Thames Valley Environmental Records Centre

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South Oxfordshire & Vale of White Horse Joint Local Plan 2041 Habitats & Species Trends

June 2023

Clockwise L-R: Yellowhammer, Chalk Hill Blue, White Helleborine, Ragged Robin. Credit: Martin Gascoigne-Pees & Brian Walker

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1.1 Quality Management

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1.2 Liability

1.2.1 This report has been prepared for use by South Oxfordshire District Council and the Vale of White Horse District Council and no other party may rely on the contents of the report. No liability is accepted by Thames Valley Environmental Records Centre for any use of this report, other than for the purposes for which it was originally prepared and provided. No warranty, express or implied, is made as to the advice in this report. The content of this report is partly based on information provided by third parties, which unless otherwise stated, has not been independently verified by TVERC.

1.3 Feedback

1.3.1 If you have any feedback on this project, please email tverc@oxfordshire.gov.uk

Figure 1: Bluebells in High Wood. Credit: Des Blenkinsopp (CC BY-SA 2.0).

2 Introduction

2.1.1 South Oxfordshire and Vale of White Horse District Councils are working together to produce a Joint Local Plan that will guide development in the districts to 2041. The councils are keen to expand their policy coverage to maximise support for nature recovery, with a key part of the emerging joint local plan vision being: "for this to be a place where nature is thriving, and nature reserves are no longer isolated pockets".

2.1.2 The councils have commissioned TVERC to provide evidence on habitats and species trends in South Oxfordshire and Vale of White Horse to inform and support appropriate policy approaches in the Joint Local Plan.

2.1.3 TVERC is a self-funding not for profit organisation that collects, collates and analyses environmental data in Berkshire and Oxfordshire. It is part of a national network of environmental record centres and is accredited by ALERC (Association of Local Record Centres).

2.1.4 In this report we describe and discuss the results of our analysis of recent changes in the quantity and quality of the habitats most important for wildlife within the two districts.

3 Non-Technical Summary

3.1 Biodiversity Data

3.1.1 Biodiversity data comes in many forms. However, in this report, we use only species and habitat or land cover data. The latter is derived mainly from analysis of satellite or aerial imagery that assigns a habitat or land cover to individual parcels of land that may be as small as 25m^2. Results of physical surveys of the habitat on the ground also augment some of this information. This kind of data allows us to know how much of a particular habitat, say grassland, is present.

3.1.2 Species data consists of records of wildlife (plants, animals etc.) observed at a particular place on a particular date. TVERC holds 1.3 million such records for South and Vale. Some records date back to the 18th century, but most are modern, post 1960. The challenge faced has been to choose sets of species records that allow us to understand both about how well individual species are faring, but also more generally about the health of the natural environment in South and Vale.

3.2 Data Selection Principles

3.2.1 Below are the six criteria that were used to select data sets for this project:

1. Minimal recording bias. That is, sets of records collected and analysed using the same methodology and that cover all or a genuinely random selection of areas in South and Vale so that conclusions drawn can be applied to the whole area.
2. Sufficient records to allow statistically significant trends to be found.
3. Collection over a long period; data either collected continuously or over several "snapshots".
4. Good quality data whose changes over time are likely linked to the quality and quantity of the natural environment in South and Vale, and whose prospects may be influenced by local decisions.
5. Data that will continue to be collected with the same methodology into the future.
6. Data that allows a comparison with national trends.

3.3 Choice of data

3.3.1 Many land-cover, habitat and species data sets were evaluated against the above criteria, and land cover, urban extent, woodland, bird and butterfly data were selected for study.

3.4 Changes in Land Cover

3.4.1 To assess how land is used in South and Vale now and how that has changed, we selected the three data sets that covered change in land cover, boundaries of built-up areas and woodland areas. These datasets cover several snapshots in time of the whole country, with good quality data and coverage of the two districts.

3.4.2 They cover different time periods and the raw data and analysis techniques to produce each set was different. It therefore was not possible to make direct comparisons between them. However, we could analyse land cover changes within individual data sets for the two districts, for Oxfordshire as a whole and for England.

3.4.3 This data showed changes in the land cover in the two districts are as follows:

- South Oxfordshire and Vale of White Horse have both seen around a 30% increase in built-up area over the periods studied, which is greater than Oxfordshire & England.
- Woodland and tree cover in both South and Vale has increased since 1995. This is broadly in line with or perhaps slightly greater than the national trend but slightly less than that for Oxfordshire.
- The growth of built up and wooded areas in both districts has been at the expense of grassland.
- South Oxfordshire and Vale have lost 8.5% and 6.5% respectively of Grassland land cover to Urban and Woodland land cover from 1990-2015.
- The loss in South Oxfordshire is greater than for both Oxfordshire and England, while loss in the Vale of White Horse is in line with national trends, but greater than Oxfordshire.

Figure 2: Chalk Grassland in Oxfordshire. Credit: Chiswick Chap.

3.5 BTO Breeding Bird Survey

3.5.1 The British Trust for Ornithology (BTO) Breeding Bird Survey (BBS) was launched in 1994 and is the main scheme for monitoring population changes of the UK's common and widespread breeding birds. It involves thousands of birdwatchers conducting standardised annual bird counts on randomly located 1km Ordnance Survey grid squares. Three annual survey visits are made to each site, one reconnaissance visit and two bird recording visits. Volunteers record all birds they see or hear as they walk their survey routes.

3.5.2 We used this data to calculate trends in spatial coverage (the area a species is recorded within) during the duration of the survey. In particular, the percentage change in coverage 1994 – 2021 was calculated to identify those species doing particularly well or particularly badly.

3.5.3 Our analysis showed that:

- Most species have not shown significant increases in their distribution.
- Seven species are now found more widely than before: Red Kite, Buzzard, Raven, Goldfinch, Chiffchaff, Blackcap and Canada Goose. One of these is a farmland indicator (Goldfinch) and two of these are woodland indicators (Chiffchaff, Blackcap). These are all species of Least Conservation Concern.
- Fifteen species are now found less widely than before, and seven of these are farmland indicators: Starling, Greenfinch, Yellowhammer, Kestrel, Stock Dove, Lapwing and Turtle Dove. Two of these are woodland indicators: Willow Warbler and Marsh Tit.

Figure 3: Turtle Dove *Streptopelia turtur* perched on a branch. This species has not been recorded by the BTO Breeding Bird Survey in South or Vale since 2014. Credit: Brian Walker.

3.6 Butterfly Conservation Data

3.6.1 TVERC hold records collected by Butterfly Conservation between 2015 and 2020. These records are mainly from regular surveys such as the UK Butterfly Monitoring Scheme (UKBMS) transects, the Wider Countryside Butterfly Survey, timed counts and species-specific surveys by local groups. However, it also contains casual records. To minimise the influence of these latter, sporadic and sometimes lower quality records, only records from the 204 1km squares where recording had occurred in each of the six years were analysed.

3.6.2 Six years isn't long enough to discern useful changes in butterfly distributions. So, we took this data as a recent "snapshot" and compared it with two previous snapshots published in the State of Butterflies in Berkshire, Buckinghamshire and Oxfordshire (2005). This gave us three views: 1987-1992, 1995-2000 and 2015-2020.

3.6.3 We concentrated our analysis on uncommon species that are dependent on either grassland or woodland as common species that always occupy most of South and Vale can't show us any changes in their distribution. We also compared the trends we observed to those from a national context using the 2022 State of Butterflies report.

3.6.4 We found:

- Butterfly species are declining in number and range across the country.
- We see this trend for grassland species in South and Vale, though a few species ranges are increasing.
- Some woodland species in South and Vale appear to be doing slightly better than nationally.

Figure 4: Silver-washed fritillary *Argynnis paphia* on a flower. Credit: Martin Gascoigne-Pees.

3.7 Discussion

3.7.1 **While life on earth is dynamic, human impact has reduced levels of biodiversity and increased the rate of species extinction.**
In the UK, this is reflected in the findings of the most recent State of Nature report, which found a 13% decline in wildlife since 1970. Our analysis explores this biodiversity loss and some of its causes: urbanisation, changes in farmland management and changes in woodland management.

3.7.2 Across England, we show that urban areas and tree cover are expanding at the expense of grassland. This may relate to the country-wide 59% drop in farmland bird numbers despite measures to protect these species, along with a 28% drop in woodland bird numbers. Long-term patterns for England's butterflies show 76% of species have decreased their ranges, while only 24% have increased.

3.7.3 The results of our analysis of species and habitats in South and Vale mostly reflect these country-wide trends. Considering the bleak national picture, we should be concerned by instances where South and Vale shows a relatively greater loss of habitats and species, while positive comparisons could serve as examples of how we can protect and restore biodiversity across the country.

3.7.4 We found that urban areas are expanding proportionately more in the two districts than in Oxfordshire or England, along with some increase in woodland land cover. Most of this growth caused the loss of grassland areas, which is probably due to human population pressure and tree-planting programmes.

3.7.5 Urban land cover increases as the human population increases, and especially in wealthier regions, start to migrate out of cities. The region between London and the Midlands has been identified as one of the largest clusters where this "sprawl" has occurred in Europe. We are losing species from these areas as their habitats are destroyed or fragmented. So, we should be concerned that in South and Vale, more houses are planned to be built, and this will reduce the grassland areas further.

3.7.6 Grassland has also been described as the "most suitable" land to plant trees on, and funding for tree planting is much higher and more readily available than for grassland conservation. There are a few different reasons for this increase including the post-war drive to plant trees, high economic value of plantations, and the close ties between trees and fighting climate change.

3.7.7 We should be concerned by these losses, as grassland supports lots of species, and helps keep carbon in the ground. This may have caused the ranges of grassland butterflies in South and Vale to shrink, which is made worse by widespread intensive farming.

3.7.8 Grasslands can support more species than forests, yet they are the least protected among European ecosystems. They are also important for carbon storage. Restoring species-rich grassland from abandoned farmland can help keep carbon in the ground and is often better than turning this land into forest.

Figure 5:

(L): Green Hairstreak *Callophrys rubi* perched on a stalk. Credit: Hellen Miller.

(R): Brown Hairstreak *Thecla betulae* on a flower. Credit: Brian Walker.

3.7.9 This loss of grassland may be related to the decreases in grassland butterfly species seen locally and nationally. Across South and Vale five of the eleven grassland species in our analysis have decreased in the time between 2000 and 2020. Three of these, Dark Green Fritillary, Green Hairstreak and Silver-spotted Skipper, increased between 1987 and 2000. Many butterfly species require several nearby patches of habitat, which they use at different times. This means that if there are not enough connected patches of habitat, they could be lost from the local area. So, they are likely to be badly affected by intensive farming, as this reduces connectivity between patches.

3.7.10 Intensive farming has also caused damage and loss to grasslands, as field edges no longer provide species with food and habitat. This has led to decreases in bird species that live on farmland and suggests that we need faster progress in transforming intensive farming with more wildlife-friendly farming practices.

Figure 6: A rapeseed field being sprayed using a tractor. Credit: Brian Robert Marshall.

3.7.11 Farming practices have become much more “productive” since the 1960s. This has led to there being less spilt or dropped seeds for birds to eat and less wildlife-friendly habitat on field edges. Increased use of chemical pesticides and fertilisers has significantly reduced invertebrate numbers, which are eaten by almost all farmland birds at some stage of their lives.

3.7.12 In South and Vale, seven of the eight farmland birds that show trends have decreased: Starling, Greenfinch, Yellowhammer, Kestrel, Stock Dove, Lapwing and Turtle Dove. Changes in farming practices are linked to declines of these species. The shift toward feeding cattle indoors has reduced the amount of short, grazed grassland for Starlings to find invertebrates in, and there is less spilt seed and scrub nest sites for Turtle Dove.

3.7.13 However, if we encourage less intensive farm practices, such as grass grazing, reduced seed-clearing and restoring wildlife-friendly habitats on field edges, species may recover. The recovery of Red Kite, Buzzard and Raven across South and Vale after DDT was banned in 1986, and the Red Kite reintroduction programme in the Chilterns, shows that if habitat conditions are right, species will return.

3.7.14 Even though woodland land cover has increased in South and Vale, we have not yet seen this benefiting populations of bird and butterfly species. It takes time for newly planted woodland to reach high levels of biodiversity, and if trees are not planted in suitable locations, they will not benefit many species.

3.7.15 Research has found that broadleaved plantations can take up to 80 years to reach biodiversity levels approaching those found in ancient woodland. However, this is only if it is planted next to existing ancient woodland, showing that tree planting is beneficial only with “the right tree in the right place”. Only 13% of the UK is forested, and rates of tree planting and woodland creation are slowing down, which suggests that the country is still far behind post-war woodland cover.

3.7.16 In South and Vale, the declining distribution of half of our woodland birds, Marsh Tit and Willow Warbler, suggest that the small gains in woodland area have not led to recovery of woodland biodiversity. Their decline may also be caused by a decline in traditional woodland management which has reduced the availability of their insect prey in the lowest forest layer.

Figure 7: (L): Marsh Tit *Poecile palustris* on a branch. Credit: Martin Gascoigne-Pees. (R): Willow warbler *Phylloscopus trochilus* perched on a branch. Credit: Steve Garvie (CC BY-SA 2.0). These species have declined by 11% and 23% respectively in South and Vale.

3.7.17 The overall state of our woodland butterflies is more positive, with five of seven species showing recent increases. However, two of these are hairstreak butterflies, for which there has been active and targeted conservation work in the area. Another species increasing, Silver-washed Fritillary, appears to have colonised areas of semi-wooded scrub, or areas where conifers have been removed to let light into existing broadleaved woodland. This suggests that suitable habitat management as well as woodland creation is needed to help species recover.

3.7.18 There are far fewer species in urban areas than in surrounding habitats. However, there are a few that have adapted to the warmer temperatures and artificial food sources.

3.7.19 Increases in urban land cover causes habitat fragmentation and loss of species diversity. Swifts, a species that breeds almost entirely in the built environment, has declined by 19% in South and Vale. A reduction in suitable nest sites, along with climate change causing wetter summers with less invertebrate prey may be reasons for their decline. The lack of nest sites can be addressed by providing nest boxes in buildings that would not otherwise be suitable for swifts.

Goldfinch, a farmland indicator, as well as Blackcap and Chiffchaff, woodland indicators, have shown to be able to adapt to urban parks and gardens. Goldfinch have benefited from reduced competition with Greenfinch, and deliberate bird feeding. Blackcap and Chiffchaff are both migrants that are now starting to spend the winter in the UK. Research shows that Blackcaps that stay in UK gardens have “longer bills and more rounded wingtips”, a signal of their varied diet and reduced need to migrate.

3.7.20 Climate change may also be helping some species spread, where suitable habitat is already present.

3.7.21 After farming, climate change is the second biggest cause of UK biodiversity changes. As most UK butterfly species have their northern, but not southern range boundaries in the UK, climate change may have positive as well as negative impacts on their distribution here. Species that breed more than once a year are more likely to be able to change the timing of their life cycle events to keep pace with climate change. In South and Vale, this may help explain the increase of Small Blue, Adonis Blue and Brown Argus, which can breed multiple times a year. Similarly, those Blackcap and Chiffchaff that migrate have changed the timing of their migration to arrive over 10 days earlier than usual in the UK.

3.7.22 Little Egret, which was first recorded by the BTO breeding survey in 2014 (South) and 2015 (Vale) may be able to survive here as our winters get milder. However, we should not downplay the need for habitat to be present for successful expansion to occur.

3.8 Conclusion

3.8.1 We found that across South and Vale, biodiversity has been in decline. More grassland has been lost to built-up areas here than across Oxfordshire and England as a whole. This is concerning, as grassland is an important habitat for many species that inhabit our districts and is an important tool to tackle climate change. There has been a slight increase in woodland land cover, however we still have only a fraction of woodland we used to, and woodland species are not doing as well as these gains might suggest. This shows that we need to restore and protect our grasslands alongside protecting and managing current woodland with careful targeting of new wooded areas to get the best outcomes for nature. With the continued loss of land to the built environment likely, the measures used to minimise its impacts and compensate for the losses to wildlife will be a key tool in turning these declining trends for wildlife around.

4 Main Report

4.1.1 This ends the Non-Technical Summary. The following sections describe in more detail the data, analysis, results and what this means for wildlife in the two districts.

5 Changes in Land Cover

5.1.1 Description

5.1.2 To assess changes in land cover we identified three sources of data to use that cover England as well as the two districts of South and Vale. These were UK Centre for Ecology and Hydrology's (UKCEH) land cover change maps, Office for National Statistics (ONS) Built-up Areas boundaries and the Forestry Commission's National Forest Inventory (NFI) woodland map (Table 1).

5.1.3 The UKCEH land cover change maps, directly compare the land cover in the UK in 1990 and 2015 (Rowland , Marston, Morton, & O'Neil, 2020). These are based on satellite imagery and CEH used the same methods to produce the revised 1990 map and the 2015 map, which allows for a direct comparison between the two years (unlike land cover maps from other years). To classify the land, they resampled Landsat-5 (1990) and Sentinel-2 (2015) satellite data. Land cover classes are simplified into 6 classes from a longer list of 21 classes (based on the UK Biodiversity Action Plan broad habitat definitions) to Woodland, Arable, Grassland, Freshwater, Built-up Areas and Other.

5.1.4 The ONS produced a map of boundaries for England and Wales as of 27 March 2011 and again in December 2022 for Great Britain to support the National Census analysis. The built-up area boundaries are generalised and were created using an automated approach based on grid squares that classifies land cover data contained in the OS MasterMap® Topography Layer.

5.1.5 The National Forest Inventory (NFI) woodland map covers all forest and woodland area over 0.5 hectares with a minimum of 20% canopy cover, or the potential to achieve it, and a minimum width of 20 metres. This map is updated annually and uses changes in Satellite and Aerial imagery along with new planting information received from grant schemes as well as using the sub-compartment database covering the Forestry England estate.

Table 1: The datasets we chose to assess land cover change in South and Vale.

Data set	Dates	Data Source	Information
UKCEH land cover change maps raster dataset	1990 and 2015	Satellite imagery	Broad habitat classes (grassland, tree cover, arable)
The ONS Built-up Areas boundaries	2011 and 2022	OS Information	Amount of built-up area
National Forest Inventory (NFI)	2010 and 2020	Satellite/aerial imagery, new planting information for the current financial year	Area of woodlands greater than 0.5 hectares with a minimum 20% canopy cover

5.1.6 Analysis

5.1.7 We used the UKCEH land cover change maps raster dataset to display the transition between land cover classes between 1990 and 2015 by comparing the class of each pixel from 1990 and 2015 as frequency data. We used a similar method to Tom White to format the data (White, 2020). The data is formatted as a 5-band raster, we used band 1 (land cover classes in 1990) and band 2 (land cover classes in 2015) with a class for each 25m^2 pixel. We then calculated the area of change in each of the 6 simplified land cover classes: for England, Oxfordshire, South Oxfordshire District and South and Vale District from 1990 to 2015.

5.1.8 The ONS Built-up Areas boundaries GIS shapefiles for 2011 and 2022 were compared using the ArcMap GIS tool and used to calculate the amount of change in hectares of Built-up Area in England, Oxfordshire, South Oxfordshire District and South and Vale District from 2011 to 2022.

5.1.9 We analysed the National Forest Inventory (NFI) woodland maps for 2010 for Great Britain and 2020 for England using ArcMap. We filtered the datasets to only include records they categorise as woodland. We used this to calculate the amount of change in hectares of Woodland in England, Oxfordshire, South Oxfordshire District and South and Vale District from 2011 to 2022.

5.1.10 Results

5.1.11 From analysing the CEH Landcover Change dataset for 1990 to 2015 the results show the area defined as Built-up has net increased by more in the two districts than in Oxfordshire and England (Table 2).

5.1.12 Results from analysing the ONS Built Up Areas GIS shapefiles from 2011 and 2021 showed that there has been a larger increase in the area defined as built up in the two districts than in the whole of Oxfordshire and England (Table 3).

5.1.13 From analysing the CEH Landcover Change dataset for 1990 to 2015 the results also show that the net area defined as Woodland has increased by more in the two districts than in England, but less than in Oxfordshire as a whole (Table 4). The woodland classification includes areas of tree cover and not just woodland.

5.1.14 Analysis of National Forest Inventory from 2010 and 2020 show that the area defined as Woodland has increased by less in the two districts than in Oxfordshire as a whole and is comparable to increases seen across England (Table 5).

5.1.15 From analysing the CEH Landcover Change dataset for 1990 to 2015, the results show that grassland cover has decreased in both South Oxfordshire and Vale of White Horse, and this is proportionately greater than the decreases seen across both Oxfordshire and England (Table 6).

5.1.16 From analysing the CEH landcover change dataset, the results show that more grassland has been lost to built-up between 1990 and 2015 in the two districts than in Oxfordshire and England (Table 7).

5.1.17 Our analysis of the CEH dataset also finds that more grassland has been lost to woodland areas across the two districts between 1990-2015 than in Oxfordshire and England (Table 8).

Table 2: Change in built-up area between 1990 to 2015, based on CEH Landcover change dataset.

	1990 total Built-Up Area	Built-Up Area Change 1990 to 2015	Built-Up Area % Change 1990 to 2015
South Oxfordshire	3,828 ha	+1,183 ha	**+30.9%**
Vale of White Horse	3,384 ha	+996 ha	**+29.4%**
Oxfordshire	16,998 ha	+3,386 ha	+20.0%
England	1,158,967 ha	+263,598 ha	+22.7%

Table 3: Change in built-up area between 2011 to 2022, from ONS data.

	2011 total Built-Up Area	Built-Up Area Change 2011 to 2022	Built-Up Area % Change 2011 to 2022
South Oxfordshire	4,877 ha	+ 1,307 ha	**+26.8%**
Vale of White Horse	4,278 ha	+1,358 ha	**+31.7%**
Oxfordshire	20,188 ha	+5,130 ha	+25.4%
England	1,375,293 ha	+200,168 ha	+14.5%

Table 4: Change in woodland area between 1990 to 2015, based on CEH Landcover change dataset.

	1990 total Woodland	Woodland Change 1990 to 2015	Woodland % Change 1990 to 2015
South Oxfordshire	7,308 ha	+1,059 ha	**+14.5%**
Vale of White Horse	3,007 ha	+519 ha	**+17.2%**
Oxfordshire	16,211 ha	+3,437 ha	+21.2%
England	1,137,623 ha	+137,005 ha	+12.0%

Table 5: Change in woodland area between 2010 to 2020, based on NFI Woodland maps.

	2010 total NFI Woodland over 0.5ha	NFI Woodland Change 2010 to 2020	NFI Woodland % Change 2010 to 2020
South Oxfordshire	9,195 ha	+197 ha	**+2.1%**
Vale of White Horse	4,597 ha	+126 ha	**+2.7%**
Oxfordshire	23,411 ha	+797 ha	+3.4%
England	1,290,000 ha	+30,000 ha	+2.3%

Table 6: Change in arable and grassland area between 1990 to 2015, based on CEH Landcover change dataset. We included arable land cover in this table to account for swapping between the two land classes due to crop rotation.

	1990 total Arable and Grassland	Arable and Grassland Change 1990 to 2015	Arable and Grassland % Change 1990 to 2015
South Oxfordshire	55,937 ha	-2,249 ha	**-4.0%**
Vale of White Horse	51,083 ha	-1,731 ha	**-3.4%**
Oxfordshire	225,503 ha	-7,395 ha	-3.3%
England	10,625,323 ha	-137,005 ha	-3.7%

Table 7: Change in grassland to built-up areas between 1990 to 2015, based on CEH Landcover change dataset.

	1990 total Grassland	Change to Built-Up Area 1990 to 2015	% Change to Built-up 1990 to 2015
South Oxfordshire	23,303 ha	-1,088 ha	**-4.7%**
Vale of White Horse	21,216 ha	-929 ha	**-4.4%**
Oxfordshire	90,618 ha	-3,777 ha	-4.2%
England	5,849,372 ha	-197,222 ha	-3.4%

Table 8: Change in grassland to woodland areas between 1990 to 2015, based on CEH Landcover change dataset.

	1990 total Grassland	Change to Woodland Area 1990 to 2015	% Change to Woodland 1990 to 2015
South Oxfordshire	23,303 ha	-889 ha	**-3.8%**
Vale of White Horse	21,216 ha	-455 ha	**-2.1%**
Oxfordshire	90,618 ha	-2,414 ha	-2.7%
England	5,849,372 ha	-175,954 ha	-3.0%

6 BTO Breeding Bird Survey

6.1.1 Description

6.1.2 The BTO Breeding Bird Survey (BBS) was launched in 1994 and is the main scheme for monitoring the population changes of the UK's common and widespread breeding birds. It involves thousands of birdwatchers conducting standardised annual bird counts on randomly located 1km grid squares of the Ordnance Survey National Grid. Three survey visits are made to each survey square per year, one reconnaissance visit and two bird recording visits. Volunteers record all birds they see or hear as they walk down their transect routes. BTO compile and analyse the data to create an annual report of population trends in the UK's breeding birds.

6.1.3 Analysis

6.1.4 Between 1994 and 2021 58 1km grid squares have been sampled in South and Vale, growing from 22 in 1994 to 46 in 2021.

6.1.5 The data was transformed to show the occupancy of each species in each surveyed 1km square each year. Then, it was summarised to count the number of 1km squares each species had been recorded in each year. To standardise this, it was divided by the total number of 1km squares sampled that year. This gives an occupancy proportion for each species for each year. This was used to calculate a rolling 10-year average occupancy for each species. A linear regression in R was performed for each species to see if there were any significant changes in occupancy over the last twenty years (R: A language and environment for statistical computing, 2022).

6.1.6 The largest increases and decreases were identified and compared to the 2021 BTO Breeding Bird Survey Annual Report (Harris, et al., 2022).

6.1.7 Results

6.1.8 Between 1994 and 2022, 139 Species have had one or more recorded sightings during the BTO Breeding Bird Survey of 1km squares within South and Vale.

6.1.9 Over that time 7 species have been recorded more regularly in more recent years with a 10% or greater increase in the number of 1km squares they are recorded in each year. These are all species of the least conservation concern. The largest increase has been seen in Red Kite, 60%, Buzzard 40% and Chiffchaff 30%. There are two of these species that are included in the DEFRA woodland bird index, and only one in the farmland bird index.

6.1.10 There have also been 15 species that have been recorded less frequently more recently, with a 10% or more decrease in the number of 1km squares they are recorded in each year. Most of these are either Red or Amber list species of conservation concern. They include Turtle Dove that was last recorded more than 10 years ago. The largest decreases have been seen in Starling (-45%) Cuckoo (-29%), Greenfinch (-29%), Mistle Thrush (-24%) and Willow Warbler (-23%). There are two of these species that are included on the DEFRA woodland bird index, and seven in the farmland bird index.

6.1.11 The results were also compared to the England section of the BTO BBS Breeding Bird Survey report 2021, to establish if the trends were being seen at a larger scale (Harris, et al., 2022). Their corresponding results are shown below. Generally, there was a good correspondence with the national picture showing similar species trends over the 25 years.

Figure 8 Lapwing *Vanellus vanellus* on grass. This species has declined by 11% in the two districts. Credit: Martin Gascoigne Pees

Table 9: BTO Breeding Bird Survey species with the largest positive occupancy trends within South and Vale.

Species	**Conservation Concern**	**Bird Indicator Group**	**BTO BBS 25 Year Trend England (Shows change in index from 100 in 1994, * shows statistically significant)**	**1994-2003 S & V Average Occupancy**	**2012-2021 S & V Average Occupancy**	**Change in S & V Occupancy**
Red Kite	Green		+25,276*	15%	79%	+64%
Buzzard	Green		+220*	20%	59%	+39%
Chiffchaff	Green	Woodland Birds	+113*	56%	82%	+26%
Blackcap	Green	Woodland Birds	+157*	74%	86%	+12%
Goldfinch	Green	Farmland Birds	+148*	64%	76%	+12%
Raven	Green		+35	0%	10%	+10%
Canada Goose	Green		+82*	18%	28%	+10%

Table 10: BTO Breeding Bird Survey species with the largest negative occupancy trends within South and Vale.

Species	Conservation Concern	Bird Indicator Group	BTO BBS 25 Year Trend England (Shows change in index from 100 in 1994, * shows statistically significant)	1994-2003 S & V Average Occupancy	2012-2021 S & V Average Occupancy	Change in S & V Occupancy
Starling	Red	Farmland Birds	-61*	78%	33%	-45%
Cuckoo	Red		-71*	44%	14%	-29%
Greenfinch	Red	Farmland Birds	-66*	78%	49%	-29%
Mistle Thrush	Red		-45*	50%	25%	-24%
Willow Warbler	Amber	Woodland Birds	-48*	48%	25%	-23%
Swift	Red		-60*	44%	24%	-19%
Yellowhammer	Red	Farmland Birds	-33*	83%	65%	-18%
House Sparrow	Red		-13*	50%	32%	-18%
Kestrel	Amber	Farmland Birds	-26*	39%	22%	-17%
Pied/White Wagtail	Green		-17*	40%	24%	-15%
Stock Dove	Amber	Farmland Birds	+36*	53%	38%	-15%
Marsh Tit	Red	Woodland Birds	-44*	16%	5%	-11%
Lapwing	Red	Farmland Birds	-34*	32%	21%	-11%
Feral Pigeon	Green		-20*	19%	9%	-10%
Collared Dove	Green		-18*	48%	38%	-10%
Turtle Dove	Red	Farmland Birds	-96*	8%	0%	-7%

7 Butterfly Conservation Data

7.1 Description

7.1.1 Butterfly Conservation collated a set of butterfly records incorporating several different sources including UK Butterfly Monitoring Scheme (UKBMS) transects, the Wider Countryside Butterfly Survey, timed counts, and other casual observation data. The data covering South and Vale was investigated and found a substantial increase in the number of records from 2015. Therefore, we only used the records from 2015 to 2020 for analysis.

7.1.2 There have been previously detailed surveys of the butterflies of the area in 1987-1992 and 1995-2000. These were analysed and used to produce a book reporting on the status of butterflies across the three counties of Berkshire, Buckinghamshire and Oxfordshire (Asher, Bowles, Redhead, & Wilkins, 2005).

7.1.3 Butterfly Conservation also have recently published a report into the current trends of the UK's butterfly populations (Fox, et al., 2022). This found that of the four UK countries England's butterflies have fared the worst with a large negative change in distribution, especially affecting specialist species.

7.2 Analysis

7.2.1 From the 2015-2020 Butterfly Conservation records, we only looked at presence/absence signals (distribution) and omitted abundance information, due to time constraints. To reduce bias from increased recording effort, we only looked at squares with at least one record each year. This reduced the 1410 total 1k squares to 204 squares. We recorded each species in the dataset as either present or absent from each of the 204 squares, each year between 2015 and 2020.

7.2.2 Using this data, we created maps in ArcPro GIS tool for each specialist species that display the distribution of records in South and Vale over the 6-year time frame. We excluded generalist species, as most of them were present in all/most of the 204 squares sampled so we could not make any conclusions using our spatial coverage.

7.2.3 We also excluded certain specialist species:

- Essex skipper (grassland) – present in most of the selected 1k squares, greater coverage needed to discern any trends
- Small copper (grassland) – present in most of the selected 1k squares, greater coverage needed to discern any trends
- Common blue (grassland) – present in most of the selected 1k squares, greater coverage needed to discern any trends
- Marbled white (grassland) – present in most of the selected 1k squares, greater coverage needed to discern any trends
- Marsh fritillary (grassland) – Upper Thames Butterfly Conservation (UTBC) comment there have been unsanctioned releases beyond their natural spread

Figure 9: Adonis Blue *Polyommatus bellargus* perched on a grass stalk. Credit: Martin Gascoigne-Pees.

7.2.4 We compared these distributions to distribution maps of records taken from two surveys: 1987-1992 and 1995-2000 (Asher, Bowles, Redhead, & Wilkins, 2005). We also used anecdotes from more recent Upper Thames Butterfly Conservation (UTBC) species reports to help us understand the drivers of trends in each species (Upper Thames Butterflies, 2023).

7.2.5 To get a better picture of how trends in South and Vale sit in the wider national context, we extracted England species distribution trends from the 2022 State of Butterflies report (Fox, et al., 2022). Distribution trends are estimated by calculating the probability that each species was present in each 1km x 1km square. These probabilities are averaged across all 1km squares in England to give an annual occupancy index, which is then put into a logistic regression model (Fox, et al., 2022). The final England values are average 10-year distribution changes.

7.3 Results

7.3.1 On balance looking at changes to distribution within South and Vale, Woodland specialists are faring better than Grassland specialists. All woodland specialists in our analysis have either retained or expanded their distribution in South and Vale between 2000 and 2020, which mirrors the national trend (only purple hairstreak and white admiral are declining across England) (Table 12).

7.3.2 From our analysis of eleven grassland specialist species in the two districts, five have decreased in distribution between 2000 and 2020, two have a stable distribution and four have increased in distribution. This is better than the ten-year England average change, where ten have shrinking distributions. However, it is notable that of the five species that had early expansions, four have reduced their distributions since (Dark Green Fritillary, Duke of Burgundy, Green Hairstreak and Silver-spotted Skipper) (Table 11).

7.3.3 Tables 11 and 12 summarise the trends for each specialist butterfly species analysed within the districts of South and Vale.

- Early Trend: shows the change between the two 2005 Report surveys (1987-1992) and (1995-2000).
- Later Trend: shows the change between the 1995-2000 Report surveys and 2015-2020 data analysis.

Figure 10: Black Hairstreak *Satyrium pruni* on a flower bud. Credit: Martin Gascoigne-Pees.

Table 11: Specialist grassland butterfly species occupancy trends for South and Vale 1987 to 2020.

Grassland Species	Early SV Trend	Recent SV Trend	UK Conservation Status	England Ten-year average Distribution trend	Notes
Adonis Blue	Increased	Increased	Vulnerable	Decreased	Overall distribution is still small. Adonis blue is at the northernmost parts of its UK range, so its trends may be influenced by climate change.
Brown Argus	Increased	No change	Least Concern	No Change	Traditionally a calcareous specialist, recent expansions into agricultural margins may be facilitated by evolutionary change (selection on genetic variation) (Buckley, Butlin, & Bridle, 2012).
Chalk Hill Blue	No Change	No Change	Vulnerable	Decreased	Horseshoe Vetch planting effort (Bowles, Chalk Hill Blue, 2019 & 2020).
Dark Green Fritillary	Increased	Decreased	Near Threatened	Decreased	There has been a statistically significant national increase in abundance since 2016 (JNCC, 2022).
Dingy Skipper	No Change	Increased	Least Concern	Decreased	Areas of expansion are to nutrient poor/ruderal areas/brownfield sites, rather than calcareous grassland/meadow.
Duke of Burgundy	No Change	Decreased	Vulnerable	Decreased	Narrow ecological niche- both larvae & adults have specific habitat requirements (Hayes, et al., 2018).
Green Hairstreak	Increased	Decreased	Least Concern	Decreased	Five Hairstreaks Project (Butterfly Conservation, 2019).
Grizzled Skipper	No Change	Increased	Vulnerable	Decreased	New records appearing in Radley Lakes, containing unimproved grassland which is being managed for wildlife by the Radley Lakes Trust
Silver-spotted Skipper	Increased	Decreased	Vulnerable	Decreased	Loss from Berkshire Downs There has been a statistically significant national increase since 2016 (JNCC, 2022).
Small Blue	Decreased	Increased	Near Threatened	Decreased	
Wall	Decreased	Decreased	Endangered	Decreased	

Figure 11: Silver-washed fritillaries *Argynnis paphia* on a leaf. Credit: G Breadmore.

Table 12: Specialist woodland butterfly species occupancy trends for South and Vale 1987 to 2020.

Woodland Species	Early SV Trend	Recent SV Trend	UK Conservation Status	England ten-year average distribution trend	Notes
Black Hairstreak	No Change	No Change	Endangered	No Change	There has been a statistically significant national increase since 2016 (JNCC, 2022). Five Hairstreaks Project (Butterfly Conservation, 2019).
Brown Hairstreak	No Change	Increased	Vulnerable	No Change	Caution: UTBC report there have been unsanctioned releases. Five Hairstreaks Project (Butterfly Conservation, 2019).
Purple Emperor	No Change	Increased	Least Concern	Increased	Favours forest canopies, sometimes difficult to observe (Robinson M. , Purple Emperor, 2023).
Purple Hairstreak	Increased	No Change	Least Concern	Decreased	Early expansion may be influenced by increased recording, as is a hard species to see (Asher, Bowles, Redhead, & Wilkins, 2005). Five Hairstreaks Project (Butterfly Conservation, 2019).
Silver-washed Fritillary	Increased	Increased	Least Concern	No Change	There has been a statistically significant national increase since 2016 (JNCC, 2022).
White Admiral	Increased	Increased	Vulnerable	Decreased	
White-letter Hairstreak	Increased	Increased	Vulnerable	No Change	Conservation project started in 2015 to look for colonies & plant Wych Elm (Cuss, White-letter Hairstreak Project, 2016).

8 Discussion

8.1.1 **While life on earth is dynamic, one of the hallmarks of the Anthropocene is the heightened rate of species extinction** (Lewis & Maslin, 2015). Levels of biodiversity in the UK are falling, with the most recent State of Nature Report in 2019 reporting a 13% decline in biodiversity abundance between 1970 and 2016, which increases to 60% for 214 priority species analysed within the same timeframe (Hayhow, et al., 2019). Our analysis explores this biodiversity loss and some of its drivers: urbanisation, changes in farmland management and changes in woodland management.

8.1.2 The results of our analysis of species and habitats in South and Vale are broadly reflected in the trends for England as a whole. The expansion of built-up areas and tree cover in England is mirrored by loss of grassland, and distributions of bird and butterfly species are mostly shrinking.

8.1.3 Our analysis of land cover data shows that built up areas have been steadily expanding across England between 1990 and 2022 (Table 2 and 3). There have also been recent gains in tree cover and woodland across the country after historical declines (Table 4 and 5). Some of the expansion in built-up areas and tree cover in England has caused the loss of grasslands (Table 7 and 8).

8.1.4 The distribution of bird populations across England are shrinking, including among farmland and woodland indicators. Despite uptake of agri-environment schemes and other targeted conservation efforts, farmland bird indicator populations are still declining (59% since 1970), with a notable 98% decline in turtle dove numbers (Burns F. , et al., 2020). Similarly, across England woodland indicators have decreased by 28% since 1970, including a 94% decline in willow tit numbers (Burns F. , et al., 2020).

8.1.5 Among England's butterfly species with long-term distribution trends, 76% have decreased in distribution compared to 24% that increased (Fox, et al., 2022). Isolating species with statistically significant trends, 61% have decreased while only 17% have increased (Fox, et al., 2022).

8.1.6 Considering the bleak national picture, we should be concerned by instances where South and Vale shows a relatively greater loss of habitats and species, while positive comparisons could serve as examples of how we can protect and restore biodiversity across the country.

8.1.7 We found that urban areas are expanding proportionately more in the two districts than Oxfordshire or England, along with some growth in woodland land cover. Most of this growth was at the expense of grassland, likely due to deliberate afforestation and human population pressure.

8.1.8 Grassland is being lost to built-up areas through a combination of human population pressure, and socio-economic drivers of counter-urbanisation (migration from cities into rural areas) (Meyer & Turner II, 1992) (European Environment Agency, 2016) (Bosworth & Bat Finke, 2020). In the UK, the region between London and Midlands is one of the largest clusters of high urban-sprawl values in Europe (European Environment Agency, 2016). The current rate of increase in urban land cover is lower than earlier in the 20th century, so while current expansion is less dramatic, it still exacerbates the habitat loss and fragmentation that has already occurred (Ridding, Watson, Newton, Rowland, & Bullock, 2020) (Krauss, et al., 2010). We should therefore be concerned that in 2018, CPRE reported that 460,000 houses are planned to be built on land released from the green belt, including 5,500 houses in South Oxfordshire and 2,710 in Vale of White Horse (Campaign to Protect Rural England, 2018). Grassland is much easier to develop on than woodland, so more protection needs to be in place to reduce its exploitation by developers (South Oxfordshire District Council, 2015).

8.1.9 Grassland is also often deliberately afforested (Flack, Lukac, & Todman, 2022) (Veldman, et al., 2015a). This could be due to the much higher funding for woodland creation compared to grassland restoration, a consequence of the post-war afforestation drive, economic value of forestry, and the association between tree planting and reducing carbon emissions (Burrascano, et al., 2016) (Ares, Coe, & Uberoi, 2021) (Ciais, et al., 2008) (Nijnik, Pajot, Moffat, & Slee, 2012). In addition, improved grassland is considered to be the "most suitable" land for afforestation (Burke et al. 2020; Wilkes et al. 2020 in Flack, Lukac & Todman 2022). If incentives for grassland conservation are increased and diversified beyond capital grants, more grassland may be restored instead of afforested (DEFRA, n.d.).

Figure 12: (L) Marsh Helleborine *Epipactis Palustris* in flower. Credit: Julie Kerans (R) Ragged Robin *Lychnis flos-cuculi* in flower. Credit: Brian Walker.

8.1.10 This loss of grassland is concerning because it supports significant biodiversity and is a valuable but underrated carbon sink. This is reflected in the declines in grassland butterfly specialists, which is amplified by loss of connectivity due to agricultural intensification.

8.1.11 Grasslands have the worst conservation status among European ecosystems (Pe'er, et al., 2014). In England and Wales, 97% of enclosed unimproved grassland was lost between 1932 and 1984 (Fuller 1987 in Ridding, Redhead, & Pywell, 2015). They also support significant biodiversity, including many threatened species (Dengler, Janisova, Torok, & Wellstein, 2014) (Wilson, Peet, Dengler, & Partel, 2012) (Habel, et al., 2013). For example, 18.1% of Europe's endemic vascular plants are associated with grasslands, which is almost double that of forests (Hobohm and Bruchmann 2009 in Habel, et al., 2013). While trees are conceptually closely linked to carbon, restoring biodiverse semi-natural grassland from arable farmland can create an important soil carbon stock (Natural England, 2021) (Yang, Tilman, Furey, & Lehman, 2019). Therefore, viewing grassland as just "forest restoration" potential will lead to further degradation of biodiversity and carbon stocks (Veldman, et al., 2015b) (Poeplau, et al., 2011) (Conant, Paustian, & Elliott, 2001).

8.1.12 These grassland losses are likely to be linked with the decreases in grassland butterfly species across South and Vale. Five of the eleven grassland specialists in our analysis have experienced recent decreases in distribution. While we have not found blanket decreases, as are occurring at a national scale, three species that showed early increases are now decreasing, Dark Green Fritillary, Green Hairstreak and Silver-spotted Skipper (Fox, et al., 2022). By contrast, the national trend shows that after a substantial drop in the 1970s, the abundance of habitat-specialist butterflies has been fluctuating (JNCC, 2022)(Figure 13).

8.1.13 Species that conform to a metapopulation structure are especially susceptible to habitat fragmentation as well as loss, as they require multiple habitat patches to support them, even if they are not all simultaneously occupied (Hanski & Thomas, 1994). Around half of the UK's butterfly species are structured as metapopulations, so if they do not have access to enough quality patches, they are at risk of local extinction (Hanski & Thomas 1994 in Hill, Thomas & Lewis 1996) (Saccheri, et al., 1998) (Schtickzelle, Mennechez, Baguette, & Mennechez, 2006) (Ockinger, et al., 2010). This risk is heightened by agricultural intensification, which has resulted in a less-well connected mosaic of suitable butterfly habitat (Perfecto & Vandemeer, 2010) (Davies, Wilson, Bereton, & Thomas, 2005).

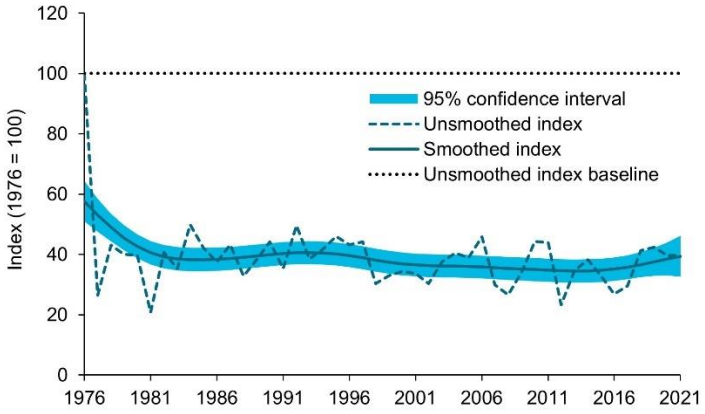

Figure 13: Trends in abundance of habitat specialist butterflies in the UK, 1976 to 2021. Reproduced from JNCC, 2022.

8.1.14 Intensive agricultural practices have also contributed to grassland degradation through loss of arable field margins, reducing habitat connectivity in the wider landscape matrix. This has led to loss of farmland bird species and reflects the need to prioritise wildlife-friendly farming.

Figure 14: Vale of White Horse landscape. Credit: IcknieldRidgeway (CC BY-SA 4.0).

8.1.15 The drive towards productivity in farming has also played a role in making the wider landscape more challenging for wildlife to thrive. Alongside grassland afforestation and urbanisation this has also had significant impacts on synanthropic species on farmland. Following the "Green Revolution" in agriculture, production-driven farm practices, loss of semi-natural habitat (such as hedgerows), increased use of inorganic fertilisers and synthetic pesticides, a reduction of spring sowing of cereals, and reduced diversity of crop rotation systems are examples of changes have negatively impacted biodiversity (Fuller, n.d.) (Matson, Parton, Power, & Swift, 1997) (Robinson & Sutherland, 2002) (Burns F. , et al., 2016). This has decimated invertebrate populations (Wilson, Morris, Arroyo, Clark, & Bradbury, 1999)(Wilson et al 1999) (Baines, Hambler, Johnson, MacDonald, & Smith, 1998) (Goulson, 2019). Insecticide-sensitive groups such as grasshoppers, sawflies and leaf-beetles being more important in the diet of declining bird species than non-declining ones (Wilson, Morris, Arroyo, Clark, & Bradbury, 1999). This is likely what is driving the decrease of seven out of eight farmland birds in South and Vale that show trends; Starling, Greenfinch, Yellowhammer, Kestrel, Stock Dove, Lapwing and Turtle Dove. These are either granivores or insectivores, and even granivores eat invertebrates during the breeding season for additional fuel (Wilson, Morris, Arroyo, Clark, & Bradbury, 1999).

8.1.16 Among these species, Starlings have declined the most; their occupancy decreased by 45% between the two study periods. These birds need short grazed grassland to forage for soil invertebrates, which is at odds with the trend of keeping cattle indoors to feed (Heldbjerg, Fox, Levin, & Nyegaard, 2016) (Devereux, Mckeever, Benton, & Whittingham, 2004). While turtle doves have a smaller decline than the other indicators, they have disappeared from the two districts: our data shows they were last recorded by the BTO Breeding Bird Survey in South and Vale in 2004 and 2014 respectively. Across England, turtle doves declined by 98% between 1970 and 2018 (Burns F. , et al., 2020). This is partly a result of reduced winter seed availability and lack of hedgerow or scrub nesting sites, both casualties of intensive agriculture (Browne & Aebischer, 2004).

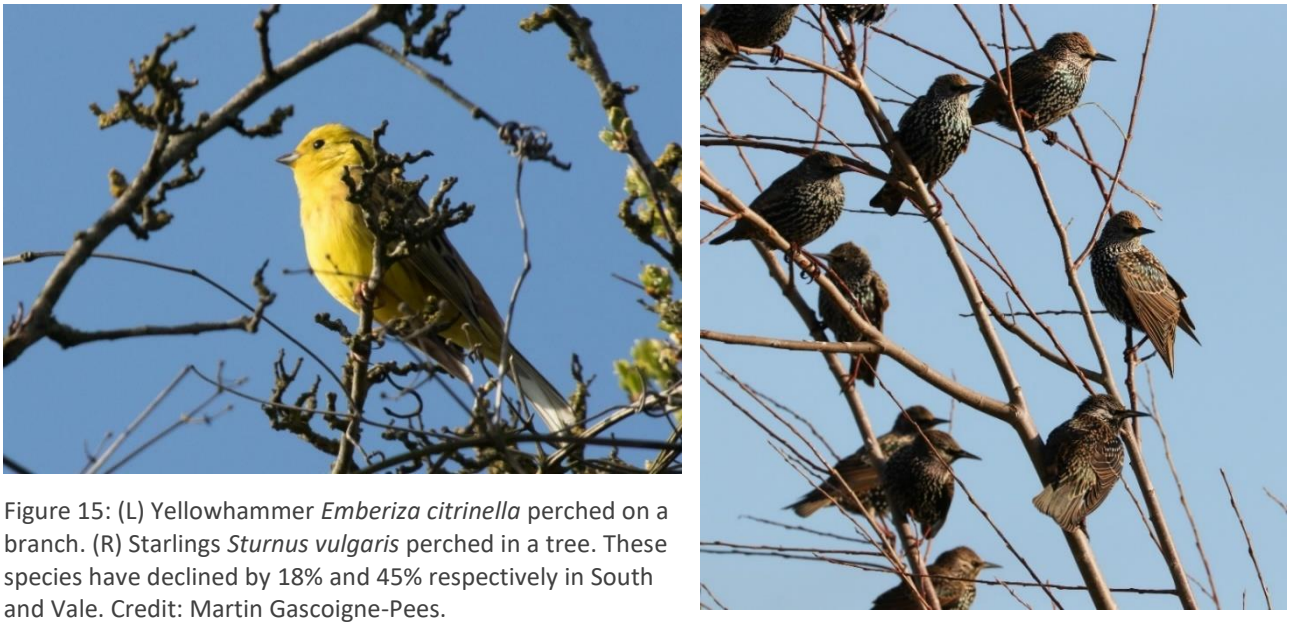

Figure 15: (L) Yellowhammer *Emberiza citrinella* perched on a branch. (R) Starlings *Sturnus vulgaris* perched in a tree. These species have declined by 18% and 45% respectively in South and Vale. Credit: Martin Gascoigne-Pees.

8.1.17 This paints a bleak picture, however encouraging traditional agricultural practices such as grass grazing, reduced seed-clearing and creating wildlife-friendly field margins could help reverse these declines (Burns F. , et al., 2016). Regimes followed by farms as part of Conservation Grade schemes including creating wildlife-friendly agricultural margins with a mix of habitat including pollen/nectar-rich habitats, and planting seed-producing crops have shown increased biodiversity (Hardman, et al., 2016) (RSPB, Fair To Nature). Moreover, Pywell found that removing 8% of land from the edge of an arable field did not decrease the productivity of that field (Pywell, et al., 2015).

8.1.18 Across the wider landscape, the recovery of Red Kite, Buzzard (and perhaps Raven to an extent) reflects wider raptor recovery since the 1986 ban on the use of organochloride pesticide DDT (RSPB, Birds of Prey in the UK: A wing and a prayer). The 64% increase in occupancy for Red Kite follows a reestablishment programme set up after the ban in England and Scotland (Smart, et al., 2010). Interestingly, this increase was greater in low-persecution areas such as the Chilterns than high-persecution areas in Scotland (Smart, et al., 2010) (RSPB, Birdcrime 2021). This helps to demonstrate that if habitat conditions are good, species can recover.

Figure 16: Clockwise L-R:

Common Raven *Corvus corvax* in flight. Credit: Andreas Eichler (CC BY-SA 4.0). Red Kite *Milvus milvus* soaring. Credit: G Breadmore. Buzzard *Buteo buteo* perched on a branch. Credit: Martin Gascoigne-Pees.

8.1.19 Conversely, the increases in woodland land cover have not resulted in clearly improving trends for woodland bird indicators & woodland butterfly specialists. This may be due to poorly targeted tree planting, and also because it takes time for newly-planted woodland to reach similar biodiversity levels as fully established woodland.

8.1.20 In broadleaved plantations created on arable land, adjacent to ancient woodland, 70-80 years was required for biodiversity levels to approach that of ancient woodland (Brunet, 2007). Connectivity is also important; the diversity reached in isolated plantations (not contiguous with existing woodland) was much lower (Brunet, 2007). So, tree planting is about "the right tree in the right place", and since the UK supports a variety of habitats, blanket afforestation benefits neither biodiversity nor the climate (Harvey , 2019) (Buscardo, et al., 2008) (Lewis & Wheeler, 2019). Despite afforestation schemes, only 13% of the UK is forested, which is one of the lowest figures in Europe, and rates of afforestation are lower than they were (Ares, Coe, & Uberoi, 2021).

8.1.21 This is reflected in that two of the four woodland bird indicators with trends in South and Vale, Willow Warbler and Marsh Tit, are declining by 23% and 11% respectively. Both species are foliage insectivores, so in the summer they rely on invertebrates taken from the foliage of trees or shrubs. A loss of natural understory caused by decline in traditional woodland management such as coppicing is linked to their decline (Fuller, Noble, Smith, & Vanhinsbergh, 2005) (Carpenter, et al., 2010) (Bellamy, et al., 2009). However, there are other potential drivers including threats on migration, reduction of invertebrate food, negative impact of land cover on woodland edges, reduced or poor management regimes and understory grazing by deer (Fuller, Noble, Smith, & Vanhinsbergh, 2005).

8.1.22 While the overall trend for woodland butterflies is more positive, with five from seven species showing increased distribution more recently, two of these are hairstreaks (Brown Hairstreak, White-letter Hairstreak), for which there has been active conservation work carried out in the area including egg searches and targeted habitat management (Butterfly Conservation, 2019) (Butterfly Conservation Upper Thames Branch, Hairstreak Conservation). Preferring tree canopies, these species can be hard to record, unless their eggs are carefully searched for, and so an extent of these increases may be influenced by greater recording effort. Silver-washed Fritillary may have increased not due to afforestation, but through a more gradual habitat succession creating areas of scrub, and conifer thinning/removal (Campbell, 2010). Nonetheless, this suggests that by careful management to improve habitat quality and connectivity, instead of solely focusing on numbers or area, species can recover.

Figure 17: (L): Purple Hairstreak on an oak leaf. Credit: Richard Parton. (R): White-letter Hairstreak on a flower. Credit: Ian Kirk (CC BY 2.0).

8.1.23 Within urban areas the overall diversity of species communities is much lower than in the wider landscape. However, there are a subset of species that are benefiting by managing to exploit higher temperatures and artificial food sources in urban areas.

8.1.24 Urban expansion further fragments the landscape and supports a low diversity of species, particularly by excluding specialists and sedentary species (Sol, et al., 2020) (Concepcion, Moretti, Altermatt, Nobis, & Obrist, 2015) (McKinney, 2006). For example, despite dedicated Swift conservation initiatives this species has declined in South and Vale by 19%, and is declining across the country (RSPB, Oxford Swift City.) Precise reasons for their decline are uncertain, however, reduced nesting success is likely to be a factor, due to a combination of climate change bringing wetter summers with less invertebrates on the wing, and also newer developments lacking the tile cavities that made older homes suitable nest sites for the species (BTO, Swift BirdFacts) (Schaub, Mefert, & Kerth, 2016). Goldfinch, though a farmland indicator, has increased occupancy in South and Vale by 12%, likely due to deliberate feeding in suburban gardens and declines in their competitor Greenfinch from the parasitic infection Trichomonosis (Plummer, et al., 2015 in BTO, Goldfinch BirdFacts). Similarly, while Blackcap and Chiffchaff are both woodland indicators, they can adapt to urban parks and gardens; a study found evolutionary change in Blackcaps that overwinter in the UK- "those in gardens had longer bills and more rounded wingtips, which may be linked to their more generalist diet and sedentary winter lifestyle" (University of Oxford, 2021) (Van Doren, et al., 2021).

Figure 18: Common Swift (*Apus apus*) in flight. Credit: pau.artigas (CC-BY-SA 2.0).

8.1.25 Climate change may also be influencing the range expansion of some species, where suitable habitat is present.

8.1.26 After agriculture, climate change is the second most significant driver of UK biodiversity (Burns F. , et al., 2016). As most UK butterfly species have their northern, but not southern range boundaries in the UK, climate change may have positive as well as negative impacts on their distribution here (Thomas, et al., 2011). This is especially the case with multivoltine species (which can have more than one brood per year), which are able to advance the timing of key life cycle events that facilitate their northward range shift (Macgregor, et al., 2019). In South and Vale this may be an explanatory factor in the increase of multivoltine specialists such as Small Blue, Adonis Blue and Brown Argus, which appear to be faring better than univoltine specialists such as Dark Green Fritillary, Duke of Burgundy, Green Hairstreak and Silver-spotted skipper.

8.1.27 Warmer temperatures are a likely explanation for why Blackcap and Chiffchaff are arriving in the UK over ten days earlier than usual and may account for the arrival and subsequent spread of Little Egret (Newson, 2016 in BTO, Chiffchaff BirdFacts). This species was first recorded by the BTO breeding survey in South and Vale in 2014 and 2015 respectively. No conclusive studies have been completed, but the BTO suggests that a combination of lack of intraspecific competition and climate change increasing winter survival rates may play a role (BTO, Little Egret BirdFacts). Their negative response to cold winters between 2007-2012 accompanied by a temporary reduction in numbers support a climate-related driver (Holt, et al., 2012 pg 88).

9 Conclusion

9.1.1 Our findings show that across South and Vale, biodiversity has been in decline. More grassland has been lost to built-up areas here than across Oxfordshire and England as a whole. This is concerning, as grassland is an important habitat for many species that inhabit our districts and is an important tool to tackle climate change. There has been a slight increase in woodland land cover, however we still have only a fraction of woodland we used to, and woodland species are not doing as well as these gains might suggest. This shows that we need to restore and protect our grasslands alongside protecting and managing current woodland with careful targeting of new wooded areas to get the best outcomes for nature. With the continued loss of land to the built environment likely, the measures used to minimise its impacts and compensate for the losses to wildlife will be a key tool in turning these declining trends for wildlife around.

10 About TVERC

10.1.1 Thames Valley Environmental Records Centre (TVERC) is a 'not for profit' organisation covering Berkshire and Oxfordshire. We are run by a partnership and are one of a national network of local records centres. We are a member of the Association of Local Records Centres (ALERC) and the National Biodiversity Network (NBN). Our funding partners include all the local authorities in Oxfordshire & Berkshire plus the Environment Agency. We also work closely with the Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT).

10.2 What we do

10.2.1 We provide our funding partners with annually updated species and sites information as GIS tables, and undertake surveys of local wildlife sites. We also carry out data analysis for the monitoring of local authority Local Plans. We provide information to parish councils, local people, conservation bodies, land-owners, students and commercial organisations such as ecological consultants and utilities companies via data searches, data licensing and data exchanges. We provide other services such as ecological surveys, data analysis & presentation and training.

10.3 Our records

10.3.1 We hold over 4.25 million records of flora and fauna in Berkshire and Oxfordshire plus information about Local Wildlife and Geological Sites, NERC Act S41 Habitats of Principal Importance (previously called UK Biodiversity Action Plan (BAP) habitats) and Ecological Networks (Conservation Target Areas and Biodiversity Opportunity Areas). We collect this data from the general public, skilled volunteer /amateur recorders, professionals working for wildlife charities (BBOWT and RSPB), professionals working for government agencies (the Environment Agency & local authorities) and ecological consultants. This information is used:

- by planning authorities and developers to make informed decisions on the design and location of sustainable development
- to help farmers, landowners and conservation organisations manage land in the best way to enhance biodiversity
- by nature partnerships to direct wildlife conservation work
- by teachers, students and scientists for education and scientific research.

10.3.2 For more information please visit our website: www.tverc.org

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12 Appendix: Detailed Results from the UK Butterfly Monitoring Scheme

Shaded blue circle: areas where butterfly has expanded into (i.e. was not present in the earlier maps from Asher et al 2005 ("The State of Butterflies in Berkshire, Buckinghamshire and Oxfordshire").

Shaded red circle: areas where butterfly has disappeared from (i.e. was present in the earlier maps).

12.1 Grassland species:

The maps show the distribution of each species using records between 2015 and 2020. Green squares indicate a presence in any year. Transparent squares indicate no records in any year.

12.1.1 Adonis Blue

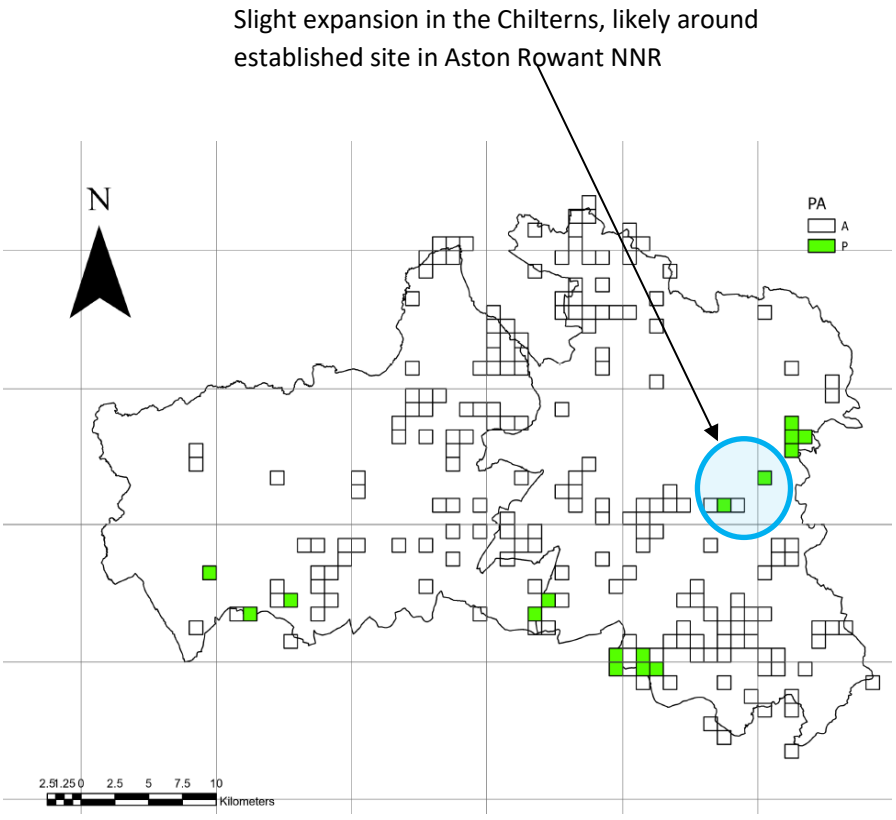
UK Conservation Status: Vulnerable

England Distribution trend: significantly decreasing, by ~13% each decade since recording began (Fox, et al., 2022)

South and Vale Distribution trends:

Early Trend: Expansion in the Berkshire Downs, and the edge of the Chilterns. New colonies appear in the Berkshire Downs to the north of Lambourn.

Recent Trend: The expansion continues south from the edge of the Chilterns, likely from their stronghold in Aston Rowant NNR.



12.1.2 Brown Argus

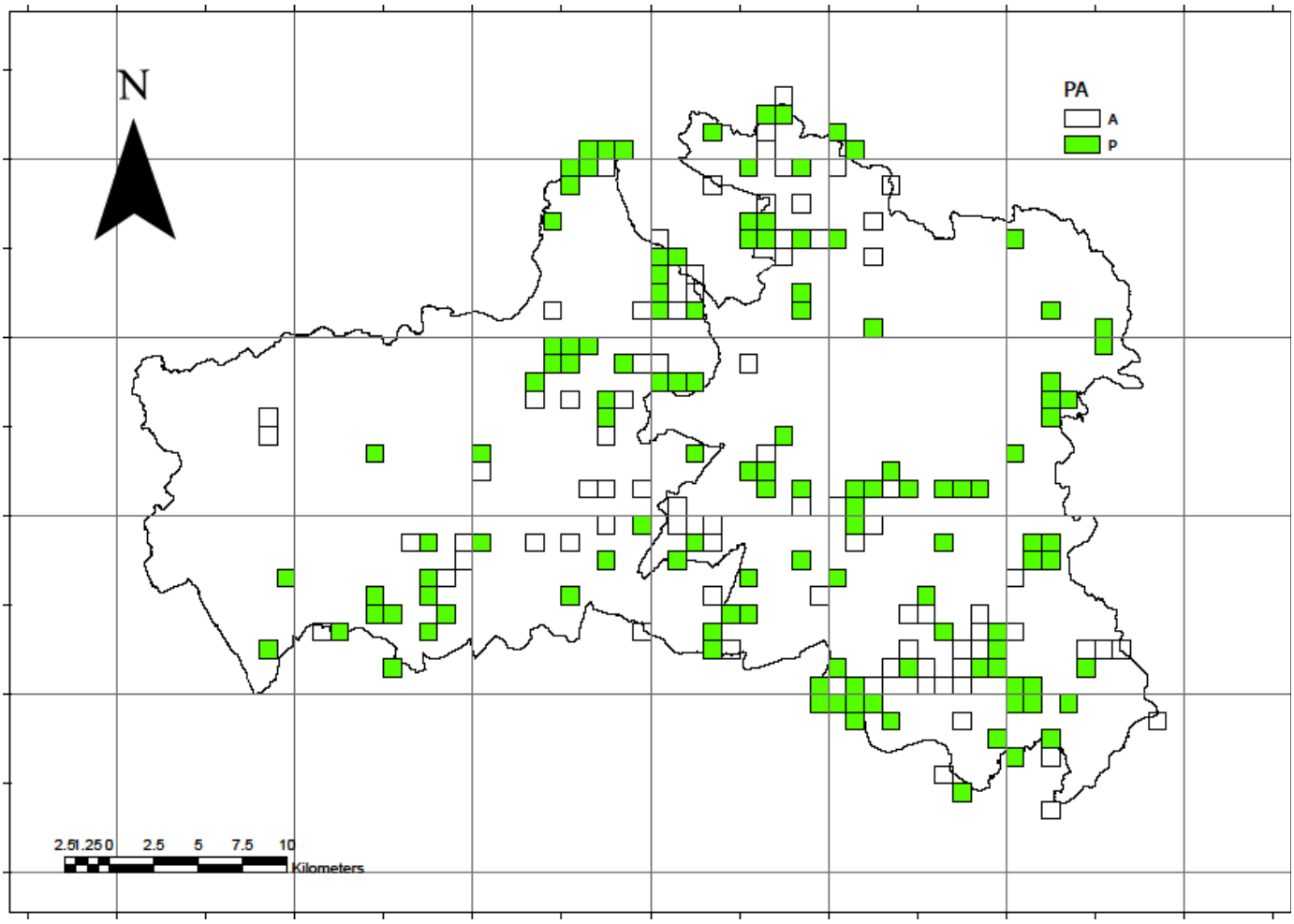
UK Conservation Status: Least Concern

England Distribution trend: No Change

South and Vale Distribution trends:

Early Trend: Expansion, new colonies in the Chiltern Hills.

Recent Trend: No Change, slight expansion from existing colonies.



12.1.3 Chalk Hill Blue

UK Conservation Status: Vulnerable

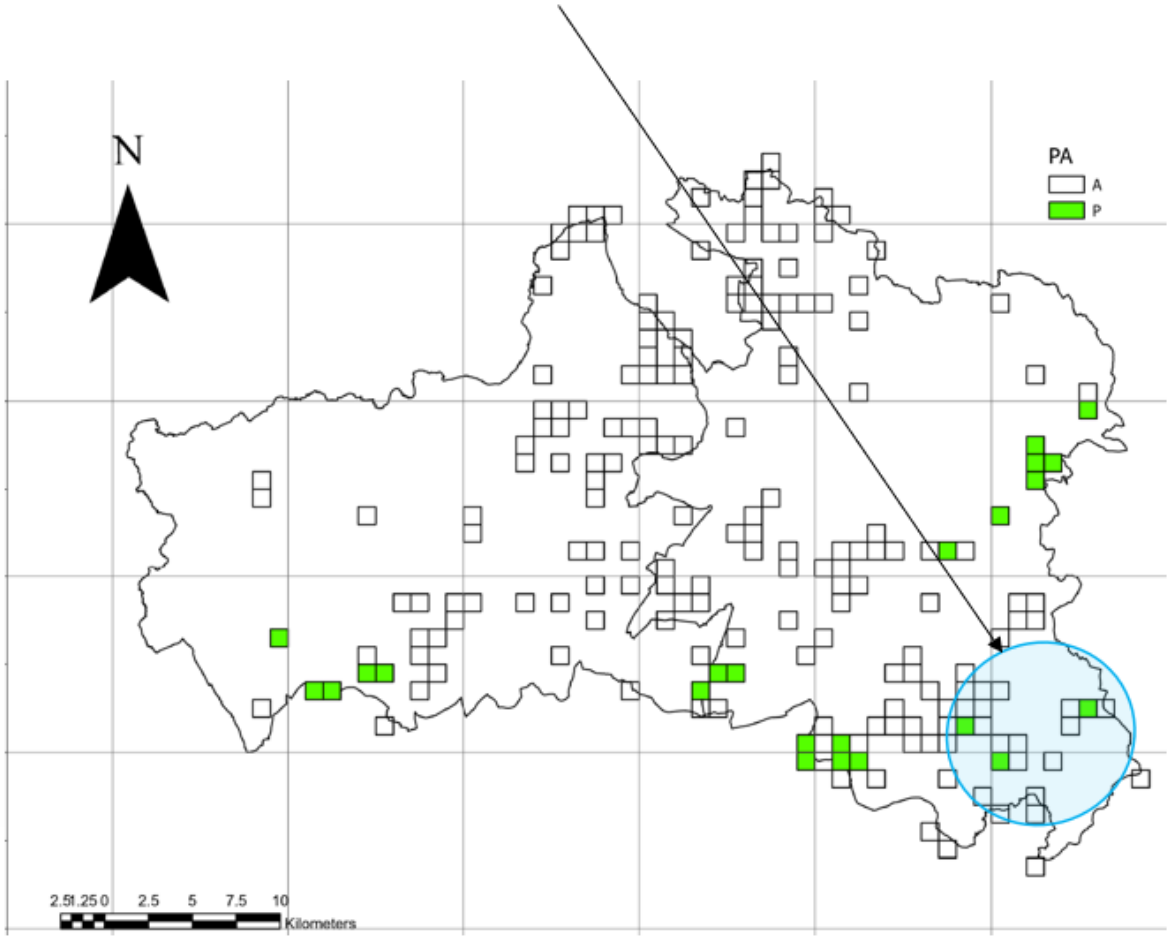
England Distribution trend: significant decrease, by ~31% every 10 years (Fox, et al., 2022).

South and Vale Distribution trends:

Early Trend: No Change.

Recent Trend: No Change. New records in the Chiltern Hills only appeared in 2019, and not in the years before or after (Bowles, Chalk Hill Blue, 2023). UTBC have coordinated Horseshoe Vetch planting effort in their area, which may explain more recent increases (Bowles, Chalk Hill Blue, 2023).

These new records were only present in 2019, and not in 2018, 2020, 2021 or 2022 (Bowles, 2023).



12.1.4 Dark Green Fritillary

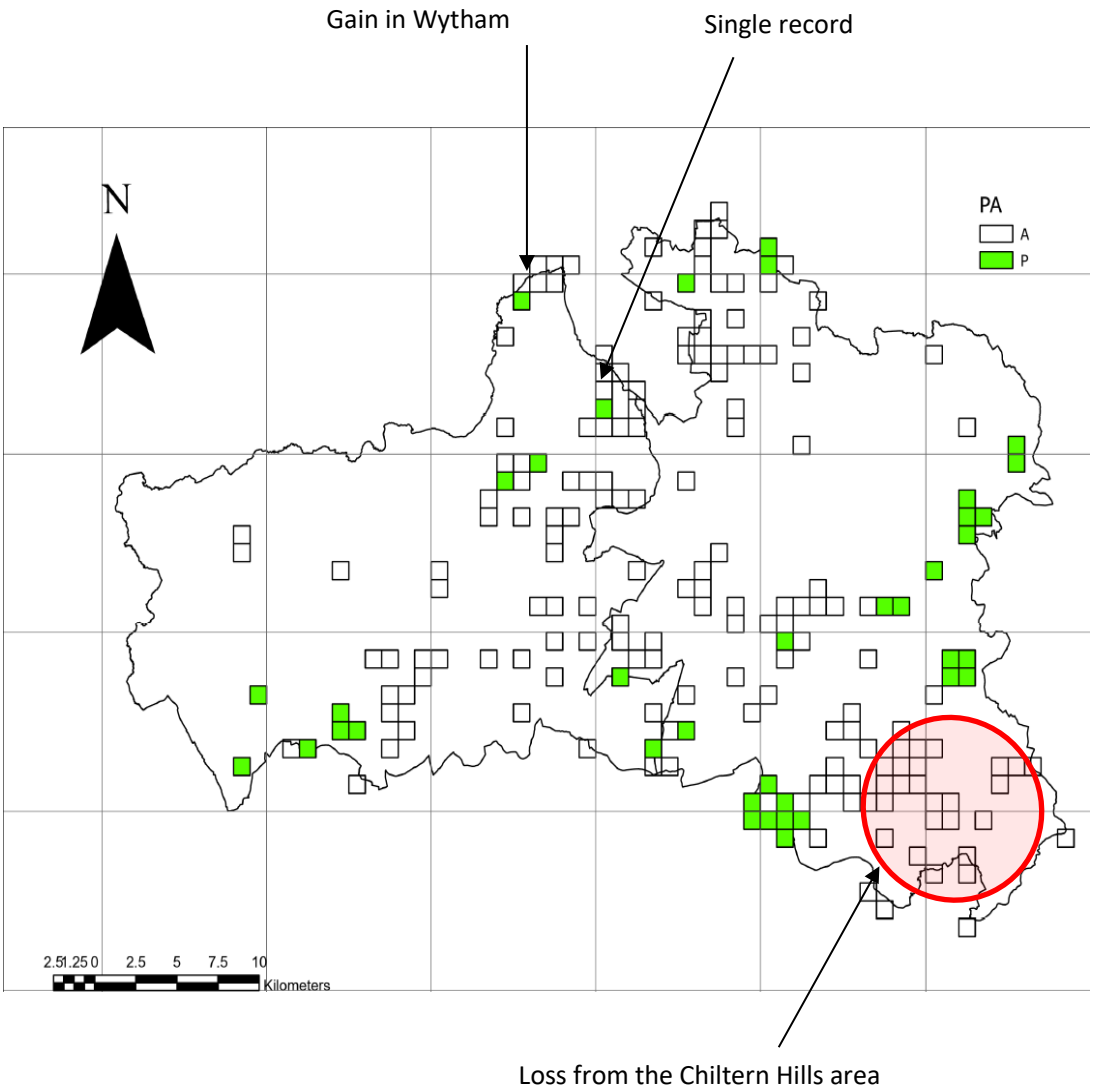
UK Conservation Status: Near Threatened

England Distribution: significantly decreased, by ~12% each decade since recording began (Fox, et al., 2022).

South and Vale Distribution trends:

Early Trend: No Change, slight expansion in the Chiltern Hills.

Recent Trend: Retraction, with colonies lost from Chiltern Hills, and a small gain in Wytham. An UTBC report in 2017 confirms that the number of scattered singleton records has increased in recent seasons (George, 2017).



12.1.5 Dingy Skipper

UK Conservation Status: Least Concern

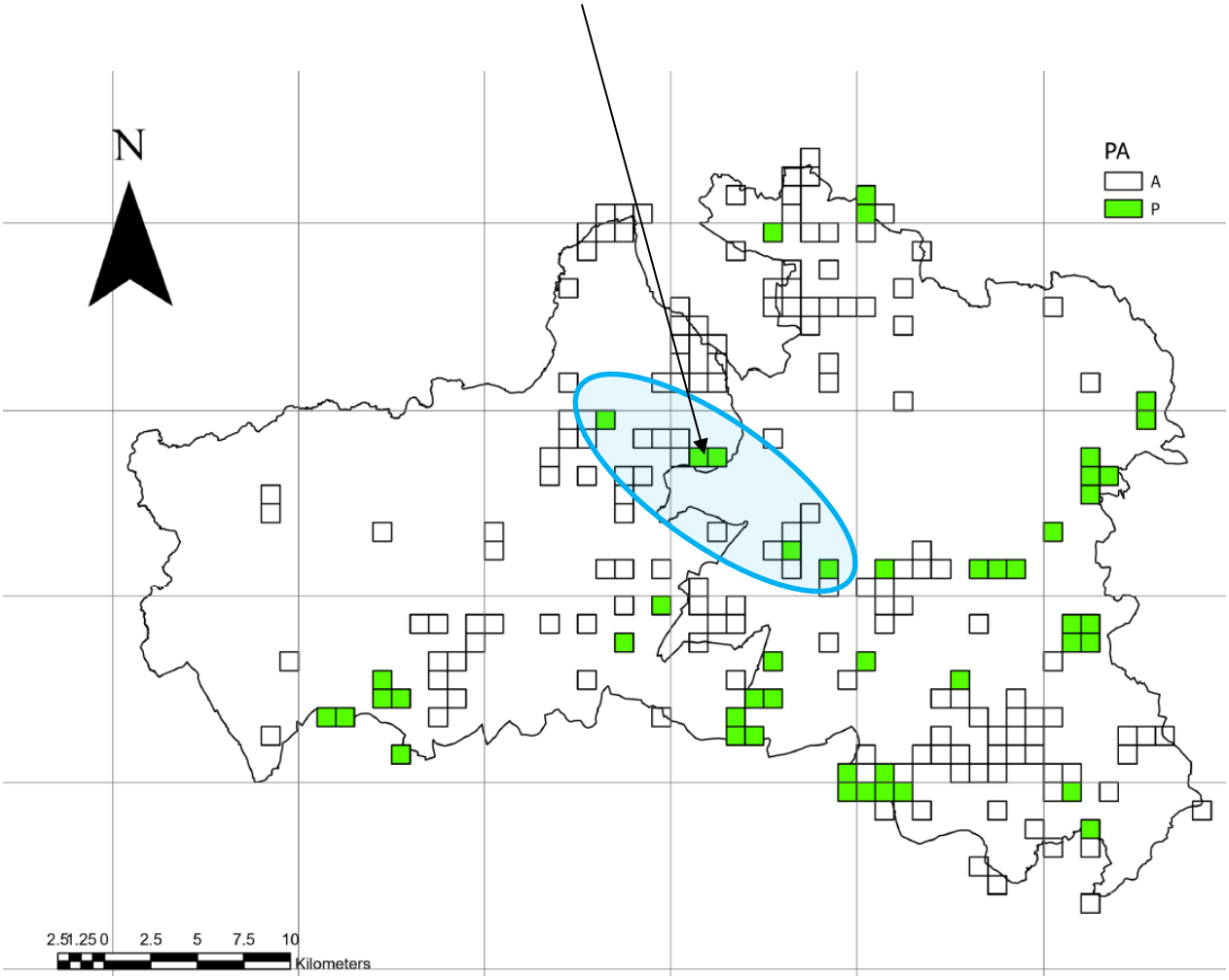
England Distribution trend: significantly decreasing, by ~9% every decade since recording began (Fox, et al., 2022)

South and Vale Distribution trends:

Early Trend: Slight expansion in the Chilterns.

Recent Trend: Expansion, new records found around the Radley Lakes area.

New records around the Radley Lakes area



12.1.6 Duke of Burgundy

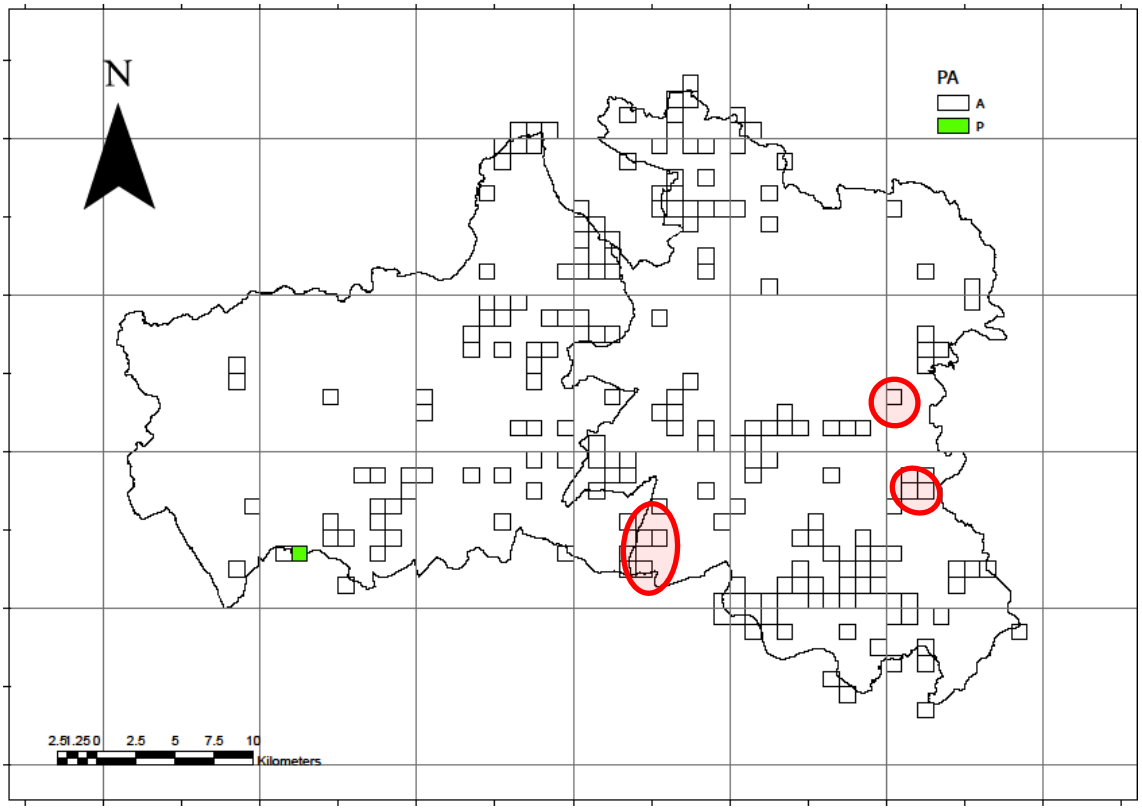
UK Conservation Status: Vulnerable

England Distribution trend: significant decrease, ~42% each decade since recording began (Fox, et al., 2022)

South and Vale Distribution trends:

Early Trend: No Change.

Recent Trend: Retraction. Apart from one colony in Vale, Duke of Burgundy has been lost from the rest of South and Vale.



12.1.7 Green Hairstreak

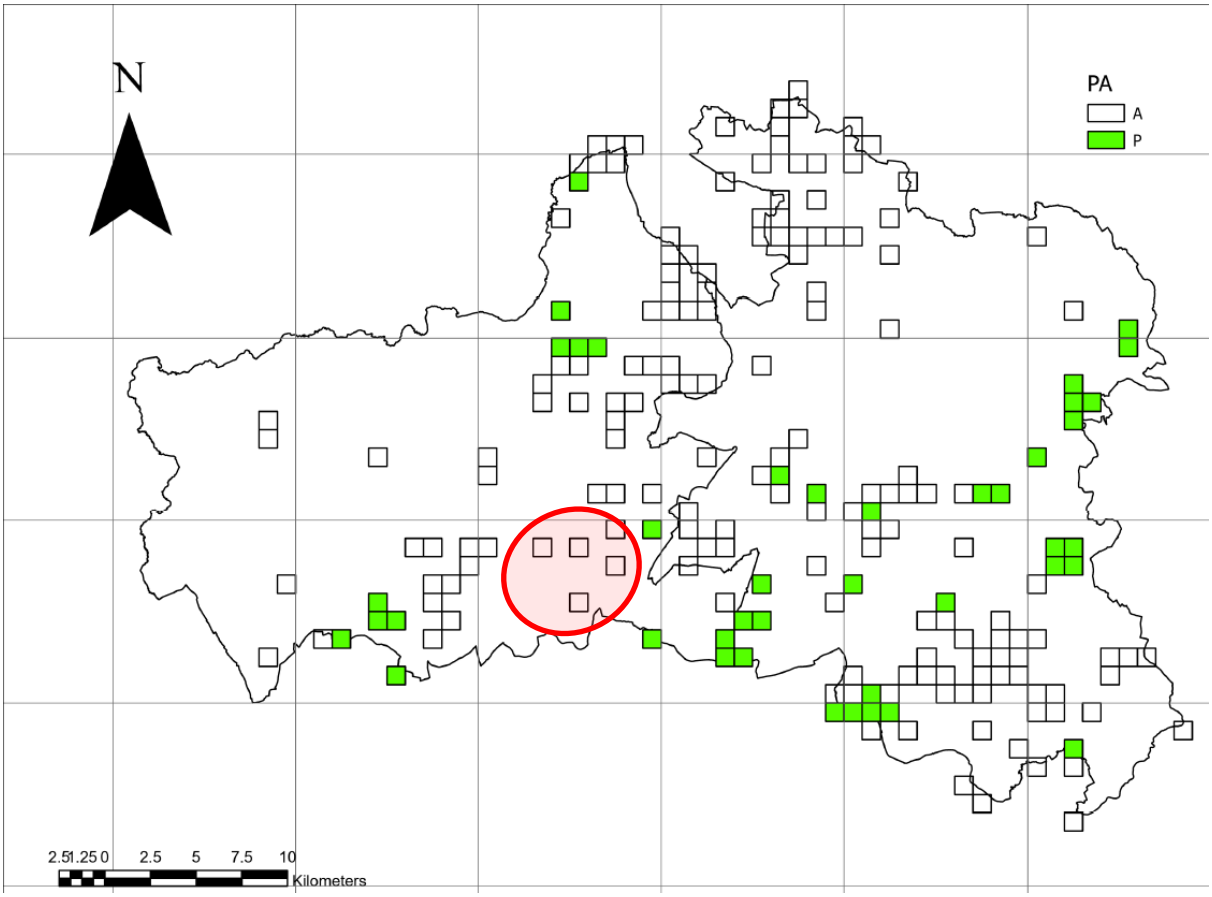
UK Conservation Status: Least Concern

England Distribution trend: significant decrease, ~7% each decade since recording began (Fox, et al., 2022)

South and Vale Distribution trends:

Early Trend: Slight expansion in the Chilterns.

Recent Trend: Slight retraction. Despite a decrease in Green Hairstreak distribution across England, there has been little change in distribution over the last 20 years in South and Vale, except for a small loss in Vale.



12.1.8 Grizzled Skipper

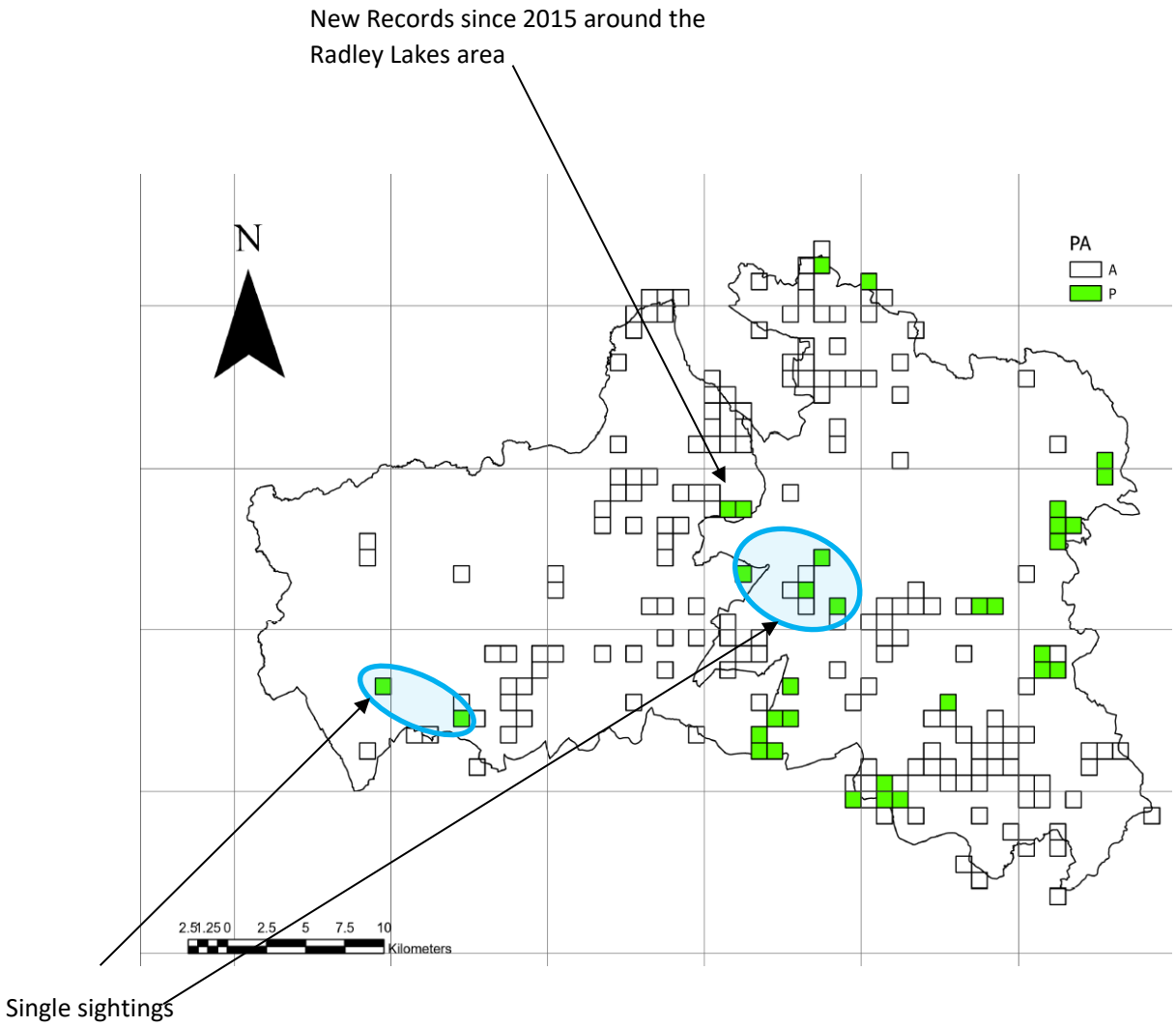
UK Conservation Status: Vulnerable

England Distribution trend: significantly decreasing, by ~14% each decade since recording began (Fox, et al., 2022)

South and Vale Distribution trends:

Early Trend: No Change, small loss in the Radley lakes area.

Recent Trend: Small expansion: No Change except for a few new single sightings, and a return of sightings in the Radley Lakes area.



12.1.9 Silver-Spotted Skipper

UK Conservation Status: Vulnerable

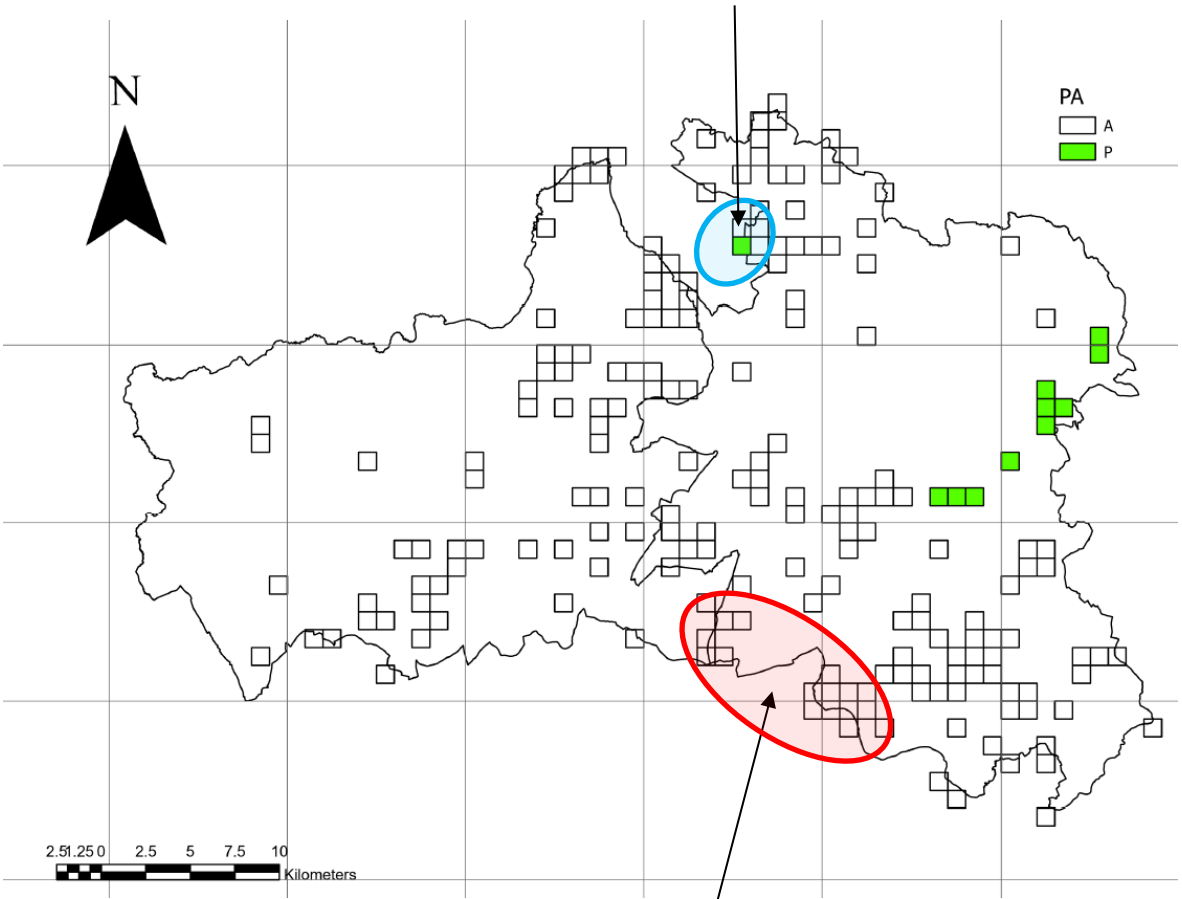
England Distribution trend: significantly decreasing, by ~30% each decade since recording began (Fox, et al., 2022)

South and Vale Distribution trends:

Early Trend: Expansion in the Chilterns and Berkshire Downs.

Recent Trend: Retraction. All colonies on the Berkshire Downs have been lost (the last recorded sighting was in 2009) (Soulsby, 2019). There have been a couple of new sightings, including in the marked blue area on the outskirts of Oxford. This sighting is 19km from suitable habitat and is unlikely to contribute to a long-term population (Soulsby, 2019).

New sighting 19km from suitable habitat, unlikely to form long-term population (Soulsby, 2019)



All colonies on the Berkshire Downs have been lost, the last recorded sighting being in 2009 (Soulsby, 2019).

12.1.10 Small Blue

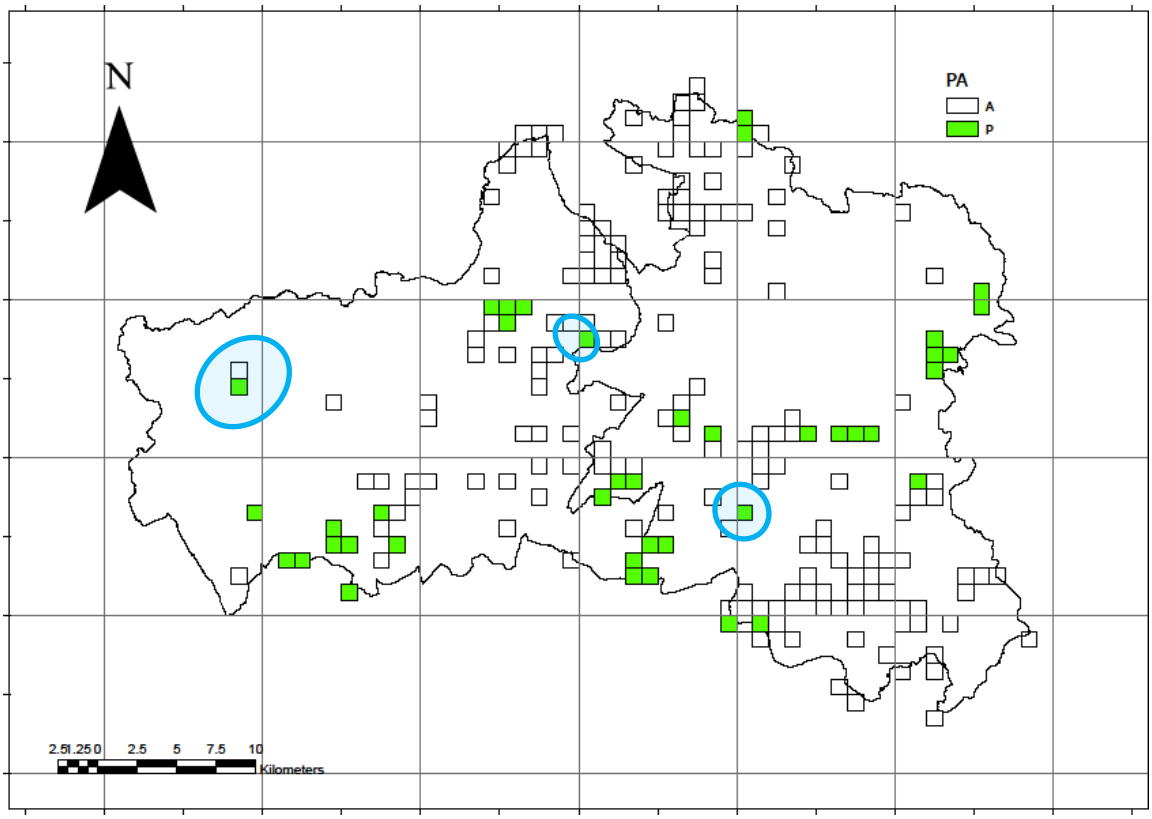
UK Conservation Status: Near Threatened

England Distribution trend: significantly decreasing, by ~14% each decade since recording began (Fox, et al., 2022)

South and Vale Distribution trends:

Early Trend: Slight retraction in Berkshire Downs and Chilterns.

Recent Trend: Expanding, UTBC also report an increase of Small Blue records & distribution across their area (Spragg, 2020). They cannot say whether the increase is due to greater recording effort or genuine expansion, but as our subset of the data only looks at 1k squares that have been sampled at least once each year 2015-2020, we can be more confident that there is genuine expansion in South and Vale.



12.1.11 Wall

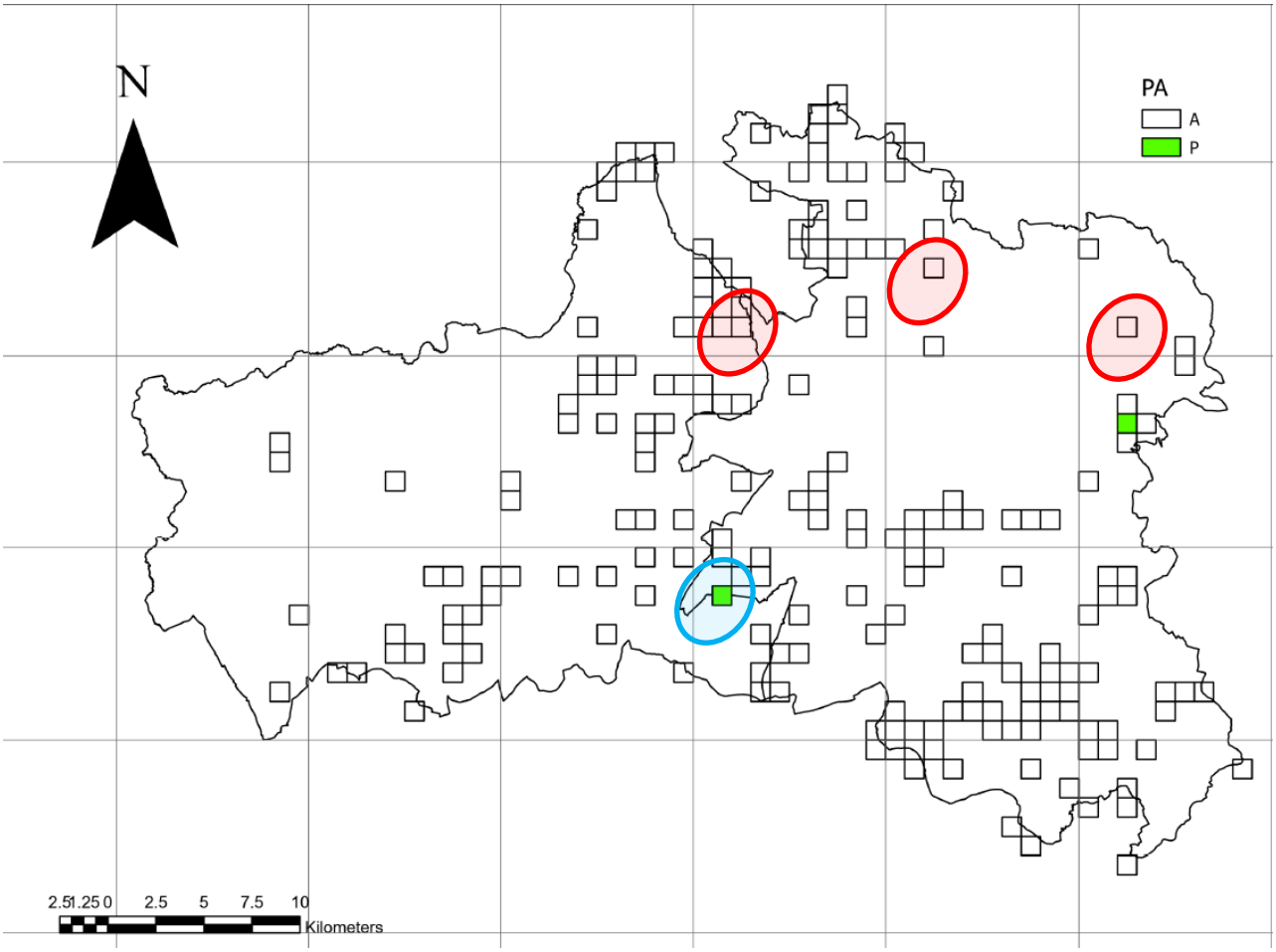
UK Conservation Status: Endangered

England Distribution trend: significant decrease, ~31% each decade since recording began (Fox, et al., 2022)

South and Vale Distribution trends:

Early Trend: Retraction. Colonies lost from all areas across South and Vale.

Recent Trend: Retracting, Wall are now vagrants in the UTBC region, and apart from a couple of singleton records in 2019, there have been no sightings between 2015 and 2020.



12.2 Woodland species

12.2.1 Black Hairstreak

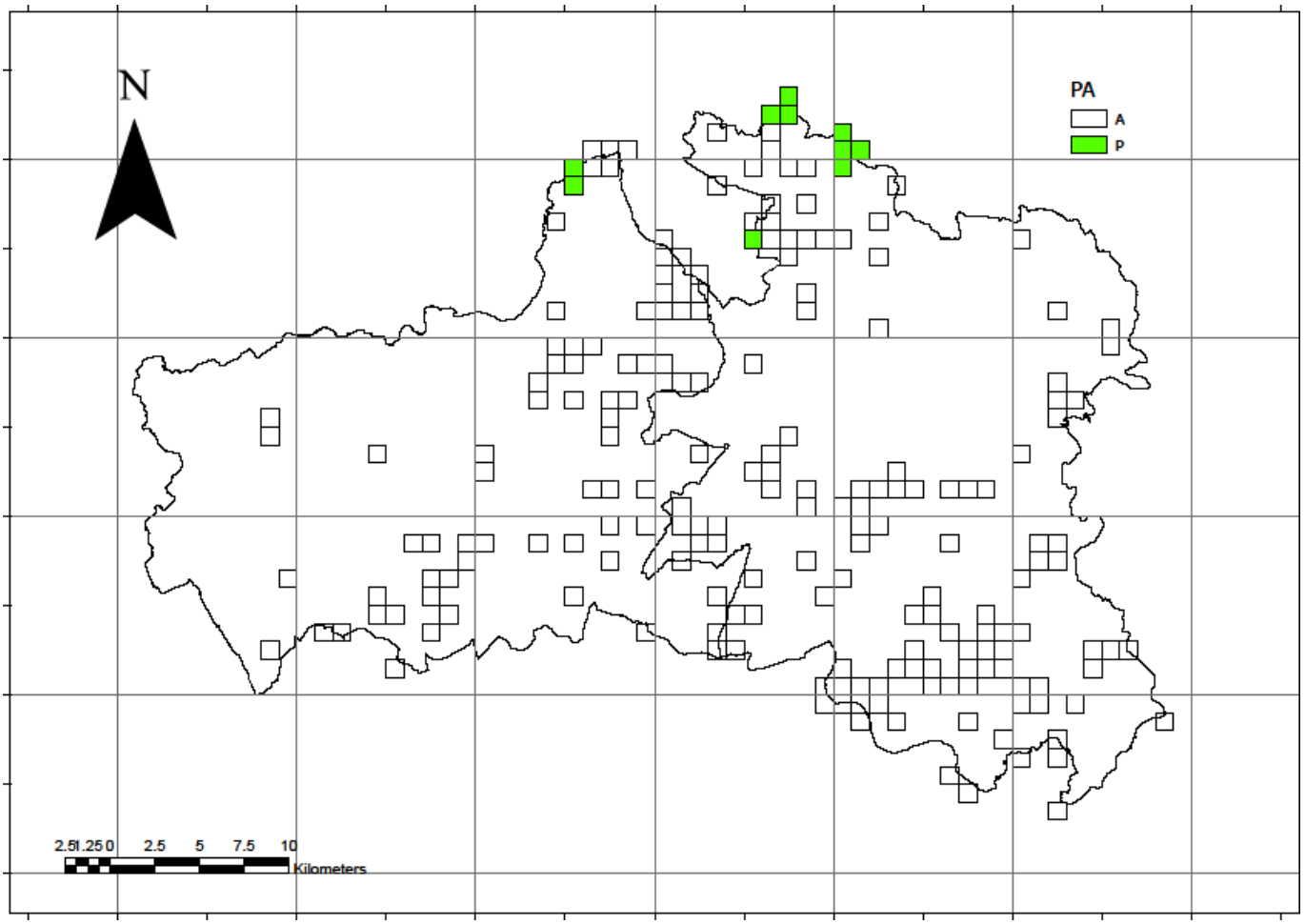
UK Conservation Status: Endangered

England Distribution trend: No Change

South and Vale Distribution trends:

Early Trend: No Change.

Recent Trend: No Change. Black Hairstreak remains rare and repeat observations are restricted to Otmoor.



12.2.2 Brown Hairstreak

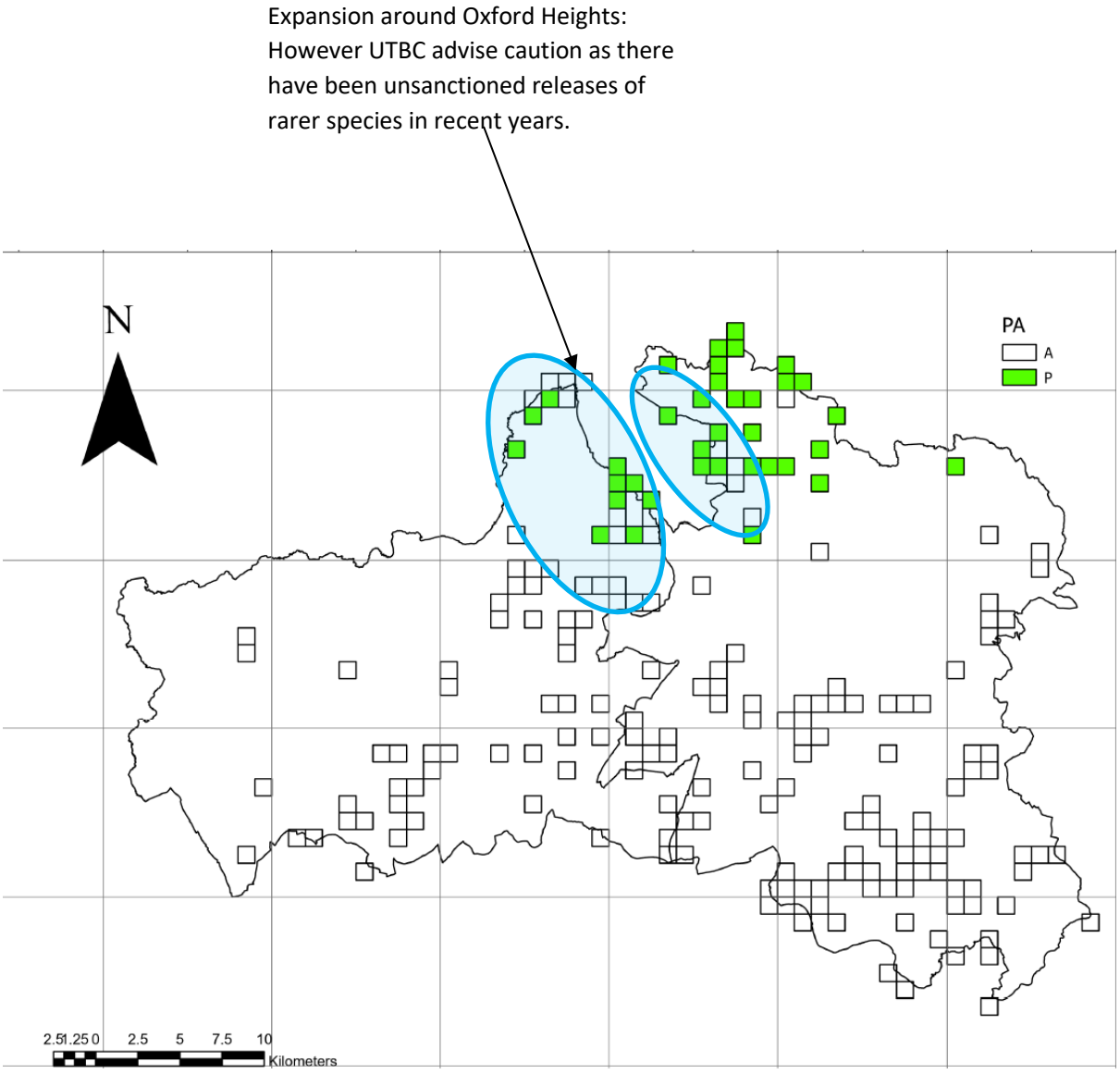
UK Conservation Status: Vulnerable

England Distribution trend: No Change

South and Vale Distribution trends:

Early Trend: No Change.

Recent Trend: Expanding West across Oxford Heights. A note of caution, as UTBC report there have been unsanctioned releases of this species in recent years, so some expansion might be artificial. However, more eggs are being found during winter egg searches, suggesting genuine expansion (Wilton, 2020).



12.2.3 Purple Emperor

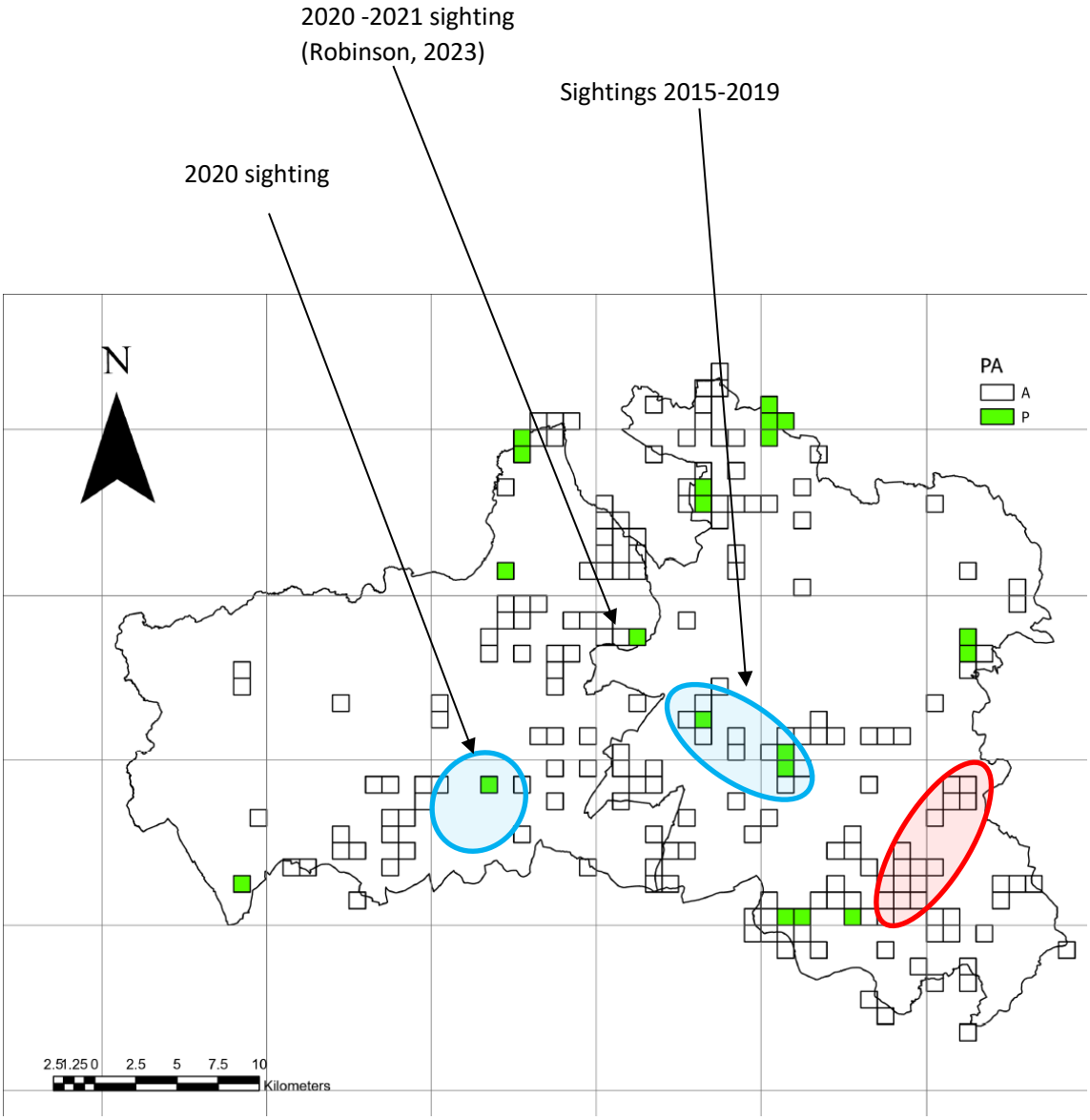
UK Conservation Status: Least Concern

England Distribution trend: significantly expanding, by ~18% each decade since recording began.

South and Vale Distribution trends:

Early Trend: Slight expansion in the Chilterns.

Recent Trend: Expanding, new colonies in the area below Oxford. However since this species prefers forest canopies, and so can be difficult to observe, it is hard to draw conclusions about these changes in distribution (Robinson M. , Purple Emperor, 2023).



12.2.4 Purple hairstreak

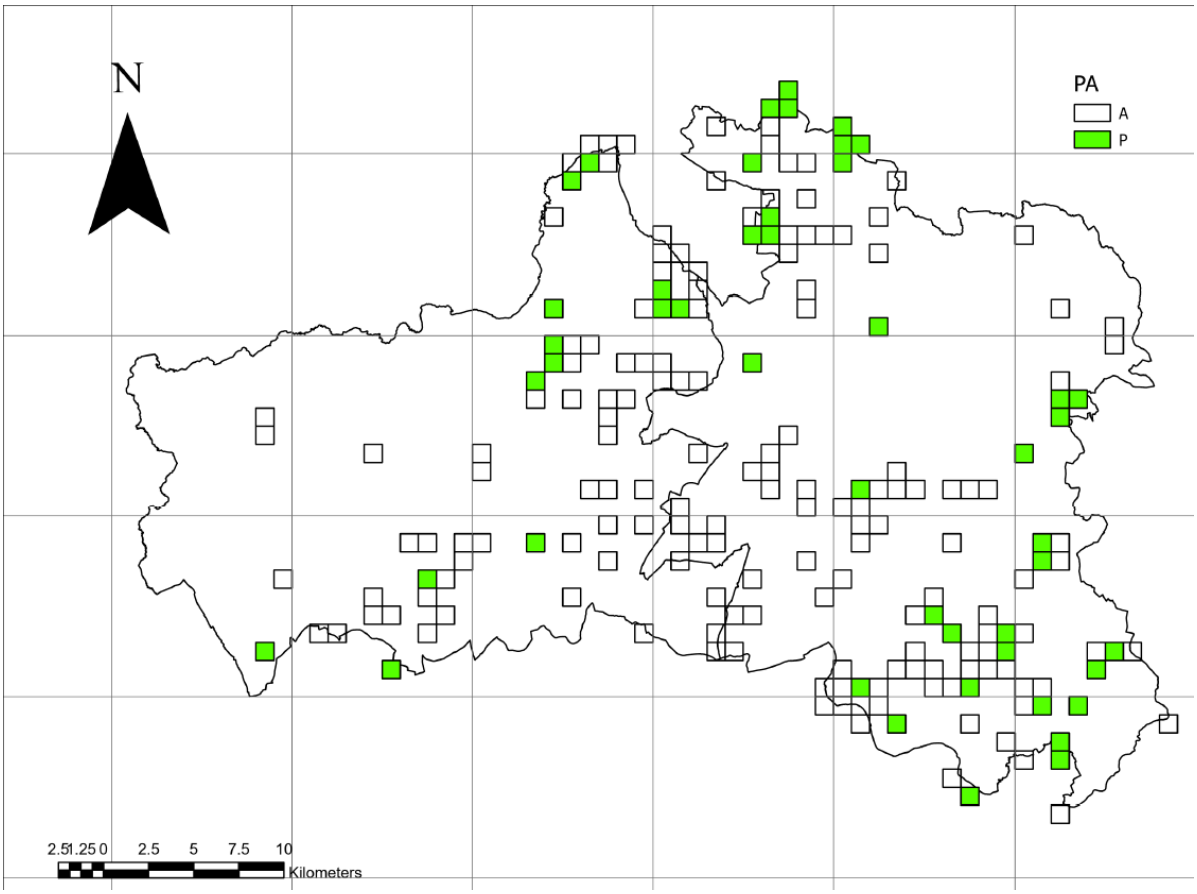
UK Conservation Status: Least Concern

England Distribution trend: significant decrease, ~18% each decade since recording began.

South and Vale Distribution trends:

Early Trend: Slight expansion in the Chilterns and below Oxford.

Recent Trend: No Change.



12.2.5 SIlver-washed fritillary

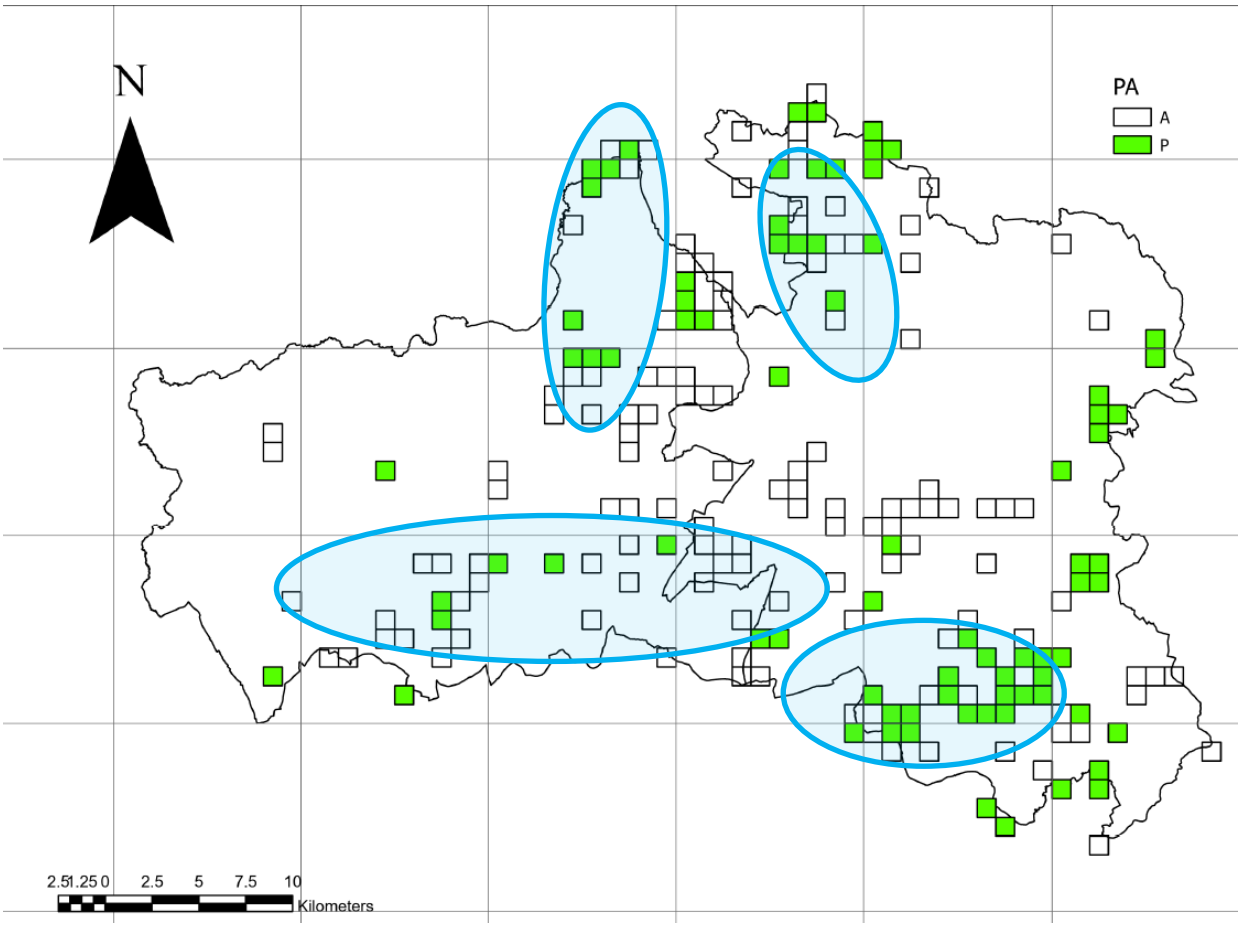
UK Conservation Status: Least Concern

England Distribution trend: No Change

South and Vale Distribution trends:

Early Trend: Expanding in the Chiltern Hills.

Recent Trend: Expanding from a stronghold in the Chiltern Hills, and across the Oxford Heights.



12.2.6 White Admiral

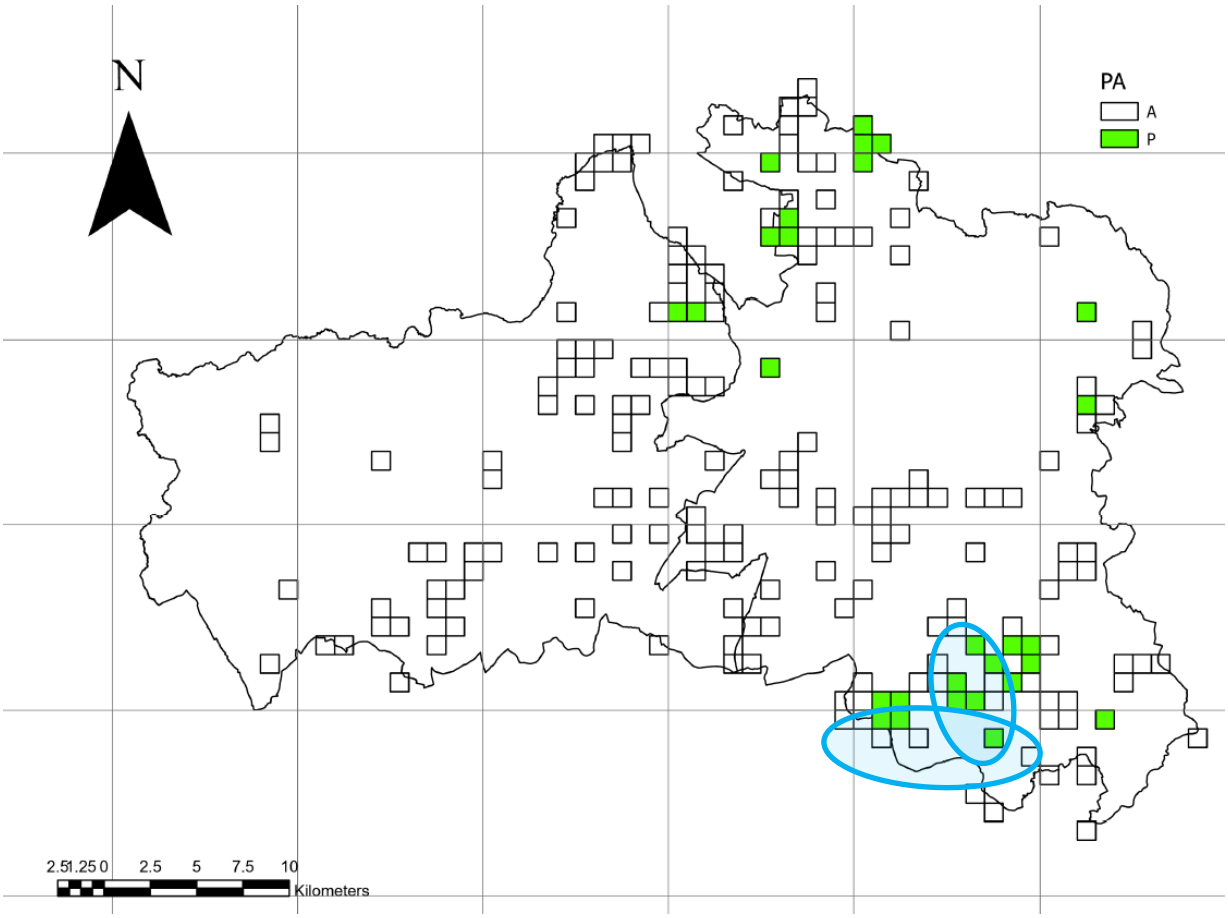
UK Conservation Status: Vulnerable

England Distribution trend: significantly decreasing, ~17% each decade since recording began.

South and Vale Distribution trends:

Early Trend: Expansion across Oxford Heights.

Recent Trend: Slight Expansion in Chiltern Hills.



12.2.7 White-letter hairstreak

UK Conservation Status: Vulnerable

England Distribution trend: No Change (Fox, et al., 2022).

South and Vale Distribution trends:

Early Trend: Expanding in Chilterns and Oxford Heights.

Recent Trend: Expansion; more records and more locations. This suggests a conservation project started by UTBC in 2015, to recruit new volunteers to look for colonies and plant more Wych Elm (their preferred larval food plant), is working (Cuss, White-letter Hairstreak, 2023).