Back from the Brink

Limestone's Living Legacies

Species Summary Sheets

Cover illustration by Rachel Hudson

NATURAL ENGLAND buglife Bumblebee Conservation Trust Butterfly Conservation Bat Conservation Trust amphibian and reptile conservation Plantlife rspb giving nature a home

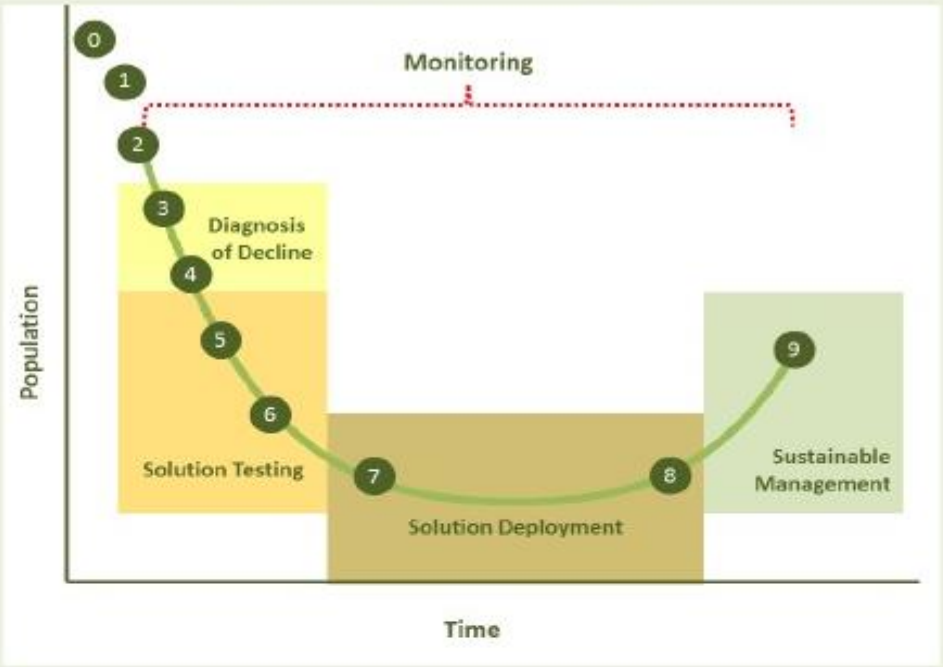
Contents (clicking on a line will take you to that species)

Introduction

Completing in 2021 - Back from the Brink was a national programme with funding from the National Lottery Heritage Fund. It aimed to save 20 species from extinction and ensure the recovery of a further 92. The Cotswold's element led by Butterfly Conservation was called Limestone's Living Legacies and it focussed on 15 key species for the Cotswolds. This document brings together the summary sheets for these species. It is prefaced with a compilation of recommendations for future work.

These sheets refer to the species recovery curve. This describes nine steps of conservation action starting from diagnosis (understanding the cause of the decline) through trial management (testing solutions) to recovery management (deploying tested solutions) and finally, sustainable management. The box below describes these nine steps as used in these sheets.

The Nine Steps of the Species Recovery Curve



Step 0
There has been no recovery activity or any activity has been negligible, ineffectual, ad hoc or unconnected with recovery

Step 1
A species' (or other taxa's) taxonomy is sufficiently well-understood to enable appropriate targeting of conservation action

Step 2
A sound assessment of the biological status of the species' population exists, providing up to date information, where relevant, on the numbers and the identity of sites occupied, the area occupied, colony size, population size and the productivity of the species within each site.

Step 3
A national monitoring plan should have been devised and agreed which is sufficiently sensitive to allow periodic reassessments of the species' biological response to conservation interventions, as well as to other 'pressures' – this, in effect, requires agreement on what constitutes the Y-axis in the recovery model for each particular species.

Step 4
The species autecology should be understood and the national monitoring plan, modified, if necessary, in the light of information gained during Step 4, should be implemented.

Step 5
The causes of rarity and/or drivers of decline should have been identified and the remedial action required to bring about recovery should have been identified and articulated.

Step 6
Potential recovery solutions have been trialled

Step 7
The most promising solutions have been embedded within 'business as usual' for the appropriate 'delivery mechanism'

Step 8
The appropriate delivery mechanisms are 'active' for the species and the species is recovering in line with numerical expectations

Step 9
The species is recovered, having achieved some pre-agreed quantitative target.

Recommendations for Future Work

Species	Recommendations for Future Work
Basil Thyme *Clinopodium acinos*	Further scrub clearance could be carried out to further help this species at the two sites where work previously started. Continued monitoring of the sites surveyed above to track Basil Thyme populations would be beneficial.
Cotswold Pennycress *Microthlaspi perfoliatum*	Continue to monitor re-excavated pits at the three sites where this work was carried out. Also continue to monitor the quarry face at the fourth site where scrub removal was carried out. Further scrub removal work along the quarry face as well as along the top edge (planned for but not carried out due to limited funds) would be beneficial to open up more of the quarry face.
Duke of Burgundy Butterfly *Hamearis lucina*	Continued targeted paddock grazing and scrub removal where necessary to get conditions right for Duke of Burgundy on known and potential sites. Continued monitoring of Duke of Burgundy populations on known and potential sites to track impacts of habitat management and restoration work.
Fly Orchid *Ophyrs insectivera*	Fly Orchid area at Painswick Beacon to be strimmed and raked in autumn/winter. Encourage landowners with Fly Orchids on their land to use rotational management to create a mosaic of thin grassland under an open scrub or grassland canopy, particularly along woodland edges.
Greater Horseshoe Bat *Rhinolophus ferrumequinum*	More surveying needed over longer periods to reinforce the conclusion that the targeted paddock grazing at Rodborough Common is providing more foraging opportunities and is therefore beneficial to Greater Horseshoe Bats. In addition, more survey work needed during winter months to show the benefit of having grazing adjacent to hibernacula. Potential to have a Master's or PhD project continue monitoring Greater Horseshoe Bat activity during the winter using a more robust survey design. Work with landowners adjacent to known hibernacula to organise winter grazing. Continue to recommend to landowners to reduce their use of anti-parasitic treatments which persist in the dung and to try other methods of parasite control.
Grey Long-eared Bat *Plecotus austriacus*	Continued efforts to restore insect-rich limestone grassland in order to provide suitable foraging habitat for when the Grey Long-eared Bat expands its range northwards into the Cotswolds.

Juniper *Juniperus communis*	Clearance and tree felling as required to recover old bushes from secondary woodland and scrub encroachment. Specific recommendations for individual bushes suffering from shading or encroachment by trees as per Painswick Beacon site advice visit in 2019. Potential for moving saplings growing in scrapes to other parts of the site – further advice needed from Plantlife on this.
Large Blue Butterfly *Phengaris arion (formerly Maculinea arion)*	The National Trust recommend that the advisory role of Habitat Designs Ltd is retained at least for the next few years to continue to deliver two grazing review visits per year in the spring and autumn to advise the Commoners and the National Trust's grazing field officer. Changes in annual grass growth can be dramatic in response to increasingly variable weather. Annual paddock fencing costs are likely to vary year to year. One output of the bi-annual review will be an updated advisory grazing rota like that produced by Habitat Designs Ltd for the Rodborough graziers Countryside Stewardship agreement. The National Trust's Area Officer will then be able to use bespoke grazing recommendations to determine the duration of each seasonal paddock graze. Regular observations of the impact of the paddock grazing should be carried out to determine when the livestock should be moved on as well as keeping records on what grazing occurred.
Marsh Fritillary Butterfly *Euphydryas aurinia*	Continue monitoring adults and webs at Strawberry Banks and the satellite site. Support landowners at the satellite site, provide habitat management advice and support with scrub volunteer work parties. Continue Marsh Fritillary working group to maintain existing occupied sites, encourage habitat improvements at potential sites, and consider a translocation into additional site/s in the future.
Pasqueflower *Pulsatilla vulgaris*	Plantlife's recommended management for Pasqueflowers involves maintaining a short sward with mixed livestock which are removed for the flowering period, or very extensive grazing followed by heavier grazing from late summer through the autumn. (For further detail see Pasqueflower management advice from Andy Byfield – pdf document). Continue annual monitoring to assess the populations at the three sites with large populations of Pasqueflowers. Continue annual monitoring of the small population at Rodborough Common to determine if paddock grazing helps the plant to spread. Potential to bring back some of the seed collected (now stored at the MSB) and carry out an introduction here if required. Research into the relationship between climate and flowering effort. Studies on the genetics and age of plants to assess vulnerabillity. Transplanting rootstock from fresh seeds grown in cultivation.

Purple Milk-vetch *Astragalus danicus*	Continued use of targeted paddock grazing at Painswick Beacon to enable to continued spread and increase in numbers of Purple Milk-vetch plants.
Red-shanked Carder Bee *Bombus ruderarius*	Recommendations from Bumblebee Conservation Trust re Prestbury Hill: *Keep existing management (particularly for Dukes & both Chalkhill & Small Blue) - lots of kidney & horseshoe vetch, plus other flowers available through the season (March-Sept), in a matrix of medium-height open grassland with rougher/longer areas around scrub patches (good nesting areas). Ruderarius needs a bit of thatch in the grass, and rougher areas with thorn scrub or brambles is good for nesting as well. Ruderatus will probably be nesting near the woodland edge and in the denser scrub areas, so keeping a matrix that includes these patches will be good for them.*
Rock-Rose Pot Beetle *Crytpocephalus primarius*	Further clearance of encroaching scrub from the area of grassland where the beetle is known to occur at Stinchcombe Hill. Discussions started re using the No Fence GPS collar system which if purchased could enable grazing of the site. Cattle grazing was introduced by the landowner of Site 2 in 2020. Need to keep an eye on the resulting sward and amend number of cattle/amount of time grazing as a result.
Ruderal Bumblebee **Also called the Large Garden Bumblebee** *Bombus ruderatus*	Recommendations from Bumblebee Conservation Trust re Prestbury Hill: *Keep existing management (particularly for Dukes & both Chalkhill & Small Blue) - lots of kidney & horseshoe vetch, plus other flowers available through the season (March-Sept), in a matrix of medium-height open grassland with rougher/longer areas around scrub patches (good nesting areas). Ruderarius needs a bit of thatch in the grass, and rougher areas with thorn scrub or brambles is good for nesting as well. Ruderatus will probably be nesting near the woodland edge and in the denser scrub areas, so keeping a matrix that includes these patches will be good for them.*
Rugged Oil Beetle *Meloe rugosus*	Further survey work required to further explore the potential host bee species of Rugged Oil Beetle. Research (Master's project?) into the association between adult Rugged Oil Beetles and vegetation height to add weight to the anecdotal evidence that the beetles require tussocks/patches of longer vegetation as well as shorter turf and bare soil. Keep an eye on grazing levels at sites such as Rough Bank, Cranham Common and Painswick Beacon to make sure a mosaic of shorter turf, bare soil and tussocks are retained. Continued survey work at selected sites (tbc) to monitor the populations in response to grazing. Research (Master's project?) into the link between adult population sizes and the availability of early spring flowers. Anecdotal evidence that sites with few early spring flowers have the smaller populations, whereas sites with larger populations have good coverage of early spring flowers and in turn lots of triungulins found. Is this a limiting factor?

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Basil Thyme

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Plantlife

Species name – common & scientific	**Basil Thyme** *Clinopodium acinos*
Photograph	 © *Alex Hyde / Back from the Brink*
Taxon group	Family Lamiaceae (dead-nettles)
Conservation status	Classified as 'Vulnerable' in The Vascular Plant Red Data List for Great Britain 2005
UK distribution	Mainly grows in southern and eastern England, very rare in Wales, Scotland and northeast England. Its distribution closely follows underlying chalk and limestone rock. Considered an alien species where it occurs in Eastern Ireland. It has suffered a substantial decline, particularly in arable situations, and across all habitats in peripheral parts of its range such as in the northeast and southwest of England.
Habitat associations	Now considered extinct as an arable weed due to herbicide use and loss of bare ground, rare populations have found refuge on high quality calcareous grassland with bare ground habitats.
BftB work carried out:	
Survey & Monitoring	Surveys carried out in 2019 at Rough Bank, Snow's Farm and three other privately owned sites. Further surveys were carried out in 2020 at Snow's Farm, Rough Bank and Swift's Hill. Plants were found at two of the privately owned sites and at Swift's Hill. No plants were found at the other sites surveyed.

Sites habitat management works	Scrub clearance work (0.2ha) by Cotswold Voluntary Wardens at one site aimed to benefit Basil Thyme and Grizzled Skipper. Scrub clearance by contractors at another privately owned site aimed to benefit Basil Thyme, among other species. The installation of a new water trough at Swift's Hill to allow for an increased number of livestock will help benefit Basil Thyme through more extensive grazing.
Technical advice provision	Site advice visit to Swift's Hill and two privately owned sites re managing for Basil Thyme. Factsheets and advice via email also provided to all three land managers.
Links made with other taxa / conservation work?	Scrub clearance work at one site also to benefit Grizzled Skipper. Scrub clearance work at another privately owned site also to benefit Cotswold Pennycress and Fine-leaved Sandwort.
Wider engagement & advocacy activities?	Species mentioned in project talks.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	Positive survey results from 3 out of 6 BftB sites surveyed. Positive sites given below. Negative survey results from Snow's Farm, Rough Bank and one of the other survey sites.
Recorded Abundance of species populations	At two of the privately owned sites surveyed, 313 plants were found at one site in 2019, one plant was found at the second site and 23 found at Swift's Hill in 2020.
Species Recovery Curve progress made	Species recovery curve score moved from 1 to 6: Recovery solutions trialled at known Basil Thyme sites and awaiting results. Other remedial solutions need to be trialled including maintenance of conditions following capital works and this was beyond the scope of the Limestone's Living Legacies project as much of this work would need to be undertaken 3-5 years after the scrapes and scrub management.
Recommendations for future work:-	Further scrub clearance could be carried out to further help this species at the two sites where work previously started. Continued monitoring of the sites surveyed above to track Basil Thyme populations would be beneficial.

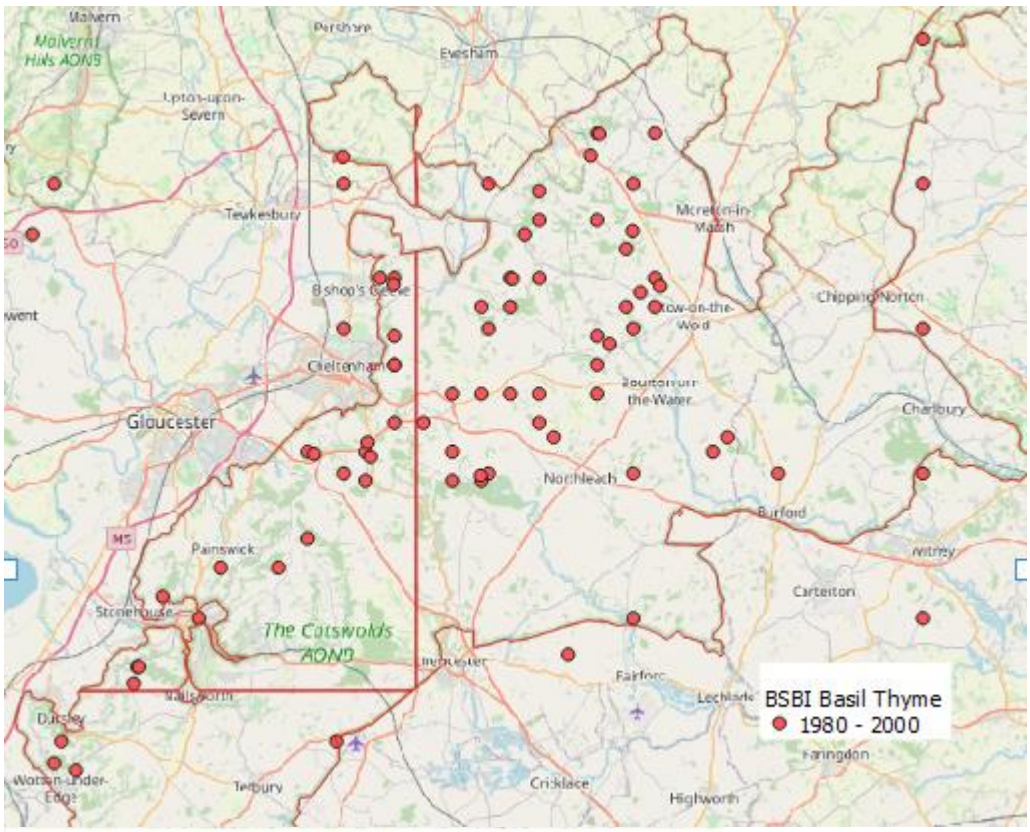

Figure 1. Cotswold distribution 1980-2000 BSBI data. In the twenty years to the end of the millennium, there was widespread recording of Basil Thyme across the countryside, with 74 Cotswold records.

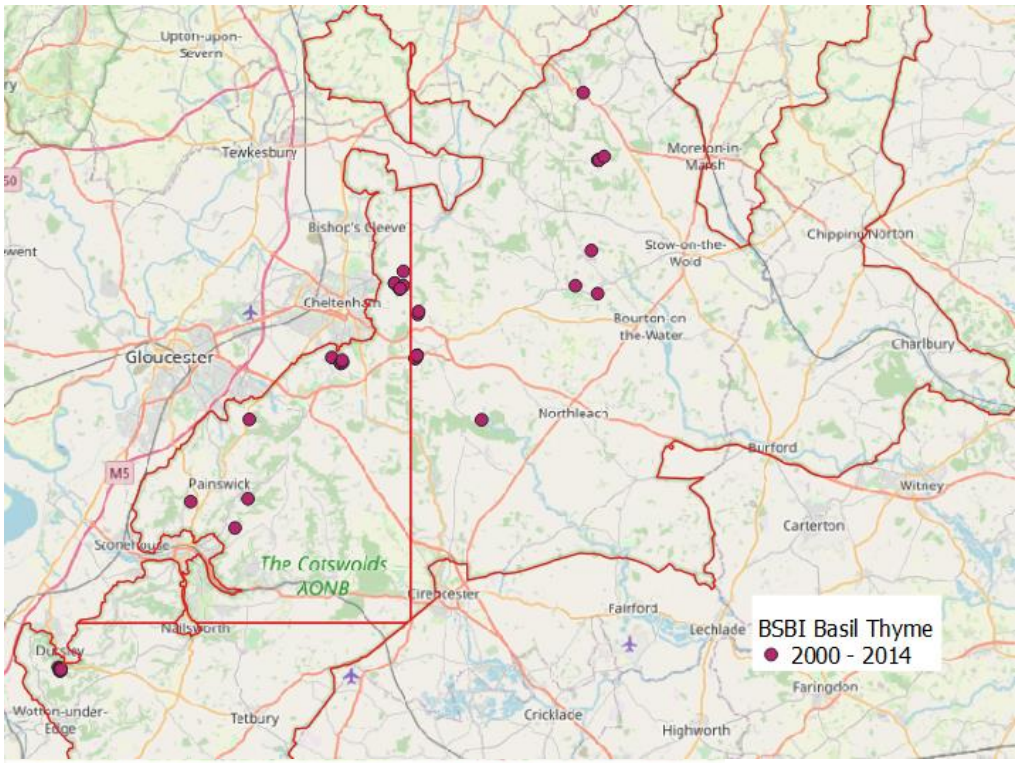

Figure 2. In the fourteen years to 2014, there are 38 records, the emphasis on finding the plant at known sites in old quarries.

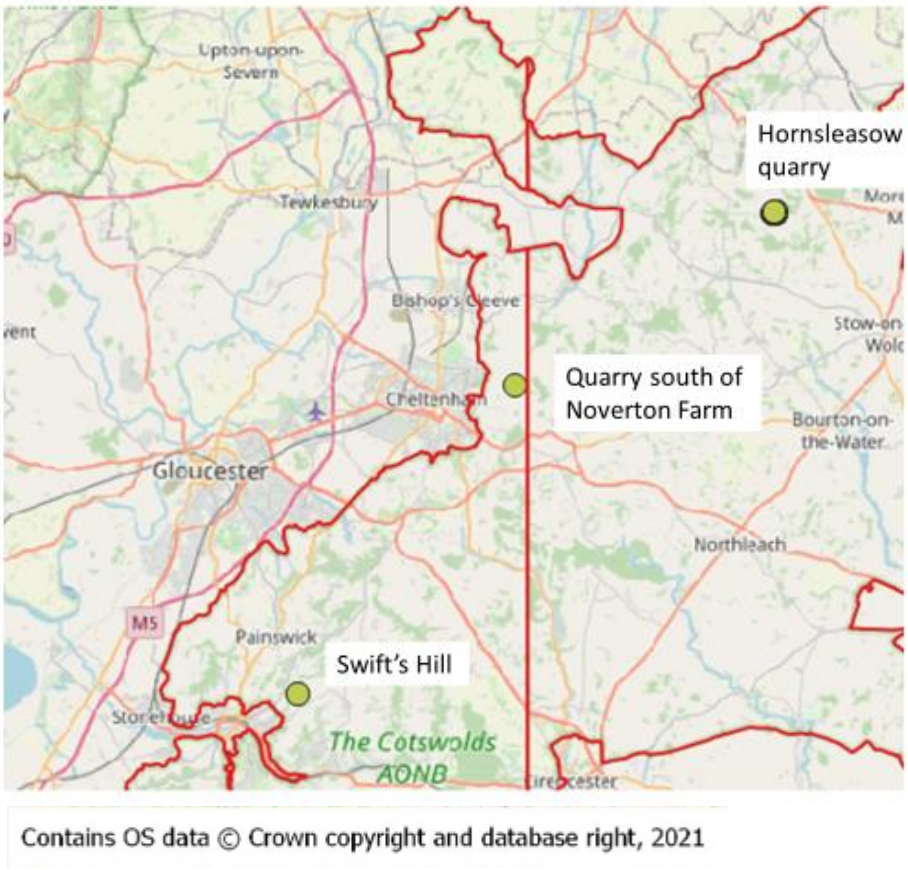

Figure 3. BftB surveys updated records at key sites. Thorough surveys of Hornsleasow Quarry in 2019 recorded 313 plants. One plant was found at Noverton Quarry, 23 at Swift's Hill.

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Cotswold Pennycress

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Plantlife

Species name – common & scientific	**Cotswold Pennycress** *Microthlaspi perfoliatum*
Photograph	 © Andrew Gagg / Back from the Brink
Taxon group	Cabbage (Brassicaceae) family
Conservation status	A species "of principal importance for the purpose of conserving biodiversity" under Section 41 (England) of the Natural Environment and Rural Communities Act 2006. Fully protected Schedule 8 of the Wildlife and Countryside Act 1981.
UK distribution	Largely confined to fewer than 15 sites in the Cotswolds, due to loss of open habitat to scrub invasion, lack of grazing or cessation of quarrying (and associated post-quarrying restoration works). It produces few seeds per capsule and has poor seed dispersal.
Habitat associations	Bare or sparsely vegetated soils on oolitic limestone. A naturally occurring species on disturbed ground within limestone pasture, but mostly associated today with small 'slate' pits and larger quarries within both Gloucestershire and Oxfordshire Cotswolds. Rarely recorded from the brashy margins of arable land, on the weathered tops of old walls, and on the 'screes' and ballast of railway cuttings.

BftB work carried out:	
Survey & Monitoring	• Surveys to two privately owned sites were undertaken in 2018. • Further surveys to the two sites surveyed in 2018 were carried out in 2019, plus to a further seven privately owned sites. • Following scrape creation and scrub removal at four of these sites, follow up surveys were carried out in 2021 to determine initial results.
Sites habitat management works	Habitat management work has focussed on four privately owned sites: • Scrub clearance work carried out in 2020. Five old slate pits re-excavated in Feb 2020 – turf and topsoil removed to expose bare limestone rubble and enable Cotswold Pennycress to spread. • Two old slate pits re-excavated in Feb 2020. • Five old slate pits re-excavated in Feb 2020. • Scrub clearance work in front of old quarry face to enable small populations on ledges to expand. (See 'Evaluation of management interventions for Cotswold Pennycress and Fine-leaved Sandwort' by Cath Shelswell, Plantlife for further detail.)
Technical advice provision	• Andrew Byfield (representing Plantlife) and Julian Bendle (Butterfly Conservation) visited three sites in 2018 to assess current status of Cotswold Pennycress and provide management advice. • Andrew Byfield, Julian Bendle and Cath Shelswell (Plantlife) visited three additional sites in 2019 to assess current status of Cotswold Pennycress and provide management advice. • Follow up visit by Julian Bendle to one site in 2020 prior to scrub clearance works. • A new Cotswold Pennycress factsheet was also produced with Plantlife.
Links made with other taxa / conservation work?	• Fine-leaved Sandwort (*Minuartia hybrida*), one of our secondary species favours similar habitat to Cotswold Pennycress and occurs on several of the known Cotswold Pennycress sites. • Scrapes at one site and scrub removal work at another also aimed to benefit Fine-leaved Sandwort and Basil Thyme.
Wider engagement & advocacy activities?	• Cotswold Pennycress mentioned in a number of talks during the project and success of scrapes/scrub removal highlighted in various talks at the end of the project.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	**2018 surveys – two sites:** Site no.1: 12 plants Site no. 2: zero found* **2019 surveys:** Site no.1: 19 plants (site no.1 in 2018) Site no.2: zero* (site no.2 in 2018) Site no.3: around 600 plants Site no.4: 40 plants Site no.5: zero found Site no.6: zero* Site no.7: zero* Site no.8: zero* Site no.9: zero*

	*Negative surveys at 5 sites with historical records for 1900-1986 and 2000-2017 date ranges. Thoroughly searched all locations shown in 2018 Plantlife report ('Section 41 species present within the Cotswolds AONB') but no plants visible. **2021 surveys:** Site no.1: an increase in Cotswold Pennycress plants was found in both areas where scrub was cleared (see 'Evaluation of management interventions for Cotswold Pennycress and Fine-leaved Sandwort' by Cath Shelswell, Plantlife) Site no.3: a number of plants found within or just on the edge of newly created scrapes (see Plantlife report) Site no.4: a number of plants found within the newly created scrapes (see Plantlife report) Site no.5: no Cotswold Pennycress plants found within newly created scrapes (see Plantlife report)
Recorded Abundance of species populations	As above.
Other results documented?	As above see - Shellswell, C 2021 Evaluation of management interventions for Cotswold Pennycress and Fine-leaved Sandwort. A report for the Back from the Brink Limestone's Living Legacies project. Plantlife
Species Recovery Curve progress made	Species recovery curve score moved from 2 to 8: Follow up visits to assess success of scrub removal work and scrape creation at known Cotswold Pennycress sites with Plantlife discovered an encouraging response and increase in Cotswold Pennycress abundance and distribution.
Recommendations for future work:-	Continue to monitor re-excavated pits at the three sites where this work was carried out. Also continue to monitor the quarry face at the fourth site where scrub removal was carried out. Further scrub removal work along the quarry face as well as along the top edge (planned for but not carried out due to limited funds) would be beneficial to open up more of the quarry face.

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Duke of Burgundy

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Species name – common & scientific	**Duke of Burgundy** *Hamearis lucina*
Photograph	 *© Iain H Leach – Back from the Brink*
Taxon group	Lepidoptera (Butterflies)
Conservation status	Section 41 species of principal importance under the NERC Act in England UK BAP status: Priority Species Butterfly Conservation Priority: High European status: Threatened Protected under Schedule 5 of the 1981 Wildlife and Countryside Act (for sale only)
UK distribution	The Duke of Burgundy is found in scattered colonies across southern England, with more isolated colonies in the southern Lake District and the North York Moors. It has declined by over 50% in recent decades and many of the colonies now have very small populations.
Habitat associations	Two principal habitats: 1. Chalk or limestone grassland, with either extensive areas of scrub or topographical shelter; 2. Clearings on ancient woodland sites, either regenerating coppice, young plantations, sizeable glades, or wide rides. In both habitats it requires foodplants growing among tussocky vegetation and on downland it prefers north or west-facing slopes, possibly because the humid conditions encourage lush growth of the foodplant. Can also be found in secondary woodland.
BftB work carried out:	

Survey & Monitoring	Building on the work of the Gloucestershire Branch of Butterfly Conservation and Habitat Designs Ltd, BftB in conjunction with the BC Gloucestershire Branch coordinated adult Duke of Burgundy surveys at 43 sites in 2018 and 27 in 2019. The results are presented in figures 1 through 5 below. In addition, larval feeding damage surveys were also undertaken at several sites.
Sites habitat management works	From Simcox et. al 2014* the butterfly needs "extensive winter grazing with cattle and regular scrub management to create a mosaic of different aged, but predominantly young, scrub". This was based on their detailed bank of work which identified the butterfly's ecological requirements on the Cotswold limestone grasslands. A programme of scrub management across nine sites (see listed below) was instigated to bring sites where the butterfly was present or had the potential for re-colonisation, back into condition. At two sites (Rodborough Common and Painswick Beacon) BftB followed up scrub removal work by introducing a suitable winter grazing regime, including investment in water troughs (at Painswick Beacon) and temporary electric fencing to create grazing paddocks. Advice was given to graziers/land managers on how to judge when the sward is the right height for moving cattle on to avoid over-grazing. This is not intuitive, as the butterfly occupies a transitional zone between grassland and scrub. List of sites where Duke of Burgundy habitat management has been delivered: Rodborough Common SAC: targeted paddock grazing through BftB and scrub clearance by the National Trust has supported one of the largest colonies of the Duke of Burgundy in the UK. Supporting the understanding and delivery of nuanced, targeted grazing regarding aspect and topography has enabled Duke of Burgundy habitat to over-lap with the much shorter turf of the Large Blue. Specialist consultants Habitat Designs Ltd advised that targeted grazing should occur every 2-3 years between August and December on areas of the slopes to maintain a varied age of Cowslips and stop the sward from becoming closed in. This needs annual review of the condition of the sward due to annual variability in grass growth and cattle available. It should be noted that the BftB project has occurred in drought years. Painswick Beacon: targeted paddock grazing through BftB and scrub clearance by Painswick Beacon Conservation Group that has also supported other key species with similar habitat requirements such as Fly Orchid. Huddinknoll Hill: scrub clearance and route cleared for electric fencing. (Electric fence installation and sheep grazing coordinated by Natural England.) Edge Common: scrub clearance Bull's Cross: scrub clearance Juniper Hill: scrub clearance and route cleared for electric fencing. (Electric fence installation and sheep grazing coordinated by Natural England.) Rough Bank: scrub clearance

	Cirencester Golf Course: scrub clearance Ravensgate: Scrub clearance by contractors
Technical advice provision	Site advice visits to discuss habitat management for Duke of Burgundy were carried out to the following sites: Edge Common Huddinknoll Hill Bull's Cross Juniper Hill Painswick Beacon Cirencester Golf Club Ravensgate Common Rough Bank Kites Hill Reserve Charlton Kings Common Plus five other privately owned sites In addition, several visits were made to Rodborough Common and Painswick Beacon to monitor progress of paddock grazing.
Links made with other taxa / conservation work?	• Scrub removal work at Edge Common also aimed to benefit Rugged Oil Beetles. • Scrub removal work at Juniper Hill also aimed to benefit Rugged Oil Beetles, Juniper, Fly Orchid and Dingy Skipper. • The need for a mosaic of longer vegetation and young scrub also links the Duke of Burgundy's habitat requirements to the Adder.
Wider engagement & advocacy activities?	• The Duke of Burgundy has been adopted as a nature recovery plan priority species by the Cotswold National Landscape. • Four Duke of Burgundy Identification and Survey workshops for both the adult butterfly (x2) and the larvae (x2) were led by Butterfly Conservation and Habitat Designs Ltd with a total of 51 people attending. • Three 'Managing Your Grassland for Wildlife' workshops included talks on how to manage grasslands for butterflies and included mention specifically of Duke of Burgundy habitat requirements. These were attended by a total of 52 people.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	See figures 1 through 4 below and supporting text. Larval feeding damage surveys proved inconclusive due to the difficulty of identifying Duke of Burgundy feeding damage confidently.
Recorded Abundance of species populations	See figures 1 through 4 below and supporting text.
Other results documented?	A review of recording effort and landscape networks (see additional information, below)
Species Recovery Curve progress made	Species recovery curve score moved from 6 to 7: Recovery solutions have been employed at several extant and extinct Duke of Burgundy sites using targeted paddock grazing and scrub removal. Management specifically for this species has been incorporated into the plans for management of several extant sites. Further surveys needed to confirm species recovery.

Recommendations for future work:-	Continued targeted paddock grazing and scrub removal where necessary to get conditions right for Duke of Burgundy on known and potential sites. Continued monitoring of Duke of Burgundy populations on known and potential sites to track impacts of habitat management and restoration work.

Additional Information

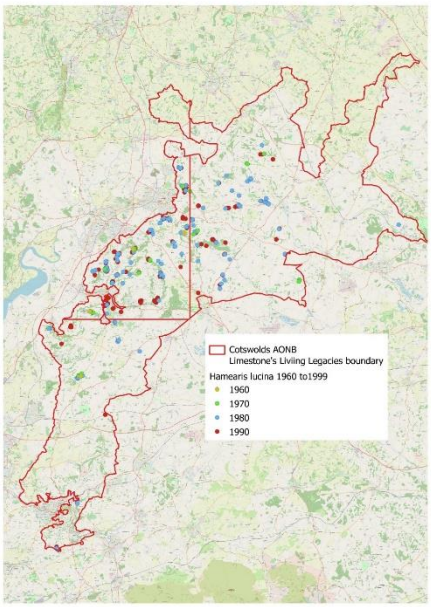

Figure 1 Recorded distribution of the Duke of Burgundy in the Cotswolds Limestone's living Legacies Back from the Brink project area pre-2000.

Analysing records from County Records centres (figure 1), casual recording though the 1970's moved to atlas work through the 1980's and 1990's led by local Butterfly Conservation members.

The atlas work showed that up until the 1990's the Duke of Burgundy had a widespread distribution across the Cotswolds, but 73% of the records pre 2000 were of single individuals.

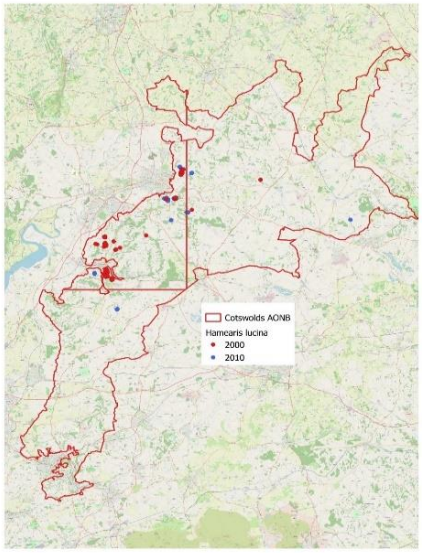

Figure 2. The distribution of the Duke of Burgundy 2000 to 2014

Post 2000, the distribution of the Duke of Burgundy in Gloucestershire collapsed by -72% (above a national trend of -46%).

In 2012 Natural England commissioned Butterfly Conservation to produce a report on the status of the butterfly across England *(Status and Conservation of the Duke of Burgundy Hamearis lucina butterfly in England Butterfly Conservation Report No. S13-19 Rachel Jones, Sam Ellis, Dan Hoare, Dave Wainwright and Amber Rosenthal. 2013)*

In 2014 Natural England commissioned Habitat Designs Ltd to undertake a detailed survey of the butterfly to identify its distribution and abundance, greatly helped by the local BC branch, and to establish the size and vulnerability of the Cotswold Duke of Burgundy population, identifying key colonies for conservation. Recorder effort increased, becoming focussed on population and transect monitoring of key sites where the species was still present. Numbers of individuals counted per record increased, with a shift to repeat counts of key colonies for conservation. The species was no longer being encountered across its 1990 range.

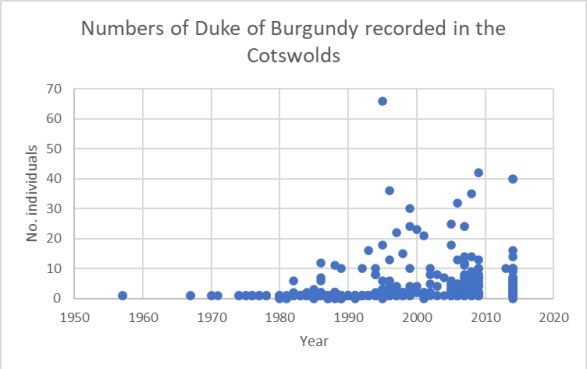

Figure 3. Maximum number of individuals per record increased from the late 1990's onward, reflecting focus on monitoring a smaller number of key sites more intensively.

The outlying record of 66 individuals was made in 1999.

A key recommendation of the 2014 Simcox report was to take a landscape-scale view of the extant colonies. Eight landscape networks had been broadly defined by Jones et al on a visual clustering of biological records by geography: Cockleford, Southam & Whittington, Withington, Painswick valley, Nailsworth, Coberley, Windrush Valley and Barnsley. The same landscapes were adopted in the Simcox report.

Testing the networks by placing a 1km buffer around the most recent Back from the Brink records of Duke of Burgundy upholds the networks broadly identified by Jones et al 2013 (Figure 4, stippled rounded shapes) and shows the relationship with the Back from the Brink project sites (in green). Where the buffers join to create a single shape, the butterfly records were closest together, with the greatest potential to already be moving towards a more secure local landscape metapopulation.

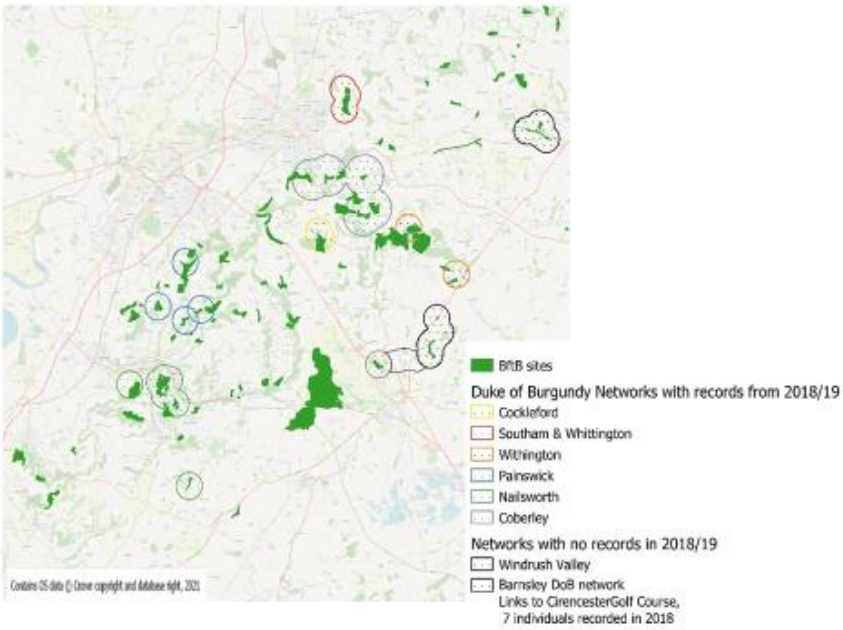

Figure 4. Back from the Brink worked on 67 Cotswolds sites (green), many falling within Duke of Burgundy landscapes in the Cotswolds identified by Butterfly Conservation in 2012. Based on 2018 & 2019 butterfly records extant networks are shown in different colours, networks with no 2018/19 Duke of Burgundy records in black.

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Fly Orchid

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Plantlife

Species name – common & scientific	**Fly Orchid** *Ophyrs insectivera*
Photograph	 © Alex Hyde / Back from the Brink
Taxon group	Family Orchidaceae
Conservation status	A species "of principal importance for the purpose of conserving biodiversity" under Section 41 (England) of the Natural Environment and Rural Communities Act 2006 Of "principal importance" under Section 7 of the Environment (Wales) Act 2016. Vulnerable: Great Britain Vascular Plant Red List and the England Vascular Plant Red List
UK distribution	Dramatic declines before 1930 (especially in East Anglia) have continued, but at a reduced rate. Centres of population in chalk and limestone landscapes: North Downs, South Downs, Salisbury Plain, Yorkshire Wolds and Chilterns, Cotswolds, Peak District and Cumbria.

Habitat associations	Habitats that are undergoing ecological succession from open habitats to woodland. Usually chalk and limestone soils in a variety of vegetation types from dappled woodland floors, open calcareous grassland, to flushes and fens, it has also been recorded in grasslands, quarries, spoil heaps, piles of railway ballast and on unstable coastal cliffs. Fly orchids benefit in the short-term from intermittent disturbance but are vulnerable in the medium-term to the decline in traditional management practices that historically maintained the open conditions.
BftB work carried out:	
Survey & Monitoring	Surveys were undertaken at the following sites following Plantlife guidance in 2019: Charlton Kings Common Painswick Beacon Swift's Hill Plus three additional privately owned sites 2020 surveys: Charlton Kings Common Painswick Beacon Sheepscombe Swift's Hill Cranham Common Snow's Farm Juniper Hill Plus one additional privately owned site 2021 surveys: Charlton Kings Common
Sites habitat management works	Habitat management work has taken place on four sites to benefit Fly Orchid: Scrub and bramble removal carried out by volunteers in 2017 and 2018 at Sheepscombe Common. Scrub removal and electric fence installed by volunteers at Juniper Hill in 2020 to enable the reintroduction of sheep grazing. Cattle handling system installed in 2018 to enable Painswick Beacon Conservation Group to continue cattle grazing at Painswick Beacon. The installation of a new water trough at Swift's Hill to allow for an increased number of livestock will help benefit Fly Orchid through more extensive grazing.
Technical advice provision	Site advice visit to Painwick Beacon with the landowner and Painswick Beacon Conservation Group to discuss management of several target species including Fly Orchid. Site advice visits with Natural England to Sheepscombe Common, Juniper Hill and Cranham Common to look at grassland management for all target species including Fly Orchid. A new privately owned site came to the project's attention in 2021. Site advice visit with landowner discussed the need for scrub clearance, strimming of tall ruderals and targeted conservation grazing - including

	prescriptions for longer swards (where there is some overlap with the habitat requirements of Duke of Burgundy). The possibility of entering into stewardship was also discussed. A new Fly Orchid factsheet was also produced with Plantlife.
Links made with other taxa / conservation work?	Paddock grazing at Painswick Beacon has also allowed management for Duke of Burgundy, Purple Milk-vetch, Rugged Oil Beetle and Large Blue. Sheep grazing at Juniper Hill is also benefiting Duke of Burgundy, Rugged Oil Beetle and Juniper. The species successional habitat requirements link it to Duke of Burgundy and to some extent Adder. Landscape networks identified for the Duke of Burgundy may also create opportunities for Fly Orchid.
Wider engagement & advocacy activities?	Fly Orchid Identification and Survey training workshop led by Plantlife in 2019 with a total of 9 people attending.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	Pre 2000, data provided by the Botanical Society of Britain and Ireland (BSBI) shows a wider distribution of Fly Orchids in the Cotswolds, with ad hoc records of single plants in the wider countryside (Figure 1). Post 2000 the species is recorded more intensively from a smaller number of wildlife sites (Figure 2). BftB has not been able to confirm extant populations at three surveys sites however has been able to build on the significance of a newly recorded population. Surveys following Plantlife guidance were undertaken at 10 sites in 2019, 2020 and 2021 – results shown in Table 1 below. A dense group of plants under trees are consistently recorded by a volunteer at Charlton Kings Common (24 plants in 2019 & 39 in 2021, 22 from the main area), where otherwise on other sites the plants have a scattered distribution. In 2020 drought conditions are believed to have burnt the flowers off at some sites, possibly why three site surveys returned negative results. In 2021 BftB followed up a new record of 70 plants from a woodland glade and ride in a small area of a privately owned site near Withington, mapping 100 flowering spikes across a wider area of the site supported by Cotswold's Glorious Grasslands volunteers.
Recorded Abundance of species populations	As per Table 1. Charlton Kings Common and a second newly discovered site identified as sites with significant populations.
Species Recovery Curve progress made	Species recovery curve moved from 1 to 5: Site visits with Plantlife identified the causes of rarity/decline at a number of sites and advice was given to the landowners/managers on remedial action required.

Recommendations for future work:-	Fly Orchid area at Painswick Beacon to be strimmed and raked in autumn/winter. Encourage landowners with Fly Orchids on their land to use rotational management to create a mosaic of thin grassland under an open scrub or grassland canopy, particularly along woodland edges.

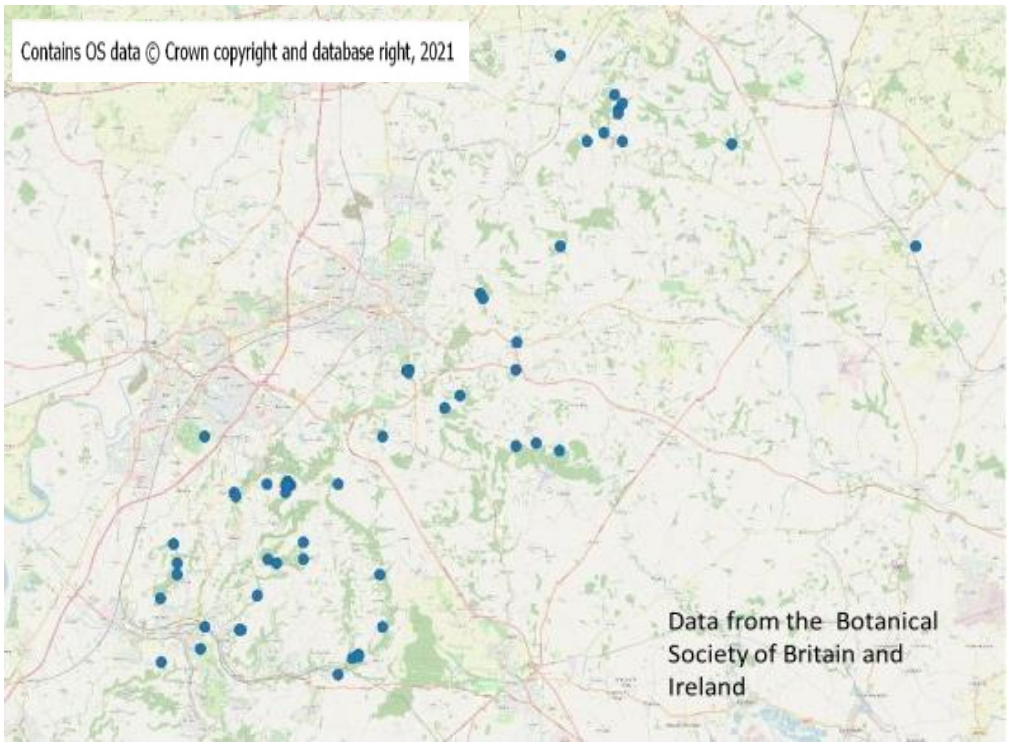

Figure 1. Fly Orchid distribution in the Cotswolds before 2000, showing a greater dispersion of locations across the Cotswolds.

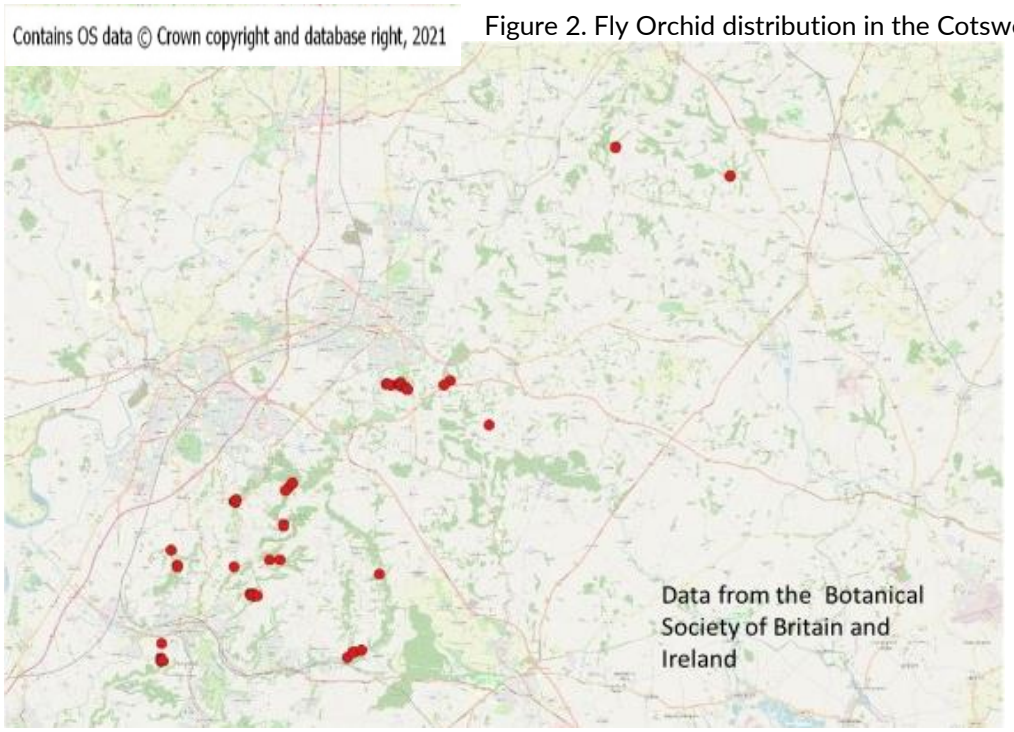

Figure 2. Fly Orchid distribution in the Cotswolds post 2000 shows a contraction from the wider countryside. As biological recording is often opportunistic and negative survey data is not available, all wider landscape records pre 2000 may not have been lost.

Table 1. Back from the Brink Fly Orchid Survey results

Site name	Fly Orchid plant counts 2019	Fly Orchid plant counts 2020	Fly Orchid plant counts 2021
Charlton Kings Common	24		39
Cranham Common		Negative	
Juniper Hill		Negative	
Private site no.1	Negative		
Painswick Beacon	13	13	
Sheepscombe Common	4	19	
Private site no.2	70*		100
Snow's Farm	Negative	Negative	
Private site no.3	3		
Swift's Hill		1	

*Independent record made by a local naturalist

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Greater Horseshoe Bat

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Bat Conservation Trust

Species name – common & scientific	**Greater Horseshoe Bat** *Rhinolophus ferrumequinum*
Photograph	 *© Gareth Jones (BCT) / Back from the Brink*
Taxon group	Mammalia, Chiroptera (Bats)
Conservation status	Section 41 of the Natural Environment and Rural Communities Act 2006 Protected in the UK under the Wildlife and Countryside Act, 1981. Priority Species under the UK Post-2010 Biodiversity Framework. European Protected Species under Annex IV of the European Habitats Directive.
UK distribution	Found largely in south west England and Wales. Its range has contracted in the last century, but with climate change alongside sensitive land management, it could spread back to its original distribution which would include as far north as Yorkshire.
Habitat associations	This species needs a patchwork landscape of grazed small pasture and woodland with hedgerows providing connectivity. Mature ancient semi-natural woodland with some areas of dense understorey. Networks of tall, bushy hedgerows are important for foraging and to connect the roost with other foraging habitats. A variety of suitable roost and hibernation sites close to foraging habitat is vital. Important winter hibernation roosts are present in old mines and

	cellars in the Stroud valleys. Recent research has shown bats wake more frequently from hibernation than previously thought and need to feed.
BftB work carried out:	
Survey & Monitoring	Volunteers were trained in how to deploy Audiomoths (static acoustic recorders) to capture the echolocation calls of feeding or commuting bats. BftB was an opportunity to trial the still 'in development' Audiomoths and their potential for more extensive recording effort needed to detect rare bat species. Surveys focussed initially on assessing if the newly introduced cattle paddock grazing at Rodborough Common was made use of as a foraging resource by Greater Horseshoe (and Lesser Horseshoe) Bats. Audiomoths were deployed around three grazing compartments prior to and during grazing in 2019 and 2020 and results analysed by Bat Conservation Trust. Further to this, Audiomoths were deployed at two additional sites, Stuart Fawkes and Jacob's Knowle (part of Minchinhampton Common) over winter to see if leaving cattle to graze over the winter provided a food resource for Greater Horseshoe Bats during milder winter evenings. Data was then sent back to Bat Conservation Trust for analysis Further details of the methodology are provided in the summary reports for each compartment and site produced by Sonia Reveley of Bat Conservation Trust.
Sites habitat management works	Dung flies and beetles are an important food for horseshoe bats, making cattle grazed pasture an important habitat. The newly introduced late summer/autumn/winter paddock grazing on the slopes of Rodborough Common will have improved the dung fly/beetle food resource closer to fringing woodland edges used by commuting horseshoe bats. In addition, winter grazing provided by Gloucestershire Wildlife Trust at Stuart Fawkes Nature Reserve will have provided a source of insects for Greater and Lesser Horseshoe Bats hibernating nearby.
Technical advice provision	Site advice visit to two adjacent sites to discuss general grassland management for a variety of species including bats. Species management factsheets and follow up email advice also provided. Site advice visit to a privately owned site to discuss habitat management for Greater and Lesser Horseshoe Bats. Species management factsheets and follow up email advice also provided. In addition, a site advice visit was made to Painswick Rococo Gardens covering general habitat management and also for bats. A new Greater Horseshoe Bat factsheet also produced with Bat Conservation Trust.

Links made with other taxa / conservation work?	The new paddock grazing at Rodborough Common was set up initially to deliver multi-taxa benefits for the Large Blue, Duke of Burgundy, Pasqueflower and Rugged Oil Beetle but also delivers benefits for both Greater and Lesser Horseshoe Bats through the provision of dung fauna.
Wider engagement & advocacy activities?	A number of landowner workshops have been delivered, both jointly with other BftB partners covering multiple species groups (x 3) and solely for Greater Horseshoe Bats (x 2). These covered advice on habitat management for horseshoe bats, as well as the importance of avoiding using ivermectins to kill livestock parasites which leads to a decline in dung fauna. These were attended by a total of 67 people.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	Distribution is recorded as the number of "bat passes" as detected by the Audiomoth acoustic recorders and classified during software processing of sound files. Audiomoths detected Greater Horseshoe Bat activity at all three surveyed compartments on Rodborough Common during summer monitoring in 2019 and 2020. Results from one compartment showed a noticeable increase in Greater Horseshoe Bat passes from prior grazing to during grazing. Greater Horseshoe Bats were also detected at both Jacobs's Knowle and Stuart Fawkes nature reserve. More detailed explanation of the results can be found in the summary reports for each compartment and site produced by Sonia Reveley of Bat Conservation Trust.
Recorded Abundance of species populations	The abundance of Greater Horseshoe Bats at each of the surveyed sites/compartments is difficult to account for as it is unknown if each recorded bat pass is a different individual each time or the same one. However, results did show an increase in Greater Horseshoe Bat passes at compartment 2 at Rodborough Common during grazing suggesting an increased use of the area and a positive impact of grazing. Unfortunately, no increase in use was found at the other two compartments from before to during grazing. This is possibly a result of a lack of data due to the short amount of time cattle grazed each compartment. This highlights a need for more surveying in order to be conclusive that cattle grazing has a positive impact on Greater Horseshoe Bat foraging behaviour. Results from the winter monitoring at Jacob's Knowle (where no livestock were grazing) and Stuart Fawkes (cattle grazing) found a maximum of one Greater Horseshoe Bat pass at Jacob's Knowle and nine at Stuart Fawkes. This suggested a positive impact of grazing during winter, however, would need further survey effort to reinforce these findings. More detailed explanation of the results can be found in the summary reports for each compartment and site produced by Sonia Reveley of Bat Conservation Trust.

Other results documented?	• Eight other species of bat were recorded by the Audiomoths at Rodborough Common: Barbastelle, Brown Long-eared Bat, Lesser Horseshoe Bat, Noctule, Serotine, Leisler's Bat, Common Pipistrelle and Soprano Pipistrelle and one species group *Myotis* (which cannot be identified by call to species level). • Six other species were recorded at Stuart Fawkes: Barbastelle, Brown Long-eared Bat, Lesser Horseshoe Bat, Serotine, Common Pipistrelle and Soprano Pipistrelle. • Three other species were recorded at Jacob's Knowle: Lesser Horseshoe Bat, Common Pipistrelle and Soprano Pipistrelle.
Species Recovery Curve progress made	Species recovery curve score remained on 6 as project aimed to learn more about Greater Horseshoe Bat use of sites with grazing animals: Targeting paddock grazing to support known populations trialled during summer and winter at several sites. Monitoring work showed some evidence of an increase in Greater Horseshoe Bat use of the sites when cattle grazing introduced, however due to the short-term nature of the grazing more work is needed to reinforce these findings.
Other measures of species recovery progress? e.g. FCS	Species recovery curve score remained on 6 as project aimed to learn more about Greater Horseshoe Bat use of sites with grazing animals: Targeting paddock grazing to support known populations trialled during summer and winter at several sites. Monitoring work showed some evidence of an increase in Greater Horseshoe Bat use of the sites when cattle grazing introduced, however due to the short-term nature of the grazing more work is needed to reinforce these findings.
Recommendations for future work:-	More surveying needed over longer periods to reinforce the conclusion that the targeted paddock grazing at Rodborough Common is providing more foraging opportunities and is therefore beneficial to Greater Horseshoe Bats. In addition, more survey work needed during winter months to show the benefit of having grazing adjacent to hibernacula. Potential to have a Masters or PhD project continue monitoring Greater Horseshoe Bat activity during the winter using a more robust survey design. Work with landowners adjacent to known hibernacula to organise winter grazing. Continue to recommend to landowners to reduce their use of anti-parasitic treatments which persist in the dung and to try other methods of parasite control.

Additional Information

For further detail on all surveys and results see the following survey summary reports by Sonia Reveley (Bat Conservation Trust):

- 2019 – 2020 Acoustic Summer Monitoring at Rodborough Common (Compartment 10).
- 2019 Acoustic Summer Monitoring at Rodborough Common (Compartment 14–15)
- 2019 – 2020 Acoustic Summer Monitoring at Rodborough Common (Compartment 2).
- Acoustic Winter Monitoring at Stuart Fawkes 2020
- Acoustic Winter Monitoring at Jacob's Knowle 2020
- Summary of the BftB Limestone's Living Legacies summer and winter monitoring of the greater horseshoe bat.

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Grey Long-eared Bat

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Bat Conservation Trust

Species name – common & scientific	**Grey Long-eared Bat** *Plecotus austriacus*
Photograph	 *© Hugh Clark (BCT) / Back from the Brink*
Taxon group	Mammalia, Chiroptera (bats)
Conservation status	IUCN least concern. EU Habitats Directive Annex IV
UK distribution	A native UK species, there are very few confirmed records, most of which are from areas close to the coast in lowland areas of southern England from Sussex to Devon through to Somerset. Found on the Isle of Wight and the Channel Islands.
Habitat associations	Research suggests that this species' range will shift northwards in response to a changing climate. Strongly associated with human settlements with a high proportion of grassland, hedges, and trees on the continent, in the UK it has mostly been associated with wet and species rich meadows, a highly fragmented habitat.
BftB work carried out:	
Survey & Monitoring	Initially accepted as not being present in the Cotswolds, therefore project work aimed to 'future-proof' in anticipation of range expansion. However, analysis of Audiomoth recordings from our winter monitoring for Greater Horseshoe Bats found a possible Grey Long-eared Bat call. Work followed to determine if the species was present in spring/summer 2021 by deploying Audiomoths at the site where the sound had been recorded. Data then sent back to Bat Conservation Trust for analysis.

Sites habitat management works	Accepted as not being present in the Cotswolds yet, so all practical habitat management work to restore insect-rich limestone grassland is providing suitable foraging habitat for this species to move into as its range expands northwards.
Technical advice provision	Site advice to landowners of a number of sites on limestone grassland management that will benefit the Grey Long-eared Bat when it reaches the Cotswolds.
Links made with other taxa / conservation work?	A possible Grey Long-eared Bat call was identified through survey work using Audiomoths for the Greater Horseshoe Bat. Ongoing efforts to restore limestone grasslands for other target species will benefit the Grey Long-eared Bat for when it reaches the Cotswolds.
Wider engagement & advocacy activities?	A number of landowner workshops have been delivered jointly with other BftB partners covering multiple species groups including bats and touching on the needs of Grey Long-eared Bats.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	No records of Grey Long-eared Bat were made until a *possible* Grey Long-eared Bat call was identified from Bat Conservation Trust analysis of Audiomoth data collected during survey work for Greater Horseshoe Bats over winter 2019-2020. Audiomoths have been re-deployed to this site over spring/summer 2021 to try and confirm the presence of this species.
Recommendations for future work:-	Continued efforts to restore insect-rich limestone grassland in order to provide suitable foraging habitat for when the Grey Long-eared Bat expands its range northwards into the Cotswolds.

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Juniper

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Plantlife

Species name – common & scientific	**Juniper** *Juniperus communis*
Photograph	 *©Alex Hyde / Back from the Brink*
Taxon group	Family Cupressaceae
Conservation status	Section 41 of the Natural Environment and Rural Communities Act 2006. Classified as Least Concern in the Great Britain Vascular Plant Red Data List (BSBI 2005). Near Threatened in the England Vascular Plant Red Data List.
UK distribution	Juniper has a highly disjunct distribution across England. Virtually absent in the Midlands, in the southern lowlands it has severely contracted in range and abundance over the past 50 years. Northern populations are faring relatively well, with good stands in the Lake District and North Pennines, but it has been eliminated from many moorland sites by burning.
Habitat associations	Juniper is a bush of calcareous grassland. Seeds require bare subsoil, often with rubble and bedrock exposed and little topsoil present, to germinate and will mature into male or female plants. Juniper has specific management requirements requiring ground disturbance to create bare soil for seed germination followed by a long period without disturbance to enable the seedlings to grow.

BftB work carried out:	
Survey & Monitoring	Following Plantlife's methodology, surveys to document all existing Juniper bushes, saplings and seedlings were carried out at Painswick Beacon and Juniper Hill. This included documenting the success of work started by Plantlife in 2010 to establish Juniper seedlings in a new bare ground scrape at Painswick Beacon.
Sites habitat management works	• Two scrapes were created underneath mature female Juniper bushes. One at Juniper Hill in 2018 created (and fenced) by volunteers by hand and one larger scrape created by contractors at Rodborough Common in 2019. • Scrub removal and electric fence installed by volunteers at Juniper Hill in 2020 to enable the reintroduction of sheep grazing. • Cattle handling system installed in 2018 to enable Painswick Beacon Conservation Group to continue cattle grazing at Painswick Beacon. • New targeted paddock grazing system at Painswick Beacon started in 2018 to benefit a range of species including Juniper. • Set up of new paddock grazing system at Rodborough Common from 2018 to benefit a range of species including Juniper.
Conservation 'interventions' incl. reintroductions & translocations	In partnership with the National Trust, 57 Juniper saplings were planted out at Rodborough Common in 2020 by volunteers.
Technical advice provision	• Site advice visits to Painswick Beacon to advise on grazing for various target species including Juniper. Advice also given on targeted interventions (e.g. scrub/tree removal) to protect specific Juniper bushes from being shaded/crowded out. • Site advice visit to Juniper Hill to discuss management for various target species including Juniper. • Site advice visit to Rodborough Common to advise on creation of scrape for Juniper following Plantlife/Buglife recommendations.
Links made with other taxa / conservation work?	Juniper has benefitted from scrub control and targeted grazing primarily aimed at Large Blue and Duke of Burgundy at sites such as Rodborough Common, Painswick Beacon and Juniper Hill. Scrape created at Rodborough Common also aimed to benefit Rugged Oil Beetle, Dingy Skipper, Grizzled Skipper and Small Blue all of which need bare ground either for nesting or to encourage colonisation by larval food plants.
Wider engagement & advocacy activities?	Juniper Identification and Survey training workshop for volunteers led by Plantlife in 2019 attended by 8 people.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	All bushes, saplings, and seedlings in the northern half of Painswick Beacon and at Juniper Hill documented and grid referenced by volunteers in 2019 following Plantlife methodology covered on training workshop. The age, sex and condition (e.g. any damage/growth type) of each bush/seedling also documented to produce a comprehensive inventory and to highlight any further work that needs doing to protect individual plants.

Recorded Abundance of species populations	See results of Juniper surveys at Painswick Beacon and Juniper Hill carried out between Sept-Dec 2019 by volunteers. Notable results included a total of 67 saplings counted in the scrape created by Plantlife in 2010. A total of 28 seedlings were counted in 2019 in the new scrape at Juniper Hill created by volunteers in 2018.
Other results documented?	See Plantlife report 'Breaking New Ground for Juniper – Painswick Beacon', 2019 for results of surveys of scrape and cages created by Plantlife carried out in May/June 2019 by Cath Shelswell.
Species Recovery Curve progress made	Species recovery curve score moved from 3 to 7: Scrapes created at Juniper Hill and Rodborough Common. 28 seedlings discovered in the scrape at Juniper Hill the following year. Areas immediately surrounding female Juniper bushes stripped of turf to encourage seedling germination at Painswick Beacon. Juniper seedlings germinated from seed planted out at Rodborough Common. Grazing reintroduced at Juniper Hill.
Recommendations for future work:-	• Clearance and tree felling as required to recover old bushes from secondary woodland and scrub encroachment. • Specific recommendations for individual bushes suffering from shading or encroachment by trees as per Painswick Beacon site advice visit in 2019. • Potential for moving saplings growing in scrapes to other parts of the site – further advice needed from Plantlife on this.

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Large Blue Butterfly

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Species name – common & scientific	**Large Blue Butterfly** *Phengaris arion* *(formerly Maculinea arion)*
Photograph	 © Keith Warmington / Back from the Brink
Taxon group	Lepidoptera
Conservation status	• Endangered (IUCN) Section 41 species of principal importance under the NERC Act in England • UK BAP: Priority Species • Butterfly Conservation priority: High • Fully protected In Great Britain under Section 9 of the Wildlife and Countryside Act (1981). • European status: Endangered EU Habitats Directive Annex IV: animal and plat species of community interest in need of strict protection. • Bern Convention Annex II: strictly protected fauna species
UK distribution	Declared extinct in the UK in 1979, populations are being introduced to selected sites in the south-west.
Habitat associations	Warm and well-drained unimproved grassland, predominantly acidic coastal grassland, or limestone grassland. It also used to occur on calcareous clay soils, probably on dry outcrops or mounds. Short swards are needed to promote warm microclimates for the correct species of host ant but retaining some sheltered scrub areas is also important for roosting adults.
BftB work carried out:	

Survey & Monitoring	Preliminary work using specialist habitat suitability and ant surveys to scope introduction sites. The introduction of larvae followed up by volunteer counts of adults and specialist counts of eggs on Thyme plants (from which the size of the adult population can be extrapolated).
Sites habitat management works	Preparation for and support of Large Blue introductions into Rodborough Common, Painswick Beacon and a third additional site. Installation of grazing infrastructure to create targeted grazing paddocks for restoration grazing. Installation of water troughs at Painswick Beacon. Temporary electric fencing moved on rotation within an August-April grazing period, subject to grazing pressure checks, the density of larval food plants and the abundance of the Red ant *Myrmica sabuleti*. Four autumn/winter seasons of targeted conservation grazing have successfully restored the shorter grass swards. In addition, scrub management, a water trough and foodplant plantings have been delivered at three other sites where the butterfly has previously been introduced and habitat management to bring a proposed fourth into condition.
Conservation 'interventions' incl. reintroductions & translocations	See section 3. Large Blue butterfly caterpillars taken as eggs from donor sites in Somerset and Gloucestershire were reared in captivity and introduced to Painswick Beacon, Rodborough Common and a third new site.
Technical advice provision	On-going expert advice on maintaining optimum sward heights to the Painswick Beacon Conservation Group, the National Trust and the Rodborough Common graziers.
Links made with other taxa / conservation work?	Large Blue is an umbrella species for skeletal soil animal and plant assemblages: Juniper, Purple Milk-vetch, Basil Thyme, and heterogeneous habitat integration with species needing longer swards: Duke of Burgundy, Rugged Oil Beetle, Fly Orchid.
Wider engagement & advocacy activities?	The Large Blue butterfly was mentioned in all general project talks and in several talks specifically on the Large Blue and other major successes of the project. The National Trust and BftB released a joint press release on the success of the Rodborough Common introduction in 2020 that gained national and international coverage, winning the Gloucestershire CPRE award, with a plaque to be awarded in a ceremony in November 2021.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	Sensitive information See Figure 1 of internal version for complete list of introduction sites.
Recorded Abundance of species populations	Specialist egg count surveys are used to estimate population size. Volunteer monitoring transects and peak counts of adult June emergence on introduction sites. Grazing pressure monitoring.
Other results documented?	Botanical survey of 21 quadrats on Rodborough Common to evidence wider benefits of the paddock grazing. Report available.

Species Recovery Curve progress made	Species recovery curve score moved from 6 to 8: Large Blue reintroduced to three new sites instead of just one originally planned with positive early results at each. A further introduction was done at a fourth site where the Large Blue had been reintroduced previously. These reintroductions have increased the distribution and abundance of this species in the Cotswolds. Two other sites appear to have been naturally colonised however further surveys are required to confirm this.
Recommendations for future work:-	The National Trust recommend that the advisory role of Habitat Designs Ltd is retained at least for the next few years to continue to deliver two grazing review visits per year in the spring and autumn to advise the Commoners and the National Trust's grazing field officer. Changes in annual grass growth can be dramatic in response to increasingly variable weather. Annual paddock fencing costs are likely to vary year to year. One output of the bi-annual review will be an updated advisory grazing rota like that produced by Habitat Designs Ltd for the Rodborough graziers Countryside Stewardship agreement. The National Trust's Area Officer will then be able to use bespoke grazing recommendations to determine the duration of each seasonal paddock graze. Regular observations of the impact of the paddock grazing should be carried out to determine when the livestock should be moved on as well as keeping records on what grazing occurred.

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Marsh Fritillary

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Species name – common & scientific	**Marsh Fritillary** *Euphydryas aurinia*
Photograph	 *© Iain H Leach / Back from the Brink*
Taxon group	Lepidoptera
Conservation status	Butterfly Conservation priority: High Section 41 species of principal importance under the NERC Act in England Listed on Section 7 of the Environment (Wales) Act 2016 Northern Ireland Priority Species Scottish Biodiversity List UK BAP: Priority Species European status: Vulnerable Fully protected under the 1981 Wildlife and Countryside Act Fully protected under the 1985 Northern Ireland Wildlife Order Fully protected under European Habitats and Species Directive (Annexe II)
UK distribution	The Marsh Fritillary was once widespread in Britain and Ireland but has declined severely over the twentieth century. Marsh Fritillary populations are highly volatile, experiencing large fluctuations in population size, making it prone to local extinction in poor years, whilst new sites can be colonised in 'good' years with high dispersal. The species requires extensive habitats or habitat networks for its long-term survival. Massively declined and now restricted to the west coast of

	Scotland, south and west Wales, Northern Ireland and south-west and central southern England. See Recorded Distribution (in BftB focal areas) section for details on Cotswold distribution.
Habitat associations	There are three main habitat types: damp grasslands dominated by tussock forming grasses, chalk grasslands (usually on the west or south-facing slopes in England) and shorter coastal grasslands (in Wales, Scotland, and Northern Ireland). Temporary colonies may also exist in large (>1 ha) woodland clearings and in other grasslands.
BftB work carried out:	
Survey & Monitoring	Surveys for the larval webs of the gregarious larvae at the butterfly's core site at Strawberry Banks and known satellite site. Webs can be counted to assess population status in August as early instar larvae, and again in early spring, when they emerge from winter dormancy to bask. Adult counts are carried out on a UK Butterfly Monitoring Scheme survey transect in May & June. Larval web counts and adult timed counts have been carried out at both Strawberry Banks and the satellite site in the following years: Strawberry Banks larval web counts: August 2018, Feb and August 2019 and Feb and August 2020 Satellite site larval web counts: March 2020 and March 2021 Strawberry Banks adult timed counts: 2018, 2019, 2021 Satellite site adult timed counts: 2018, 2019, 2021
Sites habitat management works	The objective has been to restore the condition and increase the extent of good quality breeding habitat at the satellite site, near to the core butterfly site, thus increasing the resilience of the population in this landscape. Tall sward and ruderal plant species have been mown/brush-cut and the area fenced off ready for livestock introduction (also Covid-delayed) by volunteers. An early trial graze using ponies was unsuccessful so changing to a cattle graze has necessitated some extra fencing. Preparatory work has been undertaken to propagate Devil's-bit Scabious foodplants in a nursery for planting out at the satellite site by a contractor (due to Covid restrictions, will now take place after the project finishes in September 2021).
Conservation 'interventions' incl. reintroductions & translocations	A planned trial translocation of larvae into Butterfly Conservation's Rough Bank reserve was delayed due to concerns that the larval webs may be predated by pheasants, as bird numbers from the local shoot appeared to be increasing. Good relations with the local gamekeeper have established how the shoot is run and collaborative working has been set up, including a student research project into the behaviour of pheasants on limestone grassland (see below for more details). The Marsh Fritillary working group is continuing to plan for this translocation at a future date when conditions allow.
Technical advice provision	The Marsh Fritillary working group and Butterfly Conservation have provided technical advice on a possible translocation. The project officers have given habitat management advice to the owners of the satellite site, supporting the set-up of the Countryside Stewardship agreement to finance scrub clearance, fencing work and the planting of Devil's-bit Scabious.

Links made with other taxa / conservation work?	The grazing at Strawberry Banks, will also support Rugged Oil Beetle, Duke of Burgundy, Small Blue and Grizzled Skipper which have all been recorded on site.
Wider engagement & advocacy activities?	Larval web survey training targeted at specific volunteers rather than opened up to the general public to avoid excessive trampling on site.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	Adult timed counts and larval web counts continued to monitor the population at the one known breeding site, Strawberry Banks. Larval web counts at the satellite site in 2020 discovered one large web – confirming breeding at this site for the first time in several years.
Recorded Abundance of species populations	August larval web counts at Strawberry Banks have increased year on year since 2018. 11 webs were found in 2018, 14 in 2019 and 25 in 2020 with an associated increase in the number of large and medium sized webs.
Other results documented?	A student project into the likelihood of pheasants predating Marsh Fritillary larvae is being undertaken by the Royal Agricultural University (RAU) using a combination of trail cameras, monitoring quadrats and transect counts. The pilot study report from spring 2021 showed low numbers of pheasants interacting with the grassland when larval webs would be present post hibernation (assuming a translocation can go ahead). A dissertation student from the RAU will repeat the methodology to establish if the behaviour of released juvenile birds prior to the shooting season is different in August, when webs would also be visible.
Species Recovery Curve progress made	Species recovery curve score moved from 5 to 7: Recovery solutions have been trialled and are now being employed at current extant Marsh Fritillary sites via habitat management, including carefully managed grazing. A Gloucestershire Cotswolds Marsh Fritillary Working Group has been set up to include all stakeholders and will continue (supported by BC) after the project end. The most promising solutions have been embedded at the second site by entering it into a new Higher Tier CS agreement to specifically manage for Marsh Fritillary, including additional habitat creation through larval food-plant plug planting and fencing to enable targeted grazing. All the preparatory work required to carry out a translocation (initially due for Feb 2020) to a new site has been completed however this has been put on hold due to issues at the recipient site and with the donor population.
Recommendations for future work:-	Continue monitoring adults and webs at Strawberry Banks and the satellite site. Support landowners at the satellite site, provide habitat management advice and support with scrub volunteer work parties. Continue Marsh Fritillary working group to maintain existing occupied sites, encourage habitat improvements at potential sites, and consider a translocation into additional site/s in the future.

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Pasqueflower

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Plantlife

Species name – common & scientific	**Pasqueflower** *Pulsatilla vulgaris*
Photograph	 *© Ben Andrew – Back from the Brink*
Taxon group	Buttercup (Ranunculaceae) family
Conservation status	Section 41 of the Natural Environment and Rural Communities Act 2006 **Vulnerable.** Great Britain Vascular Plant Red Data List (BSBI 2005) and the England Vascular Plant Red Data List as the more southern populations are in decline.
UK distribution	Populations are found in the Cotswolds, Chilterns, East Anglia and Lincolnshire. The largest population is in Hertfordshire with up to 100,000 plants.
Habitat associations	Pasqueflower is a species of short calcareous grassland, and is associated with open downland and small borrow pits in the Cotswolds. It is an early flowering plant in March-May, depending on the year, and favours grassland with a southern aspect often on the thinnest soils where there might be brashy oolite scattered across the surface. The main cause of decline historically for pasqueflower is agricultural intensification, including re-seeding grasslands, fertiliser, and herbicide applications and intensive

	grazing. More recently, lack of management, particularly the decline and cessation of mixed grazing, has affected pasqueflower populations with numbers declining in grasslands with rank swards. Seed is unlikely to remain viable for more than a year, making recolonisation of lost populations from the soil seed bank unlikely.
BftB work carried out:	
Survey & Monitoring	Counts of flowering plants were carried out between late April to May during peak flowering time at three privately owned sites known to have large populations in 2019 and 2021, plus the small population at Rodborough Common in 2018, 2019 and 2021.
Sites habitat management works	South facing slopes where Pasqueflower found had become under grazed so the introduction of new paddock grazing system at Rodborough Common in 2018 to benefit a range of species has also benefited Pasqueflower.
Conservation 'interventions' incl. reintroductions & translocations	Seed collection with Kew Garden's Millennium Seed Bank (MSB). Over 6,000 seeds collected from one privately owned site and now stored at the MSB. 50% are available for future sowing in the Cotswolds.
Technical advice provision	Site advice visit to Rodborough Common with Andy Byfield from Plantlife to advise on management for Pasqueflower, followed up by email advice. Printed advice material also given to National Trust re Plantlife's advice on grazing for Pasqueflower. Site advice visit to one of the privately owned sites to advise on management for Pasqueflower. Printed factsheets provided. A new Pasqueflower factsheet was also produced with Plantlife.
Links made with other taxa / conservation work?	Pasqueflower has benefitted from targeted paddock grazing primarily aimed at Large Blue at Rodborough Common. The need for bare ground and short sward also links it to Juniper, Rugged Oil Beetle and Rock-rose Pot Beetle.
Wider engagement & advocacy activities?	• Pasqueflower Survey Workshop led by Plantlife in 2019 at one of the best-known sites. Trained volunteers in how to survey for Pasqueflowers and carried out a full survey of the site. Attended by 6 people. • Pasqueflower seed collection day led by Kew Garden's Millennium Seed Bank staff with Plantlife and National Trust. • Adopted as an emblematic, priority species for nature recovery by the Cotswold National Landscape.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	Post-2000 records of Pasqueflower are generally restricted to the northern half of the Cotswolds AONB. BftB undertook plant counts at three sites known to have large populations and the small population at Rodborough Common. At each site, the flowers have a very defined area of distribution.

Recorded Abundance of species populations	Site 1: 2480 plants 2019 Site 2: 277 plants counted 2019, 841 plants counted 2021 Site 3: 177 plants counted 2019, 234 plants counted 2021 Rodborough Common: 7 plants counted 2018, 0 plants counted 2019, 11 plants counted 2021
Other results documented?	Data of maximum flower counts for the last 13 years generously supplied by a private landowner at a site near Coberley, corroborate observations made by another landowner of fluctuations in the number of flowers produced from year to year, the duration and peak of flowering.
Species Recovery Curve progress made	Species recovery curve score moved from 1 to 7: New grazing regimes adopted at Site 2 (initiated by the private landowner following advice from Conservation Officer) and at Rodborough Common. Very positive results already being seen at Site 2 and a possible slow increase starting at Rodborough Common. The information learnt from the Limestone Living Legacies project needs to be disseminated to other sites with Pasqueflower in the UK where this species is struggling. However, there are also a number of sites where the species is very healthy and the management around this could also be investigated to increase our understanding of management at extant sites.
Recommendations for future work:-	• Plantlife's recommended management for Pasqueflowers involves maintaining a short sward with mixed livestock which are removed for the flowering period, or very extensive grazing followed by heavier grazing from late summer through the autumn. (For further detail see Pasqueflower management advice from Andy Byfield – pdf document). • Continue annual monitoring to assess the populations at the three sites with large populations of Pasqueflowers. • Continue annual monitoring of the small population at Rodborough Common to determine if paddock grazing helps the plant to spread. Potential to bring back some of the seed collected (now stored at the MSB) and carry out an introduction here if required. • Research into the relationship between climate and flowering effort. • Studies on the genetics and age of plants to assess vulnerability. • Transplanting rootstock from fresh seeds grown in cultivation.

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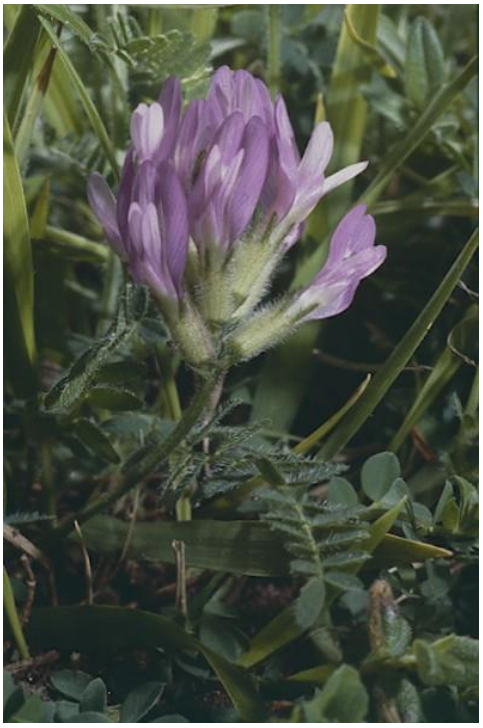
Purple Milk-vetch

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Plantlife

Species name – common & scientific	**Purple Milk-vetch** *Astragalus danicus*
Photograph	 © Andrew Gagg / Back from the Brink
Taxon group	Family Fabaceae (Peas & Legumes)
Conservation status	A species "of principal importance for the purpose of conserving biodiversity" under Section 41 (England) of the Natural Environment and Rural Communities Act 2006.
UK distribution	Populations in southern England in Gloucestershire, Wiltshire, the Chilterns and on the Brecklands of Norfolk and Suffolk. Further north the populations are mainly towards the eastern side of England, east Midlands, Lincolnshire and Yorkshire Wolds, as well as coastal grasslands in the north-east of England and Scotland. It is absent from Wales and Northern Ireland. An isolated population occurs on Aran Islands off the west coast of Ireland.

Habitat associations	Species-rich short, dry and infertile calcareous grassland, on both limestone and chalk. The plant is also found on coastal sand-dunes and in the Brecks on inland calcareous sands. It appears to be physically rather than chemically restricted to calcareous soils and will grow on moderately acid sands/gravels as long as competition from other species is kept low, primarily by adequate grazing and maintenance of low soil nutrient status. In Scotland Purple Milk-vetch is also present on old red sandstone sea cliffs and machair grassland.
BftB work carried out:	
Survey & Monitoring	Surveys were carried out at two sites during both 2019 and 2020 – Painswick Beacon and Snow's Farm.
Site habitat management works	• Cattle handling system installed in 2018 to enable Painswick Beacon Conservation Group to continue cattle grazing at Painswick Beacon. • New targeted paddock grazing system at Painswick Beacon started in 2018 to benefit a range of species including Purple Milk-vetch. This seemed to have already contributed to an increase in abundance and distribution of Purple Milk-vetch plants by 2020. • Strimming and raking of Purple Milk-vetch area by Painswick Beacon Conservation Group in winter 2020-21 following site advice visit.
Technical advice provision	Site advice visit to Snow's Farm to discuss management for various target species including Purple Milk-vetch. Several site advice visits to Painswick Beacon to discuss management for various target species including Purple Milk-vetch. Management advice covered targeted paddock grazing and targeted strimming and raking of specific Purple Milk-vetch areas that were becoming rank.
Links made with other taxa / conservation work?	Purple Milk-vetch has benefitted from targeted grazing primarily aimed at Large Blue and Duke of Burgundy at Painswick Beacon.
Wider engagement & advocacy activities?	Species mentioned in project talks.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	Surveys carried out in both 2019 and 2020 found no plants at Snow's Farm in either year. Surveys at Painswick Beacon found plants present in both 2019 and 2020, however an increase was found in both abundance and distribution in 2020 with at least 48 individual plants recorded. This included plants re-recorded in an area where they were last found in 2009 and plants recorded in a new area not recorded previously. This increase is thought to be a result of the newly introduced targeted paddock grazing initiated in 2018.
Recorded Abundance of species populations	At least 48 flowering individuals counted at Painswick Beacon in 2020, with other plants not in flower.

Species Recovery Curve progress made	Species recovery curve score moved from 1 to 6: Recovery solution in the form of targeted paddock grazing has been trialled at one site with an increase in both abundance and distribution of Purple Milk-vetch as a result. Further trialling of targeted grazing should be undertaken at other sites to identify if this result can be replicated. This is one solution and others need to be investigated such as restoring population from the soil seed bank where plants have not been recorded recently (there is a gap in knowledge regarding seed longevity) and reintroduction processes where necessary.
Recommendations for future work:-	Continued use of targeted paddock grazing at Painswick Beacon to enable to continued spread and increase in numbers of Purple Milk-vetch plants.

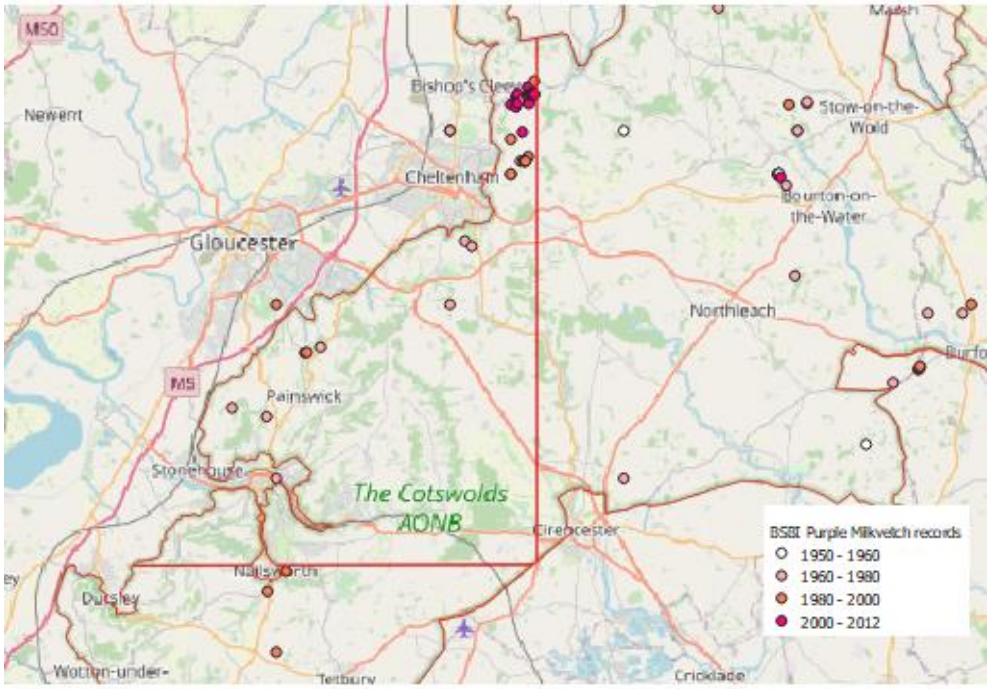


Figure 1. BSBI data on Purple Milk-vetch distribution in the Cotswolds. (Recording on Cleeve Common in 2012 supported by the Cleeve Common Trust.)

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Red-shanked Carder Bee

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Bumblebee Conservation Trust

Species name – common & scientific	**Red-shanked Carder Bee** *Bombus ruderarius*
Photograph	 *© Ben Hamers / Back from the Brink*
Taxon group	Hymenoptera Apidae (Bees)
Conservation status	A species "of principal importance for the purpose of conserving biodiversity" under Section 41 (England) of the Natural Environment and Rural Communities Act 2006.
UK distribution	Found predominantly in the south of England, but also into the Midlands and parts of south Wales. There is also a population on Coll & Tiree in the Scottish Western Isles. It has been lost from much of its former range including all of Devon and Cornwall.
Habitat associations	A variety of flower-rich habitats such as chalk or neutral grasslands, brownfield sites and coastal habitats. The range of forage plants used is wide and changes through the year. Remaining populations are largely found in regions with large, well-connected areas of semi-natural grasslands.

BftB work carried out:	
Survey & Monitoring	BftB survey work focussed on our project target sites and re-visiting historical sites for the two target bumblebee species in an effort to establish if either species was still present in the Cotswolds. Volunteers were trained to identify and survey for the two species, although being very hard to separate from more common species, surveys were often done with or by Bumblebee Conservation Trust (BBCT). 2019 surveys: Cranham Common (project target site) Edge Common (project target site) Juniper Hill (project target site) Painswick Beacon (project target site) Rodborough Common (project target site) Rough Bank (project target site) Sheepscombe Common (project target site) St. George's Field (adjacent to project target site) Snow's Farm (project target site) Stuart Fawkes (historical record *B. ruderarius*) Swift's Hill (project target site) Daneway Banks (additional site chosen by volunteers) Greystone's Farm (additional site chosen by volunteers) 2020 surveys: Cleeve Hill (historical record *B. ruderarius*) Stuart Fawkes (historical record *B. ruderarius*) Plus four other privately owned sites – two with historical records for *B. ruderarius* and two with historical records for *B. ruderatus*. 2021 surveys: Cranham Common (recent record from 2019 workshop) Prestbury Hill (adjacent to Cleeve Hill historical record *B. ruderarius*) Plus three other privately owned sites – two with historical records for *B. ruderarius* and one with historical record for *B. ruderatus*.
Site habitat management works	Not specific to the species, but general habitat management especially scrub clearance will have been beneficial.
Technical advice provision	Advice given to landowners and land managers on managing for bumblebees and the two target species on our Managing Your Grassland for Wildlife workshops. A new factsheet covering both Red-shanked Carder Bee and Ruderal Bumblebee was also produced with Bumblebee Conservation Trust.
Wider engagement & advocacy activities?	• Beginners and Intermediate Bumblebee Identification and Survey workshops run in 2018, 2019 and 2021 led by Bumblebee Conservation Trust and a local bumblebee expert. Attended by 106 people. • A separate talk was given on bumblebee ecology and identification to a local village via Zoom at the request of a new volunteer keen to make the village bumblebee friendly.

BftB results obtained:	
Recorded Distribution (in BftB focal areas)	No Red-shanked Carder Bees were found at 19 of the 20 sites that were surveyed by volunteers/BBCT in 2019, 2020 and 2021. However, it was found at one site in 2021, Prestbury Hill, a Butterfly Conservation reserve on the Cotswold escarpment north east of Cheltenham. The reserve sits adjacent to Cleeve Hill where there was a historical record for *B. ruderarius* from 1998. A single Ruderal Bumblebee was also found at Prestbury Hill on the same day.
Recorded Abundance of species populations	Only one individual found at one site in 2021.
Other results documented?	Records of the other bumblebee species found during the surveys have been compiled and sent to the Gloucestershire Centre for Environmental Records.
Species Recovery Curve progress made	Species recovery curve score moved from 1 to 5: Our surveys helped us better understand the habitat requirements of this species. It appears that our target limestone grassland sites often don't contain the right type and abundance of nectar rich wildflowers for this species. Surveys at sites with historic records also identified several sites that are no longer in good condition for bumblebees and are in need of restoration work.
Recommendations for future work:-	Recommendations from Bumblebee Conservation Trust re Prestbury Hill: *Keep existing management (particularly for Dukes & both Chalkhill & Small Blue) - lots of kidney & horseshoe vetch, plus other flowers available through the season (March-Sept), in a matrix of medium-height open grassland with rougher/longer areas around scrub patches (good nesting areas). Ruderarius needs a bit of thatch in the grass, and rougher areas with thorn scrub or brambles is good for nesting as well. Ruderatus will probably be nesting near the woodland edge and in the denser scrub areas, so keeping a matrix that includes these patches will be good for them.*

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Rock-rose Pot Beetle

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Buglife

Species name – common & scientific	**Rock-rose Pot Beetle** *Crytpocephalus primarius*
Photograph	 *© Liam Olds / Back from the Brink*
Taxon group	Coleoptera (Beetles)
Conservation status	A species "of principal importance for the purpose of conserving biodiversity" under Section 41 (England) of the Natural Environment and Rural Communities Act 2006. Endangered (IUCN) Nationally Rare (GB)
UK distribution	A scarce species in Britain mostly of calcareous grasslands in southern England, with disjunct records also from Perthshire in Scotland. Now known from just a few calcareous grasslands in Dorset, Gloucestershire and Hampshire.
Habitat associations	A species of unimproved calcareous grassland. Adults typically occur in warm, dry, sheltered conditions on south-facing slopes, suggesting an underlying thermal requirement. A short sward and an abundance of Common Rock-rose are deemed important.

BftB work carried out:	
Survey & Monitoring	Surveys with volunteers and Buglife focussed on the two known sites with recent records Stinchcombe Hill and a privately owned site, plus a third site, Rodborough Common which had historic records from 1985 but was thought to be extinct. 2018 surveys: Stinchcombe Hill (as part of Rock-rose Pot Beetle Identification and Survey workshop with Buglife) 2019 surveys: Stinchcombe Hill Site 2: A privately owned site 2020 and 2021 surveys: Stinchcombe Hill Site 2: A privately owned site Rodborough Common
Sites habitat management works	Clearance of encroaching scrub from the area of grassland where the beetle is known to occur at Stinchcombe Hill (it is currently not feasible to introduce grazing animals to this site). Following site advice, cattle grazing was introduced by the landowner at Site 2 in 2020.
Technical advice provision	Site advice visit to Site 2 with the landowner. Advice provided on management for Rock-rose Pot Beetle, followed by email advice and reports from Buglife. A new Rock-rose Pot Beetle factsheet was also produced with Buglife.
Links made with other taxa / conservation work?	The above advice visit also discussed management for Grizzled Skipper. Species requirements link to habitat management for the Large Blue and other short sward, heat-loving species.
Wider engagement & advocacy activities?	Rock-rose Pot Beetle Identification and Survey workshops led by Buglife for volunteers in 2018, 2019 and 2021. Attended by 34 people.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	2018 surveys: Stinchcombe Hill – zero found on volunteer workshop 2019 surveys: Stinchcombe Hill – 1 found Site 2 – 3 found 2020 surveys: Stinchcombe Hill – max. count in one survey of 7 Site 2 – max. count 39 Rodborough Common - first Rock-rose Pot Beetle found in 35 years. Max. count 7 2021 surveys: Stinchcombe Hill – max. count in one survey of 2 Site 2 – max. count 17 Rodborough Common – max. count 4

	Further results can be found in Buglife reports: 'Survey for Rock-rose Pot Beetle (Cryptocephalus primarius) in Gloucestershire' – Liam Olds, Buglife 'Further surveys for the Rock-rose Pot Beetle (Cryptocephalus primarius) in Gloucestershire' – Liam Olds, Buglife (Final summary report covering all survey years to come in Sept 2021)
Recorded Abundance of species populations	A total of 69 adult beetles from Site 2 in 2020 establishes it as probably the most important site for the beetle in the country. 14 were found at Rodborough Common and 9 at Stinchcombe Hill.
Other results documented?	*Cryptocephalus bipunctatus* also recorded on each survey.
Species Recovery Curve progress made	Species recovery curve score moved from 2 to 6: Potential recovery solutions continue at Stinchcombe Hill through scrub removal work. Grazing reintroduced at Breakheart Hill following advice to landowner.
Recommendations for future work:-	Further clearance of encroaching scrub from the area of grassland where the beetle is known to occur at Stinchcombe Hill. Discussions started re using the No Fence GPS collar system which if purchased could enable grazing of the site. Cattle grazing was introduced by the landowner of Site 2 in 2020. Need to keep an eye on the resulting sward and amend number of cattle/amount of time grazing as a result.

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Ruderal Bumblebee

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Bumblebee Conservation Trust

Species name – common & scientific	**Ruderal Bumblebee** *Bombus ruderatus*
Photograph	 *© Nick Owens / Back from the Brink*
Taxon group	Hymenoptera Apidae (Bees)
Conservation status	A species "of principal importance for the purpose of conserving biodiversity" under Section 41 (England) of the Natural Environment and Rural Communities Act 2006.
UK distribution	Once widespread throughout southern and central England, now found in the south of England up to Lincolnshire, the species is staging a slight recovery in the south and east of its British range.
Habitat associations	Associated with a wide variety of flower-rich habitats including grasslands, brownfield sites, coastal grazing marsh and agricultural land as long as there are lots of deep-tubed flowers such as Red Clover, White Dead-nettle, thistles, comfreys and knapweeds as well as suitable nest sites (often the burrows of small mammals).

BftB work carried out:	
Survey & Monitoring	BftB survey work focussed on our project target sites and re-visiting historical sites for the two target bumblebee species in an effort to establish if either species was still present in the Cotswolds. Volunteers were trained to identify and survey for the two species, although being very hard to separate from more common species, surveys were often done with or by Bumblebee Conservation Trust (BBCT). 2019 surveys: Cranham Common (project target site) Edge Common (project target site) Juniper Hill (project target site) Painswick Beacon (project target site) Rodborough Common (project target site) Rough Bank (project target site) Sheepscombe Common (project target site) St. George's Field (adjacent to project target site) Snow's Farm (project target site) Stuart Fawkes (historical record *B. ruderarius*) Swift's Hill (project target site) Daneway Banks (additional site chosen by volunteers) Greystone's Farm (additional site chosen by volunteers) 2020 surveys: Cleeve Hill (historical record *B. ruderarius*) Stuart Fawkes (historical record *B. ruderarius*) Plus four other privately owned sites – two with historical records for *B. ruderarius* and two with historical records for *B. ruderatus*. 2021 surveys: Cranham Common (recent record from 2019 workshop) Prestbury Hill (adjacent to Cleeve Hill historical record *B. ruderarius*) Plus three other privately owned sites – two with historical records for *B. ruderarius* and one with historical record for *B. ruderatus*.
Site habitat management works	Not specific to the species, but general habitat management especially scrub clearance will have been beneficial.
Technical advice provision	Advice given to landowners and land managers on managing for bumblebees and the two target species on our Managing Your Grassland for Wildlife workshops. A new factsheet covering both Red-shanked Carder Bee and Ruderal Bumblebee was also produced with Bumblebee Conservation Trust.
Wider engagement & advocacy activities?	• Beginners and Intermediate Bumblebee Identification and Survey workshops run in 2018, 2019 and 2021 led by Bumblebee Conservation Trust and a local bumblebee expert. Attended by 106 people. • A separate talk was given on bumblebee ecology and identification to a local village via Zoom at the request of a new volunteer keen to make the village bumblebee friendly.

BftB results obtained:	
Recorded Distribution (in BftB focal areas)	One Ruderal Bumblebee was found at Cranham Common in 2019 on a Beginners Bumblebee Identification and Survey workshop. This was a brand-new site for this species. No Ruderal Bumblebees were then found at 19 of the 20 sites that were surveyed by volunteers/BBCT in 2019, 2020 and 2021 (including follow up surveys at Cranham Common). However, it was then found at another new site in 2021, Prestbury Hill, a Butterfly Conservation reserve on the Cotswold escarpment north east of Cheltenham. The reserve sits adjacent to Cleeve Hill where there was a historical record for *B. ruderarius* from 1998 which was also found on the same day.
Recorded Abundance of species populations	Only two individuals found at two sites – Cranham Common in 2019 and Prestbury Hill in 2021.
Other results documented?	Records of the other bumblebee species found during the surveys have been compiled and sent to the Gloucestershire Centre for Environmental Records.
Species Recovery Curve progress made	Species recovery curve score moved from 1 to 5: Our surveys helped us better understand the habitat requirements of this species. It appears that our target limestone grassland sites often don't contain the right type and abundance of nectar rich wildflowers for this species. Surveys at sites with historic records also identified a number of sites that are no longer in good condition for bumblebees and are in need of restoration work.
Recommendations for future work:-	Recommendations from Bumblebee Conservation Trust re Prestbury Hill: *Keep existing management (particularly for Dukes & both Chalkhill & Small Blue) - lots of kidney & horseshoe vetch, plus other flowers available through the season (March-Sept), in a matrix of medium-height open grassland with rougher/longer areas around scrub patches (good nesting areas). Ruderarius needs a bit of thatch in the grass, and rougher areas with thorn scrub or brambles is good for nesting as well. Ruderatus will probably be nesting near the woodland edge and in the denser scrub areas, so keeping a matrix that includes these patches will be good for them.*

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Rugged Oil Beetle

BftB project: IP04 Limestone's Living Legacies

Project lead organisation: Butterfly Conservation

Contact: info@butterfly-conservation.org

Partner organisation for species: Buglife

Species name – common & scientific	**Rugged Oil Beetle** *Meloe rugosus*
Photograph	 *© Graham Lyons / Back from the Brink*
Taxon group	Coleoptera, Meloidae
Conservation status	Red Data Book: Nationally Scarce A species "of principal importance for the purpose of conserving biodiversity" under Section 41 (England) of the Natural Environment and Rural Communities Act 2006.
UK distribution	Probably always uncommon, it has a scattered distribution in southern England and south-east Wales where it is associated with calcareous grasslands on chalk and limestone. It has never been widespread, owing to its strong association with calcareous grasslands. Many recent records are confined to southern and central England, particularly in the Cotswolds and Mendip Hills.
Habitat associations	Flower-rich calcareous grasslands on chalk and limestone, including chalk downs and vegetated coastal cliffs. It is also readily found in gardens in calcareous districts.

BftB work carried out:	
Survey & Monitoring	BftB project work has focused on improving our knowledge of Rugged Oil Beetle distribution in the Cotswolds, understanding its distribution within individual sites, trying to find out the likely solitary bee hosts and increasing our knowledge of the beetle's habitat requirements. Between 2017 and 2021 a total of 28 sites were surveyed for Rugged Oil Beetles. Prior to surveys starting, 8 sites were known within the Cotswolds AONB boundary. This has now increased to 20 with an additional 3 sites having been found outside the AONB. Surveys involved visiting sites during autumn and winter after dark and on nights above 5 degrees. Surveys were carried out using torches and any beetles found were counted and 10 figure grid references taken to enable distribution maps to be created for each site. In addition, in 2021, surveys for triungulins, the Rugged Oil Beetle larvae were also carried out by volunteers following a training workshop by Buglife.
Sites habitat management works	• Scrub and ruderal clearance work carried out by volunteer groups at Edge Common, Cranham Common, Juniper Hill, Painswick Beacon and Sheepscombe Common – all known Rugged Oil Beetle sites. • Electric fencing also installed by volunteers at Juniper Hill to enable the reintroduction of sheep grazing. • Pond fenced in the Myers Field area of Rough Bank nature reserve to enable continued grazing in the Myers Fields and Rough Bank itself – another known Rugged Oil Beetle site. • Cattle handling system installed to enable Painswick Beacon Conservation Group to continue cattle grazing at Painswick Beacon. • Scrape creation for Juniper at Rodborough Common likely to also provide new nesting opportunities for solitary bees (which Rugged Oil Beetles require) and for adult Rugged Oil Beetles. • The installation of a new water trough at Swift's Hill to allow for an increased number of livestock will help benefit Rugged Oil Beetle through more extensive grazing.
Technical advice provision	Site advice visits with landowners/land managers to Painswick Beacon and Rough Bank to discuss grazing management (including for Rugged Oil Beetle) and to Rodborough Common to discuss scrape creation for Juniper and Rugged Oil Beetle. A new Rugged Oil Beetle factsheet was also produced with Buglife.
Links made with other taxa / conservation work?	Scrub and ruderal clearance for Rugged Oil Beetle also aimed to benefit a range of other species: Edge Common – Duke of Burgundy Cranham Common – Lesser Butterfly Orchid and Adder Juniper Hill – Duke of Burgundy Painswick Beacon – Large Blue Sheepscombe Common – Large Blue Scrape creation at Rodborough Common initially identified for Juniper but was also aimed at providing new nesting opportunities for solitary bees (which Rugged Oil Beetles require) and for adult Rugged Oil Beetles.

	Rugged Oil Beetles are nest parasites of solitary bees but exact host species remain unknown. Survey work carried out by Buglife at five known Rugged Oil Beetle sites aimed to help whittle down the possible host species. This work identified 9 possible bee hosts although further research is still required (see 'Other results documented' below). Surveys added further anecdotal evidence to the need for a mosaic habitat with longer swards/tussocks as well as areas of bare earth.
Wider engagement & advocacy activities?	• Volunteer training workshops on how to identify and survey for Rugged Oil Beetles were run with Buglife in 2017, 2018, 2019 and 2020 (via Zoom followed up with field visits). Attended by a total of 102 people and resulted in a number of people getting involved with surveys. • A further workshop in 2021 also run by Buglife focused on identifying and surveying for the triungulins – Rugged Oil Beetle larvae. This was attended by 5 people and was found to be another very useful way of surveying for Rugged Oil Beetles as it extends the survey season into the spring/summer and also allowed us to identify sites where previously adults hadn't been found. • A talk on Rugged Oil Beetles was given as part of the Field Studies Council's 'Virtual Meet Ups' programme in 2020. This was attended by over 90 people and is still available to watch on FSC's YouTube channel. • In addition, Buglife produced a recorded training workshop on Oil Beetles in order for people to learn how to identify and survey for all five species of UK oil beetle. This is on their website and YouTube channel. • An article on our work for both Rugged Oil Beetle and Rock-rose Pot Beetle was written for the Proceedings of the Cotteswold Naturalists Field Club. Other articles were also written covering our work for species including the Rugged Oil Beetle.
BftB results obtained:	
Recorded Distribution (in BftB focal areas)	Prior to the BftB surveys, the beetle was known from 8 sites in the Cotswolds (Figure 1). BftB surveys have since increased the number of Cotswold sites to 20 (Figure 2). Another 3 sites were identified outside of the Cotswold AONB by volunteers. (A further 3 sites have also been identified by members of the public but not fully surveyed.) The majority of these new sites were discovered via adult beetle surveys, with one identified from triungulin surveys in spring/summer 2021. No adults had been found at this site in winter 2020. Triungulin surveys at Rodborough Common also confirmed the continued presence of Rugged Oil Beetles as no adult beetles had been found in winter 2020.
Recorded Abundance of species populations	The highest abundance of Rugged Oil Beetles were found at Painswick Beacon and a privately owned site near Miserden. A total of 143 and 140 beetles were counted on surveys at these sites respectively in 2020. Other notable results included at top count of 90 at Juniper Hill in 2018 and 3 found at Bull's Cross – a site currently undergoing restoration grazing and scrub removal.

Other results documented?	Olds, L. 2020. 'An investigation into the potential hosts of Rugged Oil Beetle (*Meloe rugosus)* in Gloucestershire.' Buglife report for Limestone's Living Legacies. *"A total of 34 solitary bee species were recorded during the surveys across five study sites in the Cotswolds AONB. Of these, 9 species are potential host species of Rugged oil beetle in the Cotswolds AONB. Some caution needs to be taken when interpreting the results of this study, however, since the presence of these species on known Rugged oil beetle sites and/or within known areas of Rugged oil beetle adult activity does not categorically prove that these bee species are hosts. Determining this is difficult but it is hoped that the results of this study will at least provide a starting point for further investigation and narrow down the number of potential host bee species. Further survey work is evidently needed to further explore the potential hosts of Rugged oil beetle in the Cotswolds AONB and elsewhere in England and Wales"*
Species Recovery Curve progress made	Species recovery curve score moved from 2 to 6: Recovery solutions such as scrapes and targeted grazing trialled.
Recommendations for future work:-	Further survey work required to further explore the potential host bee species of Rugged Oil Beetle. Research (Master's project?) into the association between adult Rugged Oil Beetles and vegetation height to add weight to the anecdotal evidence that the beetles require tussocks/patches of longer vegetation as well as shorter turf and bare soil. Keep an eye on grazing levels at sites such as Rough Bank, Cranham Common and Painswick Beacon to make sure a mosaic of shorter turf, bare soil and tussocks are retained. Continued survey work at selected sites (tbc) to monitor the populations in response to grazing. Research (Master's project?) into the link between adult population sizes and the availability of early spring flowers. Anecdotal evidence that sites with few early spring flowers have the smaller populations, whereas sites with larger populations have good coverage of early spring flowers and in turn lots of triungulins found. Is this a limiting factor?

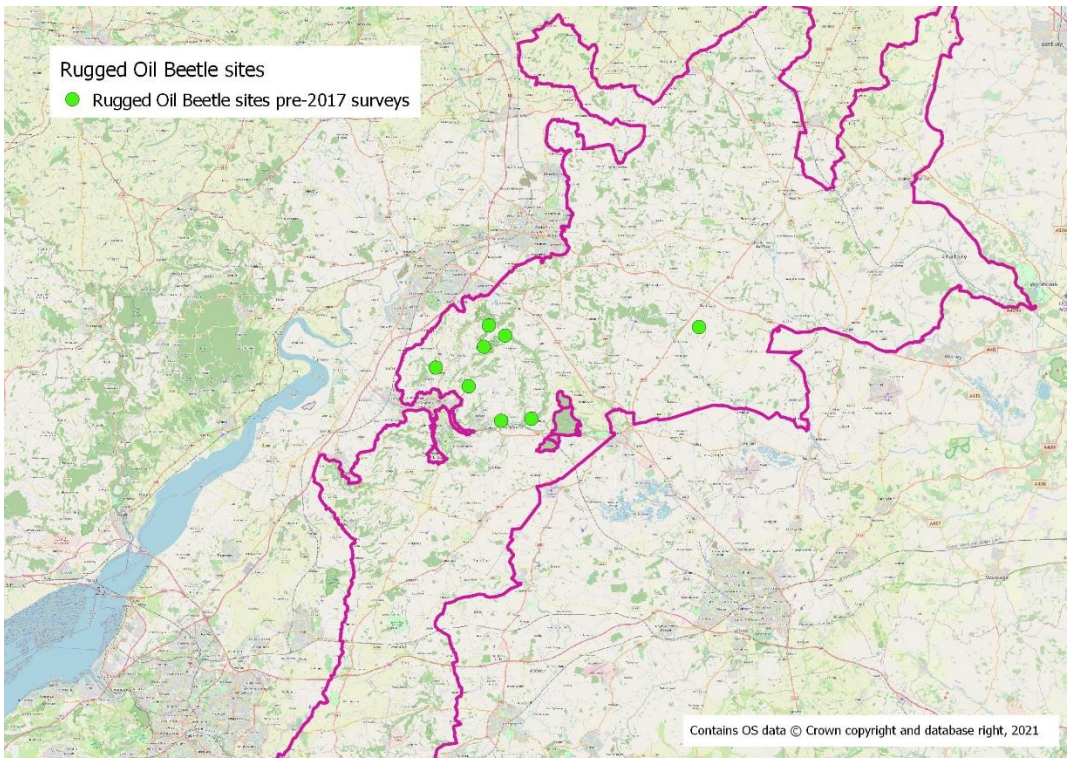

Figure 1. There were eight known Rugged Oil Beetle sites within the Cotswolds, prior to the 2017 BftB surveys starting, mostly in the Stroud Valleys area.

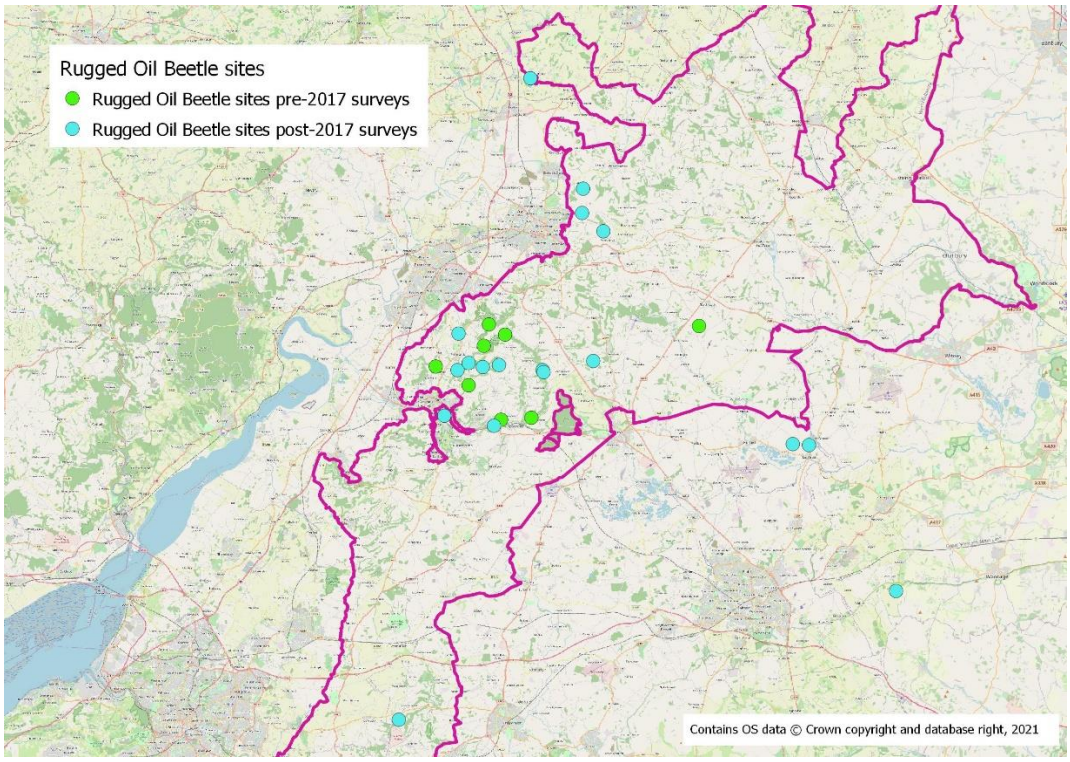

Figure 2. BftB surveys discovered the beetle at a further 12 sites in the Cotswolds and three sites outside the Cotswolds AONB boundary. (A further 3 sites were also identified by members of the public but not fully surveyed.)