

Woodland Lepidoptera of concern

Woodland butterflies of concern: habitat features and principal foodplants

Woodland butterflies of concern

Species	Woodland primary habitat	Woodland secondary habitat	Field layer	Shrub layer	Canopy layer and understorey	Closed canopy	Rides	Clearings within woodland	Woodland edge	Bracken in woodland	Principal foodplants in woodlands
Chequered Skipper	●		●				●	●	●		Purple Moor-grass
Dingy Skipper		●	●				●	●	●		Common Bird's-foot-trefoil and Greater Bird's-foot-trefoil
Grizzled Skipper		●	●				●	●	●		A variety of plants from the Rosaceae family, mainly Agrimony, Creeping Cinquefoil and Wild Strawberry
Wood White	●	●					●	●	●		Legumes, especially Meadow Vetchling, Common Bird's-foot-trefoil and Greater Bird's-foot-trefoil
Brown Hairstreak	●			●			●	●	●		Blackthorn and occasionally Wild Plum
White-letter Hairstreak	●			●	●	●	●	●	●		English Elm and Wych Elm
Black Hairstreak	●			●			●	●	●		Blackthorn and occasionally Wild Plum
Duke of Burgundy		●	●				*	●	●		Primrose and Cowslip
White Admiral	●			●		●	●	●	●		Honeysuckle
Purple Emperor	●			●			●	●	●		Sallows
Small Pearl-bordered Fritillary	●		●				●	●	●	●	Common Dog-violet and Marsh Violet
Pearl-bordered Fritillary	●		●				*	●	●	●	Common Dog-violet and occasionally other violet species
High Brown Fritillary		●	●					●	●	●	Common Dog-violet and Hairy Violet
Silver-washed Fritillary	●		●				●	●	●	●	Common Dog-violet
Heath Fritillary	●		●				*	●			Common Cow-wheat and occasionally Foxglove

* These species can breed in ride edges, but only where they are associated with regular clearings. Ride management alone is not sufficient to maintain their populations.

Other butterflies using woodlands

Species	Conservation concern	Woodland primary habitat	Woodland secondary habitat	Field layer	Shrub layer	Canopy layer and understorey	Closed canopy	Clearings within woodland	Rides and woodland edge	Bracken in woodland	Principal foodplants in woodlands
Small Skipper			●					●	●		Grasses
Essex Skipper			●	●				●	●		Grasses
Large Skipper			●	●				●	●		Grasses
Brimstone	●				●			●	●		Buckthorn and Alder Buckthorn
Large White			●	●				●	●		Crucifers
Small White			●	●				●	●		Crucifers
Green-veined White			●	●				●	●		Crucifers
Orange-tip			●	●				●	●		Cuckooflower and Garlic Mustard
Green Hairstreak			●	●	●			●	●		A wide variety of herbs and shrubs
Purple Hairstreak		●				●		●			Deciduous oaks
Small Copper			●	●				●	●		Docks and sorrels
Small Blue	●		●	●				●	●		Kidney Vetch
Brown Argus			●	●				●	●		Common Rock-rose, Common Stork's-bill and Dove's-foot Cranesbill
Northern Brown Argus	●		●	●				●	●		Common Rock-rose
Common Blue			●	●				●	●		Bird's-foot-trefoils and Black Medick
Holly Blue		●		●				●	●		Holly, Ivy, Dogwood, Spindle and other herbs and shrubs
Red Admiral			●	●				●	●		Nettles
Painted Lady			●	●				●	●		Thistles
Small Tortoiseshell			●	●				●	●		Nettles
Large Tortoiseshell	●	●			●	●		●	●		Elms and willows
Peacock			●	●				●	●		Nettles
Comma			●	●	●			●	●		Elm, hop and nettles
Dark Green Fritillary			●	●				●	●	●	Violets
Marsh Fritillary	●		●	●				●	●		Devil's-bit Scabious
Speckled Wood		●		●				●	●		Grasses
Wall	●		●	●				●	●		Grasses
Scotch Argus			●	●				●	●		Grasses
Marbled White			●	●				●	●		Grasses
Grayling	●		●	●				●	●		Grasses
Gatekeeper			●	●				●	●		Grasses
Meadow Brown			●	●				●	●		Grasses
Small Heath	●		●	●				●	●		Grasses
Ringlet			●	●				●	●		Grasses

Woodland moths of concern

Species	UK conservation status	Woodland primary habitat	Woodland secondary habitat	Field layer	Shrub layer	Canopy layer and understorey	Closed canopy	Rides	Clearings within woodland	Woodland edge	Veteran trees	Bracken in woodland	Principal foodplants in woodlands
<i>Lampronia capitella</i> Goat Moth	Nb		•		•								Currant and Gooseberry Living wood of deciduous trees
<i>Nemapogon picarella</i>	pRDB1	•				•							Bracket fungus
<i>Phyllonorycter sagittella</i>	pRDB1	•				•							Aspen
<i>Coleophora tricolor</i>	None		•	•				•	•				Basil Thyme
<i>Coleophora wockeella</i>	pRDB2	•		•				•	•				Betony
<i>Aplota palpella</i>	pRDB1	•				•						•	Mosses
<i>Anania funebris</i>	Na	•		•				•	•				Goldenrod
<i>Sciota hostilis</i> False Mocha	pRDB1 Local	•			•								Aspen Pedunculate Oak
Netted Carpet	pRDB2	•		•					•	•			Touch-me-not Balsam
Barberry Carpet	pRDB1		•		•				•	•			Barberry
Argent & Sable	Nb	•			•			•	•	•			Birches, occasionally Alder and sallows
Grey Carpet	pRDB3		•		•			•	•				Flixweed
Drab Looper	Nb	•		•				•	•	•			Wood Spurge
Barred Tooth-striped	Na		•		•			•	•	•			Wild Privet and Ash
Dark Bordered Beauty	pRDB3	•			•				•				Aspen and Creeping Willow
Sloe Carpet	Nb	•			•				•	•			Blackthorn
Scarce Vapourer	pRDB2		•		•								Various deciduous trees and shrubs
Lunar Yellow Underwing	Nb		•	•				•	•				Grasses
Cousin German	pRDB3	•		•	•								Bilberry and Heather, birches and Eared Willow
Orange Upperwing	pRDB1*	•			•								Pedunculate and Sessile Oak
Heart Moth	pRDB3	•				•						•	Pedunculate Oak
White-spotted Pinion	Na	•				•							English Elm and Wych Elm
Concolorous	pRDB3	•		•				•	•				Purple Small-reed and Wood Small-reed
Light Crimson Underwing	pRDB3	•				•						•	Pedunculate Oak
Dark Crimson Underwing	pRDB2	•				•						•	Pedunculate Oak
Common Fan-foot	Na	•				•			•				Pedunculate Oak
Clay Fan-foot	Na	•				•							Oaks
Olive Crescent	pRDB3	•				•							Oaks, Beech and occasionally other deciduous trees

* May be extinct

RDB - Red Data Book species: species that meet the criteria of the British Red Data Book for Insects (Shirt, 1987)

RDB 1 - species categorised as Endangered

RDB 2 - species categorised as Vulnerable

RDB 3 - species categorised as Rare

pRDB - proposed for inclusion in future Red Data Book listings

Na - Nationally Scarce and recorded from 16-30 10km squares in Great Britain

Nb - Nationally Scarce and recorded from 31-100 10km squares in Great Britain

*may be extinct

Butterfly species accounts

Distribution maps are based on Butterfly Conservation data from 2005-2009. Life cycle charts show approximate timings, which vary from year to year (with partial 2nd generation in light shading).

Chequered Skipper

Keith Warrington



Population structure

Found in low density colonies that are spread over large areas. Females can move 1 to 2km between nectar sources and breeding sites through open woodland and moorland. Long-term survival, as with many other species, is more likely if sites are linked, enabling dispersal between neighbouring colonies.

Foodplants

In Scotland, the main larval foodplant is Purple Moor-grass.

Woodland habitats

It is associated with the edges of damp woodlands, or open spaces within them, usually below 200m. Favoured sites are on the edges of open broadleaved woodland where richer soils produce tall growth of Purple Moor-grass, typically with scattered Bog-myrtle, Bracken and birch scrub. Many colonies now survive only in wayleave habitats under power-lines. The adults and caterpillars have different habitat requirements and at many sites their habitats occur as a mosaic. Maintenance of flower-rich areas in

sunny, sheltered locations is crucial for the adults.

Habitat management

The precise habitat requirements are not fully understood, but the following approaches are recommended:

Grazed sites: Light deer or livestock browsing is important to prevent encroaching scrub shading out nectar plants, and populations have declined where deer and livestock have been excluded. Although light grazing, especially in autumn/winter, maintains flower-rich areas, high intensity grazing (particularly by sheep in the spring) can be damaging. The caterpillars spend most of their lives high-up on the foodplant, so summer livestock grazing can remove food supplies together with the caterpillars themselves. However, breeding habitat usually occupies wetter areas which sheep generally avoid unless stocking levels are high.

Ungrazed sites: A 7-10 year cyclical clearance of scrub beneath wayleaves seems to benefit the butterfly, and similar management should be used at under-grazed sites. Provide additional open space along

paths and rides (25-30m wide) and maintain glades (25-30m across). At larger sites this clearance should be carried out over a number of years to produce open spaces at different stages of succession. Ideally rides and paths should run east-west to create a warm south-facing edge. Adding scalloped bays (c. 25m across) at intervals along ride edges will create additional sheltered habitat.



Jim Asher

Damp grassy woodland alongside streams provides important habitat for Chequered Skipper

Dingy Skipper

Mick Sinden



Population structure

The Dingy Skipper occurs in discrete colonies, many of which are very small and consist of fewer than 50 adults at the peak of the flight period. It is a sedentary species that is unlikely to colonise new areas of habitat unless they are close to existing populations. However, observations of natural colonisations reveal that a few individuals may move several kilometres.

Foodplants

Common Bird's-foot-trefoil is the usual foodplant in all habitats. Horseshoe Vetch is also used on calcareous soils and Greater Bird's-foot-trefoil on heavier soils.

Woodland habitats

Dingy Skippers occur in a wide range of habitats in addition to woodland. In woodlands, open sunny areas in rides and clearings are used. Suitable conditions occur where foodplants grow in a sparse sward, often with patches of bare ground in a sunny, sheltered situation. Taller vegetation is also required for shelter and roosting.

Habitat management

The aim is to maintain a sparse sward interspersed with plenty of bare ground but some areas of tall vegetation should be retained. Sites need not be large if high quality habitat is present and other habitats occur nearby.

Coppicing: A regular cutting sequence of woodland blocks in close proximity will ensure rapid colonisation of new habitat, particularly where open rides permit movement between clearings. Ideal conditions are provided in woodland regrowth a few years after clearance, when sheltered areas develop between coppice stools. On thin soils or where deer browsing delays initial regrowth these microhabitats can be prolonged for several seasons.

Ride management: A network of open, sunny rides and glades is beneficial and may be essential to link clearings in high forest woodland. Open rides can be maintained by short-rotation coppice (5 to 8 years), cutting back the woodland edge to 5 to 8m depending on the vigour of regrowth.

Grazing: The most suitable grazing regimes are those that produce a range of sward heights including patches of less than 5cm height. Cattle grazing is preferred to sheep grazing as it results in a less uniform sward. Late spring or early summer grazing should be avoided, as egg-laying Dingy Skippers generally avoid damaged foodplants.

Mowing: Mowing is always a poor alternative to grazing, but where grazing is impractical, a single annual cut in the autumn can maintain Dingy Skipper sites. Mow on rotation so that some areas are left uncut each year. Remove cuttings from the site.

Scrub control: Periodic scrub removal may be necessary at some sites although some light, well-spaced scrub can provide valuable shelter, especially on more exposed sites. Scrub can be cut on a rotation of 10 to 15 years to maintain existing levels of cover. Where scrub reduction is necessary, stumps should be treated with herbicide to prevent regrowth.

Grizzled Skipper

Jim Asher



Population structure

Grizzled Skipper populations are influenced by a number of factors, including the size and quality of habitat patches and the structure of surrounding vegetation. In optimal habitats with high foodplant density, colony boundaries tend to be well defined. Populations in small or sub-optimal habitats with only minor barriers to dispersal tend to have a more open structure and exchange individuals more frequently with other nearby patches. Populations are typically small (10 to 100 adults seen at peak) but some can contain as many as 1,000 adults.

Foodplants

A variety of plants from the Rosaceae family are used, mainly Agrimony, Creeping Cinquefoil and especially Wild Strawberry. The butterfly may also use Barren Strawberry, Tormentil, Salad Burnet, Bramble, Dog-rose, and Wood Avens.

Woodland habitats

Grizzled Skippers occur in a wide range of habitats including woodlands. Woodland rides, glades and clearings where the larval foodplants grow in open but sheltered conditions are favoured. They use areas where there is bushy growth of the foodplants, generally less than 10cm tall, although very short areas are not used for breeding. They prefer a mixed vegetation structure with bare ground patches for basking and tall plants nearby, which are used for roosting.

Habitat management

Aim to maintain a continuous supply of open habitat that contains foodplants growing over bare ground in sunny conditions with varied vegetation nearby. Conditions can be provided by clearing woodland plots, coppicing and by ride management.

Ride management: Occasional surface disturbance along wide sunny rides is beneficial in creating bare ground and areas where the foodplants can germinate. This can be achieved by cutting low to the ground, through scarification of the surface or through general disturbance by machinery. Coppicing ride edge vegetation on a short rotation may also be helpful where no substantial area can be managed as coppice. A network of open, sunny rides and glades is essential to link clearings within high forest woodland.

Coppicing: Cutting a regular sequence of woodland blocks in close proximity will increase the chances of new habitat being colonised, particularly where open rides permit movement between clearings. Ideal conditions are provided a year or two after clearance, once ground vegetation has started to develop but before the coppice regrowth becomes established. On thin soils, or where deer browsing delays initial regrowth, these conditions can be prolonged for several seasons.

Scrub habitat: Patches of scattered young scrub (less than 5 to 10 years old) should be retained, ideally with a proportion cut each year on rotation. As in coppice, the butterfly will use the regrowth a year or two after clearance and will disappear once scrub shades the site.



Dan Hoare

Ride edges provide ideal habitat with strawberry, cinquefoil and Bramble spreading over bare ground

Wood White

Jim Asher



Population structure

Wood Whites form discrete colonies at most sites, but these vary considerably in their size and density. In some cases, high densities occur in very discrete areas, but where the breeding habitat is more scattered, adults occur at low densities over wide areas. There may be considerable movement around the wider countryside if a suitable network of appropriate habitat is available.

Foodplants

A variety of legumes are used, the most common being Meadow Vetchling, Greater Bird's-foot-trefoil, Common Bird's-foot-trefoil and Bitter-vetch. Wood Whites often have two generations each year, and may breed on different foodplants at the same site in spring and summer broods.

Woodland habitats

Wood Whites can occupy a range of habitats but particularly strong populations are found in woodland landscapes with extensive open space and scrub. They breed in grassy vegetation in open woodland rides, sunny glades and the sheltered edges of scrub.

Habitat management

Aim to maintain a continuity of open, sunny areas with and without scrub, lightly shaded by surrounding trees. Maintain abundant vetches growing in a variety of conditions, from low vetch growth in sparse vegetation to tall straggling vetch growth through fairly dense vegetation.

Ride and glade management:

Provide suitable breeding habitat by widening overgrown, shaded rides and keeping glades open. Ensure that the tall grassland vegetation zone of the verges is cut on a 3 to 6 year rotation - shorter rotations are not suitable. Damp conditions along boundary banks and ditch edges are especially favoured and should be maintained as sheltered but unshaded habitat. The inclusion of scalloped bays and box junctions will also be beneficial and increase connectivity between existing breeding habitats. It can be beneficial to create patches of short vegetation with bare ground by scarifying ride edges and ditch banks, or by cutting the ride-side scrub zone on a long rotation.

High forest and coppicing: Suitable conditions can be provided by ensuring a sequence of felling and replanting to create an uneven-aged forest, combined with the maintenance of a network of sunny rides and glades. Reintroduction of coppicing can also improve woodland structure and provide suitable habitat. A wide ride network is also needed in coppiced woodland.



Dan Hoare

Breeding habitat for Wood Whites in spring: short vegetation with Common Bird's-foot-trefoil

Brown Hairstreak

Peter Eeles



Population structure

Colonies are normally centred on a wood, but egg laying usually extends over several square kilometres of the surrounding countryside. Adults tend to congregate around specific groups of trees, particularly in mid August when they are seeking mates. The same trees, usually prominent Ashes, are used for this purpose from year to year. Where these trees can be identified they should be retained whenever woodland management occurs.

Foodplants

Blackthorn is used exclusively by most colonies, but occasionally Wild Plum and other *Prunus* species are used. Eggs are usually laid and overwinter on young Blackthorn growth in sunny, sheltered positions, so are very susceptible to winter hedge cutting and extensive scrub management.

Woodland habitats

A complex of woodland, scrub and hedgerows with abundant, suitably managed, Blackthorn is required. Most colonies occur on clay or heavy soils where Blackthorn is a dominant constituent of the hedgerows or scrub.

Habitat Management

The overall aim is to maintain a continuous supply of young Blackthorn stands along the woodland edge, in rides and in hedgerow thickets.

Retention and planting of Blackthorn: Maintain all farm woods and broadleaved wood edges and retain any trees identified as key mating sites and congregation points. When creating new woods, rides or glades, consider planting Blackthorn along sunny, sheltered edges. Use opportunities to restore or create hedgerows using Blackthorn, especially where they can link either existing hedges and/or woodlands.

Blackthorn in coppice: Coppice or fell trees on rotation (7 years or longer). Spread any clearing or coppicing work over several years and leave some belts of woodland intact to act as focal points for the colony.

Blackthorn scrub in glades and rides: Cut on rotations of more than 3 years and do not cut entire ride sections or glades in a single year. Creating new east-west rides within woods can be valuable, especially where they link existing egg-laying areas.

Blackthorn in hedgerows and wood edges:

As eggs and caterpillars occur on Blackthorn twigs for much of the year, any hedge or wood edge trimming can remove a large proportion of the population, and annual cutting is particularly harmful. Appropriate cutting regimes are essential if this species is to survive at a site and these can be considerably cheaper than annual cutting:

- Trim hedges only once every 3 to 5 years and do not cut all the hedges in any one area in the same year. As an absolute minimum, hedges should be left uncut every other year.
- Cut as late as possible in the winter, ideally in January or February, which will also make shelter and hedgerow fruit available to other wildlife such as small mammals and birds
- Hedge laying on a rotation of over 7 years is highly suitable. It produces the young growth that provides good egg laying sites and avoids the annual cutting that can remove both caterpillars and eggs
- Avoid chemical spraying into hedge and wood edge habitat, leaving an uncultivated margin if possible
- Heavy browsing of Blackthorn by livestock such as ponies can have a negative impact on the butterfly, as can rabbit and deer browsing on young shoots

White-letter Hairstreak

Martin Warren



Population structure

Information on colony structure is sparse, but a marking experiment along one ride revealed a population of several hundred butterflies with individuals regularly moving up to 300m between trees. Many colonies are restricted to a small group of trees and most appear fairly sedentary, although wider dispersal can occur and individuals have been seen several kilometres from known breeding sites.

Foodplants

The butterfly breeds on various elm species, including Wych Elm, English Elm and Small-leaved Elm. It will also use elm hybrids. A preference and higher breeding success on Wych Elm has been demonstrated at one site and this species may be used almost exclusively in northern England. The butterfly prefers to breed on flowering trees, but smaller elms, including suckers, may be used.

Woodland habitats

The White-letter Hairstreak will breed wherever elms occur and so is not exclusively a woodland species. It can occur along sheltered hedgerows, within mixed scrub, wood edges and the edges of woodland rides. It will also use large isolated elms, irrespective of the surrounding habitat.

Habitat management

The overall aim is to maintain elm trees in suitable conditions, which will provide habitat for a wide range of invertebrates including many moths.

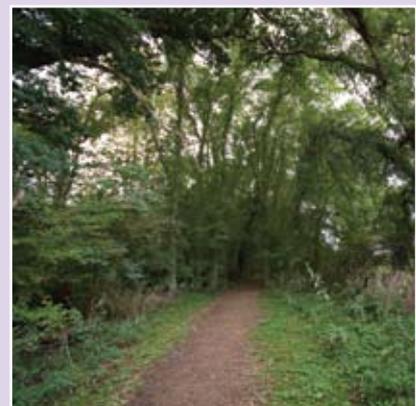
Retention of elm trees: Woodland and hedgerow management that retains elm trees will benefit the White-letter Hairstreak. Fell and debark trees infected with Dutch Elm Disease, as weak and dying elms provide the habitat for broods of elm bark beetle which will spread further infection.

Suckering, regrowth and coppicing:

Encourage suckering of elm from roots or regrowth from cut stumps. Elm regrowth usually becomes infected with Dutch Elm Disease at about 12 years, when it reaches 5 to 10m tall, so coppicing elm on a 10 year cycle will limit re-infection.

Hedgerow management: Avoid trimming elm hedgerows until after July, ensuring that larvae have a plentiful supply of flowers and young leaves to feed on. Wide field margins should be retained for nectar sources such as thistles and brambles.

Planting: Where possible include elm of local provenance in new woodlands and hedgerows. Disease-resistant hybrid trees can now be obtained, and research continues to examine their suitability for White-letter Hairstreaks.



Elizabeth Goodyear

White-letter Hairstreaks breed on elm growing in a wide variety of situations

Black Hairstreak

Peter Eeles



Population structure

The Black Hairstreak is a very sedentary butterfly that often breeds in the same small, discrete part of a wood or thick hedgerow for 20 years or more. Larger woods may contain several separate breeding areas but butterflies are rarely seen outside woods, except along thick hedgerows with abundant mature Blackthorn. The Black Hairstreak has very limited powers of dispersal. One introduced colony in Surrey spread 1.5km over more or less suitable habitat in 30 years and even slower dispersal rates are recorded in its traditional East Midlands woodlands.

Foodplants

Blackthorn is used exclusively by most colonies, but occasionally Wild Plum and other *Prunus* species are used.

Woodland habitats

Most colonies breed in dense mature stands of Blackthorn growing in sunny, but well-sheltered situations, usually along wood edges, the edges of rides or glades, or in hedgerow thickets. Smaller colonies will occur in exposed or shady situations, such as canopy gaps in mature woodland, small patches of scrub or in sheltered hedgerows.

Habitat management

The overall aim is to maintain dense mature 3 to 4m high Blackthorn stands along wood edges and rides and in hedgerow thickets.

Retention of Blackthorn: Any major clearance of Blackthorn in woods and hedges within the range of this butterfly should be avoided.

Blackthorn management: Cut even-aged Blackthorn stands in small, 10 to 15 square metre patches (or 10 to 15m lengths of hedgerow), on long rotations. Rotations of 20 to 50 years may be appropriate depending upon the site, allowing mature stands to develop. No more than 25% of habitat should be cut at any one time, substantially less on small sites. Cutting irregular indentations into the Blackthorn will provide more sheltered conditions. Create new habitat nearby by allowing Blackthorn to spread through suckering. On woodland sites, remove trees which directly shade Blackthorn thickets, but retain tall hedges where they provide shelter.

Laying Blackthorn like a hedge may also be effective, especially when the cut material is laid with a south-facing aspect maximising the sunlight received by the regrowth. However if the Blackthorn is old, laying may be impractical without snapping stems. Compared to cutting, laying also has the advantage of potentially reducing the impact of management on overwintering eggs.

Planting: Include Blackthorn stands in any new woodland plantings within the Black Hairstreak's range. Select south-facing, sheltered locations, unshaded by trees. Only plant half the available area and create indented edges.

Deer management: In some woods, natural regeneration of Blackthorn is limited by high density deer populations, particularly introduced Muntjac and Fallow deer. Cutting Blackthorn at 1.5 to 2m height or laying Blackthorn like a hedge can reduce grazing of regenerating shoots. Fencing Blackthorn regeneration plots has also been used to protect against deer damage, but reducing deer populations to acceptable limits is likely to be a more effective long-term strategy.

Duke of Burgundy

Sam Ellis



Population structure

The Duke of Burgundy can survive in very small colonies within limited pockets of suitable habitat, although it is capable of forming large populations on the rare occasions when suitable habitat conditions occur across an extensive area. Males are territorial and rarely move far from favoured positions in sheltered hollows or gaps between bushes that catch the early morning sun. In contrast, females are far less conspicuous but appear to be more mobile and move more freely through the habitat. In a mark-recapture study, over half of recaptured females had moved more than 250m. Some females may disperse several kilometres and sites have been colonised up to 5km from known populations.

Foodplants

The main foodplants are Primrose and Cowslip although 'False Oxlip', the hybrid of these two species, is sometimes used. On sites with both species, Cowslips are the preferred foodplant. Crucially, foodplants need to be in a lush, upright growth form, usually found in semi-shade or long vegetation. Exposed plants, or those with prostrate leaves low to the ground, are not suitable for breeding, and even if eggs are laid on them the plants will usually wither before the caterpillars are fully developed.

Woodland habitats

This species occurs in two types of habitat: woodlands and poorly-grazed, rough limestone grasslands. In woodlands, clearings on ancient woodland sites, regenerating coppice, young plantations, sizeable glades or wide rides are used. The butterfly requires foodplants growing among tussocky vegetation, often near to light scrub. North or west-facing slopes are preferred, possibly because the humid conditions encourage lush growth of the foodplant and prevent it from drying it during the summer.

Habitat management

Aim to ensure a continuous supply of clearings with abundant *Primulas* in sunny but sheltered conditions.

Glades: Permanent glades can be maintained by controlling scrub regrowth, brambles and coarse grasses, ensuring all cut material is removed. As well as hand tools, strimmers, clearing saws, or a mower set at 10cm can also be very effective. Annual cutting will usually leave a site too short or exposed, and management every 2 to 3 years may be more suitable. At several sites the butterfly breeds in young plantations where the crop has failed; in such conditions gradually removing small trees over several years can maintain the habitat better than suddenly clearing the site.

Coppicing: In coppice it tends to use coupes with 2 to 5 years of regrowth. A regular cutting sequence of woodland blocks in close proximity will ensure rapid colonisation of new habitat, particularly where open rides permit movement between clearings. Ideal conditions are provided in woodland regrowth a few years after clearance, when sheltered areas develop between coppice stools. On thin soils or where deer browsing delays initial regrowth these microhabitats can be prolonged for several seasons.

Rides: Breeding success is likely to be highest in east-west rides. Suitable habitat along open rides can be maintained by cutting back the woodland edge to 5-8m and by cutting bays into the scrub zone on rotation every 5-8 years, depending on the vigour of regrowth. The aim is to create sheltered areas with fresh growth of *Primulas*.



Dan Hoare

Lush Primrose plants growing among tall grasses, or at the edges of scrub, provide ideal egg-laying sites for Duke of Burgundy

White Admiral

Jim Asher



Population structure

White Admirals form discrete colonies and typically occur at low densities. The mobility of adults has not been studied in detail, but the spread of the butterfly during the 20th century indicates that it can colonise over distances of many kilometres. Between the 1920s and 1930s, the distribution extended by distances up to 100km, implying an average spread of up to 10km per year. High mobility is also indicated by sightings some kilometres from known colonies.

Foodplants

The sole foodplant is Honeysuckle, with the butterfly using trailing tangles of the plant in dappled shade. Honeysuckle growth along the ground is not used.

Woodland habitats

The butterfly is only found in woodland habitats. It occurs in deciduous, mixed deciduous/coniferous and coniferous woodland, often in neglected condition or at a mature growth stage. The young stages of coppice or woodland regrowth are not used. Both thicket stage and mature conifers can support suitable Honeysuckle growth, but this can be absent from some broadleaved woodlands, notably Ash and Beech.

Habitat management

Aim to produce semi-shaded conditions in woodlands to support the breeding habitat of spindly, trailing growths of Honeysuckle within a few metres of flower-rich, open, sunny rides and glades. Adults will require nectar sources along ride edges and in sunny glades, and will especially use flowering Bramble patches. Note that exposed, lush Honeysuckle plants are not used for breeding, which occurs inside the shaded crop edge.

Deciduous high forest and coppicing: Retain mature woodland or over-mature coppice blocks although dense over-mature woodlands which contain few sunny rides and glades are unsuitable.

Conifer plantations: Retain abundant Honeysuckle along semi-shaded ride margins. Such habitat can be enhanced by encouraging a belt of broadleaved trees along the ride edges. Thinning conifer plantations can often create suitable dappled shade and Honeysuckle growth.

Ride and glade management:

The generic managements detailed in Section 3 will provide good conditions for this species. Scallops and box junctions can also be created to provide more open habitat. Encourage and retain patches of flowering Bramble in sunny, sheltered locations.

Deer management: Extensive browsing of Honeysuckle has been highlighted as a problem at some sites, so deer control may be needed.



Neill Bruce

Honeysuckle trailing from trees or shrubs in partial shade provides ideal breeding habitat

Purple Emperor

Neil Hulme



Population structure

There is little detailed information on the structure of Purple Emperor populations, partly because the elusive adults are difficult to study. This is a canopy-dwelling species that almost invariably occurs at low population density, and the adults are inactive for long periods. Populations probably consist of adults breeding at low density in favoured spots across large, well-wooded landscapes. In some situations the males congregate around prominent trees or groups of trees, often at, or just downwind of, a highpoint in the landscape. Mated females may be highly mobile and have been seen dispersing along mature hedgerows as well as across open fields between nearby patches of woodland.

Foodplants

Goat Willow is the most widely used foodplant although it also breeds on other willows and willows. Eggs are laid mainly beneath the canopy of tall broad-leaved willows, or in other situations where the foliage is shaded from late summer sun. Willow growth in quite heavy shade, and often on larger trees, is preferred.

Woodland habitats

This is predominantly a woodland species which will occur in and around both ancient woodland and secondary woodland if suitable willows are abundant. Breeding sites can include ride edges, glades,

thicket stage conifer plantations and broad-leaved woodland, as well as the scrubby edges of adjacent habitats such as heathland.

Habitat management

The Purple Emperor requires large blocks of broad-leaved or mixed woodland, clusters of smaller woods and/or dense scrub where willows are abundant. Age diversity within a woodland complex or a group of woods is essential for this butterfly to survive and thrive over the long-term. The best sites are those which combine mature woodland and younger growth.

Focus on the provision of abundant willows in a range of situations across the landscape. Willows are comparatively short-lived trees, so it is important to ensure a continuity of trees of various ages. Purple Emperors prefer trees growing in semi-shade and in sheltered conditions, often with northerly or easterly aspects. Willow foliage exposed to full sun is not used. Egg-laying occurs in a variety of woodland situations including ride edges, scallops, woodland edges, riversides, canopy gaps and road verges. Retain willows where possible and avoid major willow clearance in woods and hedges in the area of a colony. Note that willows also provide a key nectar source and important breeding habitat for a wide variety of insects including many moths.

Sallow management: Purple Emperors will not use isolated bushes in sunny situations on the ride edge, although retaining such willows during ride widening can be valuable for other insects.

Willows growing in ride-side ditches are often trimmed to prevent them leaning over forestry tracks. Minimise damage by clearing ride edges on rotation, and developing a wider ride edge containing willows of different ages. Trees leaning over the ride can also be pushed back into the wood or laid sideways along the ride. Although pollarded willows are sometimes used by Purple Emperors, it may take many years for the vigorous regrowth to become suitable. Where damage is unavoidable, encourage growth away from the ride by creating bare muddy scrapes or planting cuttings several metres behind the ride bank.

Planting: Include willows in any woodland plantings. Willows will regenerate freely in damp bare soil, but they also be easily propagated by pushing 2cm thick, 1m long cuttings into the ground during the autumn.

Deer management: Willow regrowth is highly palatable to deer. Tree-guards may be necessary to protect new cuttings, but managing deer numbers to reduce damage is the best long-term solution.

Small Pearl-bordered Fritillary

Gareth Knass



Population structure

Colony structure and mobility appears to vary with landscape. Studies of colonies in mosaics of damp grassland and Bracken suggest that adults are highly sedentary, remaining within the same small habitat patches. However, a study in an extensive conifer forest in Wales showed much greater adult mobility with occasional movements between 1 and 3.5km. The species may also range widely in more extensive and open habitats such as those in Scotland and western and northern Britain.

Foodplants

The most widely used foodplants are Common Dog-violet and Marsh Violet, although other violets may occasionally be used.

Woodland habitats

This species can be found in a wide range of open habitats. Within woodlands the butterfly uses mainly sheltered, damp grassy habitats including glades and clearings, Bracken and patches of scrub. In Scotland it can be found in open wood-pasture and wood edges, usually where there is some grazing by deer and/or sheep.

Habitat management

Aim to provide flower-rich open clearings and rides, especially where the habitat is damp with lush vegetation. This butterfly breeds in open areas a few years after clearance, as the ground vegetation begins to develop.

Glades, clearings and coppice: Use the management options outlined in Section 3. Continuity of management is essential and clearings should be connected by broad sunny rides. Traditional coppice management can produce ideal conditions for the butterfly. Within glades, scrub clearance on rotation can be undertaken, but not all scrub should be eliminated as it often provides shelter.

Rides: The species can breed along ride edges if they are wide enough (at least 5m). Using a three zone ride system and cutting the scrub zone on a rotation of 8 to 20 years can supply this habitat. Where the taller vegetation zone has a high Bracken component, breeding habitat can be produced by cutting sections on a 3 to 5 year rotation (adjust the rotation according to the growth rate of Bracken, violets and the build-up of litter). Damp conditions along boundary banks and ditch edges are especially favoured and should be maintained as unshaded habitat. The inclusion of scalloped bays at intervals along the south-facing edge can provide additional sheltered

habitat.

Bracken dominated clearings:

Aim to maintain abundant violets in medium height swards in association with Bracken. Suitable conditions are most easily identified in spring when violets are more conspicuous before the Bracken canopy closes. Grazing is a good management option (cattle or ponies are best), but if this is not possible, then some other form of Bracken management is often needed to maintain the violets and the required grass/Bracken mosaic (see Section 3).

Wayleaves: The regular cutting of regrowth on wayleaves provides suitable sheltered sunny habitat, and their linear nature means that they can act as ideal corridors along which individuals can fly to neighbouring colonies.

Wood-pasture: Light cattle and pony grazing can be a useful management tool, helping to keep the habitat open whilst also promoting floral diversity. Trampling by stock can provide suitable ground conditions for the establishment of violets. However, heavy grazing will remove nectar sources and damage breeding habitat, particularly during spring. If foodplants are threatened by the development of tall or dense ground vegetation this should be controlled, initially by heavy grazing and then maintained with lighter, intermittent grazing.

Pearl-bordered Fritillary

Gareth Kneass



Population structure

Usually forms discrete colonies around suitable breeding areas, often comprising many hundreds of adults, although most habitats are transient. Adults move freely within their colonies and regularly cover 100m or more. When population densities are high a significant proportion of butterflies will disperse, particularly during sustained hot weather. Marking experiments have shown that individuals can move at least 4.5km between adjacent colonies. Nearby colonies are thus often linked and the butterfly almost certainly forms metapopulations covering networks of discrete breeding areas. Conversely, in poor weather adults are highly sedentary and may fail to colonise suitable new habitat nearby.

Foodplants

Common Dog-violet is used most widely. Other violets such as Heath Dog-violet and in the north, Marsh Violet and Hairy Violet can be used.

Woodland habitats

This species was closely associated with coppice in the past, but has been lost from many woods where management is too infrequent to support it. Colonies are also found in other habitats such as Bracken-dominated rough grasslands, and in Scotland these habitats are often side by side.

In woodland the butterfly uses rides and clearings such as recently coppiced or clear-felled woodland, and wayleaves and open woodland in Scotland, where most sites have a sunny, south-facing aspect. In all habitats it requires abundant foodplants growing in short, sparse vegetation with plentiful leaf litter or dead Bracken fronds. Bracken is an important feature in most woodland colonies. Bugle is an important nectar source, and adults are often seen nectaring along rides, but it is the violet-rich, warm leaf-litter habitat used by the caterpillars that appears to be the key factor limiting population growth at most sites.

Habitat management

Aim to produce a succession of flower-rich, sunny clearings with violets growing amongst sparse vegetation where there is abundant brown leaf litter or dead Bracken. Maintain open space to allow adults to disperse to adjacent colonies and newly cleared habitat. Providing an interconnected network of open habitat is crucial, as even a 100m wide stand of 10 year old coppice has been shown to act as a barrier to females.

Glades, clearings and coppice:

Best produced by coppicing or group felling of high forest, but continuity of management is essential and clearings should be connected by broad sunny rides. Note that many clearings are unsuitable, including those on damp ground, or those dominated by plants such as Dog's Mercury, Bluebell or vigorous grasses.

Ideally, coppice adjacent woodland plots of 0.5 to 2ha in succession and retain standard trees (especially oaks) at less than 20% canopy cover. Standards provide essential leaf litter, although the leaves of some species such as Ash and Beech are less suitable, and standard density should never be so high that it casts excessive shade. In high forest, suitable conditions can be provided by a regular sequence of felling and replanting with deciduous trees.



Egg-laying site for Pearl-bordered Fritillary among sparse debris in recently cleared coppice



Conifer removal on the northern edge of this track has created breeding habitat in a sheltered, sunny ride edge with scattered bracken

Bracken-dominated rides and clearings:

Grazing is an excellent management option for this butterfly (cattle or ponies are best). As an alternative, other forms of management will be needed to keep Bracken at the right level: too much and the foodplants are shaded out; too little and there is insufficient litter for basking caterpillars. The Bracken management detailed in Section 3 can be used to produce and maintain the required sheltered microhabitat: violets in short, sparse vegetation with patches of light Bracken litter, often where last year's fronds have collapsed. Where the litter forms a thick even layer it will no longer be suitable, and raking or grazing will be needed to encourage violet germination. Suitable conditions are most easily identified in spring when violets are most conspicuous before the Bracken canopy closes.

Rides: The species can breed in ride edges if verges are at least 5m wide, but colonies rarely survive in rides alone, and usually require additional scallops, coppicing or clearfells to maintain populations in the long-term. Rides should be managed to produce a continuous supply of violets growing amongst sparse vegetation with abundant leaf litter. Using a three zone ride regime and cutting the scrub zone on a rotation of 8 to 20 years can supply this habitat. Where the tall grassland zone of the verge has a large Bracken component then breeding habitat can be produced by cutting sections on a 3 to 5 year rotation.

Boundary banks and ditch edges are often favoured as they provide the warm, well-drained conditions needed for larval development. Rides running east to west are ideal as they have a greater proportion of warmer south-facing edges. Including scalloped bays at intervals along the south-facing edge provides additional sheltered habitat.

Deer management: The effects of deer on Pearl-bordered Fritillary habitat are complex and can vary considerably between sites. Fencing coppice coupes or controlling deer numbers may be necessary where browsing is damaging regeneration. However at some sites high deer populations can prolong habitat patch occupancy by slowing the rate of regrowth.

Wayleaves: The regular cutting of regrowth on wayleaves provides suitable sheltered and open habitat, and their linear nature means that they can provide good connections between colonies, particularly in dense plantation woodlands. Regular management to maintain a mosaic of Bracken and flower-rich grassland, or rotational cutting which approximates to a short coppice regime can both produce breeding habitat for this species.

Grazing: The ideal management of non-coppice sites for Pearl-bordered Fritillary is often light cattle and pony grazing. This helps keep glades open whilst also keeping areas flower-rich. Trampling by stock can help prevent scrub from becoming too dominant, as well as providing suitable ground conditions for the establishment of violets. However, heavy grazing will remove nectar sources and damage breeding habitat.

High Brown Fritillary

Neil Hulme



Population structure

The butterfly forms discrete colonies that rarely contain more than a few hundred adults. However, the adults are highly mobile and are often seen feeding on flowers 1 to 2km away from main breeding areas. They seem to travel freely between such areas and the flight area of many colonies is over 50-100ha. In favourable years the butterfly may establish temporary colonies in smaller or marginally suitable habitats, although potential breeding areas can come in and out of suitability, possibly as a result of variability in grass growth.

Foodplants

Common Dog-violet is used in all habitats, but Hairy Violet is also used in limestone areas. It may occasionally use Heath Dog-violet and Pale Dog-violet.

Woodland habitats

In the past this was considered to be a woodland species associated with coppice, but most of its few remaining colonies are now outside of woodland or in atypical woodland habitats. Within woodlands the butterfly uses Bracken-dominated clearings or grass and Bracken mosaics on south facing slopes or level ground below 300m. Limestone rock outcrops where woodland or scrub has recently been cleared or coppiced are used in the Morecambe Bay Limestones of south Cumbria and north Lancashire.

Habitat management

In woodland, ride verges do not seem to produce adequate habitat for this species although coppice coupes, patchy scrub, and Bracken-dominated clearings do support colonies.

Coppice and woodland/scrub clearings on limestone rock: Aim to maintain a regular supply of clearings with abundant violets. Ideally, cut coppice on adjacent plots of 0.5 to 2ha in size in succession with open, sunny rides interlinking plots. Similarly, patchy scrub clearance can also provide regular openings in which suitable ground vegetation may develop, particularly on rock outcrops or very thin soils. Breeding may also occur in adjacent limestone grassland where soils are naturally very thin and where violets are abundant. Light grazing may also help maintain these habitats although precise stocking regimes are not well understood.

Bracken and grass mosaics, including woodland clearings:

Aim to maintain mosaics of moderate/dense Bracken interspersed with grassy patches and canopy gaps. The species requires abundant violets growing through variable, but fairly deep levels of Bracken litter (usually at least 1.5 cm deep). See Section 3 for more on Bracken management. Importantly, there should be only limited grass cover or other vegetation. Grazing is the most effective option, but cutting, spraying or burning can also be used. Suitable conditions are most easily identified in spring when violets are conspicuous before the Bracken canopy closes.



Sara Ellis

Ideal breeding habitat for High Brown Fritillary on recently coppiced limestone rock outcrops, Cumbria.

Silver-washed Fritillary

Peter Eeles



Population structure

Silver-washed Fritillary adults are highly mobile and fly rapidly between clearings, including over the woodland canopy. In most regions the butterfly forms discrete but loose colonies within individual woods. However, individuals have been seen considerable distances from known breeding areas in several regions, especially in south-west England where they are regularly seen flying along wooded lanes.

Foodplants

The main foodplant is Common Dog-violet growing in shaded or semi-shaded positions on the woodland floor, amongst pockets of leaf litter and other sparse vegetation. Eggs tend to be laid in fairly shaded locations, on tree trunks near patches of violets.

Woodland habitats

The main habitat for this species is woodland, although in parts of south-west England and Ireland, wooded hedgerows and sheltered lanes near to woods are also used for breeding. The butterfly occurs primarily in broadleaved woodland, especially oak woodland. However, some types of broadleaved woodland, notably Ash and Beech do not seem to be favoured. Other habitats used include mixed broadleaved and conifer plantations, especially where these have been thinned to promote a broadleaved understorey.

Habitat management

Aim to maintain open canopy deciduous woodland with flower-rich, sunny rides and glades. The butterfly is the most shade tolerant of the violet feeding fritillaries and does not require the large open spaces needed by the other species.

High forest and coppicing:

Occasional thinning of deciduous high forest woodland, combined with the maintenance of sunny rides and glades provides suitable conditions. Opening up the canopy too much will promote excessive coarse grass and Bramble growth to the detriment of the violets, although winter bramble cutting and raking can maintain suitable conditions for at least a few years. Traditional coppicing also provides some suitable breeding habitat at the shady edges of recently cut areas, within older coppice or around standard trees. The species can tolerate higher standard densities, and more shade, than the other violet-feeding fritillaries.

Ride management: A three zone ride regime supplemented with rotational cutting of clearings is ideal. Scallop and box junctions can also be created to provide more open edge habitat. Management should be planned in sections to avoid disrupting large areas at any one time. Leaving scattered brush on scallop edges may discourage deer from excessive browsing of breeding areas.

Glade management: Applying the management approaches described in Section 3 is likely to provide ideal Silver-washed Fritillary breeding habitat.



Dan Hoare

Oak standards amid an open sunny understorey provide ideal breeding habitat for Silver-washed Fritillary

Heath Fritillary

Caroline Bulman



Population structure

This species is highly sedentary and forms compact colonies centred on its favoured breeding areas. Adults rarely move more than 100m but a few individuals have been known to disperse up to 2km. Despite the fact that its habitats are often short-lived, it has a very limited colonising ability and suitable habitats more than 600m from a population are colonised only slowly, if at all. Effective conservation therefore needs to include careful planning of successive clearings in a very local network.

Foodplants

The main foodplant on woodland sites is Common Cow-wheat, although Ribwort Plantain and Foxglove can be secondary foodplants. Other foodplants are used on a few heathland habitats in south-west England.

Woodland habitats

The Blean Woods of Kent are the stronghold of the Heath Fritillary. The butterfly has also been re-established at four woodland sites in Essex and one site in Devon since the 1980s. It also occurs outside woodlands in sheltered heathland combs on Exmoor. In woodland, the favoured habitat is recently cut Sweet Chestnut or Hornbeam coppice where Common Cow-wheat is abundant, as well as newly felled woodland on acid soils.

Habitat management

Aim to ensure a succession of sunny clearings with abundant Common Cow-wheat, in otherwise sparse vegetation. Coppicing or group felling of high forest woodland best produces such clearings, but continuity of management is essential as is the close proximity of new habitat to existing colonies.

Ride management: Wide sunny rides are needed for the species to move to new, freshly cleared areas where conditions are suitable for breeding. Open rides can be maintained by cutting back the woodland edge to 5 to 8m and cutting the scrub-zone on short-rotation (cut 5 to 8 years), depending on the vigour of regrowth. In the Blean Woods, small colonies can occur in ride edges where Common Cow-wheat occurs, and occasional colonies have been found on Ribwort Plantain where the main foodplant is absent. Ride habitat on its own appears insufficient to support populations in the long-term, which require the occasional larger areas of high quality breeding habitat provided by woodland clearings.

Coppice: Coppice coupes (0.4 to 2ha) on a rotation of 10 to 20 years, preferably cutting adjacent plots within three years, or within 300m of an existing colony. Coupes can be colonised in the first year after felling, but will rarely remain suitable for more than four years before the regrowth becomes too dense.

Deer management: Where deer are abundant it will normally be necessary to fence newly coppiced areas, to allow good regrowth of both the coppice stools and the foodplant. In the long-term, managing deer populations to reduce their impact may be a better option.



Common Cow-wheat growing in sunny situations provides ideal breeding habitat, while shaded plants may not be used



Coppice coupes do not remain suitable for long, so a regular cycle of clearance is needed

Dan Hoare

Dan Hoare