

BROADLEARS FIELD AGROFORESTRY PROJECT

DARTINGTON ESTATE, DEVON

2019 Butterfly Survey – Final Summary Report



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CONTENTS

1. INTRODUCTION

1.1 Background to Broadlears Field Agroforestry Butterfly Survey

1.2 The site

1.3 Aims of Survey

1.4 Method

2. 2019 SURVEY FINDINGS

2.1 Numbers and species

2.2 Distribution by Transect

2.3 Comparisons between the 2018 and 2019 seasons – numbers, species and distribution

3. REFLECTIONS

3.1 Butterfly numbers

3.2 Clover and hemp cultivation

3.3 Land management and operation of contractors

3.4 Future integrity of field margins

APPENDICES

1. Plan of Broadlears Agroforestry Field and location of Butterfly Transects

2. List of images

3. References

Front cover image: Marbled White

Steve Turner – Dartington Volunteer (November 2019)

BROADLEARS FIELD AGROFORESTRY PROJECT - DARTINGTON ESTATE, DEVON

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1. INTRODUCTION

1.1 Background to Broadlears Field Agroforestry Butterfly Survey

1.1.1 In early 2017 a brief was established by the Dartington Trust for a volunteer to carry out a butterfly survey in connection with the Agroforestry project in Broadlears Field on the Dartington Estate. The field is located to the south west of Dartington Hall Gardens and south of Upper Drive, situated within a largely agricultural setting. This is a multi-cropping and multi-tenanted agricultural scheme that involves the cultivation of trees and crops alongside each other. The first Survey was carried out in summer 2017, followed by a second in 2018. This Report summarises the findings of the 2019 Butterfly Survey, the third annual survey to have been carried out in Broadlears Field. Paragraph 1.4.1 below provides further details regarding the differences between these three surveys.

1.2 The site

1.2.1 The Agroforestry project covers a field extending over 48 acres. It is dissected by a service track and on each side, at an angle to the track, the field is planted out with rows of saplings of elderflower, a variety of apple and Sichuan pepper. During 2017 and 2018, the wide bands between each of the tree rows were sown with red clover, which was subject to periodic harvesting. During 2019, a mixed clover and hemp crop was planted, both of which have also been harvested at various times of the year and in different parts of the field. The margins of the site are rich in wildflowers throughout the seasons and there is an abundance of birdlife and other wildlife in and around the field.



Image 1 - Broadlears Field (looking north)



Image 2 - Broadlears Field (looking south)

1.2.2 The introduction of elderflower and apple appears to have been successful and plants are now well-established, with relatively high individual survival rates and continuing growth and fruiting. The Sichuan peppers have been less successful, exhibiting low survival rates and limited growth due in part to the presence of rodents. In an attempt to control this rodent population, in particular voles, raptor perches have now been introduced to the field. The objective is to help increase birds of prey to the area by giving them more vantage points to hunt from. This is particularly relevant for voles, which have a tendency to eat plants and vegetables beneath the surface by the use of feeding channels.



Image 3 - Mixed hemp and clover crop



Image 4 - Kestrel on raptor post



Image 5 - Apple tree



Image 6 - Elderflower bush



Image 7 - Sichuan pepper plant

1.3 Aims of survey

1.3.1 The butterfly survey was instigated in order to provide base data to help measure the levels of biodiversity on the site and to provide indicators of environmental health in the locality. In turn, this time-series data will begin to provide some evidence of the ongoing conservation impact of the agroforestry project. Although the surveys are still in their infancy, patterns are already beginning to emerge regarding the nature of the butterfly population within the area.

1.4 Method

1.4.1 The survey is carried out on a weekly basis each year between the start of April and the end of September, in accordance with Butterfly Conservation best practice. However, in 2017, the inaugural survey did not start until mid-summer, the time when the volunteer was first appointed; as a result, the timescale of this particular survey was limited to 15 consecutive weeks between June and the end of September 2017.

1.4.2 The survey site covers the entire Broadleaves Field and this in turn is divided into 10 survey routes (Transects), each of which are walked as part of the survey. There were 8 in 2017 – two new Transects were added in 2018 to provide fully comprehensive site coverage, and to reflect more effectively the butterfly population of the field and its surroundings. For each Transect (all of which remain fixed for each survey year to ensure consistency of data collection), the number and species of butterfly identified are recorded on a survey sheet. Wind speed and direction, temperature and sunshine cover are also noted.

1.4.3 Transects were identified (a) around the perimeter field margins (in most instances wildflower-rich and defined by woodland and agricultural hedgerows), (b) along the margins of the internal service track, and (c) along selected rows of the different formally planted tree species. Depending on the level of butterfly activity recorded and photographs taken, the survey typically takes between one and a half and two hours.

2. 2019 SURVEY FINDINGS

2.1 Numbers and species

2.1.1 The total number of butterflies recorded within Transects 1 to 10 during the 26 week survey period (the start of April to the end of September) for 2019 was 1505. The highest weekly total was 284 (in Week 15, w/c 8 July) and the lowest was 0 in Week 2 (w/c 8 April). The peak volumes lasted over a period of three consecutive weeks (Weeks 13, 14 and 15) in late June / early July.



Image 8 - Meadow Brown



Image 9 - Painted Lady

2.1.2 The total number of species of butterfly identified during 2019 was 21, as follows:

Meadow Brown (622 counted); Small White (235); Painted Lady (165); Ringlet (152); Common Blue (50); Large White (40); Peacock (37); Speckled Wood (36); Small Skipper (31); Orange Tip (28); Small Tortoiseshell (28); Gatekeeper (26); Green-veined White (19); Red Admiral (13); Clouded Yellow (9); Marbled White (5); Brimstone (2); Small Copper (2); Holly Blue (2); Wall (2); Comma (1)
(Total: 1505)



Image 10 - Ringlet



Image 11 - Common Blue

2.1.3 The largest range of species identified in any week was 12 (Week 18) and the smallest range was 1 (Week 1). In Week 2 however, not a single butterfly was recorded. As can be seen, the four most frequently occurring species, by a considerable margin, were the Meadow Brown (622 - 41%), the Small White (235 - 16%), the Painted Lady (165 - 11%) and the Ringlet (152 - 10%). The five most infrequent species were the Brimstone (2 - <1%), the Small Copper (2 - <1%), the Holly Blue (2 - <1%), the Wall (2 - <1%) and the Comma (1 - <1%).

2.2 Distribution by Transect

2.2.1. There continues to be a very uneven pattern of distribution of butterflies across Transects, as was the case in 2017 and 2018. The largest numbers (84%) were recorded along the peripheral field margins, including the margins adjacent to the service track dissecting the field. Very few (16%) were found along the rows of planted trees. Butterflies recorded in these locations again appear to be 'en-route' rather than to be feeding specifically along and within the tree sapling belts. This is notwithstanding the gradual maturing of the various tree species and presence of increasing amounts of seasonal blossom and later autumnal berries.

2.2.2. Details of the distribution of butterflies (by number) for each Transect are as follows:

Transect 1 (field margin): 368

Transect 2 (field margin): 158

Transect 3 (field margin): 23

Transect 4 (field margins parallel to central service track): 150

Transect 5 (planted elderflower): 79

Transect 6 (planted apple): 78

Transect 7 (planted Sichuan pepper): 65

Transect 8 (planted apple): 25
Transect 9 (field margin): 236
Transect 10 (field margin): 323

Total in all Transects: 1505



Image 12 - Peacock



Image 13 - Speckled Wood

2.3 Comparisons between the 2018 and 2019 seasons – numbers, species and distribution

2.3.1 A full comparison with findings for the 2017 season is not possible due to the late start of the survey for that year and the fact that eight rather than ten Transects were surveyed. No assessment has been undertaken where a comparison *is* possible (namely during Weeks 12 to 26 and within Transects 1 to 8) since there is now a full dataset available for 2018 for analysis purposes. However, it is relevant to point out that, unsurprisingly, the highest weekly totals were registered at the end of June/start of July in each of the three years, albeit of a different magnitude. In 2017, 2018 and 2019, the peak volumes each lasted over a period of three consecutive weeks within the mid-June/early July period.

2.3.2 The total number of butterflies recorded in 2019 (1505) represented a very significant 64% increase on the total of 915 for 2018. Early July was the peak season for butterfly numbers in 2019, with the largest number (284) being recorded in Week 15 (w/c 8 July). In 2018, the peak season started a week earlier, in June, with the highest numbers (151) recorded in Week 14 (w/c 2 July). However, much larger numbers of butterflies continued to be recorded during August and September 2019, compared to the same months in 2018. A lengthening of the butterfly season appears to have taken place this year, accompanied by substantially more butterflies in the peak season than in 2018. The number of survey weeks when no butterflies were recorded fell from 2 in 2018 to 1 in 2019.

2.3.3 The 21 different species identified during 2019 represented a very positive 24% increase over the figure of 17 for 2018. All 17 of the 2018 species reappeared in 2019; the new species identified this year were the Clouded Yellow, Small Copper, Holly Blue and Marbled White. The highest number of species to be recorded were in the last two weeks of July in 2019 (11 and 12 species respectively). Figures for 2018 also peaked over two weeks in July (11 and 11 species respectively) but occurred a week earlier.

2.3.4 By far the most prolific species of butterfly was once again the Meadow Brown but numbers were much higher this year. Small Whites were the next most common-place, increasing to 235 from 90 in 2018. Painted Ladies expanded enormously from 4 in 2018 to 165 in 2019, as did Ringlets, up almost six-fold from 26 in 2018 to 152 in 2019. The growth in Painted Lady numbers reflected the well-documented national phenomenon of the 2019 summer migratory 'invasion', an event that occurs only occasionally depending on availability of particular food sources and weather conditions. Other species also displayed significant increases in numbers compared to 2018, notably the Small Skipper (up from 1 to 31), Common Blue (from 22 to 50), Small Tortoiseshell (11 to 28), Peacock (13 to 37), Speckled Wood (16 to 36), Green-veined White (6 to 19) and the Orange Tip (8 to 28). A number of these increases, including those for the Common Blue, Green-veined White, Small White and Speckled Wood, were in contrast to national declines evidenced by the Big Butterfly Count 2019. In sum, where comparison was possible, 2019 witnessed increased numbers for 17 individual species, compared with figures for 2018.



Image 14 - Small Skipper



Image 15 - Orange Tip (female)

2.3.5 In contrast, four species showed a decline in numbers. Large Whites, the second most prolific species in 2018) declined dramatically by 78% (from 179 to 40 in 2019). Less markedly, recordings of the Red Admiral dropped to 13 from 15, Commas fell to 1 from 6 and Gatekeepers reduced from 42 to 26.

2.3.6 Whilst butterflies are naturally seasonal and can normally be predicted to appear at certain times of the year, 7 out of the 21 species identified were recorded in 11 or more of the 26 survey weeks in 2019. The Small White was identified in 19 separate weeks, the Painted Lady over 12 weeks and the Large White, Small Tortoiseshell, Peacock, Speckled Wood and Meadow Brown over 11 weeks. By contrast, the Brimstone, Small Copper, Holly Blue, Comma and Wall were each sighted in single individual weeks only.

2.3.7 A map illustrating the location of the ten Transects used as the framework for this survey is contained in Appendix 1. The largest number of butterflies recorded were located in Transect 1 (368), closely followed by Transects 10 (323), 9 (236) and 2 (158). Significantly these Transects comprise the wildflower-rich areas adjoining the field margins and the central track running through Broadlears Field. Whilst these same five Transects also contained the greatest number butterflies in 2018, some significant increases in numbers have been recorded in them this year. In particular, Transects 1 and 2 have shown 92% and 58% increases respectively over 2018.

2.3.8 Interestingly, although figures are again relatively low along the Transects that comprise the elderflower, apple and pepper plantings (Transects 5, 6, 7 and 8), it is perhaps encouraging that there have nevertheless been large increases in numbers recorded for these Transects in 2019. There has been little change for Transect 2 but a marked decrease for Transect 3. Transects 9 and 10 (added to the Survey in 2018) have had particularly high yields during the peak weeks of the season.



Image 16 - Small Tortoiseshell



Image 17 - Gatekeeper

2.3.9 Seven of the ten Transects have recorded an increase in the number of separate butterfly species present, a reflection of each Transect's ability to support a widening range of butterflies and perhaps an encouraging indication of a broadening of diversity. Transects 1, 4, 9 and 10 continue to support the widest range of species. Importantly, increases in the number of species have been recorded in three of the four purpose-planted Transects, the highest number being associated with the elderflower planting. Importantly, in each of these four Transects, the total numbers of butterflies recorded have increased significantly over those for 2018. A large number of Painted Lady butterflies were observed to be sheltering in the clover foliage alongside these planted Transects.

3. REFLECTIONS

3.1 Butterfly numbers

3.1.1 The generally dry, warm and sunny weather that extended throughout the summer months (conditions which generally suit adult butterflies) has provided the context for an increase in both the numbers of butterflies and the number species recorded in 2019. The hibernation periods of caterpillars and in turn the butterfly chrysalis stages have not been impacted by the extremes of temperature experienced in 2018, when spells of both extreme cold or heat during the spring and summer would have impacted on breeding patterns. This would include the drying out of caterpillar food plants and lowering of survival rates. Notwithstanding the 2018 drought conditions, sufficient new greenery emerged between autumn 2018 and spring 2019 to support the healthy development of this season's generation of butterflies. Food sources, both wildflowers and grasses, have not only been varied and plentiful throughout the peripheral and central margins of Broadleaves but also long-lasting, therefore sustaining a food supply (and thus increased numbers) over a longer season.

3.1.2 The introduction of new Transects 9 and 10 in 2018 has proved to be an extremely important addition to the framework of the survey, borne out by the large number and wide range of recorded butterflies in these locations. These peripheral margins are rich in wildflowers and grasses and

collectively have continued to yield increasing numbers during successive seasons. Adding this final 'link in the chain' around Broadlears Field now provides a much more robust picture of the butterfly habitat relating to the agroforestry project and its setting. Of note is that Transects 9 and 10 jointly accounted for some 37% of all recorded butterflies in Broadlears Field.



Image 18 - Green-veined White



Image 19 - Red Admiral

3.2 Clover and hemp cultivation

3.2.1 It was noticeable that in 2017 butterflies were not particularly attracted to the flowering clover in the broad strips comprising the key agricultural element of the agroforestry project. This appeared to have been less the case in 2018, when numerous butterflies of varied species (but particularly the Meadow Brown) were seen to be feeding on the clover crop. In that year those flowers continued to remain hugely attractive to a vast number and type of bees, and to a variety of moths (including large numbers of the Silver Y moth) that also sheltered within the clover foliage.

3.2.2 In 2019 however, a slightly different picture emerged. In spring 2019, part of the land hitherto cultivated with clover was sown with a hemp crop. As the weeks progressed, much of the hemp had grown to a considerable height, overshadowing the clover crop in many locations. In very broad terms, it was apparent that far fewer bees were in evidence on the clover crop. There were also considerably fewer Silver Y moths but a large volume of both grass hoppers and (unidentified) micro moths. Individual examples of the Wood Carpet and Blood Vein moths were also observed. There have still been examples of Butterflies feeding on the clover (in particular Meadow Browns and Common Blues) but most noticeable was the abundance Painted Lady butterflies sheltering within the clover, including those areas alongside the runs of elderflower, apple and pepper. Equally evident was the absence of butterflies feeding or resting on the foliage of the hemp crop.

3.2.3 The clover crop remains particularly invasive, both within the individual tree belts and the wildflower habitats of the field margins. This will continue to have implications for availability of the range of food sources for butterflies in subsequent years if other existing species are over-run. In the meantime, there remains little evidence of much in the way of self-seeding of indigenous wildflowers along the tree belts. The observation made in both the previous 2017 and 2018 Summary Reports therefore still remains pertinent, namely that it may be mutually beneficial (both in terms of the future productivity of the fruit trees and the improvement of the butterfly feeding habitat) to consider under-planting a mix of wildflowers to attract a wider range of pollinators. Such

an approach clearly continues to present resource and maintenance implications for the various agroforestry partners.



Image 20 - Clouded Yellow

Image 21 - Wall

3.3 Land management and operation of contractors

3.3.1 Three issues emerged during the 2018 season that were of relevance to the long-term integrity of the field margins and therefore warrant further comment following the end of the 2019 season:

(a) The loss of about 35% of established wildflower margin in Transect 1 (a high yielding survey area for butterflies) as a result of soil excavation and the creation of an access road by contractors engaged in a riding school development project in an adjoining area of the Estate.

Notwithstanding a relative fall in numbers recorded in 2018 as a consequence of this work, the area had regenerated successfully by the start of 2019 season. There is some evidence too that the excavations may have unearthed previously dormant wild plant seeds, adding to the diversity of the location. In any event, the butterfly count has been higher for this Transect in 2019 than in 2018.

(b) The storage of large numbers of bales of harvested clover within Broadleaves Field.

The prolonged storage of bales within the wildflower margins of Transects 1 and 4 during the 2018 butterfly feeding season undoubtedly led to a reduction in their food sources. Although around 30 bales were still lying alongside Transect 4 in May 2019, these were subsequently removed and storage on site has not been an issue at all during the 2019 season.

(c) The impact of seasonal hedgerow and path maintenance, and field cultivation.

In 2018 various margins were used by vehicles for access for hedge cutting and related maintenance purposes, resulting in the crushing of vegetation and the establishment of service tracks within the field margins along the perimeter of the field. In 2019, the wildflower margin adjacent to Transect 4 was reduced in width by 50% to 75% as a result of field ploughing in May. This represented a significant reduction in the butterfly food source. In July, the wildflower margins adjacent to Transects 1, 2 and 3 were reduced by 50% as a result of a mowing regime that sought to improve pedestrian access around the south west section of the field. This has been accompanied by the introduction of a new activity within Broadleaves Field – this same section is now firmly established as a horse riding/exercise circuit for the adjoining new riding school. With the growth and maturity of the elderflower crop, 2019 also witnessed the arrival of pickers in the field for the first time, together with related vehicles requiring access across the field strips and alongside the bushes.

3.3.2 Broadlears Field is part of a working farm and it is acknowledged that some of the above practices are part of the agricultural calendar. It is to be hoped however that all parties will be able to share an awareness of the butterfly survey work being undertaken and that as a consequence caution will be shown with the implementation of the planting, harvesting and maintenance regimes in order to minimise damage to the wildflower margins.



Image 22 - Wildflower species in Broadlears Field

3.4 Future integrity of field margins

3.4.1 These matters and the issues that they have raised continue to highlight the importance and relative vulnerability of the margins of wildflowers, tall grasses and hedgerows within the wider ecosystem of the field. As such, the comments made in this same section of the 2018 Butterfly Survey are still considered to be applicable. These can be summarised as follows:

- ✓ Maintaining the status quo and working with the current land management practices would be a pragmatic future option but does not fully address the issues identified above.
- ✓ Whether or not changes might be beneficial depends on the Trust's vision for Broadlears Field. The problems identified suggest that action of some sort is required to ensure that, on balance, the integrity of the field margins is both maintained and enhanced. In this context the observations made at the end of the 2018 Butterfly Survey regarding the potentially detrimental impact of the Dan Pearson Landscaping Plan on Broadlears Field remain valid.
- ✓ An alternative option would therefore be to raise the 'conservation' status of the field by introducing positive management of field margins (and tree belts) as wildflower corridors. If

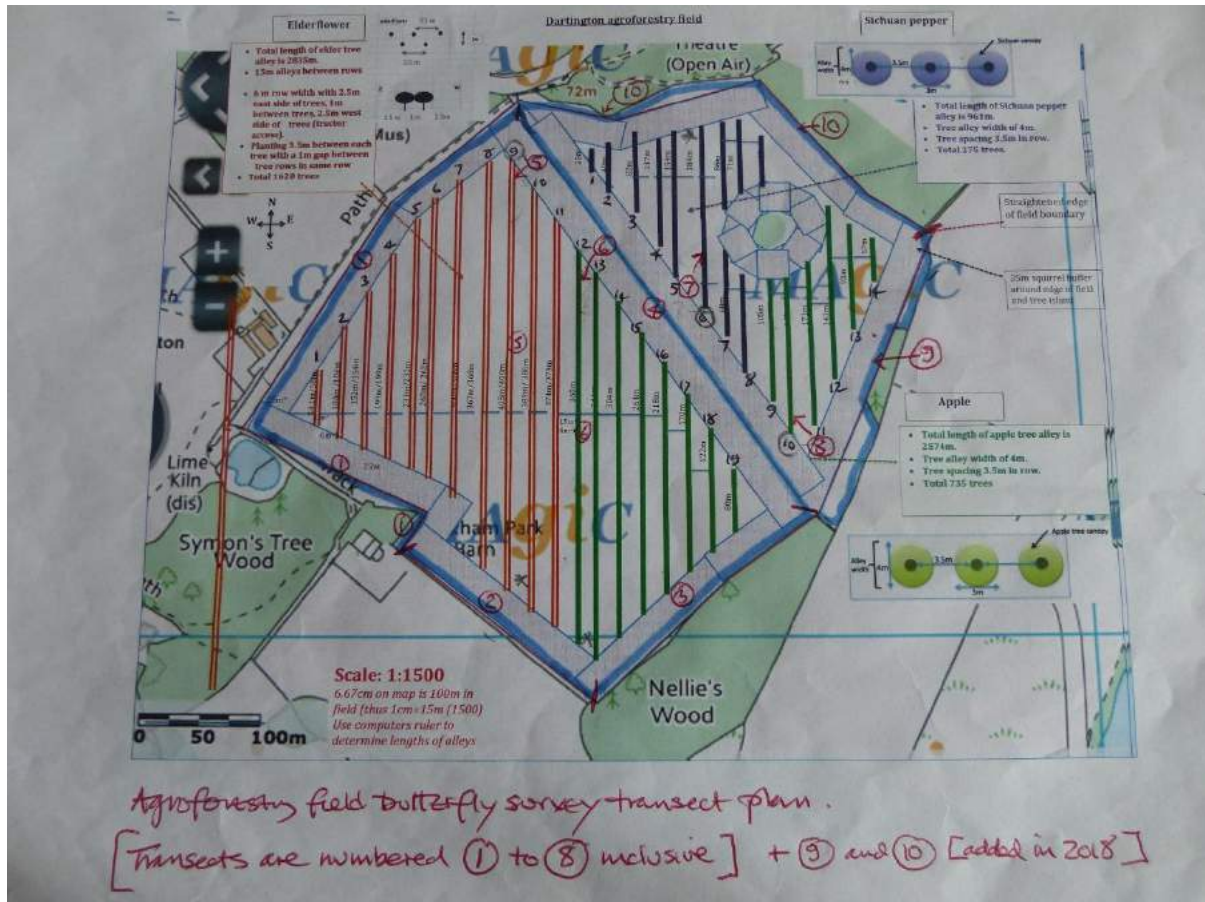
embodied in a code of practice, for example, that also sought to enhance the various land management practices currently in place, this could bring wider ecological benefits to the agroforestry project by improving levels of biodiversity. Butterflies, along with most other insects, are very susceptible to changes to the environment, which in turn makes them vulnerable to habitat degradation, as well as the various manifestations of climate change. Supporting habitat improvements provides much needed food not only for butterflies but other pollinating insects essential for the fertilisation of crops and trees.



Image 23 - Wildflower field margins in Broadlears Field

APPENDIX 1 LOCATION PLAN

Plan of Broadleaves Agroforestry Field and location of Butterfly Transects



APPENDIX 2 LIST OF IMAGES

Cover Image	Marbled White
Image 1	Broadleaves Field (looking north)
Image 2	Broadleaves Field (looking south)
Image 3	Mixed hemp and clover crop
Image 4	Kestrel on raptor post
Image 5	Apple tree
Image 6	Elderflower bush
Image 7	Sichuan pepper plant
Image 8	Meadow Brown
Image 9	Painted Lady
Image 10	Ringlet
Image 11	Common Blue
Image 12	Peacock
Image 13	Speckled Wood
Image 14	Small Skipper
Image 15	Orange Tip (female)
Image 16	Small Tortoiseshell
Image 17	Gatekeeper
Image 18	Green-veined White
Image 19	Red Admiral
Image 20	Clouded Yellow
Image 21	Wall
Image 22	Wildflower species in Broadleaves Field
Image 23	Wildflower field margins in Broadleaves Field

(All photographs taken in Broadleaves Field during 2019 season by Steve Turner)

APPENDIX 3 REFERENCES

Previous Survey Reports

1. DARTINGTON ESTATE, DEVON - BROADLEARS FIELD AGROFORESTRY PROJECT
2017 Butterfly Survey - Final Summary Report
2. DARTINGTON ESTATE, DEVON - BROADLEARS FIELD AGROFORESTRY PROJECT
2018 Butterfly Survey - Final Summary Report

2019 Survey Sheets

1. DARTINGTON ESTATE, DEVON - BROADLEARS FIELD AGROFORESTRY PROJECT
2019 Weekly Butterfly Survey Sheets - Week 1 (w/c 1 April) to Week 26, 2019)

2017-2019 Survey Data Analysis Tables (unpublished)

1. DARTINGTON ESTATE, DEVON - BROADLEARS FIELD AGROFORESTRY PROJECT
Table A - Butterfly numbers and number of species recorded weekly, by survey year (Weeks 1 to 26 within Transects 1 to 10)
2. DARTINGTON ESTATE, DEVON - BROADLEARS FIELD AGROFORESTRY PROJECT
Table B - Butterfly numbers and species recorded in each survey transect, by survey year (Weeks 1 to 26 within Transects 1 to 10)
3. DARTINGTON ESTATE, DEVON - BROADLEARS FIELD AGROFORESTRY PROJECT
Table C - Butterfly numbers recorded in each survey transect, by survey week, by year (Weeks 1 to 26 within Transects 1 to 10)
4. DARTINGTON ESTATE, DEVON - BROADLEARS FIELD AGROFORESTRY PROJECT
Table D - Butterfly species (incidences and totals) recorded annually, by survey year (Weeks 1 to 26 within Transects 1 to 10)
5. DARTINGTON ESTATE, DEVON - BROADLEARS FIELD AGROFORESTRY PROJECT
Table E - Butterfly species identified in each transect, by survey year (Weeks 1 to 26 within Transects 1 to 10)

