BUTTERFLY CONSERVATION'S UK CONSERVATION STRATEGY 2025

CONTENTS

1. INTRODUCTION 3

2. WHY CONSERVE BUTTERFLIES AND MOTHS? 3

3. THE DECLINING STATUS OF BUTTERFLIES AND MOTHS 3

3.1 Species Trends 4

3.2 Grouped Species Trends 4

4. DRIVERS OF DECLINE 6

5. HABITAT SPECIALISTS AND WIDER COUNTRYSIDE SPECIES 7

5.1 Conserving Habitat Specialist Species 8

5.2 Conserving Wider Countryside Species 8

6. SPECIES RECOVERY STRATEGY AND THE SPECIES RECOVERY CURVE 10

6.1 STATUS ASSESSMENT (Stage 1): PRIORITISING THREATENED SPECIES 12

6.1.1 Assessing UK Threat Priority using Distribution and Abundance Criteria 12

6.1.2 Changing Threat Status of UK Butterflies 13

6.1.3 Conservation Priority of Threatened UK Butterflies 14

6.1.4 Conservation Prioritisation of Threatened UK Moths 14

6.2 DIAGNOSIS (Stage 2) 16

6.3 SOLUTION TESTING (Stage 3) 17

6.4 PRIORITISATION OF LANDSCAPES (Stage 4) 18

6.5 KEY CONSERVATION DELIVERY MECHANISMS (Stages 4 and 5) 29

6.5.1 Provision of Advice 29

6.5.2 Habitat Management Intervention 29

6.5.3 Reserves 30

6.5.4 Re/introductions 30

6.5.5 People 30

6.5.6 Partnerships 31

6.5.7 Conservation Evidence 31

7. IMPLEMENTING THE CONSERVATION STRATEGY 32

7.1 Where are the UK's Threatened Lepidoptera on the Species Recovery Curve? 32

7.2 What are the Conservation Action Priorities for the UK's Threatened Lepidoptera? 33

7.3 Reviewing and Developing the Conservation Strategy 33

8. REFERENCES 34

9. APPENDIX 1: WHY BUTTERFLIES AND MOTHS ARE IMPORTANT 35

10. APPENDIX 2: HABITAT SPECIALIST AND WIDER COUNTRYSIDE BUTTERFLIES 37

1. INTRODUCTION

Butterfly Conservation (BC) is the UK charity dedicated to the conservation of butterflies and moths (Lepidoptera). Three quarters of butterfly and two-thirds of moth species are in decline, highlighting the scale and severity of the problems which they face. Whilst important in their own right, they are also indicators of a healthy environment and enhance the quality of life for many people.

BC undertakes scientific research and provides land management advice to help create a landscape fit for butterflies and moths. We run conservation programmes for more than 100 threatened species and manage over 30 nature reserves. Our conservation priorities have been determined using data from our extensive survey and monitoring programmes, whilst our conservation delivery programmes are underpinned by robust scientific evidence.

This Conservation Strategy describes our approach to the conservation of butterflies and moths over the next 10 years. The strategy provides a broad framework for conservation delivery across the United Kingdom through our country and regional conservation strategies, guided by our specific conservation policies (e.g. conservation science, reserves, re/introductions) and informs our short and long-term work programmes.

2. WHY CONSERVE BUTTERFLIES AND MOTHS?

There are around 150,000 (estimates vary between 120,000 and 175,000) species of Lepidoptera in the world, of which around 20,000 are butterflies (Chakravarthy and Sridhara, 2016). In terms of planetary biodiversity, Lepidoptera comprise 15% of all insect species and 12.5% of all described species on the planet. One in eight species is either a butterfly or a moth, making them the fourth largest group after beetles, flies, bees wasps and ants.

There are many reasons why butterflies and moths are important, both in their own right and as quality of life indicators. They should be conserved for their intrinsic, aesthetic, educational, scientific, economic, cultural value and their contribution to health and wellbeing of society (see Appendix 1). The term ‘natural capital’ is now being increasingly used to describe the parts of the natural environment that produce value to people. Natural capital underpins all other types of capital – manufactured, human and social – and is the foundation on which our economy, society and prosperity is built. Butterflies and moths are a part of this natural capital. Butterflies and moths are indicators of a healthy environment and help to provide a range of ecosystem services such as pollination.

3. THE DECLINING STATUS OF BUTTERFLIES AND MOTHS

BC runs world-renowned recording and monitoring schemes on butterflies and moths. Thousands of recorders contribute to the Butterflies for the New Millennium (BNM) and the National Macro-moth Recording (NMRS) schemes which respectively generate time series distribution data for butterflies and moths across the UK. The UK Butterfly Monitoring Scheme (UKBMS) is jointly run by BC, the Centre for Ecology & Hydrology and the British Trust for Ornithology and provides scientifically robust annual abundance data and long-term (since 1976) trends for 57 of the 59 UK butterfly species, from a network of more than 2,500 sites.

These schemes have generated a database of more than 30 million records that provide the evidence to assess distribution and abundance trends for individual or species groups. These trends are reported by BC annually (e.g. UKBMS Annual Report) or on a five-year rolling programme (The State of UK Butterflies and the State of UK Moths reports).

3.1 Species Trends

Butterflies and moths are in rapid decline in the UK and require urgent conservation action. Between 1976 and 2014, 76% of the UK's 59 resident and regular migrant butterfly species declined in distribution and/or abundance, compared to 47% of species which increased in one or both measures (Fox et al, 2015).

The latest population trends (1976-2016) from the UK Butterfly Monitoring Scheme (UKBMS) show that 59% of habitat specialists have long-term negative trends, with 45% in significant decline. 57% of wider countryside species have long-term negative trends, with 32% in significant decline (see section 5 for definitions of habitat specialist and wider countryside species).

Population trends from the Rothamsted Insect Survey showed that two-thirds of 337 common and widespread moth species declined in abundance during the period 1968-2007 (37% declined by at least 50%), with one third becoming more abundant (Fox et al, 2013).

3.2 Grouped Species Trends

Analysis of grouped measures of butterfly abundance (Figure 1) show that across the UK, 26 habitat specialist species have significantly declined by 74% and 24 wider countryside species by 57% between 1976 and 2016.

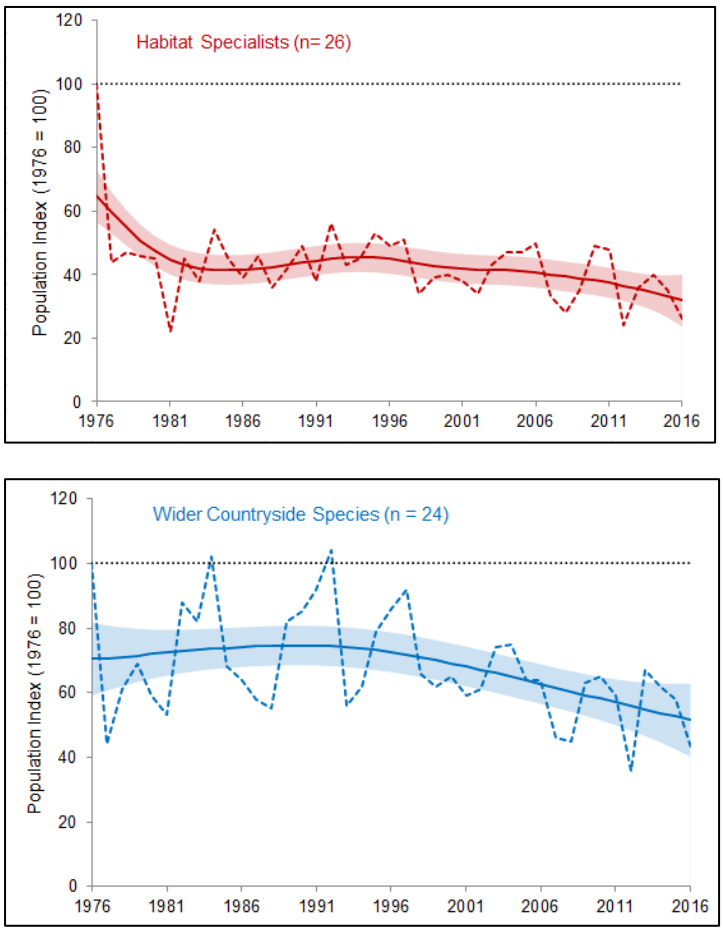

Figure 1: Composite abundance trends for UK butterfly populations 1976-2016 Dotted lines = unsmoothed trends; solid lines = smoothed trends; shaded = 95% confidence interval.

Grouped measures of butterfly abundance by broad habitat type (Figure 2) also show significant rapid declines. In England, butterflies on farmland (semi-natural grasslands, as well as intensive farming) declined by 55% and in woodland by 64% between 1990 and 2016. Across the UK, butterflies in urban areas declined by 65% during the same time period.

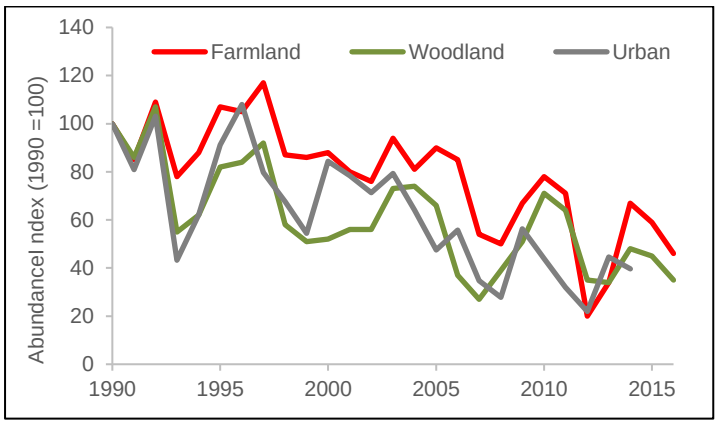

Figure 2: Composite butterfly abundance trends for three broad habitat types 1990-2016

Similarly a grouped measure of moth abundance (Figure 3) from the Rothamsted Insect Survey, showed larger moths have declined by 28% across Britain over the period 1968-2007 (Fox et al, 2013).

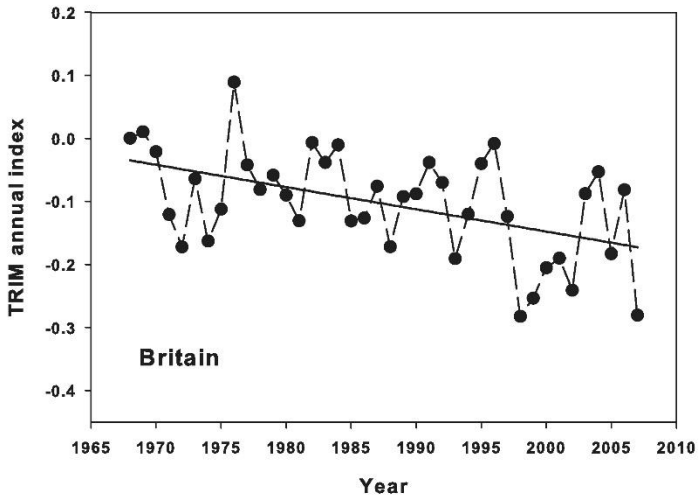

Figure 3: Composite abundance trend for larger moths caught in the Rothamsted light-trap network 1968-2007

Rates of decline vary considerably between species. Declines may be long-term or more recent and may be more pronounced in some countries or regions than others. As well as declining species there are others, especially amongst the moths, which are geographically restricted in range and have always been rare. **Butterflies and moths which are rare or in long-term decline or both at the UK scale are referred to as threatened species.** Without intervention many of these species will continue to decline and there is a very real danger of extinction at the county, regional, country or even at the UK scale. **Halting and reversing the decline of threatened species therefore remains BC's primary conservation objective.**

4. DRIVERS OF DECLINE

In order to reverse such declines, the drivers of change need to be identified for those species at risk. A wide range of potential drivers of decline in butterflies and moths have been identified and the extent to which these factors, either singly or synergistically, cause decline will vary from species to species:

Habitat loss: The direct loss of semi-natural habitat such as unimproved grassland, woodland, heathland, moorland, fenland and brownfield due to intensification of farming, forestry and development.

Changing habitat management: Changes in the management regimes of remaining semi-natural habitat such as over and under grazing, agricultural abandonment and cessation of woodland coppicing, leading to habitat structures which do not meet the specific requirements of the species concerned.

Increasing habitat fragmentation and isolation: Increasing fragmentation is caused by direct habitat loss and land use change (particularly over-simplification of the matrix - the surrounding unsuitable habitat) and may reduce population viability for habitat specialists even when habitat quality within remaining patches is high. This is because these species persist as metapopulations in fragmented landscapes, comprising local populations occupying remaining semi-natural habitat patches connected by occasional dispersal. Smaller habitat patches tend to support smaller local populations which are more susceptible to extinction due to chance events, demographic or genetic effects. Isolated habitat patches are less likely to be re-colonised following extinction. When the rate of local population extinction exceeds the rate of re/colonisation, the metapopulation is no longer in equilibrium and at greater risk of extinction across the landscape.

Climate change: A warming climate has caused both upward altitudinal and northwards latitudinal shifts in butterfly and moth distributions. However, responses are variable with species with declining populations less likely to expand their distribution northwards. Climate change can have negative impacts too, both on butterfly and moth species themselves (e.g. extreme climatic events such as very mild winters, summer drought) and on habitats. A warmer and wetter climate may impact directly on habitat quality, by for example longer growing seasons leading to increased grassiness in Bracken habitats or more rapid scrub and coppice regrowth which require shorter management rotations to offset.

Pesticides and fertilisers: The use of pesticides and artificial fertilisers has had significant indirect effects by allowing the agricultural intensification of semi-natural habitats. Neonicotinoid pesticides are used on a wide range of arable crops to control insect pests. There is growing evidence that they are harming bee populations and other pollinators; the decline of widespread butterflies has been correlated with neonicotinoid use.

Air pollution: Nitrogen deposition, in particular, is suspected to have an indirect effect on butterflies and moths by altering plant communities. For example, nutrient enrichment is encouraging coarse grasses on semi-natural grasslands and woodland rides. It may also, either independently or synergistically with climate change, be leading to increased grassiness of Bracken habitats.

Light pollution: Increasing levels of outdoor, artificial light can kill moths directly by contact with hot glass or bulbs or affect them indirectly by altering their behaviour, life cycles or predation rates.

Invasive species: Non-native invasive plants (e.g. Cotoneaster, Rhododendron) can spread rapidly and affect habitat suitability for many butterfly and moth species.

Plant health: Concerns relating to plant health appear to have increased in recent years and control measures have been implemented. In a very few cases these control measures could impact on a wide range of butterfly and moth species (including threatened species), at least at the local level.

Collecting: Although there is little evidence to suggest collecting was a major cause of decline in the past, it could have had an impact on a few highly prized species where populations had been reduced to low levels due to other factors such as habitat loss or declining habitat quality. Whilst collecting is much reduced from its Victorian heyday, it still occurs and the most restricted and highly threatened species (e.g. Large Blue, New Forest Burnet moth) are rightly accorded the highest level of protection.

The extent to which BC is able to influence the drivers of decline is central to the conservation strategy. Some, like declining habitat quality caused by management change, lend themselves to direct intervention, at least for some species and in some landscapes. Others such as climate change or pesticide use are beyond our capacity to control and can only be influenced indirectly by BC through policy change and advocacy, although we may be able to mitigate their effects through habitat management in some cases.

5. HABITAT SPECIALISTS AND WIDER COUNTRYSIDE SPECIES

In order to evaluate distribution and abundance trends, assess threat and plan conservation action, it is convenient to recognise two broad categories (Table 1) of butterflies and moths based on their ecological attributes (after Asher et al, 2001).

Table 1: Ecological attributes of habitat specialist and wider countryside butterflies and moths

HABITAT SPECIALISTS	WIDER COUNTRYSIDE SPECIES
Confined to specific, discrete 'islands' of (usually semi-natural) habitat that are localised or patchy within the modern landscape (e.g. species of unimproved grassland, heathland, coppice woodland)	Use habitats that are widely distributed in the farmed, upland or urban landscape (e.g. species of generalist grassland, woodland, parks and gardens), including linear features such as hedgerows, field margins and road verges
Relatively specific habitat requirements (e.g. larval foodplant species and their growth form, microclimate) and usually only one or very few habitat types	Broad habitat requirements and found across a wide range of habitat types
Usually only one (monophagous) or two species of larval foodplant	Often several species of larval foodplant or polyphagous
Relatively sedentary, though can colonise new suitable habitat within sites and occasionally disperse over longer distances to colonise new sites and landscapes	Relatively mobile, easily colonising new suitable habitat as it becomes available
Mostly have a single generation per year	Often multi-brooded

However, the distinction is a continuum and maybe more applicable to butterflies (see Appendix 2) than to moths. For example, some habitat specialist moths are able to use linear habitats. Also, some species have different requirements in different parts of their range. For example, some habitat specialists (e.g. Pearl-bordered Fritillary) of southern Britain are more widespread in the unenclosed landscapes of northern Britain because their habitats are more widespread and less fragmented. The term 'wider countryside' is interpreted here as land which is not designated for nature conservation and as such can include urban greenspace or other habitats in the built environment. Wider countryside species are also sometimes referred to as 'widespread species' because for the most part, they and the habitats they utilise are widely distributed across one or more of the UK countries. Habitat specialists can also be widespread regionally (e.g. Green Hairstreak, Dark Green Fritillary), where large extents of semi-natural habitats (such as moorland) occur.

5.1 Conserving Habitat Specialist Species

Habitat specialists tend to be restricted to patches of high quality semi-natural habitat and ecological studies of these species have identified habitat loss, declining habitat quality due to management change and fragmentation/isolation of remaining habitat as the three primary drivers of decline. Whilst direct loss of semi-natural habitat has largely abated in recent decades, **changes in habitat quality are ongoing and this remains the chief threat for species that are restricted to very narrow niches**. The importance of fragmentation and isolation as a driver is not reduced by lower rates of habitat loss because the loss of high quality habitat has the same effect on a metapopulation as direct loss of habitat itself. Furthermore, the most recent studies suggest climate change is a fourth key factor driving declines of habitat specialists, but separating its impact from those of the other drivers is not easy.

Declining habitat quality can be reversed through appropriate habitat management, and this remains BC's core conservation activity. However, generic prescriptions are usually insufficient as most habitat specialist species require bespoke management in order to provide suitable high quality habitat. In order for this to be effective metapopulation theory suggests that **targeted management to maintain, restore or create high quality habitat needs to be applied at the landscape-scale**, targeting individual sites but taking account of their spatial context in terms of area and isolation.

The objectives of landscape-scale conservation as applied to threatened habitat specialist species should be, in order of priority, to:

- Ensure viable populations persist in the long-term in all currently occupied landscapes, though the species need not necessarily be present in all site networks (group of sites located in close proximity - such as the same valley system).
- Restore populations to formerly occupied landscapes where viable.
- Establish populations in previously unoccupied landscapes where these are likely to contribute to more robust metapopulations.

Landscape-scale conservation can be applied at different spatial scales. Although some habitat specialist butterflies and moths are restricted to just one or a few sites, opportunities to restore or create habitat patch or site networks should always be explored to reduce the chances of extinction.

5.2 Conserving Wider Countryside Species

Although a number of wider countryside species have expanded their distributions and abundance, most likely in response to climate change, many others have undergone declines. These declines are particularly evident in southern Britain and in urban areas.

The reasons for these declines are not well understood and may be far more complex than those driving declines in habitat specialists. As wider countryside species are less restricted by habitat type or larval foodplant choice, are relatively mobile and often multi-brooded, they are less likely to be affected by the habitat-specific factors driving the decline of habitat specialists. Nevertheless, studies which demonstrate the positive effects of wider field margins and hedgerow trees on wider countryside moths in intensively farmed landscapes show that habitat factors are still likely to be important drivers of decline. However, other drivers, such as the use of pesticides and fertilisers could be equally important in the intensively farmed landscape. In the urban landscape, light pollution may be an important driver of decline of wider countryside moth species.

The immediate conservation priority for wider countryside species is therefore focused on research into the likely drivers and their interaction, developing appropriate solutions and establishing wider countryside pilot projects to test those solutions. To date conservation efforts have focussed on policy change (e.g. developing agri-environment scheme options), but may require more active intervention in the future through provision of farm/landscape-scale advice in the wider countryside.

Arable reversion in the countryside and new roadside verge schemes in the built environment can provide significant opportunities to create both new habitat and improve connectivity for wider countryside species, as well some habitat specialists. Most such schemes aim to create species-rich grassland through seeding low nutrient status substrates with local provenance plants. In the built environment habitat creation is usually low maintenance and is therefore an increasingly attractive cost-effective solution compared to traditional landscaping techniques. The urban environment also supports much greenspace (e.g. parks, gardens), which if appropriately managed and better connected, has the potential to make a significant contribution to increasing the populations of wider countryside species.

6. SPECIES RECOVERY STRATEGY AND THE SPECIES RECOVERY CURVE

Species recovery means taking action to improve the conservation status of threatened (rare or in long-term decline) butterflies and moths. Since there are more species falling into an adverse conservation status than there are resources to ensure their recovery, it is essential we have a strategy which identifies how we prioritise species for action and how best we utilise those limited resources.

The process by which BC approaches species recovery is broadly consistent between habitat specialist and wider countryside species, even though the mechanisms used to achieve favourable outcomes may be very different. The process can be described by the **species recovery curve** (Figure 4): a simple and effective representation of the stages by which a species returns to favourable status. **At the heart of our conservation strategy is the aim that for all species we try to move them further along the curve towards sustainable management and a more positive/favourable conservation status.**

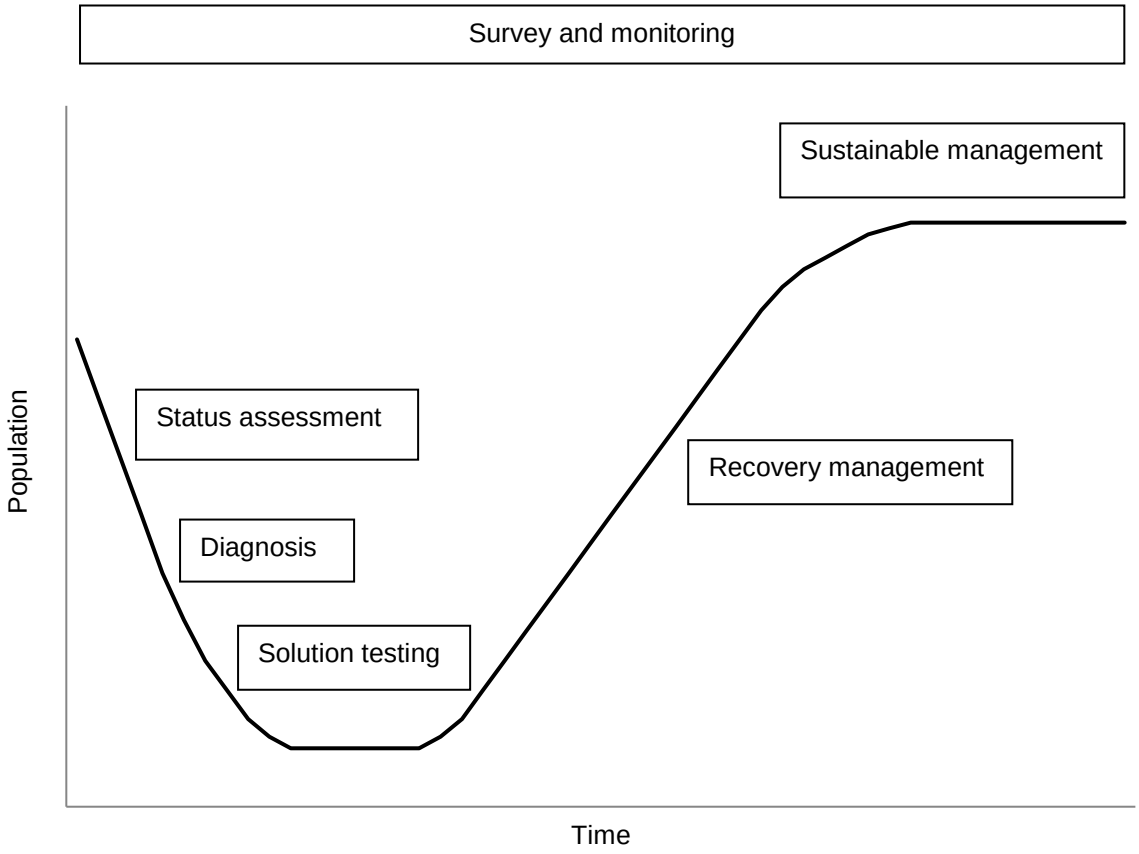

Figure 4: The five stages of Butterfly Conservation's species recovery curve

This concept is utilised by other species conservation organisations, but BC's version recognises five stages, with survey and monitoring an integral thread running through all these:

<u>Stage 1: Status Assessment:</u>

- Distribution and population data are used to assess geographical extent and trends.
- Species are prioritised for conservation action by rarity (area of occupancy) and/or decline (rate of occupancy and population change).
- The location of occupied, former and potential sites should be identified, tabulated and mapped. Sites should be grouped into networks (i.e. within the known

colonisation range of the species) and separated from other networks by a geographical barrier) and then into landscapes (which comprise one or more networks).
- Where practical, population size on each site should be assessed.
- For the most threatened species site dossiers should be produced.

Stage 2: Diagnosis:
- Autecology of species is researched.
- Drivers of decline are identified.
- Recovery requirements are identified and articulated.

Stage 3: Solution Testing:
- Potential recovery solutions are trialled.
- Effective solutions are identified.

Stage 4: Recovery Management:
- Recovery solutions applied to all occupied sites within landscapes.
- Recovery solutions applied to most appropriate unoccupied (former and potential) sites within landscapes.
- Improvements in connectivity implemented to encourage natural re/colonisation of restored former and potential sites.

Stage 5: Sustainable Management:
- Long-term management solutions (e.g. agri-environment schemes) are identified and implemented.
- For many species of early successional or temporary habitats, successful conservation requires ongoing habitat management interventions.
- Distribution/population targets are achieved.

Ongoing survey and monitoring are integral to the species recovery curve enabling:

- Quantitative assessment of distribution and population status.
- Assessment of the effectiveness of potential recovery solutions.
- Formulation of UK, national and regional distribution and population recovery targets.
- Recording conservation evidence of management intervention: geospatial recording of sites, advice provision and habitat management.
- Measuring the biological impact of management intervention: habitat quality (condition assessment); site/habitat patch occupancy; area occupancy; comparing site/landscape trends with regional/national/UK trends; metapopulation modelling to predict likelihood of persistence across landscapes.
- Assessment of progress towards sustainable management.

Although the species recovery curve is a useful tool for assessing progress, there are some caveats:

- The curve is schematic and it may never be possible to determine a timescale.
- Some species may be at different points along the curve in different parts of the UK.
- For some species it will take longer to progress to the sustainable management phase.
- Progression along the curve may not be linear and could be reversible. For example, the recovery solutions developed and applied to Bracken habitat following diagnosis for several threatened fritillary butterflies may no longer be suitable as climate change lengthens the growing season leading to increased grassiness.

6.1 STATUS ASSESSMENT (Stage 1): PRIORITISING THREATENED SPECIES

A range of status assessments have been previously applied by government, its agencies, the EU and BC to the UK's butterflies and moths to prioritise the most threatened species:

- Great Britain Red List status (based on International Union for Conservation of Nature (IUCN) threat criteria): butterflies only
- Red Data Book status (currently based on restricted distribution criteria): moths only
- Irish Red List status (based on IUCN threat criteria)
- Wildlife and Countryside Act (1981): legal protection
- UK Biodiversity Action Plan: now superseded by s41, s7, Scottish Biodiversity List and Northern Ireland Priority List.
- Natural Environment and Rural Communities Act (2006) Section 41: England only
- Environment Act (Wales) (2016) Section 7
- Scottish Biodiversity List
- Northern Ireland Priority List
- EU Red List status (based on IUCN threat criteria)
- Habitats Directive: Annexes 2 (core areas designated SACs) and 4 (strict protection across entire natural range)
- The Conservation of Habitats and Species Regulations 2010 (Large Blue and Fisher's Estuarine Moth are listed under Schedule 2)
- BC's UK threat priorities in 1997 (Warren et al, 1997 and used in Asher et al, 2001): butterflies only
- BC's UK threat priorities in 2005 (Bourn et al, 2005): butterflies only

6.1.1 Assessing UK Threat Priority using Distribution and Abundance Criteria

In this strategy we have revised and simplified the threat criteria used to prioritise the butterflies at the UK scale by analysing distribution and abundance data:

High Threat Priority (H) species

1. *International status*: e.g. IUCN, EU listing
2. *Rarity*: present in less than 50 1-km squares
3. *Distribution trend*: >50% decline in occupancy over the last 25 years or longer since 1976
4. *Population trend*: >50% decline in relative abundance over the last 25 years or longer since 1976

Medium Threat Priority (M) species

1. *Rarity*: present in less than 100 1-km squares, negative trend in distribution or abundance or data deficient
2. *Distribution trend*: 33-49% decline in occupancy over the last 25 years or longer since 1976
3. *Population trend*: 33-49% decline in relative abundance over the last 25 years or longer since 1976

Summaries of these status assessments, including those which are historic for comparison, are provided for 26 butterfly species in Appendix 3 and for 103 moth species in Appendix 4 considered to be most under threat in the UK. Occupancy data (number of occupied 1-km and 10-km squares 2010-14), long-term distribution (changes in occurrence 1976-2014) and population trends (changes in abundance 1976-2016) are included for the butterflies and these are highlighted red or yellow where they meet the high or medium threat priority thresholds. A species was deemed to be High or Medium Threat Priority in 2016 if it met one or more of the relevant criteria.

All moth species which are listed on Section 41 of the NERC Act (2006), Section 7 of the Environment Act (Wales) (2016), the Scottish Biodiversity List and the Northern Ireland Priority List are considered High Threat Priority in 2016. However, an analysis of distribution trends for macro-moths will be undertaken by 2018, enabling a re-assessment of these threat priorities.

These assessments also list the threat priorities (high or medium only) assigned in BC's regional (England) and country (Scotland, Wales, Northern Ireland) conservation strategies. Whilst reflecting UK priorities these assessments allow BC staff and Branches to raise (or occasionally lower) those priorities at the country or regional level.

6.1.2 Changing Threat Status of UK Butterflies

In 2005 25 threatened butterfly species were listed as High Threat Priority, with 23 of these identified in need of conservation action and two species (Wall and Small Heath) identified as research priorities. The majority of these species are habitat specialists. Excluding the two research priorities, only the White-letter Hairstreak is a wider countryside species. A further eight species, all habitat specialists, were listed as Medium Threat Priority.

In 2016 the number of High Threat Priority threatened species increased to 29. This revised list includes two former Medium Threat Priority habitat specialists (Swallowtail, Chalk Hill Blue) and four wider countryside species identified as research priorities (Small Skipper, Essex Skipper, Small Tortoiseshell, Purple Hairstreak). Two habitat specialist species were downgraded from High to Medium Threat Priority (Brown Hairstreak, Small Blue).

The number of Medium Threat Priority species increased to nine with the addition of Cryptic Wood White following confirmation of its species status in 2011. Two wider countryside species were identified as Medium research priorities (Gatekeeper, Small Copper) and two habitat specialists were downgraded from Medium to Low Threat Priority (Silver-spotted Skipper, Adonis Blue). The Medium Threat Priority status of Dark Green Fritillary, Purple Emperor, Green Hairstreak and Large Copper remained unchanged between 2005 and 2016.

In the context of this conservation strategy there is a need to rank further those butterfly and moth priority species threatened at a UK scale, so that BC can utilise its resources for conservation action as effectively as possible. This ranking excludes all research only species (see section 6.2) and four Medium Priority butterflies, either considered threatened to a lesser degree at a UK scale (Dark Green Fritillary, Purple Emperor, Green Hairstreak) or extinct but a candidate for future re/introduction (Large Copper). As both Brown Hairstreak (-49% 1976-2014 distribution trend) and Small Blue (-44% 1976-2014 distribution trend) are close to the High Priority threshold, these species are retained in the ranking until further data becomes available.

For both butterflies and moths, prioritisation is based on the degree of risk as assessed using several criteria.

6.1.3 Conservation Priority of Threatened UK Butterflies

Species are ranked into three threat categories (Table 2) taking into account the following criteria:

1. Priority species are defined as species listed in relevant sections of country legislation or otherwise classed as High Priority or Medium Priority by BC in light of subsequent data (but see 6.1.2 for exclusions).
2. The species has an especially high threat level due to extreme rarity or very rapid decline or the species is highly conservation dependent and/or globally threatened.
3. The chief threat is related to reversible changes in habitat (i.e. through management).
4. The 'standard' habitat prescription on key sites is not appropriate or is not sufficient to conserve species without additional intervention.

Table 2: Prioritisation for conservation action of 26 threatened UK butterfly species (Note: all species are identified as BC High Priorities at the UK scale except * which are Medium Priorities but close to the High Priority threshold)

Conservation Priority A Action urgent across UK range	**Conservation Priority B** Action necessary in parts of UK range	**Conservation Priority C** Action necessary in parts of UK range but less urgent
Chequered Skipper Lulworth Skipper Wood White Pearl-bordered Fritillary High Brown Fritillary Marsh Fritillary Heath Fritillary Duke of Burgundy Large Blue	Dingy Skipper Grizzled Skipper Large Heath Grayling Small Pearl-bordered Fritillary Glanville Fritillary Silver-studded Blue Northern Brown Argus	Swallowtail Cryptic Wood White Mountain Ringlet White Admiral Brown Hairstreak * White-letter Hairstreak Black Hairstreak Small Blue * Chalk Hill Blue
9 species	**8 species**	**9 species**

6.1.4 Conservation Prioritisation of Threatened UK Moths

Species are ranked into three threat categories (Table 3) taking into account the following criteria:

1. Priority species are defined as those species listed on Section 41 of the NERC Act (2006), Section 7 of the Environment Act (Wales) (2016), the Scottish Biodiversity List and the Northern Ireland Priority List. Note this does not include all the UK's threatened moths; other Very High Priority Species at a country or regional level are included in Appendix 4.
2. The species has an especially high threat level due to extreme rarity or very rapid decline or the species is highly conservation dependent and/or globally threatened.
3. The chief threat is related to reversible changes in habitat (i.e. through management).
4. The 'standard' habitat prescription on key sites is not appropriate or is not sufficient to conserve species without additional intervention.
5. The life history of some species is poorly understood (and will require considerable effort to address this lack of knowledge).
6. Some species are elusive and require considerable effort to locate, and a few species, despite effort, are difficult to find/have not been found in the early stage.

Table 3: Prioritisation for conservation action of 103 UK moth species

Conservation Priority A Action urgent across UK range	**Conservation Priority B** Action less urgent across UK range, but may be required at the country/regional level	**Conservation Priority C** Action less urgent, but may be required at the landscape/site level. Also includes species with poorly understood autecology
Stigmella zelleriella *Agonopterix atomella* *Syncopacma albipalpella* Large Gold Case-bearer (*Coleophora vibicella*) Basil-thyme Case-bearer (*Coleophora tricolor*) Betony Case-bearer (*Coleophora wockeella*) *Scythris siccella* Fiery Clearwing Slender Scotch Burnet New Forest Burnet Scarce Crimson & Gold (*Pyrausta sanguinalis*) Kentish Glory Bright Wave Silky Wave Dingy Mocha Netted Carpet Barberry Carpet Scarce Pug Dark Bordered Beauty Belted Beauty Black-veined Moth Straw Belle Sussex Emerald Shoulder-striped Clover Reddish Buff Marsh Moth Marsh Mallow Moth Small Dark Yellow Underwing	Currant Shoot-borer (*Lampronia capitella*) Richardson's Case-bearer (*Eudarcia richardsoni*) *Archinemapogon yldizae* *Phyllonorycter scabiosella* *Phyllonorycter sagitella* *Swammerdamia passerella* *Levipalpus hepatariella* Water-dock Case-bearer (*Coleophora hydrolapathella*) Irish Plume (*Platyptilia tesseradactyla*) *Epermenia insecurella* *Periclepsis cinctana* *Aethes rutilana* Mistletoe Marble (*Celypha woodiana)* Liquorice Piercer (*Grapholita pallifrontana*) Welsh Clearwing Forester Transparent Burnet Scotch Burnet (Mountain Burnet) Narrow-bordered Five-spot Burnet (Talisker Burnet ssp. *jocelynae*) *Sciota hostilis* *Anania funebris* Beautiful Pearl (*Agrotera nemoralis*) Scarce Hook-tip Small Eggar Narrow-bordered Bee Hawk-moth Yellow-ringed Carpet Drab Looper Argent & Sable Grey Carpet Barred Tooth-striped Netted Mountain Moth Sloe Carpet Scarce Vapourer Speckled Footman Common Fan-foot Four-spotted Striped Lychnis White-spotted Pinion Grey Lunar Yellow Underwing	*Nemophora fasciella* *Nematopogon magna* *Nemapogon picarella* *Callisto coffeella* *Aplota palpella* *Agonopterix capreolella* *Syncopacma suecicella* *Apotomis infida* Goat Moth Weaver's Wave False Mocha Chalk Carpet Pretty Pinion Rest Harrow Wood Tiger Round-winged Muslin Clay Fan-foot Olive Crescent Dark Crimson Underwing Light Crimson Underwing Sandhill Rustic (spp. *leechi*) White-mantled Wainscot Brighton Wainscot (prob. extinct) Concolorous Fenn's Wainscot Orange Upperwing (prob. extinct) Sword-grass Heart Moth Pale Shining Brown Bordered Gothic (prob. extinct) White-spot Silurian Ashworth's Rustic Northern Dart Cousin German
28 species	**40 species**	**35 species**

6.2 DIAGNOSIS (Stage 2)

Once a species status has been determined, understanding the underlying causes of decline (or expansion) is a critical step in the conservation of that species. Over the last 40 years our understanding of the autecology of many of our most threatened species has been researched and much conservation action has followed. This research tended to focus on populations of varying sizes and attempted to explain that observed pattern (i.e. what makes one site better than another for a species) with a view to understanding the reasons why a species is declining and then how to recover it.

Such research demonstrated the importance of a key life stage where resources limit the populations of the species being studied. This was usually an immature life stage such as the specific requirements of the egg laying site or larval resources. **Research successfully switched conservation action from an emphasis on adult resources (e.g. nectar availability, roost sites) to the provision of larval foodplants growing in a very specific growth form required by the butterfly or moth at that key life stage**.

Currently some of this research requires revisiting as the widespread impacts of climate change on butterfly and moths becomes more apparent. For example the Brown Argus has successfully expanded in the last two decades as a warmer climate has allowed it to exploit Dove's-foot Cranesbill and Common Stork's-bill as larval foodplants. These species were only rarely utilised previously because of unsuitable microclimates.

Monitoring data from the UKBMS indicates that several wider countryside species are now showing significant declines and our understanding of the drivers is less well understood than the ecology of our habitat specialist species. Several hypotheses exist including, continuing impacts of agricultural intensification and associated habitat deterioration and isolation, pesticide use (including neonicitinoids), increasing nitrogen in the environment, causing faster growth and poorer foodplant quality, and climate change.

These knowledge gaps are hugely significant and we will continue to undertake research and seek further academic partnerships to help improve the fortunes of both our habitat specialist and wider countryside species.

Eight threatened wider countryside butterfly species have been identified as priorities for research (Table 4) to determine the underlying drivers of decline.

Table 4: Wider countryside butterfly species priorities for research

Essex Skipper	High Priority
Small Skipper	High Priority
Wall	High Priority
Small Heath	High Priority
Gatekeeper	Medium Priority
Small Tortoiseshell	High Priority
Small Copper	Medium Priority
Purple Hairstreak	High Priority
8 species	

A total of 71 wider countryside moth species have been identified (Table 5) as widespread but declining species in need of urgent research to identify drivers of decline.

Table 5: Wider countryside moth species priorities for research

Anomalous	Feathered Gothic	Oak Lutestring
August Thorn	Figure of Eight	Oblique Carpet
Autumnal Rustic	Flounced Chestnut	Neglected Rustic
Beaded Chestnut	Galium Carpet	Pale Eggar
Blood-vein	Garden Dart	Powdered Quaker
Brindled Beauty	Garden Tiger	Pretty Chalk Carpet
Brindled Ochre	Ghost Moth	Red Carpet
Broom Moth	Grass Rivulet	Rosy Minor
Broom-tip	Green-brindled Crescent	Rosy Rustic
Brown-spot Pinion	Grey Dagger	Rustic
Buff Ermine	Grey Mountain Carpet	Sallow
Centre-barred Sallow	Haworth's Minor	September Thorn
Cinnabar	Heath Rustic	Shoulder-striped Wainscot
Crescent	Hedge Rustic	Small Emerald
Dark-barred Twin-spot Carpet	Knot Grass	Shaded Broad-bar
Dark Brocade	Lackey	Small Phoenix
Dark Spinach	Large Nutmeg	Small Square-spot
Deep-brown Dart	Large Wainscot	Spinach
Dusky Brocade	Latticed Heath	Sprawler
Dusky-lemon Sallow	Minor Shoulder-knot	Streak
Dusky Thorn	Mottled Rustic	V-Moth
Dot Moth	Mouse Moth	White Ermine
Double Dart	Mullein Wave	White-line Dart
Ear Moth	Oak Hook-tip	
71 species		

6.3 SOLUTION TESTING (Stage 3)

Once the causes of decline have been determined then possible solutions need to be developed and tested. This can often involve experimental management trials to determine changes in land management that will recover the target and other species. A key role in our understanding of the impact of management on priority sites has also been possible through the extensive monitoring undertaken through the UKBMS. This research has led, for example, to major management trials on Exmoor undertaken in partnership with the National Trust to determine the most effective management of Exmoor coombs for the Heath Fritillary. We have also recently instigated grassland restoration trials on the Dorset coast for Lulworth Skipper.

Once studies have identified appropriate solutions, new management prescriptions can be confidently rolled out and incorporated into our range of advisory publications for dissemination to site managers (see section 6.5.1).

Solution testing will remain a crucial element of BC's work. With climate change and other new environmental pressures, some threatened habitat specialist species in some regions are failing to respond to habitat management prescriptions developed and implemented successfully in the 1980s and 1990s. Moreover, the emerging issue of an accelerating decline in wider countryside species means that diagnostic research and solution testing will need to be applied to a different suite of threatened butterflies and moths in habitats which have previously received limited attention (e.g. intensively managed farmland, hedgerows, urban greenspace).

6.4 PRIORITISATION OF LANDSCAPES (Stage 4)

As the majority of the UK's most threatened butterflies and moths are habitat specialists which require a landscape-scale approach to their conservation, identification and prioritisation of landscapes which support those species is a key element of the conservation strategy.

Our approach to landscape-scale conservation involves action across a large spatial scale, beyond individual site boundaries, often focused on one or a few semi-natural habitat types which may support several priority species.

BC's landscape boundaries encompass networks of sites supporting one or more metapopulations of threatened species, and we use the ecology of our target species to decide the appropriate scale for a given landscape. Where possible, to facilitate working in partnership, we work to agreed boundaries for landscapes or protected areas, such as National Parks or Areas of Outstanding Natural Beauty, although we focus our activity on the habitats upon which our priority butterflies and moths depend.

Within each region or country the most important landscapes for threatened butterflies and moths are identified and mapped as **Priority Landscapes** (Figures 5-13). These 200 landscapes have been selected to ensure the majority, or in some cases all, of the distribution of the most threatened species is encompassed by the landscape boundaries. However, not all sites supporting threatened species fall within defined landscapes, especially those habitat specialist moths known from only one or two locations and these are identified and mapped as **Priority Sites** within the country and regional conservation strategies.

Some conservation action for threatened butterflies and moths undoubtedly occurs in all these priority landscapes, but that may be limited to survey and monitoring. With unlimited resources BC would ensure appropriate landscape-scale conservation was undertaken in each, but in practice we have prioritised 95 as **High Priority Landscapes** because they support:

1. A high number of priority species.
2. A significant proportion of the distribution or number of occupied sites for one or more higher priority species.
3. Networks of occupied, former and potential sites for one or more higher priority species which lend themselves to a landscape-scale conservation approach.
4. One or more semi-natural habitat types which lend themselves to appropriate management intervention.

It is in these landscapes that BC has developed all of its funded, staff-led landscape-scale projects. However, funded projects have not been developed in all, partly because resources are limited and sometimes because other organisations or partnerships are leading work which benefits threatened butterflies and moths. To some extent developing landscape-scale projects is opportunistic, and some have been developed because a specific funding opportunity has arisen.

In the event of resources for landscape-scale conservation becoming even more limited then there will be a case for BC to prioritise further, focusing on even fewer High Priority Landscapes selected on the basis of three criteria:

1. Relative importance of that landscape to the highest priority species (Conservation Priority A species in Tables 2 and 3).
2. Existing and recent BC commitments to that landscape.

3. Extent of delivery by conservation partners, prioritising landscapes where there is a higher probability of threatened species extinction without continued BC input.

Appendix 5 lists the regional or country conservation strategy species priorities for each of these landscapes. Appendix 6 provides a qualitative assessment of progress with conservation delivery in each landscape for each priority species using the following categories:

0 = Unknown.
1 = No conservation delivery:
- Occasional recording of target species.
- Target species monitored on few sites.

2 = Limited conservation delivery:
- Co-ordinated surveys undertaken enabling distribution of target species across the landscape to be mapped.
- Co-ordinated monitoring undertaken across several sites, enabling assessment of target species abundance trend.
- Management advice provided on some sites.
- Recovery management implemented on some sites (e.g. work parties).

3 = Full conservation delivery:
- Co-ordinated monitoring programme established on many sites enabling assessment of target species abundance trend and effectiveness of conservation action.
- Management advice given to landowners across whole site networks.
- Co-ordinated programme of recovery management implemented across whole site networks.
- Long-term sustainable management (e.g. agri-environment schemes) implemented across sites.

Note this analysis only assesses conservation action and does not measure species responses and a 'favourable' assessment does not imply BC need no longer target work for that species in that landscape.

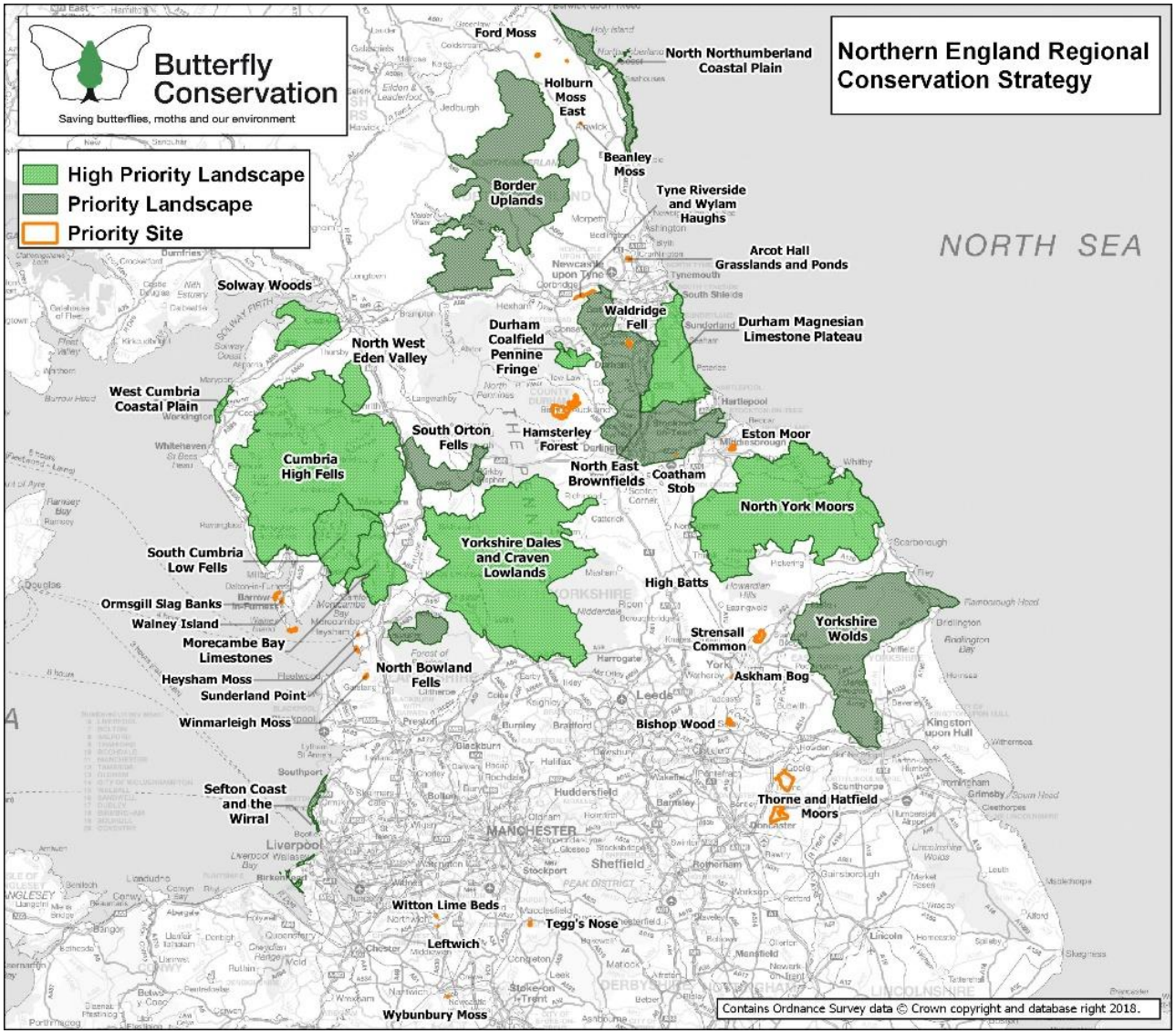

Figure 5: Location of BC's priority landscapes and sites in Northern England

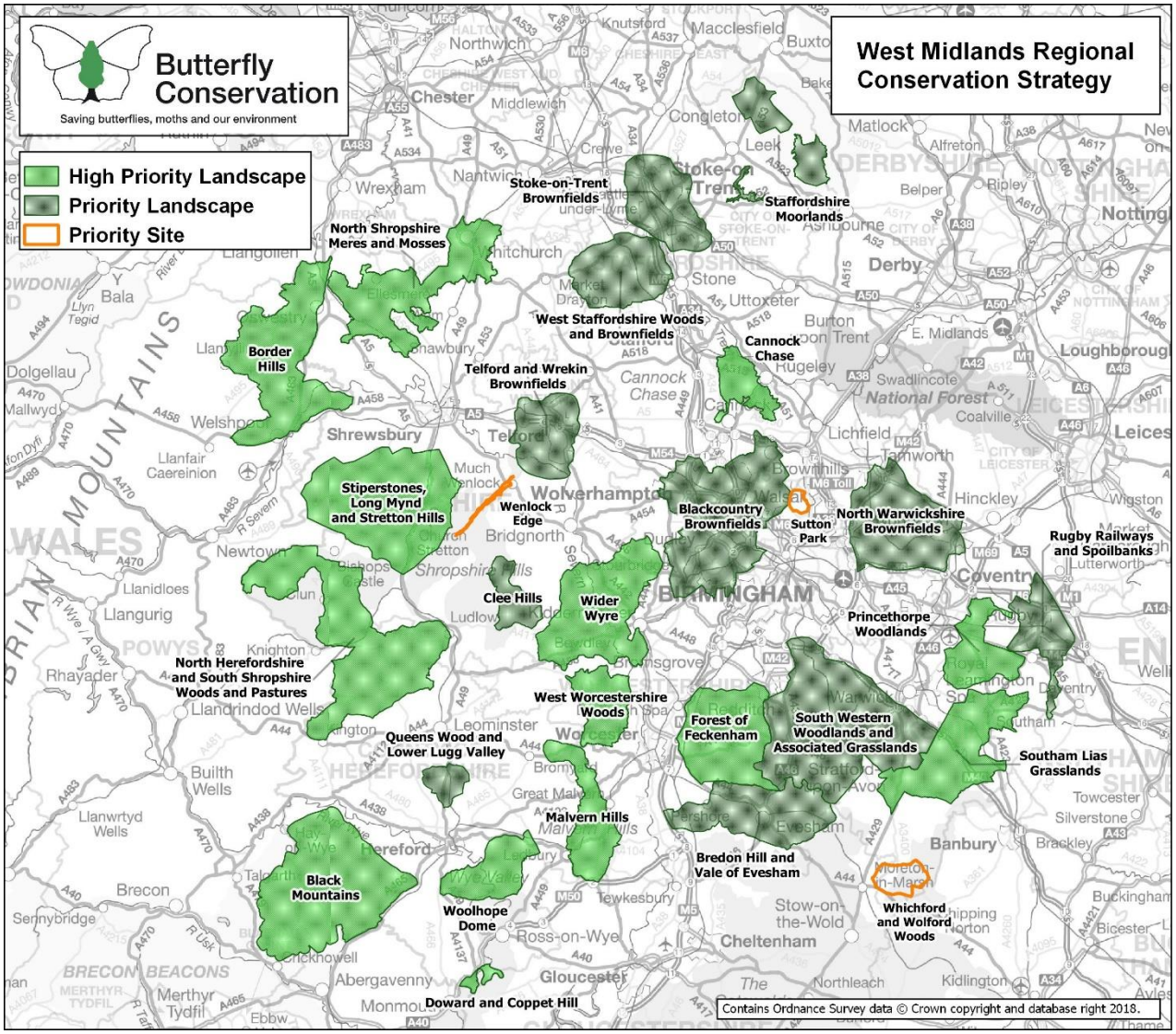

Figure 6: Location of BC's priority landscapes and sites in the West Midlands

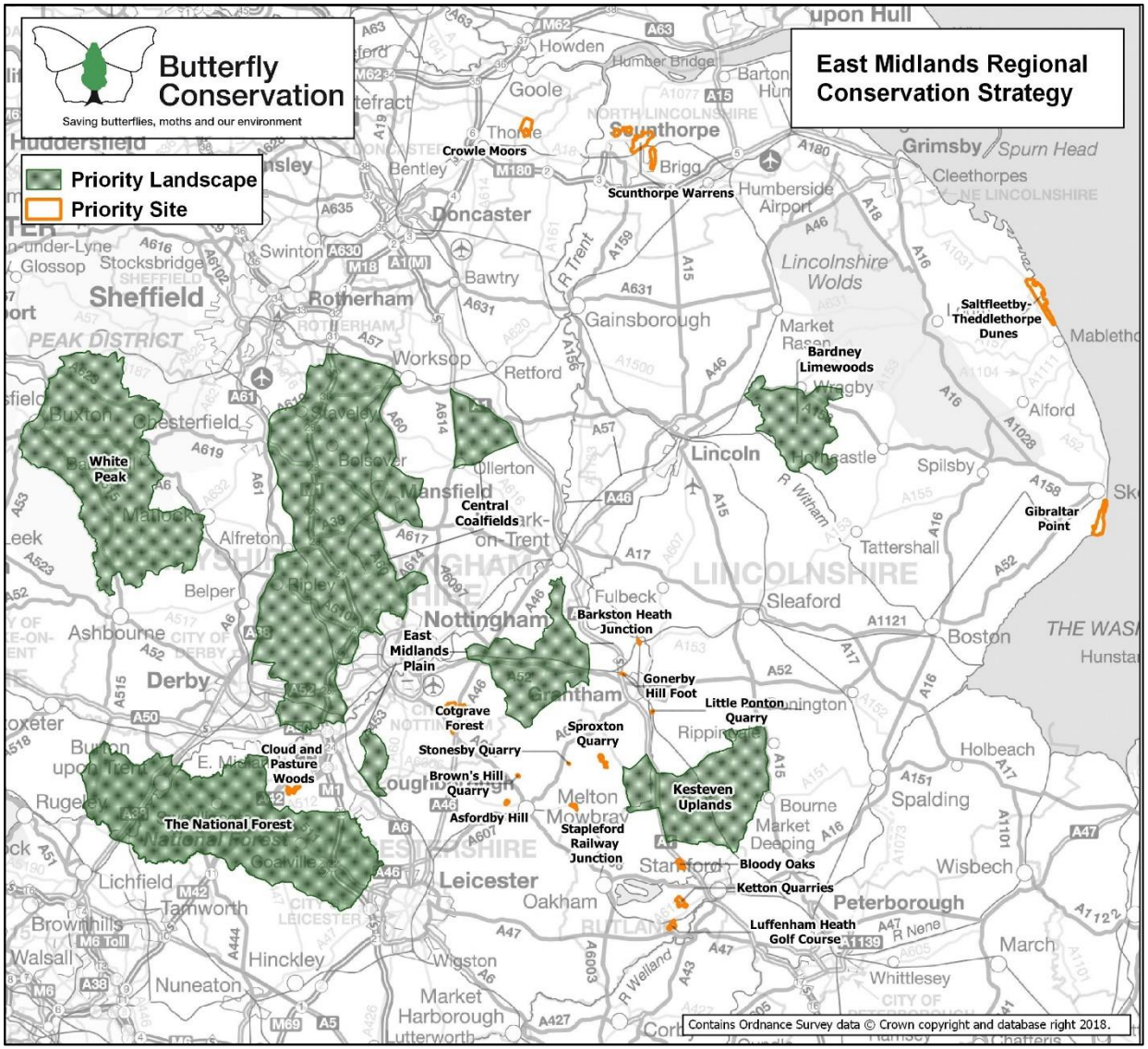

Figure 7: Location of BC's priority landscapes and sites in the East Midlands

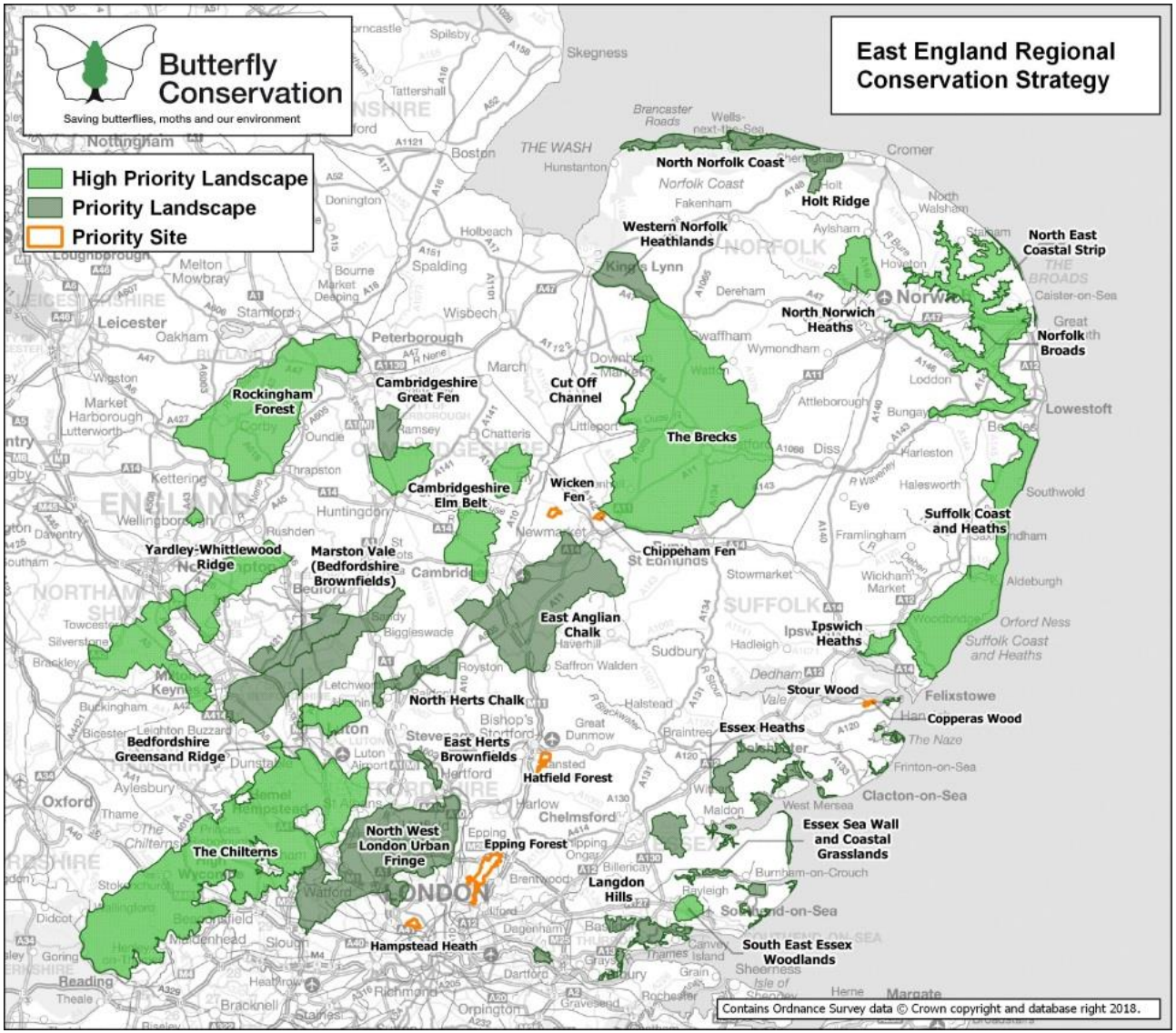

Figure 8: Location of BC's priority landscapes and sites in East England

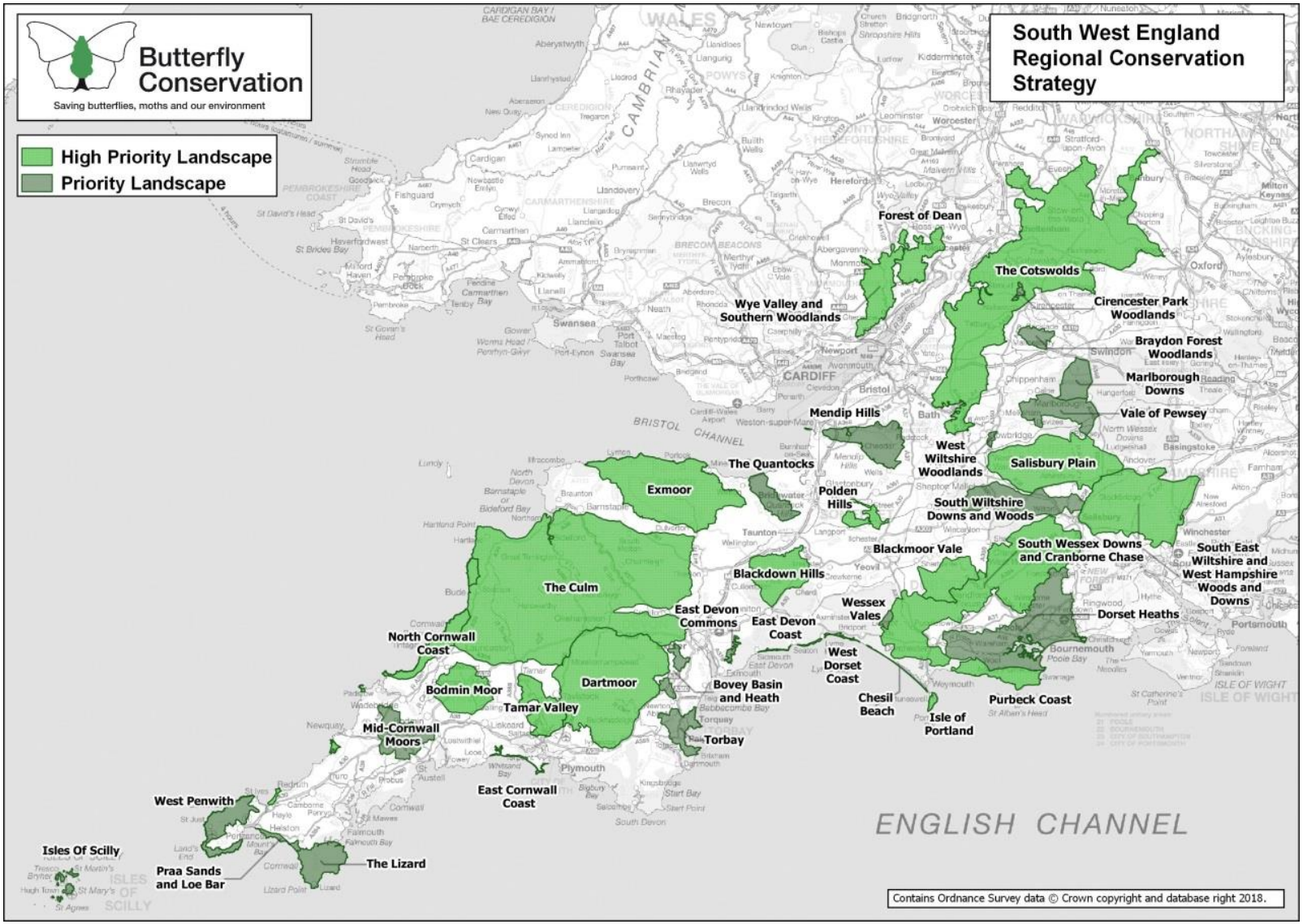

Figure 9: Location of BC's priority landscapes in South West England

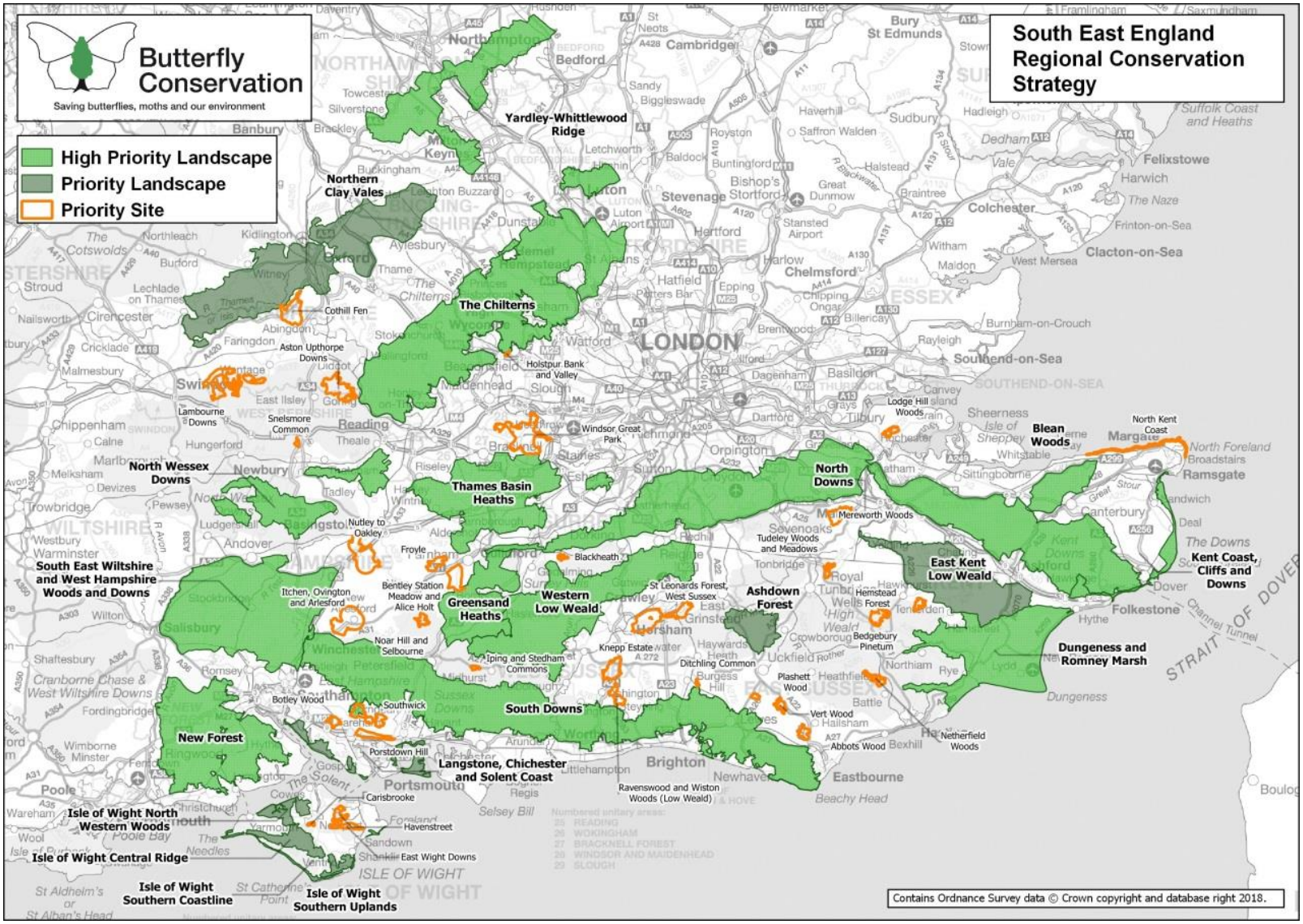

Figure 10: Location of BC's priority landscapes and sites in South East England

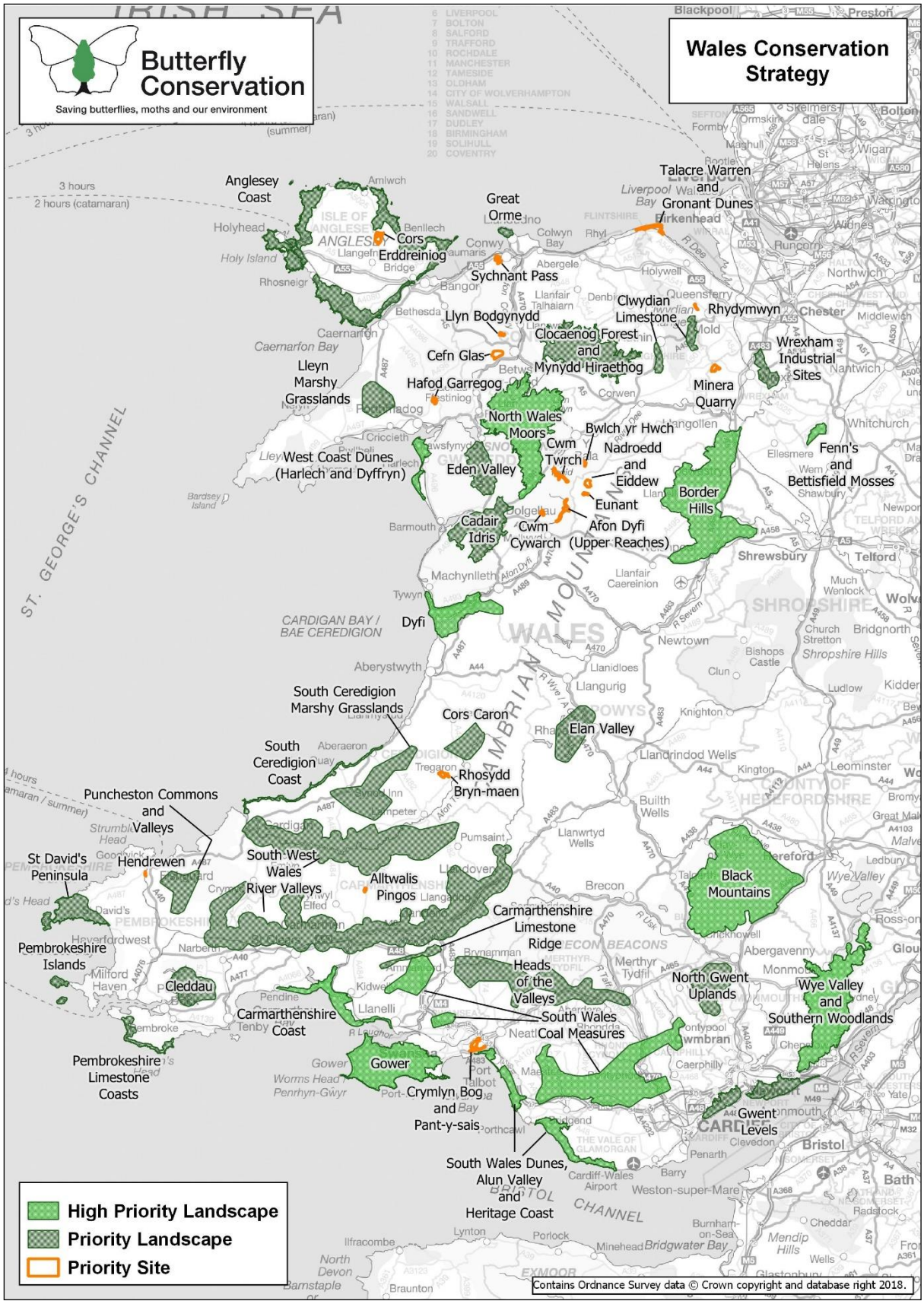

Figure 11: Location of BC's priority landscapes and sites in Wales

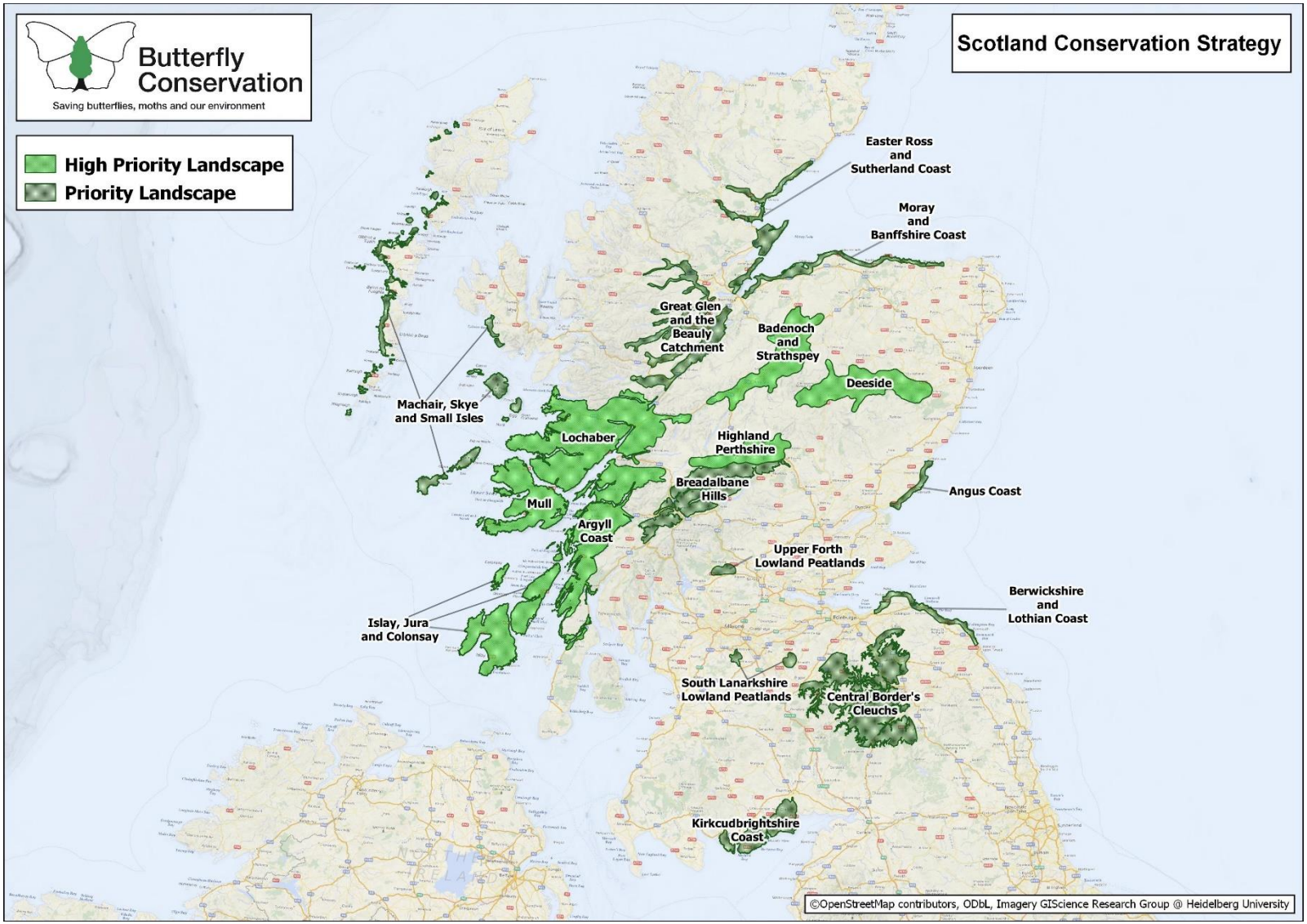

Figure 12: Location of BC's priority landscapes in Scotland

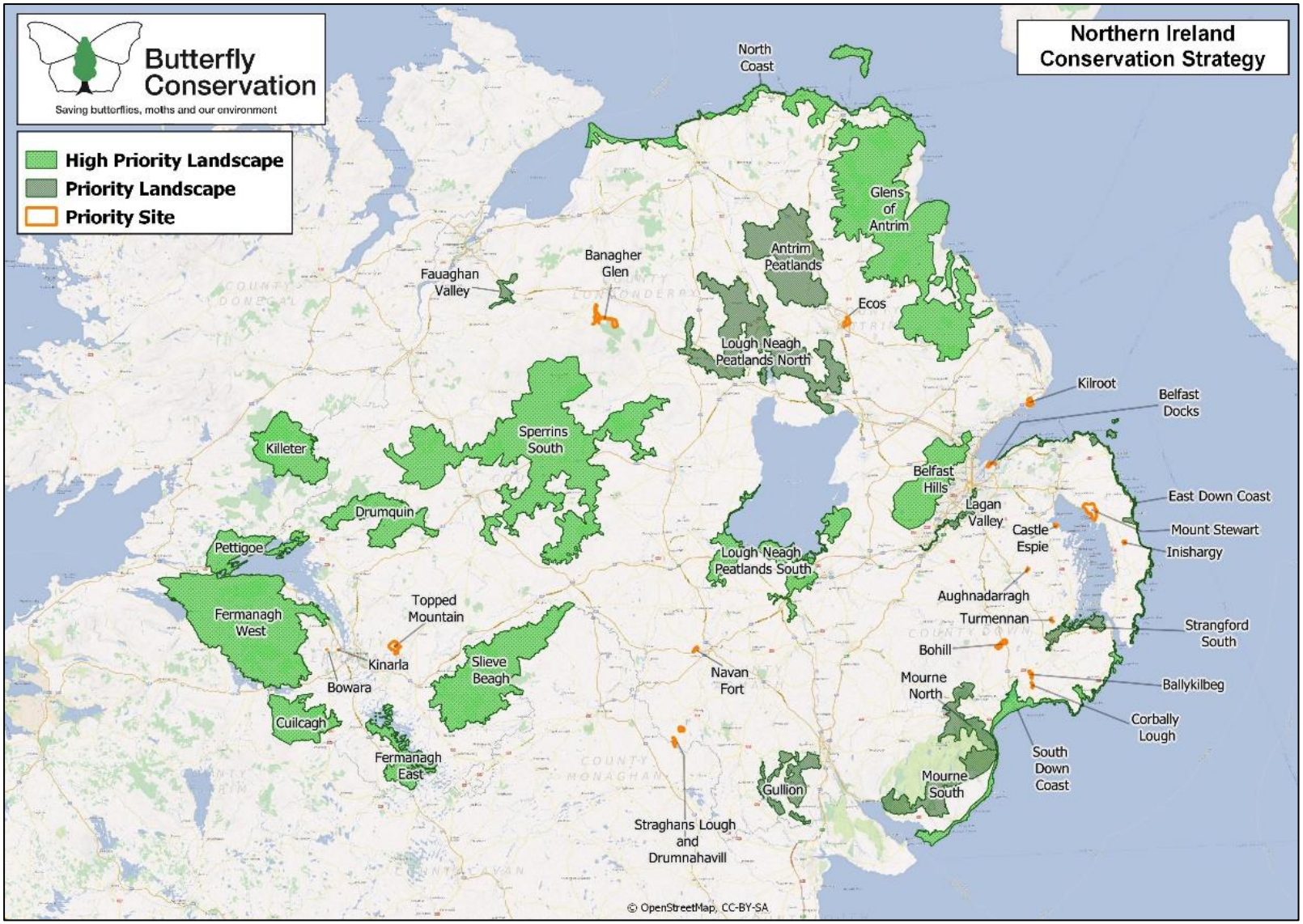

Figure 13: Location of BC's priority landscapes and sites in Northern Ireland

6.5 KEY CONSERVATION DELIVERY MECHANISMS (Stages 4 and 5)

BC utilises a wide range of delivery mechanisms to conserve threatened habitat specialist and wider countryside species:

6.5.1 Provision of Advice

The provision of advice to landowners and land managers is a key conservation delivery mechanism which is implemented by both staff and volunteers. BC aims to provide only evidence-based advice which reflects research to identify the ecological requirements of threatened species and management solutions which have been successfully demonstrated in practice. However on some sites it may be appropriate to test new solutions for improving habitat quality or reversing population declines, for both habitat specialist and wider countryside species, in which case trials should be closely monitored to provide evidence of efficacy.

Advice is usually site-specific and provided directly to the landowner or land manager, but is backed up by one or more of BC's suite of advice publications:

- Priority species or species assemblage (e.g. Aspen moths) advice factsheets.
- Habitat management leaflets or factsheets (e.g. Bracken for Butterflies).
- Landscape-specific species/habitat leaflets.
- Best practice guides (e.g. Woodland Management for Butterflies and Moths).

Some of these (e.g. Wood White and Small Blue species factsheets) have been recently updated in the light of developments in management practice. All should be kept under review particularly where new research identifies changing ecological requirements leading to revised management prescriptions.

Nearly all this advice focusses on habitat specialists and to date BC has produced relatively little on wider countryside species in either rural (a Butterflies and Farmland leaflet) or urban (a Butterflies in Towns and Cities booklet) environments. A key element of BC's Conservation Science Strategy will be to research the drivers of decline of wider countryside species. Once these are identified and potential management solutions tested, then the portfolio of wider countryside species advice will be expanded and the capacity to provide more farm, estate or landscape -scale advice for wider countryside species increased. Our existing wider countryside species publications focus on species assemblages and by definition the advice is generic. There may be opportunities in the future to produce species-specific advice for wider countryside species such as the Small Heath and Wall.

There are an increasing number of examples of innovative major infrastructure projects, which incorporate cost effective habitat creation schemes which demonstrably benefitted both habitat specialists and wider countryside species.

6.5.2 Habitat Management Intervention

Habitat management intervention on sites is also a key conservation delivery mechanism. There is a long history of BC Branches and partner organisations undertaking work parties (e.g. scrub control, coppicing) on sites supporting threatened habitat specialist species. More recently the scale of this work has significantly increased with a shift to funded landscape-scale conservation projects. Habitat management is still undertaken on individual sites, but more account is taken of its spatial context and potential contribution to maintaining a species across the landscape.

In some instances management work is undertaken directly by contractors under the guidance of BC staff and in others, by encouraging and assisting landowners to apply for agri-environment scheme funding to undertake management work. Managing landscape-

scale conservation projects is complex and requires skilled project staff. Increasingly BC Branches and partner organisations align their work parties with delivery programmes for landscape-scale projects.

Funded conservation projects provide the capacity to relatively easily undertake restoration management at the landscape-scale. However, sustaining management beyond the funded period is more problematic and for some species in parts of their range may be unachievable due to constraints beyond BC's control (e.g. inappropriate or inadequate agri-environment schemes). BC should promote economically sustainable models of land management which maintain suitable habitat for threatened species. For example, some BC projects have improved the woodland infrastructure (e.g. widened rides, hard surfacing) sufficiently to enable commercial coppicing to be undertaken. BC Branches and partner organisations also have a key role in sustaining project outcomes by undertaking maintenance management work parties following funded restoration.

Funding for landscape-scale conservation projects is becoming increasingly uncertain, as is funding for agri-environment schemes which both deliver and help sustain project outcomes. This is perhaps BC's greatest conservation challenge over the next decade, how to deliver both restoration and maintenance management with significantly reduced external funding.

6.5.3 Reserves

There are several examples where reserves have made a significant contribution to efforts to conserve threatened species (e.g. Heath Fritillary, Lydford Old Railway; Silver-studded Blue, Prees Heath Common). With a shift to a landscape-scale approach, the contribution a single site can make to conserving a metapopulation is by definition more nuanced than was thought at the time when many reserves were acquired. Some individual sites have a much more strategic landscape importance than others, for example by supporting high habitat quality and thus an important or large population, or because they comprise a large area of suitable habitat at the centre of a site network. The importance of landscape-scale conservation and of a specific site within a landscape is therefore an important element within Butterfly Conservation's reserve and reserve acquisition strategies. BC reserves which are located within priority landscapes have a particularly important role as exemplars of best management practice and can help facilitate practical management across multiple sites.

6.5.4 Re/introductions

BC remains strongly opposed to unplanned and unauthorised re/introductions and should continue to promulgate this message to our members, supporters and partners. However, BC recognises that re/introduction is potentially an important tool in the context of landscape-scale conservation enabling species to be restored to unoccupied landscapes or site networks within their former range or to strengthen viable networks where natural re/colonisation of restored unoccupied sites is unlikely. In the future there may also be a role for assisted translocations in response to climate change.

Re/introduction proposals should continue to be strategic, properly planned, vetted and monitored. The Introductions and Re-introductions Policy should be reviewed to take account of the landscape-scale and climate change context and examples of best practice should be collated and publicised to a wider audience.

6.5.5 People

Well trained, highly motivated staff and volunteers are BC's most important resource. BC staff develop and implement landscape-scale conservation projects in our priority landscapes, providing advice to landowners and land managers, overseeing contractors and working in partnership with BC Branches and other organisations.

Volunteers make a massive contribution to BC's survey and monitoring effort but they also play a key role in delivering practical management through work parties. The most experienced volunteers undertake more senior conservation roles, such as providing advice to landowners and land managers, helping to develop, implement and sustain landscape-scale projects. In the future BC needs to make even better use of its volunteer base, providing specific training to volunteers to enable them to carry out conservation functions in priority landscapes and sites where currently there is only limited engagement or to assist BC staff working in high priority landscapes.

6.5.6 Partnerships

BC has always worked in partnership with statutory agencies, non-government organisations and individuals. Historically this reflected BC's capacity and was viewed as the most effective means of making best use of limited resources. Some partnerships (e.g. High Brown Fritillary Action Group) were established over 30 years ago and as BC's staffing increased, our role became more prominent.

With the advent of landscape-scale conservation, many more partnerships have been established in our priority landscapes. These partnerships play a role in 1) developing a shared vision of outcomes, 2) supporting large and complex project development and 3) their implementation because partner organisations often own the sites where proposed management is targeted.

6.5.7 Conservation Evidence

BC holds some of the largest biological recording (e.g. BNM, NMRS, Big Butterfly Count) and monitoring (e.g. UKBMS, Wider Countryside Survey) datasets in the world. One of its primary uses is to generate status assessments which enable BC to prioritise species for conservation action.

Since 2001 BC has matched its biological recording efforts by also recording the conservation action of its staff. These systems have improved over time and BC staff now routinely record:

- Site data: The location of sites supporting, or having the potential to support, threatened species are mapped using Geographical Information System (GIS) software.
- Site visit data: Records of visits to provide management advice, agri-environment scheme advice and/or support applications, undertake site management, manage contractors, develop projects, development control, undertake monitoring and host public outreach, training events and publicity events.
- Site management data: The location of management works undertaken through BC projects are mapped using GIS. Where possible, data on habitat condition and threatened species responses are also recorded.

These site and management data, when analysed in conjunction with UK-wide monitoring schemes (e.g. by comparing site with regional or landscape with regional, national or UK trends), will enable the effectiveness of our conservation programmes to be quantitatively assessed. Such analyses enable us to produce evidence-based reports (e.g. Ellis et al, 2012) which demonstrate our success in ways which other conservation organisations are rarely able to match.

However, BC Branches do not systematically record similar data (e.g. locations of Branch work parties, guided walks) or at least they are not centrally collated. A key element of our conservation strategy is to continue building this evidence base across the whole organisation.

7. IMPLEMENTING THE CONSERVATION STRATEGY

7.1 Where are the UK's Threatened Lepidoptera on the Species Recovery Curve?

In order to assess BC's overall progress towards improving the conservation status of threatened species, the 26 butterfly and 103 moth conservation priorities (see Tables 2 and 3) were assigned to one of the five species recovery curve categories (Appendices 7 and 8). Whilst relatively simple for the majority, conservation progress for some species varied across their range sufficiently to warrant listing in two stages in the assessment. Summaries of these data by conservation priority (Figure 14) clearly indicate that a higher proportion of the most threatened species are further along the species recovery curve than those in lower categories.

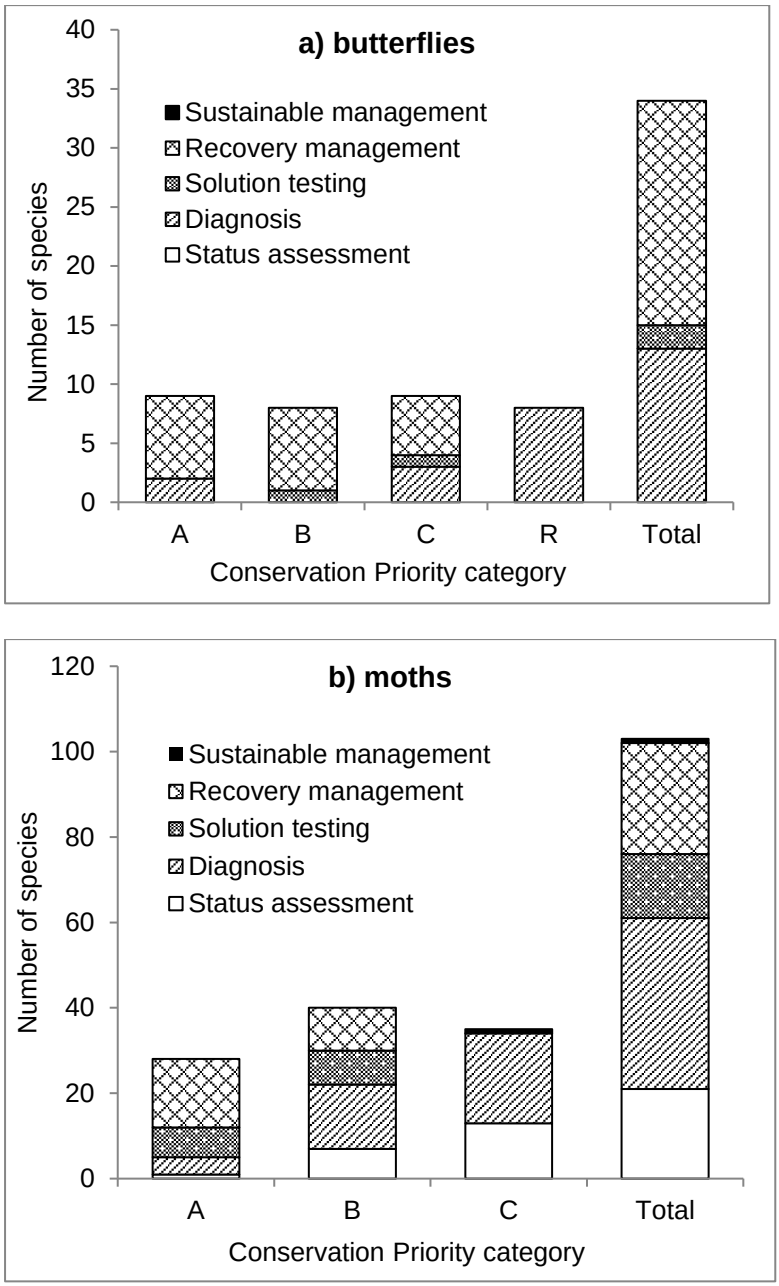

Figure 14: Number of butterfly and moth species on different stages of the species recovery curve by conservation priority category (Note: species on more than one stage of the curve were placed in the category applicable to the greater part of its range)

7.2 What are the Conservation Action Priorities for the UK's Threatened Lepidoptera?

Figure 14 shows that **only one conservation priority species** (Olive Crescent moth) **is considered to be in sustainable management**, although both the Silver-spotted Skipper and Adonis Blue butterflies also fall into this category. These two former Medium Threat Priority species are beneficiaries of agri-environment schemes which maintain suitable habitat; their stable distributions and significantly increasing abundance trends have allowed them to be downgraded to Low Threat Priority status.

In order to move a species further along the recovery curve, it is essential to identify the main conservation actions that need to be applied. These fall broadly into five categories:

1. Survey: This action implies the existing level of surveying is insufficient to ascertain either the current distribution (though it may be complete in some parts of the range) or the distribution trend of that species (Stage 1: Status Assessment).
2. Monitoring: This action implies the existing level of monitoring is insufficient to ascertain the abundance trend of that species. However, monitoring may be underway on a sample of populations covering at least part of the species range which can provide an insight to site, landscape or regional trends (Stage 1: Status Assessment).
3. Research: Research is needed to identify the ecological requirements of that species, the drivers of decline and test potential recovery solutions, especially habitat management (Stage 2: Diagnosis, Stage 3: Solution Testing).
4. Bespoke Management: The targeted application, at a site or landscape-scale, of tailored habitat management to meet the specific ecological requirements of the species (Stages 4 Recovery Management; Stage 5: Sustainable Management).
5. Mosaic Management: The application of generic or best practice habitat management which integrates the ecological requirements of a suite of species (Stages 4 Recovery Management; Stage 5: Sustainable Management).

Appendices 7 and 8 list the relevant actions for 26 butterfly and 103 moth species which are priorities for conservation action. **For most butterfly species the application of appropriate management is the primary action,** and **for the most threatened this needs to be bespoke as these have the most specialised habitat requirements**.

However, there is a **group of wider countryside butterfly and moth species for whom research is the primary action** but which could benefit from the application of mosaic management.

For the majority of moths, survey and monitoring remains an essential action because our knowledge of their distribution, and capacity to assess distribution and abundance trends, is less advanced than for butterflies. However, **our understanding of the ecological requirements of many of the most threatened species has increased such that research is less of a priority than the application of bespoke management**.

7.3 Reviewing and Developing the Conservation Strategy

This conservation strategy will be formally reviewed every five years. However, the species and landscapes prioritisations may require more frequent review in response to the latest UK butterfly and moth status reports or other analyses.

Only a small number of species are considered to be in sustainable management and this is in any case is a qualitative judgment. In the next few years BC needs to develop measurable species recovery targets which would enable quantitative assessments of conservation progress to be undertaken.

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9. APPENDIX 1: WHY BUTTERFLIES AND MOTHS ARE IMPORTANT

There are many reasons why butterflies and moths are important, both in their own right but also as quality of life indicators. The following attributes form the rationale for conserving butterflies and moths in the UK and around the world.

Aesthetic value

- Butterflies and moths are part of our natural heritage and have been studied for over 300 years.
- Butterflies and moths are beautiful, with many being iconic and popular.
- People like butterflies.
- There are many references to butterflies and moths in literature, from the Bible through Shakespeare to modern day literature, and from poetry to musical lyrics.
- Butterflies are used by advertisers and illustrators the world over as way of indicating that something is environmentally friendly.
- Butterflies are often portrayed as the essence of nature or as representing freedom, beauty or peace.

Ecosystem value

- Butterflies and moths are indicators of a healthy environment and healthy ecosystems.
- They indicate a wide range of other invertebrates, which comprise over two-thirds of all species.
- Areas rich in butterflies and moths are rich in other invertebrates. These collectively provide a wide range of environmental benefits, including pollination and natural pest control.
- Moths and butterflies are an important element of the food chain and are prey for birds, bats and other insectivorous animals (for example, in Britain and Ireland, Blue Tits eat an estimated 50 billion moth caterpillars each year).
- Butterflies and moths support a range of other predators and parasites, many of which are specific to individual species, or groups of species.
- Butterflies have been widely used by ecologists as model organisms to study the impact of habitat loss and fragmentation, and climate change.

Educational value

- Butterflies and moths have fascinating life-cycles that are used in many countries to teach children about the natural world. The transformation from egg to caterpillar to chrysalis is one of the wonders of nature.
- Other educational aspects include the intricate wing patterns and iridescence, and as examples of insect migration.

Scientific value

- Butterflies (and moths to a lesser extent) are an extremely important group of ‘model’ organisms used, for centuries, to investigate many areas of biological research, including such diverse fields as navigation, pest control, embryology, mimicry, evolution, genetics, population dynamics and biodiversity conservation.
- The long history and popularity of butterfly study have provided a unique data resource on an insect group unmatched in geographical scale and timescale anywhere in the world. This has proved extremely important for scientific research on climate change.

Health value

- People enjoy seeing butterflies both around their homes and in the countryside.
- Over 10,000 people record butterflies and moths in the UK alone, involving getting outside and walking considerable distances. Over 1500 sites are monitored each week in the UK and collectively volunteers have walked the equivalent of the distance to the moon counting butterflies.
- Several hundreds of thousands of people garden for wildlife in the UK, many of them specifically for butterflies and moths.
- Tropical butterfly houses in the UK are extremely popular.

Economic value

- Thousands of people travel abroad each year looking for butterflies and moths. Eco-tours bring income to many European countries and developing countries around the world (e.g. the valley of the butterflies in Rhodes and the Monarch roost in Mexico).
- Every butterfly and moth has developed its own suite of chemicals to deter predators and parasites, find a mate, and overcome the chemical defences of its host plant. Each of these chemicals has a potential value and could be exploited economically. For example, powerful antibiotics have been found in the Meadow Brown, one of our commonest and most widespread species.

Intrinsic value

- Butterflies and moths have a right to exist, as much as any other species on the planet.
- Butterflies and moths have been around for at least 50 million years and probably evolved some 150 million years ago.
- They are part of Life on Earth and an important component of its rich biodiversity.
- Butterflies and moths are a highly diverse group comprising over 250,000 species and make up around one quarter of all named species.
- Butterflies are flagship species for conservation in general, and in particular for invertebrates.

10. APPENDIX 2: HABITAT SPECIALIST AND WIDER COUNTRYSIDE BUTTERFLIES

Habitat Specialists	Wide Countryside Species
Swallowtail	Essex Skipper
Dingy Skipper	Small Skipper
Grizzled Skipper	Large Skipper
Chequered Skipper	Cryptic Wood White
Lulworth Skipper	Orange-tip
Silver-spotted Skipper	Large White
Wood White	Small White
Large Heath	Green-veined White
Mountain Ringlet	Clouded Yellow
Grayling	Brimstone
Pearl-bordered Fritillary	Wall
Small Pearl-bordered Fritillary	Speckled Wood
Silver-washed Fritillary	Small Heath
Dark Green Fritillary	Scotch Argus
High Brown Fritillary	Ringlet
White Admiral	Meadow Brown
Purple Emperor	Gatekeeper
Marsh Fritillary	Marbled White
Glanville Fritillary	Red Admiral
Heath Fritillary	Painted Lady
Duke of Burgundy	Peacock
Brown Hairstreak	Small Tortoiseshell
Green Hairstreak	Comma
Black Hairstreak	Small Copper
Small Blue	Purple Hairstreak
Large Blue	White-letter Hairstreak
Silver-studded Blue	Holly Blue
Northern Brown Argus	Brown Argus
Adonis Blue	Common Blue
Chalk Hill Blue	