report, Butterfly Conservation, Wareham.

Warren , M.S. & Oates, M. R. (1995) The importance of Bracken habitats for butterfly populations. In: R.T. Smith & J.A. Taylor (Eds) Bracken: An environmental issue. 178-181. International Bracken Group Special Publication No.2, Aberystwyth (available from School of Geography, University of Leeds).

Appendix 1 The current distribution of the High Brown Fritillary

Butterflies for the New Millennium project (2001).
Copyright of Butterfly Conservation/Biological Records Centre.
(Dark full spot all records from 1995-1999; open circles all records between 1970-1982; cross all pre 1970 records).



Appendix 2 Implications of the Wildlife and Countryside Act 1981 in the UK

The Wildlife and Countryside Act 1981 gives limited protection to the High Brown Fritillary butterfly.

Under this Act it is a criminal offence if any person:

- intentionally kills, injures or takes a specimen from the wild (this, in effect prohibits collecting for any purpose).
- has in their possession or control any live or dead wild specimen or any part of or anything derived from such specimen.
- sells, offers or exposes for sale, or has in their possession or transports for the purpose of sale, any live or dead specimen (the object is to prevent trading).

Ova, larvae and pupae as well as mature insects are covered by the Act. It is presumed in law that the specimen in question comes from the wild, unless the contrary is shown.

Appendix 3 Regional surveys of the High Brown Fritillary

Abbott, A.M. (1992) High Brown Fritillary survey, Somerset. Unpublished report to Butterfly Conservation and English Nature.

Abbott, A.M., & Clarke, S.A. (1993) High Brown Fritillary survey (Exmoor) . Unpublished report to Butterfly Conservation and English Nature.

Baker, N.R. (1992) A survey of the habitats of the High Brown Fritillary, *Argynnis adippe* at the Dunsford and Deadman's Corner breeding sites in Devon 1992. Unpublished B.Sc. report, Exeter University.

Butterfly Conservation West Midlands Branch (1992) A survey of selected sites in Herefordshire, Staffordshire and Shropshire for the High Brown Fritillary. Unpublished Report to English Nature.

Clements, M. (1994) The monitoring of the High Brown Fritillary, *Argynnis adippe*, at Grenofen Wood and West Down SSSI. Unpublished report to Butterfly Conservation.

Coombes, P.D. (1992) High Brown Fritillary: Conservation on Dartmoor West Down - Tavistock. Unpublished report for Butterfly Conservation.

Coombes, P.D. (1993) High Brown Fritillary conservation on Tavistock Commons, West Devon. Unpublished report for Butterfly Conservation.

Grove, S, Knight, W & Baldock, N. (1992) A report on surveys of the High Brown Fritillary butterfly on Dartmoor. Unpublished report for Dartmoor National Park and Butterfly Conservation.

Oates, M, R. (1986) A survey of butterfly populations on the carboniferous limestone hills of the Morecambe Bay region 1983 - 85. Unpublished report to the Nature Conservancy Council.

Oates, M, R. (1986) A survey of High Brown Fritillary populations in Herefordshire. . Unpublished report to the Nature Conservancy Council.

Oates, M.R. (1987) The conservation of the High Brown Fritillary in Herefordshire & Worcestershire. Unpublished report to the Nature Conservancy Council.

Oates, M, R. (1988) A survey of High Brown Fritillary populations in Herefordshire. . Unpublished report to the Nature Conservancy Council.

Oates, M.R. (1989) The conservation of the High Brown Fritillary in Herefordshire & Worcestershire. Unpublished report to the Nature Conservancy Council

Oates, M.R. (1989) The High Brown fritillary in Devon and NW Somerset. Unpublished report to the Nature Conservancy Council.

Oates, M.(1991) The conservation of the High Brown Fritillary on Dartmoor. Unpublished report for Butterfly Conservation, Dartmoor National Park and English Nature.

Spencer, S. (1995) The status of The High Brown Fritillary in Montgomeryshire. Unpublished report to the Montgomeryshire Wildlife Trust.

Stuart, R. (1994) The status and conservation of the High Brown Fritillary at Barkbooth Lot, Cumbria. Project report submitted in partial fulfilment of the requirements for BSc in Environmental Mangement, University of Manchester.

Sutcliffe, O. (1993) The ecology, distribution and compositon of vegetation associated with Bracken on Warton Crag in Lancashire, and its implications for the High Brown Fritillary. Unpublished B.Sc. project report, Department of Biological Sciences, University of Wales, Aberystwyth.

Vickery, K. (1993) High Brown Survey. Mendips, Somerset. Contract report for Butterfly Conservation.

Warren, M.S. & Lewis, O. (1993) High Brown Fritillary in Wales. Unpublished CCW Contract Science Report No.58.

Warren, M.S., Baker, N.R. & Oates, M.R. (1995). High Brown Fritillary: Site dossier for Britain, 1990-94. Confidential Report. Butterfly Conservation, Wareham.

Appendix 4 Conservation requirements of the High Brown Fritillary

Habitat	1. Bracken dominated habitats - usually on open but sheltered slopes, often south-facing. 2. Woodland or scrub clearings, with rock outcrops-limestone mosaic habitats containing coppiced woodland, scrub, regenerating scrub and sparse sward grassland - (currently confined to carboniferous limestone around Morecambe Bay, N W England).
1. Bracken dominated habitats	Maintain highly dissected Bracken stands with frequent flushes of violets, broken Bracken litter, sparse ground flora and numerous small canopy gaps. Ideal conditions are created by extensive grazing by ponies and cattle, though sheep may also be suitable when in reasonably high numbers (preventing the build up of dead litter). On ungrazed, or lightly grazed sites, suitable conditions may be maintained by cutting areas (0.5-1ha) of Bracken during July and August on a 5-10 year rotation combined with cutting of paths in late June (immediately prior to the adult flight period). Alternatively, high violet densities may be maintained by periodic cutting or raking and disturbance of Bracken litter during autumn and winter. However, the long-term effects of cutting regimes remain unknown and this form of management requires further research. Periodic burning of Bracken litter (usually during February & March) may also play a crucial role in maintaining high violet densities on some sites and restoration of poorly neglected sites, but again the effects are poorly understood.
2. Woodland/scrub clearings with rock outcrops	Maintain regular supply of clearings, either by coppicing or patchy scrub clearance, in areas where these are rock outcrops or very thin soils. Breeding may also occur in adjacent limestone grassland where soils are naturally very thin and where violets (often Hairy Violet) are abundant. The latter habitat may also require some light grazing though this is not well understood.