Prime Environment
Ecology - Arboriculture

LAND AND PARTNERS

BAT ACTIVITY SURVEYS

LAND NORTH OF LONG COPSE LANE

EMSWORTH, HAMPSHIRE

PROJECT NO: 043

REV 2

South and South East
0330 2233 806
southeast@primeenvironment.co.uk

Midlands and North
0330 2233 825
central@primeenvironment.co.uk

www.primeenvironment.co.uk Registered Office: Prime Environment Ltd, 6 Bridge Street, Belper, Derbyshire, DE56 1AX. *Company Number: 08407111*

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CONTENTS

1 Introduction

In 2016, Prime Environment Limited (Prime Environment) was instructed by Land and Partners (the Client) to undertake bat activity surveys of an area of land north of Long Copse Lane, Emsworth (Ordnance Survey (OS) grid Reference SU 747 079) (The Site).

The Site is 15.9 hectares and comprises horse paddocks, ménage, spoil heaps, small woodland copses and a residential property with a garden. The site is partially bordered by woodland to the north and west.

A bat activity report was issued in 2017[1] following survey undertaken in 2016. Due to detector equipment failure at some static locations, the incomplete sessions were repeated in 2017, for which this report provides the updated survey results.

Figure 1. Aerial photograph showing site boundary.

[1] Prime Environment (2017). Bat Activity Surveys – Land North of Long Copse Lane, Emsworth. Rev. 0. Prime Environment: Cromford.

1.1 Aims and Objectives

The aims of the study were to:

- Identify the species of bat active within the Study Area
- Identify patterns of bat activity across the Study Area
- Quantify the levels of activity of bats.

Ecological information for the assessment was provided by bat transect and automated surveys.

Information regarding the habitats present within the Study Area and discussions and recommendations are presented in a separate Ecological Impact Assessment (EcIA).

2 Method

The survey methodology was based on the BCT guidelines[2] for a site of Medium Habitat Quality. Surveys were spread throughout the bat activity season with surveys being undertaken once per month. Surveyors involved with the bat surveys are listed in Table 1.

Table 1. Surveyor details

Name	Licence reference	CIEEM membership level
Chris Morrell	2015-17144-CLS-CLS	Full MCIEEM
Mike Morton	n/a	Full MCIEEM
Gemma Mantle	n/a	Full MCIEEM
Kristy Kelly	n/a	Associate ACIEEM

2.1 Bats

2.1.1 Automated surveys

Automated bat surveys were undertaken by Chris Morrell, a licenced and experienced bat surveyor (class 2 survey licence, 2015-17144-CLS-CLS) and full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). Automated surveys were undertaken using Song Meter SM2 automated bat detectors. These units automatically record bat echolocation calls in full spectrum. Analysis of the recordings was undertaken by Jon Moore MCIEEM (Class 2 Survey Licence 2015-15080-CLS-CLS).

Four detectors were deployed on the site at four separate locations once per month between May and October 2016, and left to record on site for 5 consecutive nights. Survey dates are provided in Table 2. 30 nights of survey were aimed to be completed.

Table 2. Automated survey dates – original surveys 2016

Month	Date start	Date end	Consecutive nights
May	26/05/2016	31/05/2016	5
June	20/06/2016	25/06/2016	5
July	20/07/2016	25/07/2016	5
August	25/08/2016	30/08/2016	5
September	21/09/2016	26/09/2016	5
October	22/10/2016	27/10/2016	5
Total			30

Following issues with sound recordings of bat detector units in the 2016 surveys at Locations A and C, detectors were redeployed at these locations in 2017 for months where data was missing. The dates and land locations are provided in Table 3.

Table 3. Automated survey dates – repeated surveys 2017

Month & location	Date start	Date end	Consecutive nights
May (A & C)	23/05/2016	28/05/2016	5

[2] Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London

August (A)	25/08/2016	28/08/2016	3.5[3]
September (A)	11/09/2016	16/09/2016	5
October (A)	19/10/2016	24/10/2016	5
Total			18.5

2.1.2 Transect surveys

Walked transects were undertaken using broadband detectors. The units automatically recorded bat sound and tagged each call with the geographic location of the unit when it recorded each bat pass, and the routes taken by the surveyor.

One dusk transect was undertaken per month between May and October 2016. An additional dawn transect was undertaken following the dusk survey in August. The dates of surveys, detectors used and surveyors undertaking the surveys are listed in Table 4.

Two transect routes were plotted across the site with two laps each visit. Routes were circular and the order and starting point changed on each trip. The survey lasted approximately 2 hours (starting at sunset). Surveyors aimed to complete the same number of laps each visit, to standardise the walking pace. Routes were chosen to include a selection of habitats which represent the site, i.e. hedgerows, tree lines, woodland and within open fields.

Table 4. Transect survey dates and surveyors

Date	Dusk/ Dawn	Transect	Surveyor
30/05/2016	Dusk	1	KK
		2	CM
20/06/2016	Dusk	1	MM
		2	CM
28/07/2016	Dusk	1	CM
		2	MM
24/08/2016	Dusk	1	MM
		2	CM
25/08/2016	Dawn	1	MM
		2	CM
21/09/2016	Dusk	1	GM
		2	CM
19/10/2016	Dusk	1	MM
		2	CM

2.1.3 Data analysis

Sound analysis software was used to analyse the recorded bat echolocation data. Transect data was analysed in Bat Sound and automated detector data was analysed in Kaleidoscope 3.1. Automated detector data was initially analysed using Kaleidoscope's automatic identification processes, but each call was manually verified. All analysis was guided by the

[3] Battery failed on detector resulting in 3.5 nights of data

bat call parameters published by Russ (2012[4]). Species were attributed to each file or group of files to calculate activity levels for each species. Species labels/codes are provided in Table 5.

There is considerable crossover between echolocation calls within British bat species. Where calls could not be attributed to a specific species, genus level identification was used where possible, any calls which could not be attributed to a genus were labelled as an unclassified bat. Files with no bat calls present, were labelled as noise and omitted from the data.

Transects

For the transect data, one bat pass was defined as up to 10 seconds of activity. This may include several groups of files where short series of bat calls were recorded. Where two bats were present, a bat pass was attributed to each bat i.e. two different bats would equal two bat passes.

Automated Detectors

A bat pass was defined as the presence of a bat echolocation call or series of calls within one file. The software was configured to split the data into a maximum of 10 second duration files. Bat passes were extracted from the data and activity levels were calculated and graphically presenting using Excel 2016. Bat passes per night (bp/n) was used as an index of activity. This was calculated by dividing the total number of bat passes by the number of survey nights for each location.

The Kaleidoscope software limits one species label being attributed to each file. Therefore, in the automated data where multiple bat species echolocation pulses were present in a file, a species priority hierarchy was applied to identify one species. The hierarchy considers detection rate of the species' echolocation calls and conservation status. The hierarchy is outlined in Table 5 and defined in Table 6.

[4] Russ, J. (2012). British Bat calls: A Guide to species Identification. Pelagic Publishing: Exeter.

Table 5. Species labels ordered by the labelling priority hierarchy

Priority	Species label	Common name	Scientific
1	BABA	Barbastelle	*Barbastella barbastellus*
2	RHFE	Greater horseshoe	*Rhinolophus ferrumequinum*
3	RHHI	Lesser horseshoe	*Rhinolophus hipposideros*
4	PINA	Nathusius' pipistrelle	*Pipistrellus nathusii*
5	MYBD	Broadband Myotis call	*Myotis* sp. – could include *Myotis bechsteinii*
6	PLSP	*Plecotus* bat	*Plecotus auritus OR Plecotus austriacus*
7	EPSE	Serotine	*Eptesicus serotinus*
8	BIG	Serotine OR *Nyctalus* species	*Eptesicus serotinus OR Nyctalus sp.*
9	MYSP	*Myotis* species	*Myotis sp.*
10	NYLE	Leisler's	*Nyctalus leisleri*
11	NYSP	*Nyctalus* species	*Nyctalus sp.*
12	NYNO	Noctule	*Nyctalus noctula*
13	PIPN	Common OR Nathusius' pipistrelle	*Pipistrellus pipistrellus OR Pipistrellus nathusii*
14	PIPY	Soprano pipistrelle	*Pipistrellus pygmaeus*
15	PIPP	Common OR soprano pipistrelle	*Pipistrellus pipistrellus OR Pipistrellus pygmaeus*
16	PIPI	Common pipistrelle	*Pipistrellus pipistrellus*
17	NoID	Unclassified bat	*Chiroptera*
18	Noise	Non-bat sound	Non-bat sound

Table 6. Rational for labelling priority hierarchy

Priority	Common name	Conservation status[a] (Common, Rarer or Rare)	Echolocation call detection rate[b]
1	Barbastelle	Rare	Low
2	Greater horseshoe	Rare	Medium
3	Lesser horseshoe	Rare	Medium
4	Nathusius' pipistrelle	Rare	High
5	Broadband Myotis call	Rare (possible Bechstein's bat [c])	Low
6	Brown OR grey long-eared	Common to rare	Low
7	Serotine	Rarer	High
8	Serotine or Nyctalus species	Common to rarer	High
9	Myotis species	Various (common to rare)	Low to medium
10	Leisler's	Rarer	High
11	Nyctalus species	Common to rare	High
12	Noctule	Common	High
13	Common OR Nathusius pipistrelle	Common to rare	High
14	Soprano pipistrelle	Common	High
15	Common OR soprano pipistrelle	Common	High
16	Common pipistrelle	Common	High
17	Unclassified bat	Unclassified	Unclassified
18	Non-bat sound	N/A	N/A

[a] There is no UK published list of the conservation status of bats. Status has been determined by applying a number of factors including: BCT statistics; Habitats Directive Annex II species; UK BAP Priority Species and the IUCN Red List.

[b] Detection rate is based on knowledge of echolocation characteristics, including amplitude and directionality. High detection calls are not directional and have a high amplitude and are attributed to bats which have a significant constant frequency component in their calls. Low detection calls are either directional or of low amplitude and often have significant frequency modulated components to their calls. Medium detection rates have components from both low and high rates.

[c] This classification is set at lower priority as other Annex II species as it may also include the more common Natterer's bat.

2.2 Constraints

2.2.1 Age of data

Any ecology assessment must be considered as a 'snapshot' of the Site conditions at the time of the survey; ecological constraints will change over time and therefore the findings of this report are considered to be valid for a period of one year from the survey, after which the report should be reviewed to assess whether updated surveys are necessary.

2.2.2 Determining numbers of bats

Whilst automated detectors are able to determine levels of bat activity at a survey location, it is not possible to use the data to accurately determine the number of bats present. For example, 10 bat passes may be from 10 different bats commuting past a detector; but equally could be one bat flying past the detectors multiple times.

2.2.3 Directional and low amplitude bat calls

Long-eared *Plecotus* species and potential Bechstein's bats *Myotis bechsteinii* have been recorded during the surveys. Due to the low amplitude of the calls of these species, it is also likely that these bats are recorded less frequently than other bats with higher amplitude such as *Nyctalus* and *Pipistrellus* bats. It is therefore likely that these classifications are underrepresented in the data.

2.2.4 Equipment malfunctions

Equipment malfunctions and deployment issues resulted in data being lost. Details are provided below and summarised in Table 7.

May 2016

The automated detectors placed at Locations A and C experienced an unknown fault resulting in data being recorded only once per hour. Whilst some bat activity was recorded at these times, the five-night survey period was not fully sampled. With only a total of seven passes recorded at the locations, this is considered to be an unsuccessful sampling period at these locations and so data have not been presented in the survey results.

These locations were re-sampled in the 2017 survey window.

August to October 2016

The detector placed at Location A experienced high levels of interference noise between August and October. During July, the microphone extension cable was damaged by livestock. A shorter cable was then used to try and rectify the problem; however, this brought it closer to an electric fence which is considered to be the source of the interference which was not identified until the survey had been completed. The interference level was high enough to prevent any bat calls being identified in the sound files. Hence this issue resulted in no bat activity data being recorded Location A and is excluded from the survey results.

This location was re-sampled in the 2017 survey window.

August 2017

The detector placed at Location A experienced high levels of interference noise and subsequently resulted in battery failure after 3.5 nights. Bat were however recorded in the data.

3 Results

3.1 Species and genera identified

Species recorded during surveys at the Study Area were as follows:

- Common pipistrelle *Pipistrellus pipistrellus*
- Soprano pipistrelle *P. pygmaeus*
- Nathusius' pipistrelle *P. nathusii*
- Serotine *Eptesicus serotinus*
- Barbastelle *Barbastella barbastella*
- Noctule *Nyctalus noctula*

In addition to the above species, bat calls classified to the following genus level were also recorded:

- *Myotis*[5] species and Broadband *Myotis* species
- Long-eared bat *Plecotus auritus*
- *Nyctalus* species[6]
- 'Big bat' species[7]

Bats with echolocation calls between the given parameters for the common and soprano pipistrelle were recorded in the data, as were calls between the parameters given for the common and Nathusius' pipistrelle.

Totalling individual identified species and single species from unaccounted genera (*Myotis* and *Plecotus*), a minimum of eight different bat species were recorded during the activity surveys. Based upon the known geographic distribution of species and the habitats present on the Site, accounting for potential additional species from the *Nyctalus*, *Plecotus* and *Myotis*, up to 13 species may have been recorded in the surveys; however, this is considered unlikely.

It should also be noted that either one or multiple *Myotis* species may be present, and as grey long-eared bats have been recorded in the area, they may also be both grey long-eared *Plecotus austriacus* and brown long-eared bats *Plecotus auritus* recorded in the data. It should be noted that some quieter echolocating bats (such as brown long-eared, barbastelle and

[5] The call characteristics of the *Myotis* genus have a large overlap and so identification to species level is not usually possible from calls alone, although Bechstein's bat *M. bechsteini* and Natterer's bat can sometimes be identified due to their broadband calls – files with *Myotis* calls with a start frequency above 100KHz and end frequency below 30kHz of at least three pulses were labelled as Broadband *Myotis* (MYBD) .

[6] *Nyctalus* species include the noctule and Leisler's bats.

[7] Due to the similarity between some of the calls of *Nyctalus* species bats and the serotine, the 'Big bats' classification is attributed to bat calls which cannot be differentiated between these two genera.

Natterer's bat *Myotis nattereri*) are difficult to record with bat detectors and may be under represented.

3.2 Automated survey results

In the following sections, for the purpose of examining differences between survey locations and months, the results from the original survey in 2016 has been joined with the surveys in 2017. It should be noted when interpreting this data that the different years of survey may impact the overall results due to potential differences in environmental conditions and the presence and abundance of foraging resources at the times of the survey.

3.2.1 Total activity levels

Successfully completed sampling nights and equipment failures are shown in Table 7. Accounting for all four sampling locations, a total of 118.5 sampling nights of the scheduled 120 nights were successfully completed, equating to a mean of 29.6 nights per sampling location. This accounts to a sampling success rate of 98.75% for the season between May and October in 2016 and 2017.

A total of 1,291 hours of automated survey was completed, equating to a mean of 322.8 hours per location. As a site of 15.9 hectares, this equates to a total of 107.6 hours survey per hectare, and a mean of 26.9 hours survey per hectare at each location.

Table 7. Completed automated survey nights.

	Completed survey nights at locations				
Month	**A**	**B**	**C**	**D**	**Site total**
May	5[a]	5	5[a]	5	10
June	5	5	5	5	20
July	5	5	5	5	20
August	3.5[a]	5	5	5	15
September	5[a]	5	5	5	15
October	5[a]	5	5	5	15
Total	**28.5**	**30**	**30**	**30**	**118.5**
Mean per month	**4.75**	**5**	**5**	**5**	**19.75**
Successful completion	**95%**	**100%**	**100%**	**100%**	**98.75%**
Total recorded hours	**306.6**	**328.0**	**328.5**	**328.0**	**1,291.1**

[a] surveyed in 2017. All other surveys completed in 2016

3.2.2 Total activity levels (all species)

A total of 10,126 bat passes were recorded during the automated surveys equating to 339.8 bp/n across the whole site and a mean of 85.0 bp/n per location. The distribution between each genus and species of bat is shown in Figure 2. Further breakdown amongst locations, time and species are provided in the following sections.

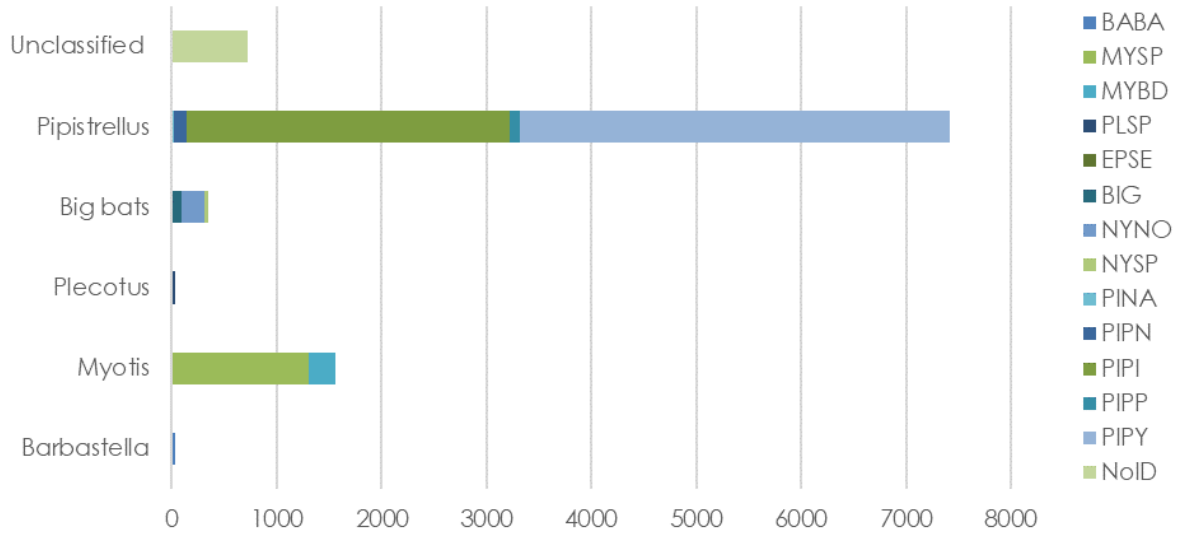


Figure 2. Total count of automated bat passes by bat genera

Pipistrellus species bats dominated activity levels accounting for 73.2% of total activity. All three UK pipistrelle species were recorded: soprano were highest with a mean of 34.4 bp/n per location, common second with 103.2 bp/n and Nathusius' third with 0.1 bp/n. The crossover between soprano and common accounted for 0.8 bp/n per location, and between common and Nathusius' 1.0 bp/n: this indicates that activity levels may be slightly higher for the each pipistrelle species, however the numbers suggest this change would be minimal.

Myotis species bats were the second highest amongst the genera with 15.4% of total activity. Bats classed as broadband *Myotis* had a mean of 2.2 bp/n per location and other *Myotis* 11.0 bp/n. Accounting for the high likelihood of multiple species of *Myotis* species being present within these classifications, activity for individual species would be lower. Given the *Myotis* species known to be on or near the Site and species typically found associated with the habitats present, it is likely that at least Bechsteins, Natterer's and whiskered are present. Brandt's may also be present, whilst Daubenton's may commute through the site to watercourses and waterbodies in the area.

Big bats were the third highest genus group with 3.5% of total activity. Noctules accounted for the highest amongst this group with 1.8 bp/n per location, followed by the Big bat classification with 0.8 bp/n, *Nyctalus* sp. with 0.4 bp/n and serotine with 0.1 bp/n (3 passes). With serotine recorded, and records classified as Big bats, it is likely there activity level was higher. Similarly with noctule present it is likely their activity was also higher. Leisler's may have been present within the *Nyctalus* and Big bat classifications, but if so there activity level would be minimal.

Plecotus species and barbastelle bats were the most infrequently recorded genera each with 0.4% with a mean of 0.30 bp/n per location (34 passes) and 0.32 bp/n (36 passes) respectively. The remaining data was classified as unidentified bats with 7.1% of activity.

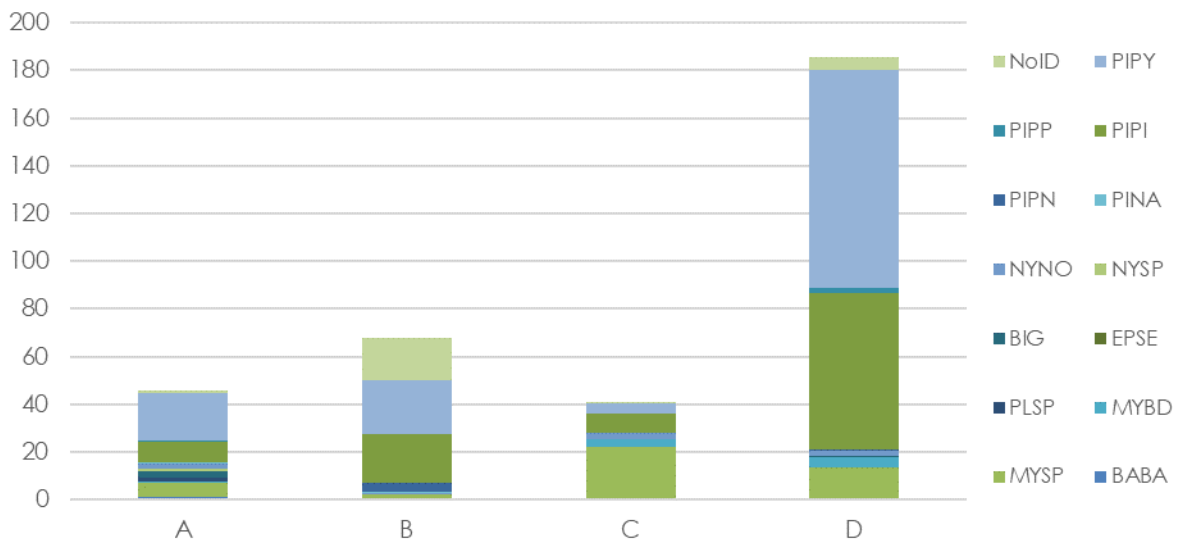


Figure 3. Season total of bat passes per night per species classification across all locations. Data labels show percentage of overall activity.

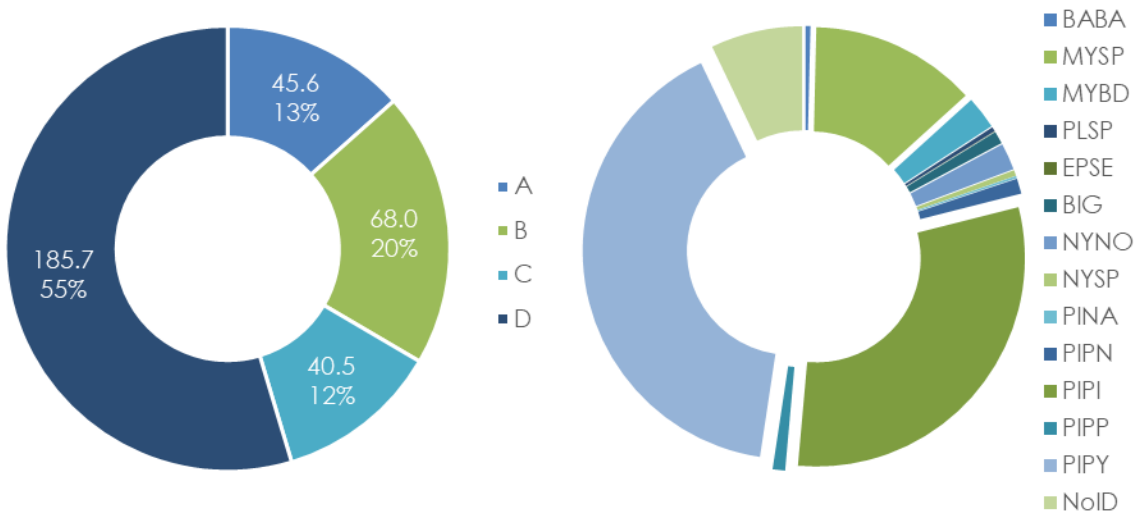


Figure 4. Pie charts showing the distribution of activity between locations (left), and between each species classification (right).

3.2.3 Spatial distribution

Figure 4 displays the distribution of activity between survey locations. Automated survey detector locations are shown on Figure 8. Across all survey months, the highest level of activity was recorded at Location D with 185.7 bp/n. This was followed by Location B (68.0 bp/n), Location A (45.6 bp/n) and Location C (40.5 bp/n).

Barbastelle were only recorded at Location A, and only during the 2017 surveys. *Plecotus* sp. activity was also highest at A, with only a single pass recorded at C and D.

All *Myotis* species activity was highest at Location C with 25.4 bp/n followed by D with 18.0 bp/n. Location A had 6.6 and B 2.4 bp/n. Broadband *Myotis* followed a similar pattern with activity highest at C and D.

Serotine was only recorded at D, whilst the Big bats classification was highest at A. Noctule had a similar level at A, C and D but was lowest at B.

Common and soprano pipistrelles were recorded at all locations; however, 64% and 69% of activity respectively was recorded at Location D. Common pipistrelles were lowest at Locations A and C with 8.2 and 8.6 bp/n and sopranos were lowest at C with 4.0 bp/n.

Nathusius' pipistrelle was highest at A and B, with only one pass at D. 96% of the crossover between Nathusius' and common pipistrelle was recorded at B indicating possibility that Nathusius' activity may be higher than the data suggests at this location, or common pipistrelles are echolocating at a lower frequency whilst foraging and commuting over the open habitat here.

3.2.4 Temporal distribution

Figure 5 plots bp/n recorded at all locations against each month of survey. Bp/n in this section are expressed as a mean per location calculated by dividing number of bat passes by the total number of successfully completed survey nights for each month.

There were peaks of activity in May (183.5 bp/n) and in October (104.1 bp/n). The lowest level of activity was recorded in August with 26.0 bp/n. The remaining months ranged between 31.4 bp/n in June to 87.5 and 75.8 bp/n in July and September respectively.

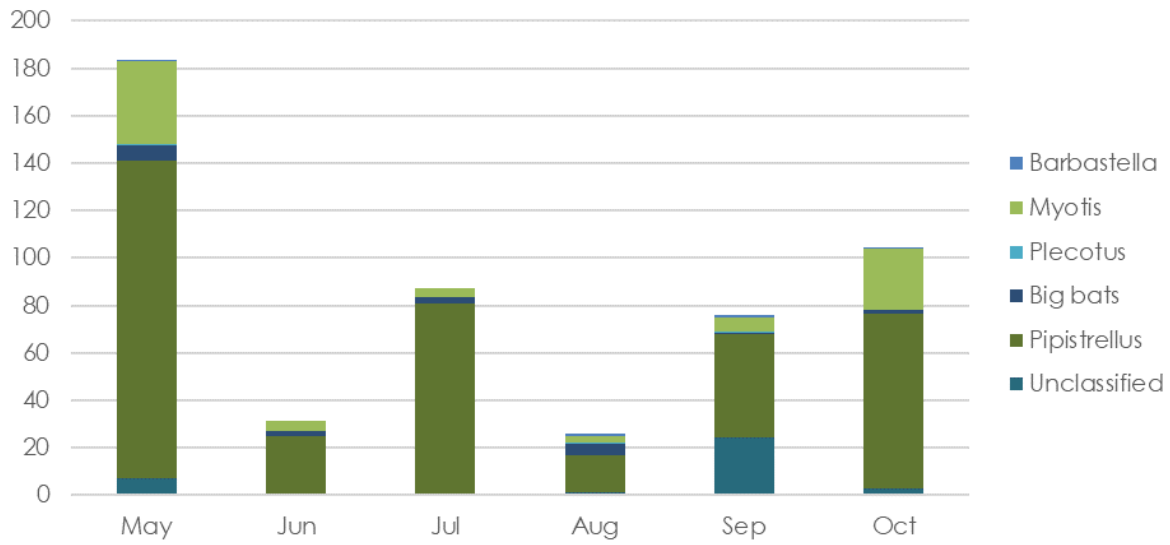


Figure 5. Distribution of bat passes per night throughout the season

The high level of *Pipistrellus* bats largely accounted for the fluctuations between each month. However, *Myotis* bats were also highest in May and October. The levels of activity do not suggest a swarming site is present on the Site, but the higher level of activity in October

suggests bats may be foraging on the Site prior to hibernation at a site in the area, and may be leaving the same site during the spring in May. The lower levels in the core summer months between June and August suggest that the site is unlikely to be important for any maternity roosts in the area.

Unclassified were highest in September – unclassified were largely attributed to social calls which the sound analyst believed to be largely *Pipistrellus* bats: social calls from these bats with no echolocation calls to aid accurate identification are often present in data. September is the mating time for these bats, and it is likely that males were advertising for mates. The level was highest at B in September suggesting at least one *Pipistrellus* species mating roost was active at this time in this area.

Plecotus and barbastelle were not recorded in June and July, but were present during the remaining months at low levels. Big bats were highest in May and fluctuated at low levels during the remainder of the season.

3.2.5 Roosting behaviour

On average across the whole site during the 30 nights of survey, bats were first recorded on the site within 30 minutes on 58% of survey nights, within 60 minutes within a further 14%, and within 90 minutes on a further 8%. Figure 7 displays the distribution of passes after sunset for non-*Pipistrellus* bats.

Bats were recorded within 30 minutes of sunset most often at Location B (73% of nights), followed by D (67%), A (54%) and C (40%). Location A and C showed greater levels of first passes within 30 to 60 minutes after sunset at 18% and 20% of survey nights, and also between 60 to 90 minutes with 11% and 13% of nights respectively.

Between the species noctules and common and soprano pipistrelles were the most frequent bats recorded within 30 minutes of sunset.

Pipistrellus bats are early emerging bats typically emerging from sunset to 30 minutes after. Common pipistrelles are earlier emerging bats, typically emerging from sunset to 30 minutes. They were recorded most frequently within 30 minutes of sunset at Location B (60% of nights) and Location D (30%). When these bats were recorded at B within 30 minutes (18 nights), they were recorded before D, and all other locations. The data suggests there is likely a common pipistrelle roost present near Location B in the southern area of the Site or the immediate surroundings. An early emerging common pipistrelle trend wasn't followed throughout 4 nights in July and all of August suggesting any roosts present may have moved during this time.

Soprano pipistrelles showed a different trend with early emerging bats most often recorded within 30 minutes of sunset at D (67% nights), with the earliest pass recorded at 11 minutes after sunset with a mean of 46 minutes. Early passes were also recorded at Location C with the lowest at 5 minutes before sunset on one night in July, and also at B at 4 minutes after sunset; however, this pattern was irregular with only occasional early passes. It is likely that a soprano pipistrelle roost is on the Site or the immediate surroundings. This may be multiple roosts being used at different times of the year or may be from an area between these locations with bats commuting towards D on a more regular basis.

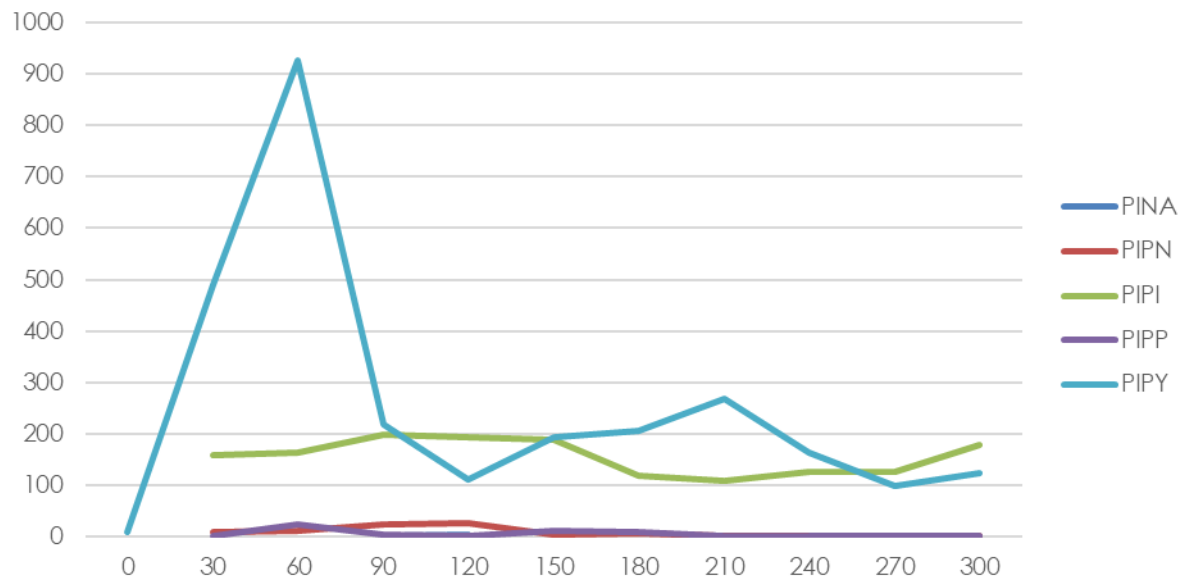


Figure 6. Count of bat passes in 30 minute intervals up to five hours after sunset (300 minutes). *Pipistrellus* bats only.

Nathusius' pipistrelle were recorded at all locations but the earliest pass was 81 minutes after sunset. It is unlikely these bats are roosting on or near the Site.

Noctule bats typically emerge from roosts close to sunset. Earliest passes by noctules were recorded before sunset at Locations A, B and C and within 3 minutes at D, and were within 30 minutes at A and D on 39% and 40% nights respectively. Location A also had the lowest mean first pass at 50 minutes after sunset in comparison to the second lowest at D with 113 minutes. With passes before sunset it is highly likely a noctule roost is near to the Site, but due to the highly mobile nature and loud calls of these bats it is difficult to determine the direction in relation to the Site; however, they may be flying over the Site from the west passing near Location A before moving towards D.

Myotis bats are later emerging species. *Myotis* pass (MYSP) were recorded within 30 minutes of sunset at B, C and D for a combined total of 9% of nights. Broadband *Myotis* (MYBD) were recorded within 30 minutes at B and D at 28 minutes on single nights. Both classifications passes were recorded within an hour of sunset at all locations on 22% and 9% of nights respectively. The earliest pass for *Myotis* was recorded at B at 19 minutes after sunset, 22 mins at C, 28 mins at D, and 37 mins at A.

There was no consistent pattern of activity demonstrating bats emerging first at one location with first passes commonly recorded at both B and D. This suggests there may be *Myotis* species roosts close to both the previously identified Bechstein's roost in the woodland at B, and in the woodland to the north of C and D.

Serotine are early emerging bats, typically emerging close to sunset. Serotine activity was first recorded at 35 minutes after sunset on one night at Location D. These were recorded within 60 minutes of sunset at Locations D and A. The Big Bat classification showed the same trend. It is therefore unlikely that these bats are roosting on or close to the site.

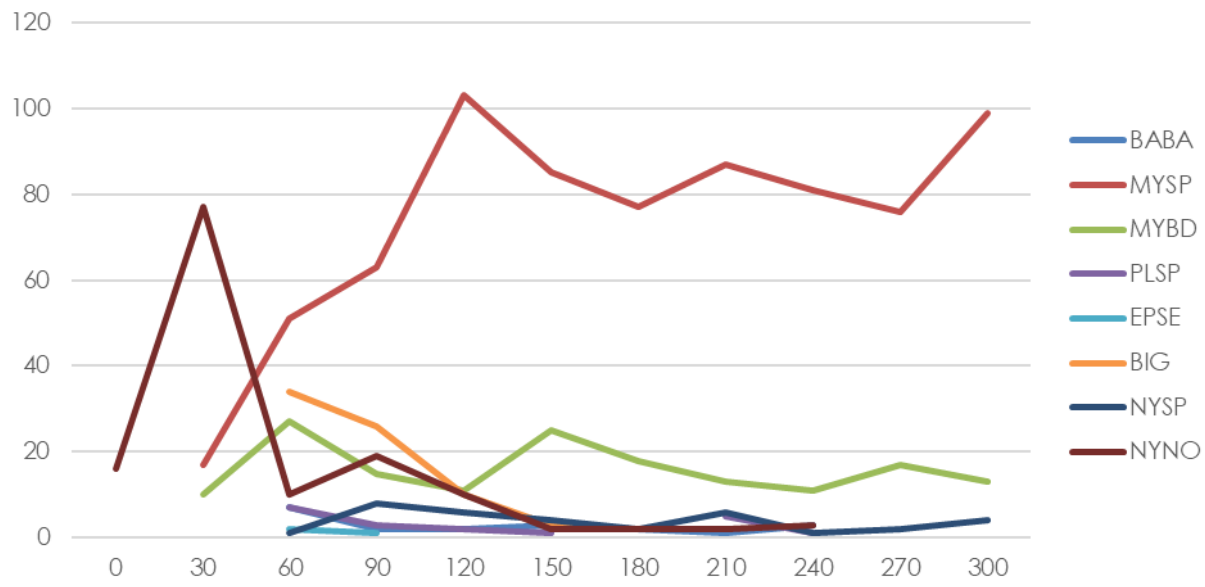


Figure 7. Count of bat passes in 30 minute intervals up to five hours after sunset (300 minutes). Non-*Pipistrellus* bats only.

Plecotus species and barbastelle bat activity was low across the site. Both are later emerging species. No activity was recorded within 30 minutes for either classification. Barbastelle bats were recorded within 60 minutes of sunset at Location A on 4 nights (14% of total) during the 2017 surveys, at 36, 48, 49 and 57 minutes after sunset. *Plecotus* bats were first recorded within 60 minutes of sunset on 3 nights at Location A only, 37, 53 and 55 minutes after sunset.

The early passes and low level of activity from *Plecotus* and barbastelle suggest a roost may be nearby but the data suggests these would likely be irregularly used or these bats are not often commuting from the roost through the Site.

3.3 Transect survey results

The two transect routes are plotted in Figure 8. The routes took in the majority of the Site and sampled the different habitats present.

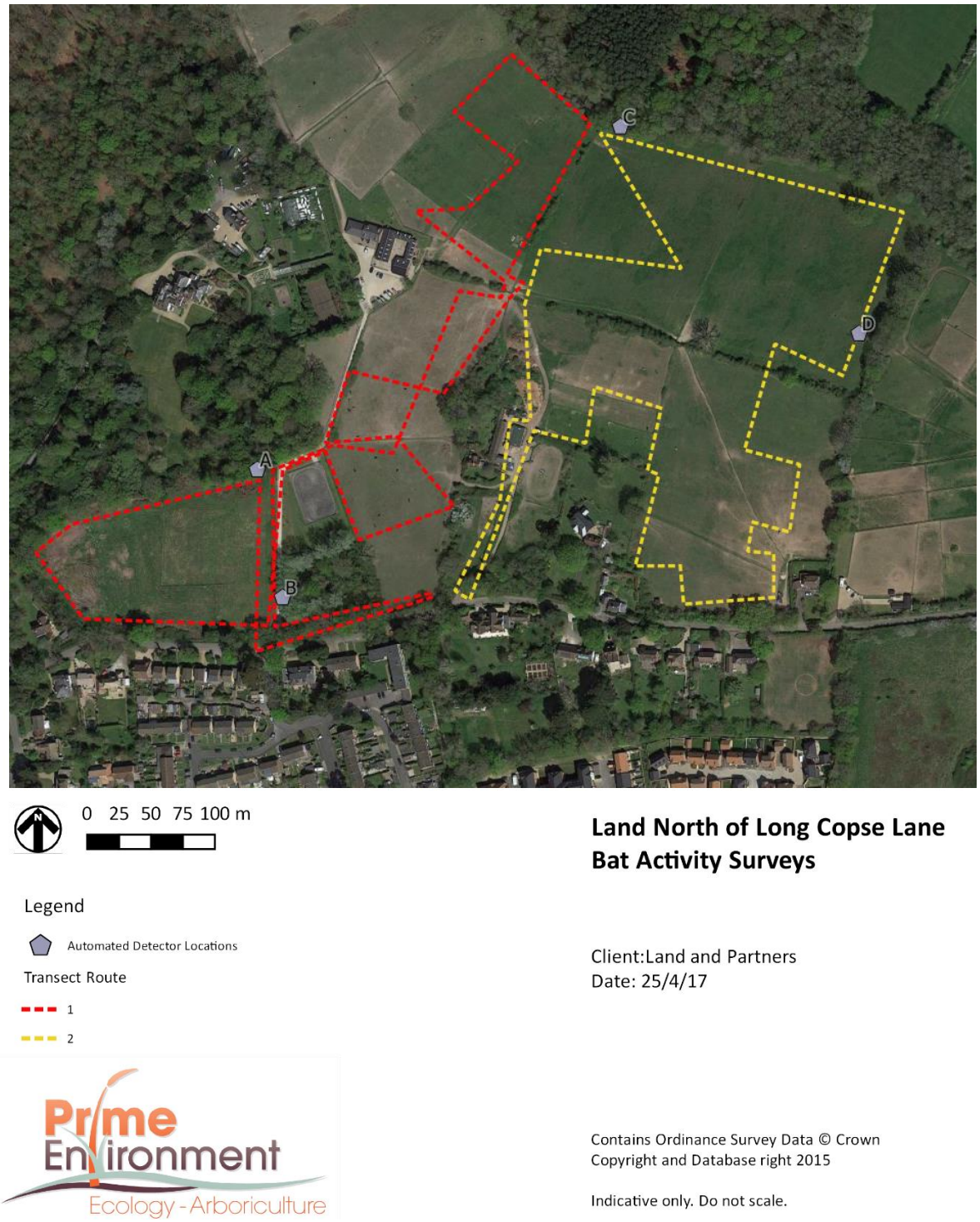


Figure 8. Transect routes and automated locations

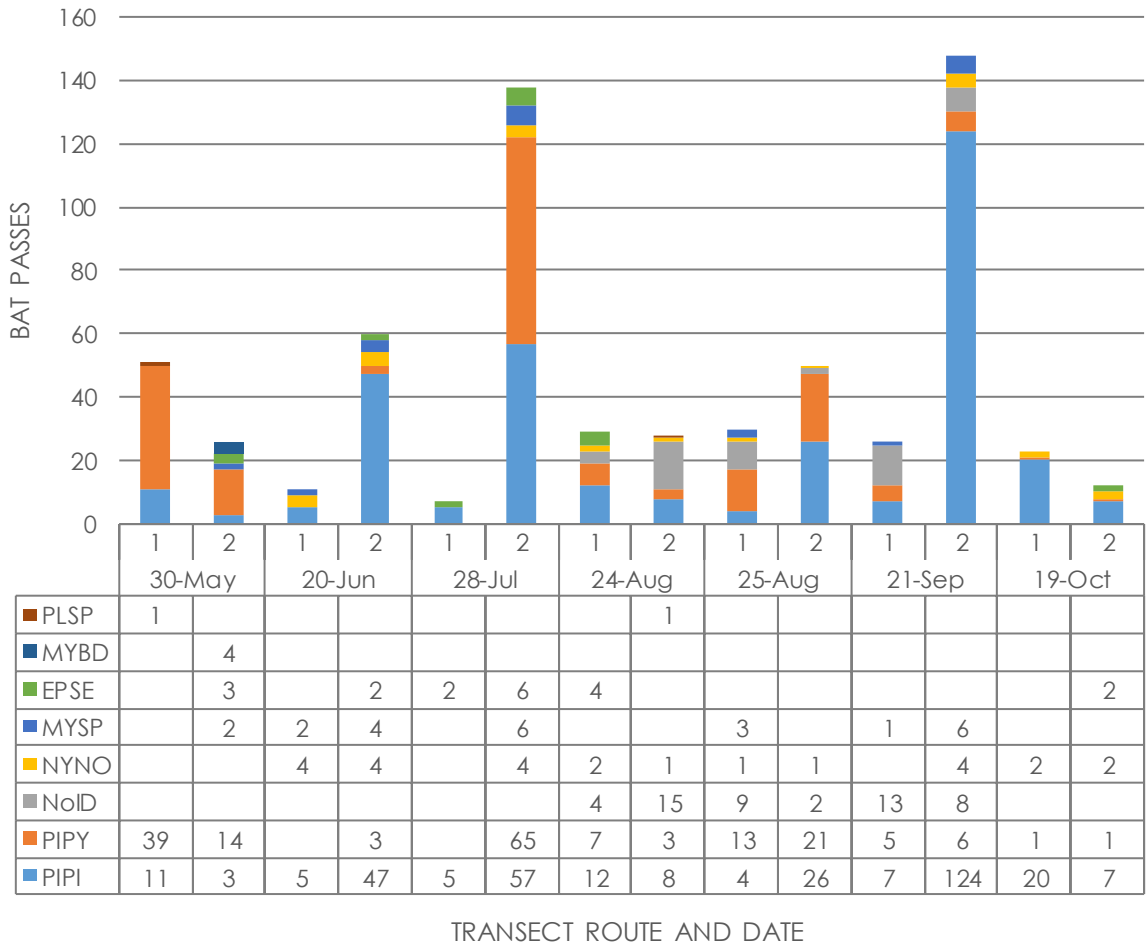
Total counts of bat passes are presented in Figure 9. A mean of 91.3 passes were recorded per transect survey. Activity levels were highest on Transect 2 (mean of 66 passes per survey) which covers the eastern area of the site, where activity was over twice as high as Transect 1 (mean of 25.3) covering the west. With the exception of unclassified bats and *Plecotus* species, activity of all other species was highest on Transect 2.

Activity was dominated by *Pipistrellus* bats with 80.4% of activity. Common pipistrelles demonstrated a higher level than soprano or Nathusius' pipistrelle bats, with 52.6% of total activity, 81.0% of which was recorded on Transect 2.

A total of 24 passes were classified to *Myotis* (MYSP and MYBD). *Myotis* species (MYSP) demonstrated higher activity on Transect 2 (mean of 2.6 per survey) and all four broadband *Myotis* passes were recorded on Transect 2.

Noctules and serotines had a similar level of activity as *Myotis*, with means of 3.6 and 2.7 passes per survey respectively. Each also showed higher levels of activity at Transect 2 with 64% and 68% respectively of their total activity on that transect. Only four *Plecotus* species were recorded, with two passes on each transect route.

Total activity fluctuated throughout the season with peaks seen in both the summer and autumn as shown in Figure 9. Activity was highest in September (mean of 87.0 passes per transect) followed by July (mean of 70.3). The lowest levels of activity were recorded in October (mean of 17.5 passes) and the August dusk (mean of 28.5).



	30-May 1	30-May 2	20-Jun 1	20-Jun 2	28-Jul 1	28-Jul 2	24-Aug 1	24-Aug 2	25-Aug 1	25-Aug 2	21-Sep 1	21-Sep 2	19-Oct 1	19-Oct 2
PLSP	1							1						
MYBD		4												
EPSE		3		2	2	6	4							2
MYSP		2	2	4		6			3		1	6		
NYNO			4	4		4	2	1	1	1		4	2	2
NoID							4	15	9	2	13	8		
PIPY	39	14		3		65	7	3	13	21	5	6	1	1
PIPI	11	3	5	47	5	57	12	8	4	26	7	124	20	7

Figure 9. Number of bat passes on Transects 1 & 2 on each survey date. Numbers are given in the data table and plotted on the chart for each transect route instance.

Bat passes were plotted in GIS and the maps are presented in Figure 10, with a heat map shown in Figure 11. *Myotis* passes are shown in Figure 12.

The survey results shown an association of activity with hedgerows and woodland edges with little activity in the in open grassland areas. Pipistrelle species were spread out across the site with a strong association with woodland edges. Noctule and serotine records were also spread out across the site, which is expected due to the higher amplitude of their calls. All *Myotis* activity was associated with woodland edges.

Furthermore, the heat map (Figure 11), demonstrates that there is a higher level of activity along the woodland edge in the northeast corner of the site, and along the adjacent treeline.

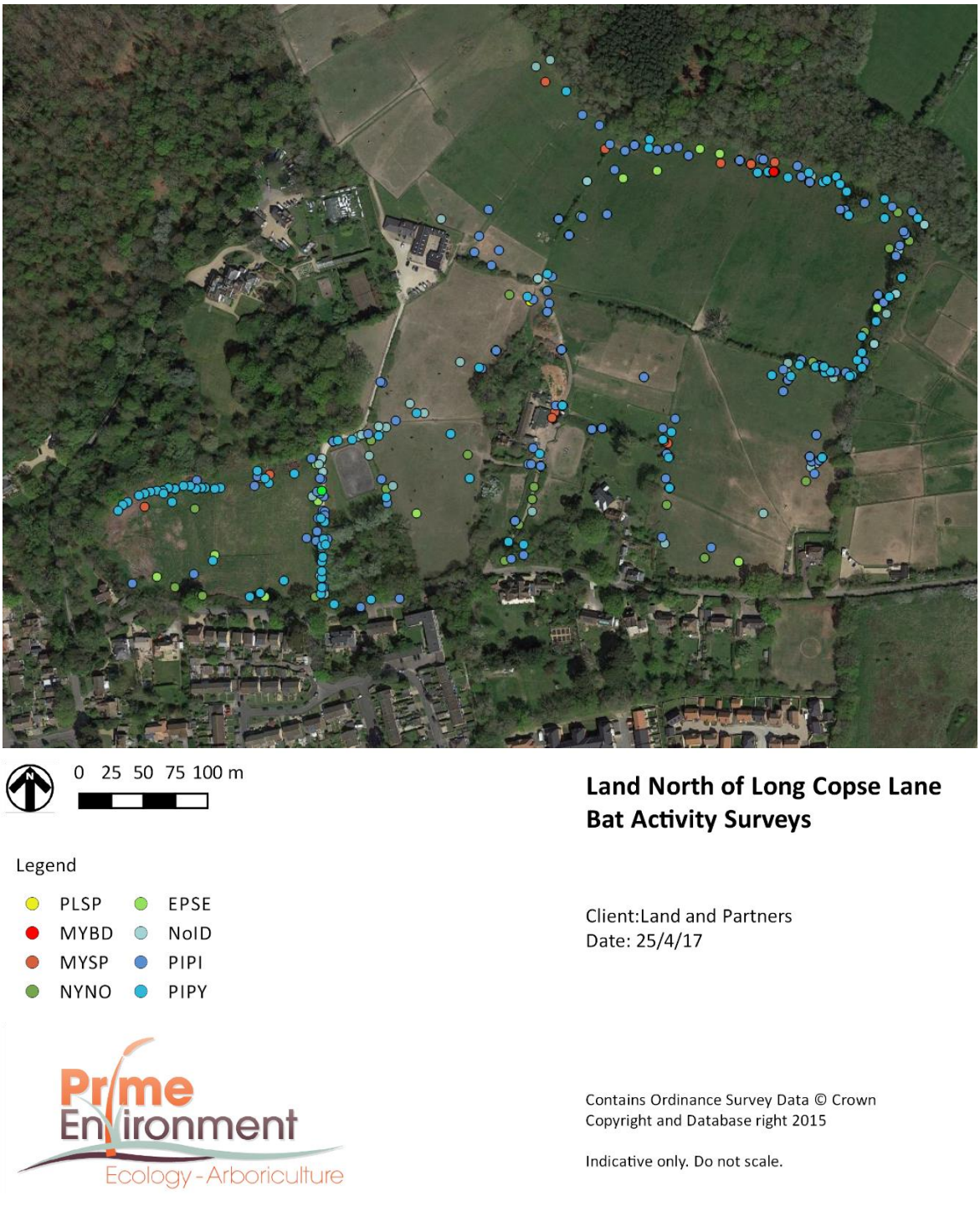


Figure 10. Recorded bat passes for all bats

0 25 50 75 100 m

Land North of Long Copse Lane
Bat Activity Surveys

Legend

Transect Route

1

2

Client:Land and Partners
Date: 25/4/17

Prime Environment
Ecology - Arboriculture

Indicative only. Do not scale.

Figure 11. Heat Mat Indicating Areas of Higher Activity

0 25 50 75 100 m

Land North of Long Copse Lane
Bat Activity Surveys

Legend

MYBD

MYSP

Client:Land and Partners
Date: 25/4/17

Contains Ordinance Survey Data © Crown Copyright and Database right 2015

Indicative only. Do not scale.

Figure 12. Bat passes by *Myotis* species bats.

4 Conclusions

Common and soprano pipistrelles had the highest level of activity on the survey site. These were distributed across the Site, with some evidence of concentrations of activity in the east area of the site, particular on the tree line at location D. Activity reduced further northwest on the adjacent woodland edge as demonstrated by lower levels of activity at location C and on transect 1. Pipistrelle activity was mainly associated with hedgerows, tree lines and woodland edges, showing that open areas are used little.

Although there may be common and soprano pipistrelle bat roosts close to the Site, unless the roost is within the Study Area, it is unlikely to be a significant resource for this species – pipistrelles are relatively adaptable to urban areas and are highly mobile; they are likely to make use of the new gardens for foraging or utilise other habitats in the area following development.

Nathusius' pipistrelle activity was very low, yet were recorded throughout the year with a small peak in September and October, which coincides with when bats from the mainland continental Europe arrive in the UK. However, the low levels suggest the site is not important for these bats.

Myotis activity was generally low, and highest along the tree line and woodland edge in the east area of the site in the automated surveys, yet were more spread out across the site during the transects with small concentrations in the west and centre of the site. This tree line is likely to be a foraging and commuting route for the bats roosting in the woodland at location B and/or in the woodland to the north of C and D.

Noctule and serotine activity was very low, which indicates that these bats are commuting across the site only, likely to and from over the woodlands to the north.

Plecotus and barbastelle activity was very low, it is likely these bats were under recorded; however, with a mean of 0.3 bat passes per night at each location for each species concentrated at Location A, the site is unlikely to be important for these species.

Prime Environment

Registered Office:

Ground Floor, Carriage House, Mill Road

Cromford

Derbyshire

DE4 3RQ

Company Number: 08407111

For the South and South East

southeast@primeenvironment.co.uk

Tel: 0330 2233806

For the Midlands and North

central@primeenvironment.co.uk

Tel: 0330 2233825

Prime Environment

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