



Species Action Plan

NORTHERN BROWN ARGUS
Aricia artaxerxes

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The Action Plan was prepared in consultation with the following organisations with the intention that they will participate in the actions outlined: English Nature, Countryside Council for Wales, Scottish Natural Heritage, National Trust, National Trust for Scotland, Scottish Wildlife Trust, Durham Wildlife Trust, Keele University, National Museum of Scotland, Tihill Economic Forestry, Institute of Terrestrial Ecology, the Peak District and Lake District National Parks, Ministry of Agriculture, Fisheries and Food and the Scottish Office Agriculture, Environment and Forestry Department.

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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 Northern Brown Argus *Aricia artaxerxes* is a nationally scarce species that is included in the Guidelines for the Selection of Biological Sites of Special Scientific Interest (NCC 1989) and protected under Schedule 5 of the Wildlife and Countryside Act 1981 with respect to trade.
- The British population forms two subspecies, both of which may be endemic. One subspecies, *A. a. salmacis*, is restricted to small areas of northern England (and perhaps N. Wales), where it has declined severely, and the other, *A. a. artaxerxes*, to Scotland, where it appears widespread but is of uncertain status.
- The major threats to the species are the extremes of overgrazing or neglect of its grassland habitat; combined with fragmentation of habitat leading to small colony size and increased chance of local extinction.
- The major objectives of the plan are to ensure existing populations are maintained through appropriate management of sites; to increase biological knowledge of the species; and to encourage restoration of former habitats.
- The objectives of the plan will be achieved by encouraging beneficial land management on existing sites, especially those that occur on nature reserves, surveying the entire range of the Northern Brown Argus as part of an overall review of its status in the UK and restoring and maintaining a network of habitat. Research will be supported, particularly concerning conservation management, the role of ants in the life cycle, metapopulation structure, and the ecology of the species in northern Scotland.
- The Action Plan and the conservation of this butterfly will be publicised. Funds will be sought to ensure that proposed actions are implemented.
- 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 Northern Brown Argus is a nationally scarce species and is included in the Guidelines for the Selection of Biological Sites of Special Scientific Interest (NCC 1989). It has declined in northern England (23% loss of 10km squares since 1970) and is confined to seven areas (Ellis 1994a) (and perhaps N. Wales). It has been over-looked in Scotland, but appears to be widespread (see Appendix 3). Its general conservation requirements are fairly well understood, but more information is needed on some critical aspects of its ecology in Scotland.

The Northern Brown Argus probably qualifies as a globally threatened (vulnerable) species under the new IUCN criteria: 1) it is probably endemic to the UK (although this is not yet proven, some authors e.g. Kudrna (1986) believe it to be endemic and this should be assumed as a precaution); and 2) it qualifies as a vulnerable species as its area of occupancy is less than 2000ha, its habitats are severely fragmented and it shows a continuing decline (criteria B1 and B2, Warren *et al* in prep.). A **high** priority should thus be afforded to conservation action for the species in the UK, though this should be reviewed when better survey data and genetic information on its endemic status becomes available.

1.2 BROAD OBJECTIVES

1. Maintain present range.
2. Halt decline in N. England and maintain and enhance all known populations.
3. Increase biological knowledge of the species, especially its conservation status in Scotland.
4. Encourage restoration of suitable habitats in former range.
5. Long-term objective of restoring 1970 range.

1.3 LEGAL STATUS

The Northern Brown Argus is listed on Schedule 5 of the 1981 Wildlife and Countryside Act for sale only.

1.4 Status and Level of Biological Knowledge

Population	-size	Number of colonies and colony size poorly known in Scotland but species apparently widespread. Confined to seven parts of northern England where most colonies are small and vulnerable, and perhaps N. Wales.
	-trend, numbers	Few data available on trends in numbers.
	-trend, range	Overall reduction from 172 10km squares to 106 post 1970 (38% loss). Apparently widespread in Scotland and many new colonies discovered by recent survey despite extinctions in south Scotland, Northumberland and Yorkshire.
Knowledge of	-status	Good for northern England. Moderate and increasing in Scotland. Recent survey in part of Scotland increased known squares from 70 to 114. Review of national status is needed urgently.
	-trends	Fair in England, patchy in Scotland.
	-conservation	Good for N. England but clarification of requirements required for some aspects e.g. metapopulation structure and role of ants in life cycle. Requirements in Scotland thought to be similar but require further work.

Part 2 Biological Assessment

2.1 INTRODUCTION

The Northern Brown Argus *A. artaxerxes* occurs on well-drained and usually base-rich sites where its larvae feed on Common Rock Rose *Helianthemum nummularium*. It occurs as two subspecies in Britain: *A. a. artaxerxes* (the nominate subspecies) occurs in Scotland and *A. a. salmacis* in northern England. Both of these subspecies are endemic to Britain and another subspecies *A.a. allous* is found across the western Palaearctic from Spain to central Russia (Melling 1990). Some authors consider the latter to be a separate species (*A. allous*) and *A. artaxerxes* endemic to the UK (Kudrna 1986). The precautionary principle suggests that it should be treated as an endemic when considering its conservation. *Aricia artaxerxes* is recognised as a separate species from the Brown Argus *A. agestis*, found in southern England and Wales, by the work of Jarvis and Hoegh Guldberg (e.g. Jarvis 1976, Hoegh Guldberg 1979, Shreeve 1993 and references therein). Some authors consider *A. artaxerxes* and *A. agestis* to be variations of the same species (Smyllie 1992, 1995). At present, however, the status of these species is recognised (see Shreeve 1993). The subspecies of *A. artaxerxes* are distinguished by morphological characteristics (Melling 1990). Their ecology and habitat requirements are thought to be essentially similar throughout. The genetic relationship of the *Aricia* complex is the subject of current research at Keele University (J.Cameron pers. comm.).

2.2 ECOLOGY

The Northern Brown Argus occurs on thin soils that are usually south-facing and up to 350m altitude. It is often associated with coastal valleys and quarries. In northern England, it often occurs on limestone pavement and outcrops. In inland areas of north-east England, 70% of inland sites are primary limestone grassland and the remainder secondary grassland (quarries and roadside cuttings) (Ellis 1994a). The lightly grazed or ungrazed grassland habitat often has a profusion of the larval foodplant *H. nummularium*, nectar sources such as Thyme *Thymus praecox* and Bird's-foot Trefoil *Lotus corniculatus*, and often with bare ground resulting from grazing, landslips, footpaths or limestone outcrops (Melling 1990). However, there are some colonies where the foodplant is more dispersed and where there is no bare ground (Ellis 1994a). In northern England, the foodplant *H. nummularium* is associated with *Festuca ovina* and *Sesleria albicans* grassland (Rodwell 1992). In Derbyshire, colonies are on *Festuca-Avenula pratensis* grasslands, particularly on the *Dicranium scoparium* sub-community (NVC CG2d) (Ben Le Bas pers. comm.).

In Scotland, *H. nummularium* is not restricted to calcicolous sites and can be found on sites of relatively low pH dominated by heathers, but these are also always well-drained (Grime *et al* 1992). Of 13 colonies studied in 1986, only three were found to be calcicolous grassland (four were neutral and five acidic) (Clunas 1986). Other foodplants have been reported; Storksbill *Erodium cicutarium* (Brooks and Knight 1982), Bloody Crane's-Bill *Geranium sanguineum* (Selman *et al.* 1973) and Hoary Rock Rose *Helianthemum canum* (Oates 1985), although *H. nummularium* is thought to be the sole foodplant at most sites.

The butterfly is univoltine, although in the extreme south of its range it may be bivoltine in some years. In inland northern England emergence varies greatly between early June to early

July and the flight period peaks between late June and mid-July. Adults are only abundant for 3-4 weeks but the flight period last 7-8 weeks into August (Ellis 1994a). On the coast of N. England, however, the flight period is shortened to 3-5 weeks (Selman *et al* 1973). In Scotland, the flight period is variable between years and regions, sometimes starting in June, sometimes not until mid-July in northern Scotland and butterflies may be seen into September (Clunas 1986).

Adults are highly active in sunshine and spend most of their time flying. Males actively search for females (and are not territorial) and courtship is elaborate and characteristic (Clunas 1986, Ellis 1994a). Adults feed mainly on Bird's-foot Trefoil, Thyme and Red Clover *Trifolium pratense* and can move 200m to nectar sources (Thomson 1980). Nectar sources are characteristically abundant on colonies. Adults are found roosting communally head downwards high in the vegetation (never below 20cm in Durham, Ellis (1994a)), often in sheltered areas at the base of slopes.

Eggs are nearly always laid singly, usually on the upper side of a leaf of *H. nummularium* (Melling 1990, Ellis 1994a, Cooch 1995), where they are highly visible and easily counted. They are occasionally laid on nearby plants. They are laid in a range of topographical situations, occurring at any height between 1 and 24cm from ground level in Durham (Ellis 1994a) or 1-30cm in Cumbria (Cooch 1995) and studies have also suggested that higher densities are laid in ungrazed situations than grazed (Holroyd 1994, Cooch 1995). There are good data on egg-site selection in N. England. Large quantities of *H. nummularium* appear unimportant as eggs may be laid where this covers 6-75% of the ground (Ellis 1994a, Cooch 1995).

Females select plants that are rich in nitrogen (Ellis 1994a) and often those that grow in sheltered situations among the vegetation (Cooch 1995). They also tend towards larger leaves (Ellis 1995). Cooch (1995) also found such a relationship but observed that nitrogen-rich plants were abundant and unlikely to be limiting. Bourn and Thomas (1993), however, have shown that the suitability of *H. nummularium* for the Brown Argus (which, in southern England, shows a similar preference to the Northern Brown Argus) may only be critical in some years when growth may be affected *e.g.* in drought years.

Eggs hatch after 6-15 days. Larvae do not eat the eggshell but move to the underside of the leaf where they pierce the lower epidermis and feed on the interior of the leaf, leaving the upper surface of the leaf intact. This feeding damage is characteristic although it can be confused with other insects with similar feeding behaviour and is therefore of limited value in surveys. They hibernate in the second or early third instar in September or early October at the base of the foodplant or on the ground amongst grass. The larvae start basking in early spring before recommencing feeding when feeding damage becomes more apparent, although larvae rarely eat more than half the underside of a leaf. With practice they can be located after emergence from hibernation. They pupate after the fifth or sixth instar in late May when about 12mm long. The pupa is often unattached, lying on the ground on a silk mat, or attached by silk threads to ground vegetation. The pupa, 8-9mm long, hatches after about three weeks.

It is assumed that there is a relationship between larvae of *A. artaxerxes* and ants as is typical of lycaenid butterflies. Larvae possess ant-attracting organs on the abdomen; retractile tubercles which are used by closely related species to deliver sugar to attendant ants

(Malicky 1970). There is some evidence that ants tend post-diapause larvae (*Formica lemani*, P. Summers pers. comm.) although Ellis (1994a) has never found pre-diapause larvae attended by ants. Clunas (1986) also found no evidence of a relationship and Cooch (1995) found only one attended by *Lasius flavus*. *Formica lemani* has been found on most sites studied in Scotland (Clunas 1986) and some in N. England (Ellis pers. comm.). Jarvis (1959) attributed reductions in predation of Brown Argus larvae in captivity to the introduction of the ant *L. flavus*. However, larvae reared in captivity and placed on foodplants in the spring do not appear to become attractive to ants and, in contrast to wild larvae, remain easy to locate (Ellis 1995).

Nor is there any evidence of an ant-relationship from experimental studies of oviposition. Females do not select plants near ants' nests in Durham (Ellis 1995) but in Cumbria, 30% of eggs were found on plants growing on *L. flavus* mounds, although it is not clear whether this was an influence of topography or other features of the foodplant (Cooch 1995). The role of ants in the life cycle, critical in the ecology of closely related species e.g. the Brown Argus (Bourn & Thomas 1993), requires clarification.

The presence of parasitoids in the life cycle has been investigated recently (M.R. Shaw pers. comm.). Of 214 collected post-diapause larvae, 67% were found to be parasitised, and 94% of these were by one parasitoid (the ichneumonid wasp *Hyposoter notatus*), possibly a host-specific parasitoid of *Aricia* species. Only three sites examined so far have failed to yield this parasitoid. Larvae were tended by ants (P. Summers pers. comm.) but the parasitoid probably lays eggs in larvae pre-diapause (M. R. Shaw pers. comm.).

The Northern Brown Argus requires light grazing of its grassland habitat by livestock (sheep, cattle or horses) or rabbits. Heavy grazing is detrimental (Ellis 1994a). Ungrazed habitats can also support high densities of butterflies but widespread scrub development and bracken invasion is ultimately detrimental (Clunas 1986, Ellis 1994a). Appropriate grazing regimes are not well established, but 4-10 sheep or 0.5-1 cattle per hectare may be appropriate over the summer months, or a lower rate year round. Light grazing is beneficial because it produces a varied vegetation structure and foodplants of the preferred growth form. Therefore the butterfly can exist in a range of situations as long as the habitat is not too rank or overgrazed and limited scrub development is beneficial (Ellis 1994a, 1995). An uneven sward with a mean height of 6-10cm is optimal at sites studied in Scotland (Clunas 1986) and vegetation heights up to 30cm occur on sites in northern England (Ellis 1994a, Cooch 1995). Eggs are not laid in overgrazed areas (Holroyd 1994) and they may be vulnerable in these situations as they are always laid close to the top of a plant regardless of sward height (Ellis 1995). The possible importance of shelter is emphasised by the high densities of eggs that are found on *H. nummularium* plants growing in grassy rides among woodland coppice at some sites (Cooch 1995).

In Yorkshire, the Northern Brown Argus also occurs on lightly grazed sites (Sutton and Beaumont 1989). In Scotland, there is less information available, especially where it occupies sites that are less obviously base-influenced, but in southern Scotland most sites are rabbit grazed and usually lightly grazed by sheep or cattle (Clunas 1986). Further north, no colonies are found on heavily grazed areas despite the presence of abundant *H. nummularium* (D. A. Barbour pers. comm.), which suggests that site selection criteria similar to colonies in N. England apply here also. Some colonies occur on sites that have been planted for forestry and these are threatened due to conifer growth (B. Cooper pers. comm.).

2.3 DISTRIBUTION AND POPULATION

Distribution

The subspecies *A. a. artaxerxes* and *A. a. salmacis* are possibly endemic to Britain and may represent a separate endemic species (Kudrna 1986). Otherwise, the Northern Brown Argus and related species extends across the Western Palaearctic from Spain and northern Africa to central Asia. *Aricia artaxerxes* generally occurs in more mountainous habitats in Continental conditions and these subspecies are generally larger with prominent black pupillation on the undersides (Melling 1990).

The distributions of the two subspecies are divided by the political boundary of England and Scotland. The English subspecies *A. a. salmacis* is locally distributed in seven separated areas of northern England. The most southerly is a stronghold in the Derbyshire Peak District where there are about 14 small colonies in the five dales of the NNR (Ben Le Bas pers. comm.). There are three areas in Yorkshire; the Wolds, the Vale of Pickering and Upper Wharfedale and two populations in Cumbria; around Kirkby Stephen and Morecambe Bay (also spilling into north Lancashire). The most northerly populations of this subspecies occur in County Durham between Sunderland and Hartlepool and inland to Durham (about 13 colonies, Ellis 1994a). The possibility of small populations occurring in Clwyd, N. Wales is discussed by Rawsthorne & Whitehead (1995).

In N. England, colonies have always been locally distributed, but extinctions have occurred in areas that now separate populations and the Northern Brown Argus used to occur in Northumberland between the current ranges of *A. a. artaxerxes* and *A. a. salmacis*. Local extinctions continue and it is estimated that inland Durham colonies have been lost at a rate of 35% per decade, mainly due to habitat destruction and poor management (Ellis 1994a). Overall, the number of 10km squares *A. a. salmacis* occurs in has decreased from 47 pre-1970 squares to 36, a 23% loss (Ellis 1994a).

In southern Scotland, the Northern Brown Argus is found in the Borders, along the east coast and Dumfries and Galloway in the west, but then has a primarily eastern distribution northwards through Fife and Grampian to south-east Sutherland, with strong populations in Perthshire and northern Tayside. Its status is less clear than in N. England and colonies may have been overlooked (Thomson 1980). It has certainly declined markedly in places, especially in the south of its range in the Borders and around Edinburgh (where it became extinct in the type locality, Arthur's Seat, in 1869). Its decline has been apparently more marked than in N. England, from 125 pre-1970 squares to 70 post-1970 squares (44% loss) (Northern Brown Argus overall: 172 to 106 post-1970 squares, Ellis (1994a)). Recent surveys, however, have located several new colonies (D. A. Barbour pers. comm.), supporting Thomson's view, and the number of current squares has increased from 70 to 114.

Population structure

Colonies of the Northern Brown Argus are small and scattered. Population estimates in inland Durham suggest that colonies vary in size between 25 and 2000 adults but most (11 of 13 studied) were composed of less than 200 adults at the peak of the flight period (Ellis 1994a). Most colonies are less than 1ha in size and only one exceeds 10ha, but patches of

0.2-0.25ha can support viable populations. A comparison of features of extinct sites with extant sites indicated that smaller sites (<0.1ha) were more likely to become extinct. Small colonies are also more vulnerable to collecting but generally this activity only has limited potential for reducing populations (Ellis 1994a). Studies in southern Scotland suggest similar population sizes and 11 of 13 sites were less than 1ha in area in 1986 (Clunas 1986). In Derbyshire, most colonies are probably <1ha in size (Ben Le Bas pers. comm.).

Observations of the mobility of individuals support the theory that small and scattered populations of butterflies are generally closed. Daily movements of about 30m were recorded for males and females and there were indications that mobility may be reduced at small and isolated sites where adults moved about 18m per day (Ellis 1994a). Overall, 96% of recorded movements were below 100m. Within populations spread over a number of habitat patches, there was some interchange of adults (25% of movements), occasionally over distances greater than 100m, and over scrub barriers. A large proportion of movements, however, were intra-patch (68%). Similar figures have been recorded by Clunas (1986) in Scotland where males were found to move only 20-30m over several days and females tended to move less than 10m, although adults were capable of crossing large bands of scrub. These observations suggest that many small sites are highly isolated, prone to local extinction and are unlikely to be re-colonised.

2.4 LIMITING FACTORS

Historical

Overgrazing of unimproved grasslands.

Neglect of unimproved grassland habitat and scrub invasion, including effects of decline of rabbit population through myxomatosis.

Habitat destruction, especially by agricultural improvement and industrial activities such as forestry, quarrying and mining, and resulting habitat fragmentation.

Current and Future Limiting Factors

Difficulty of implementing appropriate management of grassland habitat (light winter grazing by livestock, occasional scrub removal).

Lack of knowledge of ideal regimes.

Lack of control of rabbit populations which are important grazers on many sites.

The increasing isolation of sites.

Small size of sites, especially in northern England, increasing chances of local extinctions.

Changes in agricultural policy which may affect grazing levels on unimproved grasslands.

Forestry in some areas of Scotland.

(N.B. There is little evidence to suggest that collecting is a threat on most sites).

2.5 RESUMÉ OF CONSERVATION TO DATE

The first specimen of the Northern Brown Argus was found in Scotland, probably on Arthur's Seat, Edinburgh, which became the type locality. It was first formally described by Fabricius in 1793 from material from Arthur's Seat. This site became a popular venue for commercial collectors and they may have played a role in the butterfly's extinction in about 1869; although road building at the time may have been more significant (Thomson 1980). The taxonomy of the genus *Aricia* is complex, and the Northern Brown Argus and its subspecies have been variously classified as subspecies of other *Aricia* species. The genetic relationships of the British *Aricia* species are the subject of current research at Keele University (J. Cameron pers. comm.).

Until preliminary ecological studies on *A. a. artaxerxes* by Clunas (1986), most work had focused on its separation from *A. agestis* and biological observation (e.g. Jarvis 1976, Selman *et al* 1973, Hoegh Guldberg 1979). Most recently, local populations of *A. a. salmacis* in Durham have been the subject of detailed conservation studies by Ellis (1994a, 1995) and those in Cumbria by Cooch (1995).

The management requirements of the Northern Brown Argus have been studied by Ellis (1994a, 1995), Holroyd (1994) and Cooch (1995). Most colonies that have died out in north-east England are either unmanaged (57%) or heavily grazed (29%), the two extremes of management (Ellis 1995). Those that are extant are lightly grazed by any livestock, and particularly by rabbits. Others may be managed by scrub removal or be unmanaged. None are heavily grazed. At one rabbit grazed site in Cumbria, recent additional winter grazing by ponies has encouraged a thriving population (Cooch 1995). Site managers at St Abb's Head NNR in the Borders removed heavy sheep grazing that had reduced the species to a handful of sightings per year in the 1980s. A cessation of grazing for two years, followed by selective spring and autumn grazing, has led to a dramatic increase in the population since 1992 (O. Leyshon pers. comm.).

There are few surveys of the status and distribution of the Northern Brown Argus. The Durham population, once thought to be a unique subspecies, has been most thoroughly described (Ellis 1994a, 1995, Leakey & Ellis 1994). Surveys of the distribution and sizes of populations in the remaining areas of England, N. Wales and Scotland are needed. Surveys were undertaken in some parts of Scotland in 1995 (D. A. Barbour, C. Sullivan pers. comms.).

Levels of protection of colonies appear to be high in the areas studied (Durham and Cumbria/N.Lancs) and many occur on nature reserves, offering opportunities for correct management. The butterfly responds well and quickly to a cessation of heavy grazing pressure or re-introduction of winter grazing. Of the 13 surviving colonies in inland Durham, 10 are on SSSIs, and four of these are on Wildlife Trust reserves and three on NNRs. Many colonies in the Cumbria / North Lancashire population also occur on nature reserves (Cooch 1995) although this requires quantification. Most colonies in Derbyshire will be in SSSIs as most limestone dales are designated (Ben Le Bas pers. comm.). Otherwise, there is little

information on its status and a review throughout its range, but particularly in Scotland, is overdue.

Six colonies of the Northern Brown Argus are monitored as part of the Butterfly Monitoring Scheme; four in England (one in the Peaks (Lathkill Dale), three in Cumbria) and two in Scotland (one in Grampian, one in Tayside), and others are monitored as part of reserve management by the RSPB, WTs and National Trust. The numbers and distribution of these has yet to be assessed. Populations at St Abb's Head NNR in Scotland have been monitored for 10 years in concert with vegetation monitoring.

Re-introductions of the species to former sites have been attempted in Durham owing to the current isolation of remaining colonies. The butterfly died out on Castle Eden Dene NNR in 1976 due to scrub encroachment but recent corrective management has created suitable conditions. In 1993, adults were released on the site from a nearby colony and a small population was present in 1994 (Ellis 1995) and 1995 (S.Ellis pers. comm.). Preliminary surveys have also been undertaken on Arthur's Seat, Edinburgh, to assess the suitability of habitat and potential for re-introduction to its most famous locality (Ellis 1994b).

Part 3 Actions and Work Programme

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.

3.1 POLICY AND LEGISLATIVE

	Lead organisation(s) concerned
Action 1 PRIORITY: HIGH	
Include habitat requirements of the Northern Brown Argus in management prescriptions for ESAs (e.g. Breadalbane, Cairngorm), Countryside Stewardship and other agri-environment schemes, (Wildlife Enhancement Scheme etc.).	SOAEFD, MAFF, SNH, EN, CCW
Action 2 PRIORITY: HIGH	
Refuse grants for inappropriate conifer plantations on known sites or close to breeding areas.	FA

3.2 SITE SAFEGUARD AND ACQUISITION

Action 3 PRIORITY: HIGH	
Designate as SSSI up to five colonies per search area, concentrating on large or medium sized colonies, where this will aid site management or site protection.	SNH, EN, CCW
Action 4 PRIORITY: HIGH	
Oppose any development proposals affecting any strategically important site.	BC, SNH, EN, WTs, CCW, NT, NTS

3.3 LAND MANAGEMENT

Action 5 PRIORITY: HIGH

Promote beneficial land management on all Northern Brown Argus sites. **ALL**

Action 6 PRIORITY: HIGH

Encourage positive management of all SSSIs with Northern Brown Argus populations through management agreements etc. **SNH, EN
CCW**

Action 7 PRIORITY: HIGH

Encourage positive management on nature reserves with populations and incorporate requirements into management plans. **SNH, EN, BC,
WTs, NT, NTS,
NP, FE, CCW**

Action 8 PRIORITY: MEDIUM

Restore suitable habitats within former range, especially in north-east England (to encourage re-colonisation or, if necessary, conduct strategic introductions). **ALL**

3.4 SPECIES MANAGEMENT, PROTECTION AND LICENSING

Action 9 PRIORITY: LOW

Conduct strategic introductions to suitable habitats in the former range of the Northern Brown Argus, especially in northern England (using appropriate subspecies and detailed monitoring). **BC, SNH
EN, CCW**

3.5 ADVISORY

Action 10 PRIORITY: HIGH

Advise conservation agencies and site owners/ managers on habitat management for the Northern Brown Argus. **BC, SNH,
EN, CCW**

Action 11 PRIORITY: MEDIUM

Produce leaflet/practical information on habitat management for the Northern Brown Argus once better information becomes available.

**BC, SNH
EN, CCW**

3.6 INTERNATIONAL

Action 12 PRIORITY: LOW

Make information on conservation requirements of the Northern Brown Argus in the UK available to other countries.

BC, JNCC

3.7 FUTURE RESEARCH, SURVEY AND MONITORING

Action 13 PRIORITY: HIGH

Conduct further research on the taxonomic status of the Northern Brown Argus and related taxa to clarify the status of the UK populations.

**EN, SNH
CCW**

Action 14 PRIORITY: HIGH

Collate all records and update national distribution map.

**JNCC (CCW,
EN & SNH),
BC, BRC**

Action 15 PRIORITY: HIGH

Conduct survey of distribution and status, particularly in under-recorded regions.

**SNH, EN, BC
CCW**

Action 16 PRIORITY: HIGH

Collate transect and management data from all monitored sites (in addition to BMS) annually and calculate annual index to compare trends on individual sites. Review and extend network if necessary.

**BC, SNH, EN
WTs, NT, NTS
CCW**

Action 17 PRIORITY: LOW

Survey former habitats in England and identify suitable sites for habitat restoration (see Action 7).

BC, EN

Action 18 PRIORITY: HIGH

Conduct further research on the autecology of the Northern Brown Argus, especially relations with ants and the structure of metapopulations.

**SNH, EN
CCW**

Action 19 PRIORITY: HIGH

Investigate role of parasitoids in population dynamics. Survey presence at a range of sites and investigate their specificity.

BC, NMS

3.8 COMMUNICATIONS AND PUBLICITY

Action 20 PRIORITY: MEDIUM

Publicise this Action Plan, the status of the Northern Brown Argus and the measures being taken to conserve it.

**BC, SNH, EN
CCW**

3.9 REVIEW

Action 21 PRIORITY: HIGH

Monitor this Action Plan annually and review every five years if necessary.

BC

Key to abbreviations

BC	Butterfly Conservation
BRC	Biological Records Centre
CCW	Countryside Council for Wales
EN	English Nature
FA	Forestry Authority
FE	Forest Enterprise
JNCC	Joint Nature Conservation Committee
MAFF	Ministry of Agriculture, Fisheries and Food
NMS	National Museum of Scotland, Edinburgh
NP	National Parks
NT	National Trust
NTS	National Trust for Scotland
SNH	Scottish Natural Heritage
SOAEFD	Scottish Office Agriculture, Environment and Forestry Department
WTs	County Wildlife Trusts

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Appendix 1: Conservation management for the Northern Brown Argus.

Habitat

In south of range, well-drained base-rich grassland on thin soils of limestone pavement or outcrops. Also quarries and other areas of secondary grassland on disturbed areas, such as roadside cuttings. In Scotland, sites are more acidic supporting more heathy vegetation. Suitable grassland has a profusion of the larval foodplant, Common Rock Rose and nectar foodplants such as Thyme, and is lightly grazed or ungrazed with patches of developing scrub. There are usually patches of bare ground resulting from disturbance by grazing animals, landslips or from outcrops of limestone or other rocks.

Management

Most recorded colony extinctions have occurred mainly through habitat neglect which allows the development of coarser, taller vegetation as well as scrub invasion, and an eventual reduction in the abundance of the foodplant. However, most authors agree that some light, well-spaced scrub is beneficial on colonies, probably for shelter. Site size is also important, and a minimum of 0.1ha is recommended to support a population. Intensive management can also cause extinction, primarily through overgrazing. The precise grazing regime that is most suitable has yet to be determined, but "light" to "medium" grazing pressure is preferable. Light year round grazing or heavier summer grazing by cattle, sheep or horses occurs on many colonies. Rabbits are primarily responsible for maintaining many colonies in Scotland. Suggested stocking rates for limestone grassland are 4-10 sheep or 0.5-1 cattle per hectare in the summer months, or lighter year round grazing, although this may represent over-grazing in more fragile hill systems and sites in Scotland. Some periodic scrub removal may be necessary at some sites. Ideal overall sward heights are in the range 6-10cm, but a varied vegetation structure is important, and patches of grassland should vary in height up to 30cm.

Appendix 2

Distribution of the Northern Brown Argus in the UK.

Butterflies for the New Millennium project (2001).

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(Dark full spot all records from 1995-1999; open circles all records between 1970-1982; cross all pre 1970 records).

