Natural England Research Report NERR012

Radio tracking study of Greater Horseshoe Bats at Dean Hall, Littledean, Cinderford

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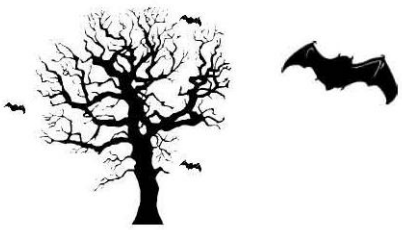
Greena Ecological Consultancy



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Project details

A summary of the findings covered by this report, as well as Natural England's views on this research, can be found within Natural England Research Information Note RIN012: Radio tracking study of Greater Horseshoe Bats at Dean Hall, Littledean, Cinderford.

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Summary

The study was requested in order to discover the activity patterns of Greater Horseshoe bat, Rhinolophus ferrumequinum whilst at their summer breeding roost at Dean Hall Site of Special Scientific Interest which is situated to the South East of Littledean in the Forest of Dean. A total of ten bats were radio tagged and they were then tracked for a period of five days during late August 2007.

Bats regularly commuted at least 9 kilometres to foraging areas. The total area used by the population covered at least 18 1km squares, comparing to using a traditional academic evaluation by convex polygon (joining up the dots in straight lines) gives an exaggerated 61 1km squares.

Bats foraged primarily around field systems with high hedges.

A total of six foraging areas, six night roosts and one new day roost were identified during the study. The most significant foraging area during this study period was the Hinders Farm area.

The main commuting route used by the bats leaving the roost at Dean Hall was identified as a track to the east of the Hall, and often flying close to Popes Hill to the North.

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1 Introduction

Objectives

1.1 To identify the principal foraging areas and linear features of the landscape used by mature female and juvenile Greater Horseshoe bats as flight routes while roosting at Dean Hall. Secondary objectives were to identify any night roosts used by the bats.

Background

1.2 This study was commissioned by Natural England and was carried out by Greena Ecological Consultancy from a temporary holiday cottage base at Lower Lydbrook. In this study the movements of ten Greater Horseshoe bats in total, six mature females, three juvenile females and one juvenile male were studied.

Study area

1.3 Dean Hall, Littledean, Cinderford (GR SO 672130) is a Greater Horseshoe maternity colony and small hibernation roost, situated close to the Forest of Dean, Gloucestershire. The roost supports at least 200 individuals during summer (D. Priddis pers comm.). The study area encompasses an area dictated by the extent of the foraging range of the bats at Dean Hall during August. The Forest of Dean is in close proximity to the roost to the west side and the river Severn is to the south and east. There are also various scattered woodlands and copses, interlinked by mature high hedgerow complexes.

2 Methods

2.1 A total of ten Greater Horseshoe bats were radio tagged at Dean Hall and were tracked over 5 nights from 24th August – 29th August 2007.

2.2 All bats were caught in a hand net from within the roost. The bats were fur-clipped and the transmitters glued between the shoulder blades, using SkinBond adhesive. Bats were fitted with 0.7 & 0.57g 173 MHz radio transmitters, manufactured by Biotrack, with a specified minimum nine-day battery life. The bats were given time to settle down before release. Captured bats were also weighed, sexed, measured and examined to ascertain breeding condition. The bats were also checked for the presence of rings and ring damage.

2.3 Up to four fieldworkers used Australis 26K and Sika receivers with Yaggi rigid aerials to track bats, two staff under contract assisted by two experienced volunteers. Whip omni directional antennas were used to search for bats by vehicle. Tailor-made recording sheets were used to record data. Radio sets and mobile phones were used for two-way communication. Accurate bearings of bat locations were taken from hand held sighting compasses. Global Positioning Systems were used to increase the speed and accuracy of the surveyors. Duet bat detectors were used to confirm the presence of horseshoe bats by listening for their characteristic echolocation calls.

2.4 For all detectable bats the following data was recorded: observer location, bat ID number, triangulation bearings were taken when possible, signal strength, apparent location or route and behaviour. When bats were commuting, or at their first foraging sites, they were usually observed from elevated points with each surveyor based at separate locations, in contact by radio set or mobile phone. Both receivers were able to automatically scan through different frequencies which made it possible to search for a number of tagged bats. On occasion, surveyors were able to make close approaches to bats, to ascertain the exact foraging area and behaviour or commence pursuit if the bat was moving away.

2.5 Tracking ended when the bats moved away or the fieldwork period ended. No tags fell off or malfunctioned during the study period.

2.6 At the start of each survey night, estimations of environmental conditions were noted: wind (Beaufort scale) and direction, rain (0-5), cloud cover (0-100%) and air temperature (Celsius). Any marked changes in weather throughout the survey period were also noted.

Table 1 Starting/observation points used during August 2007 radio tracking

Grid Reference	Description
1. SO 6650 1341 2. SO 8619 1438 3. SO 673 128	1. A4151 above Littledean 2. Chestnut Hill 3. Dean road
1. SO 6856 1445 2. SO 7027 1696	1. Popes Hill
1. SO 6798 1290 2. SO 6782 1229	1. Corner of field above Littledean
1. SO 6848 1463 2. SO 6758 1344	1. Popes Hill 2. Field above Littledean

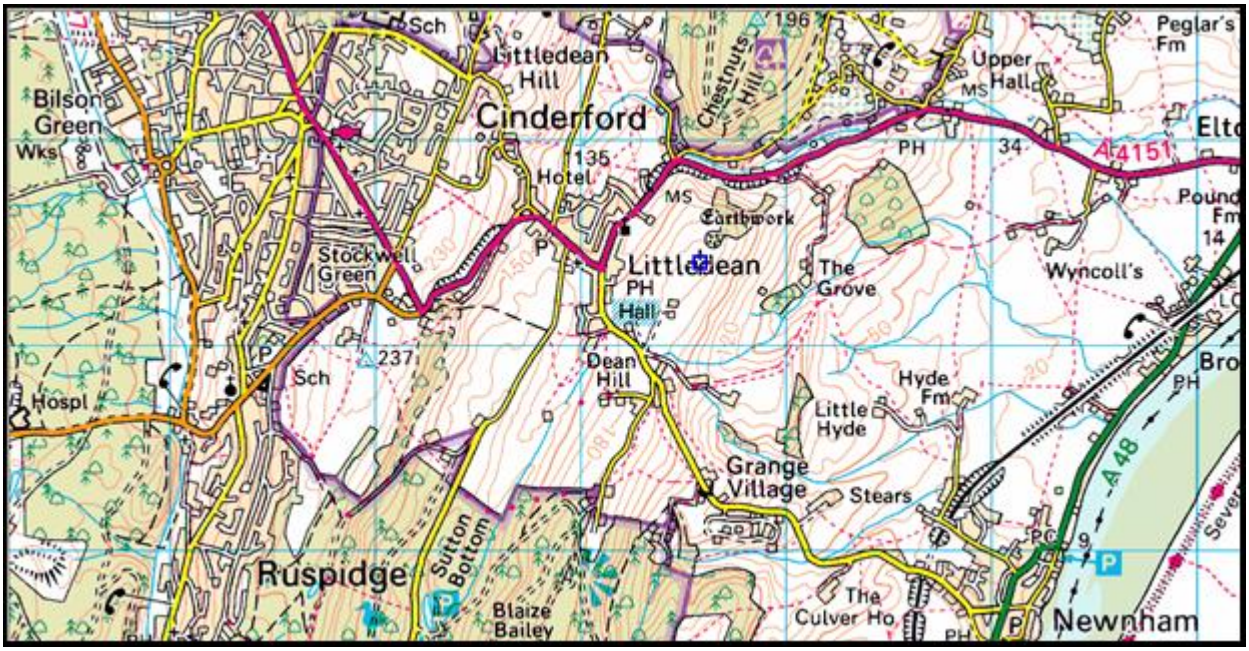

Figure 1 Location of Dean Hall, Littledean, Cinderford (SO 672 130)

3 Results

Tracking and bat data

3.1 A total of 21 Greater Horseshoe bats were caught during the studies. Of these, 10 were fitted with radio transmitters (Table 2).

Table 2 Greater Horseshoe bat captures at Dean Hall, Littledean, Cinderford

Date	Total caught	No. of mature females	No. of mature males	No. of juvenile males	No. of juvenile females	No. radio tagged
24th August 07	21	10	4	3	4	6 Mature females 3 Juvenile females 1 juvenile male Total radio tagged = 10

3.2 In total, 5 days of radio tracking data was collected.

3.3 Welfare considerations for the bats took precedence over all other issues during capture and tagging. No abnormal behaviour of the bats were detected from radio tagging or during tracking of the bats. Bat tag numbers 1, 2 and 10 are juvenile females whilst bat tag number 3 was fitted to a juvenile male. The remaining six bat tag numbers were fitted to adult females.

Table 3 Dean Hall Greater Horseshoe Catching Data, Catch Date 24th August 2007

Sex	Age	Breeding status	Forearm (mm)	Weight (g)	Ring Number	Track number	Comments & Historical Data
F	Sub-adult 1-3 years	Not yet bred No ft	55.2	17.8	RF X2021	No tag	1st ringed 06.08.06 DH born 2006 RF 13.08.06 DH
F	Sub-adult 1-3 years	Not yet bred	56.7	18.1	RF X2038	No tag	1st ringed 23.07.06 DH born 2006
F	Mature adult	Old breeding female	56.4	20.5	RF E6450	No tag	1st ringed 17.02.88 BM born 1987 RF 29.08.89 DH KB No ft RF 12.04.97 Bullo KB ftx2
M	Sub-adult 1-3 years	No testes	56.3	18.1	RF X1996	No tag	1st ringed 09.07.06 DH born 2006

Table continued…

Sex	Age	Breeding status	Forearm (mm)	Weight (g)	Ring Number	Track number	Comments & Historical Data
F	Mature adult	Bred this year	56.0	19.1	RF M8785	9	1st ringed 01.08.99 DH born 1999 RF 12.12.99 BM TG RF 26.11.00 BM KB RF 09.12.01 BM KB No ft
	Juvenile	No testes	54.1	16.9	RF X2444	No tag	1st ringed 22.07.07 DH born 2007
F	Mature adult	Bred this year	57.5	21.2	RF M9281	8	1st ringed 8.07.01 DH born 2001 RF 09.07.01 & 15.07.01 DH RF 22.07.01 & 02.10.01 DH RF 15.01.07 DH
M	Mature adult	Testes swollen	57.5	18.9	RF M9441	No tag	1st Ringed 04.07.02 DH born 2002 RF 07.07.02 DH
M	Mature adult	Testes swollen	55.3	19.2	RF M9523	No tag	1st Ringed 11.07.02 DH born 2002 RF 14.12.02 BM TG No T
F	Mature adult	Bred this year	56.8	22.9	RF M4672	5	1st ringed 09.12.96 BM TG born 1996 RF 12.04.97 BHRT KB No ft RF 26.11.00 BM KB ftx1
F	Mature adult	Bred this year	55.2	19.8	RF M9099	7	1st ringed 13.07.03 DH born 2003
F	Mature adult	Bred this year	53.8	19.9	RF X1308	6	1st ringed 07.08.05 DH born 2005
F	Mature old adult Some tooth wear	Bred this year	56.0	21.9	RF X2450	No tag	Previously un-ringed. New ring by DJP this session on 24.08.07 at DH
M	Mature adult	Testes swollen	55.2	18.6	RF X1281	No tag	1st ringed 10.07.05 DH born 2005 RF 17.07.05 DH
F	Mature adult	Bred this year	56.3	21.4	RF X1039	4	1st ringed 01.08.04 DH RF 08.08.04 & 15.08.04 DH
F	Juvenile	Not yet bred No ft	55.2	18.2	RF X2168	10	1st ringed 08.07.07 DH born 2007 RF 15.07.07 (RCO) & 22.07.07 DH

Table continued…

Sex	Age	Breeding status	Forearm (mm)	Weight (g)	Ring Number	Track number	Comments & Historical Data
M	Juvenile	No testes	56.1	18.4	RF X2172	No tag	1st ringed 08.07.07 DH born 2007 RF 15.07.07 & 22.07.07 DH
M	Juvenile	No testes	56.3	18.9	RF X2187	3	1st ringed 08.07.07 DH born 2007 RF 15.07.07 & 22.07.07 DH
F	Juvenile	Not yet bred No ft	53.4	15.4	RF X2436	1	1st ringed 22.07.07 DH born 2007 RF 29.07.07 DH
F	Juvenile	Not yet bred No ft	55.4	17.5	RF X2183	No tag	1st ringed 08.07.07 DH born 2007 RF 15.07.07 & 22.07.07 DH
F	Juvenile	Not yet bred No ft	55.1	18.9	RF X2170	2	1st ringed 08.07.07 DH born 2007 RF 15.07.07 & 22.07.07 DH

DH = Dean Hall

BM = Buckshaft Mine

BHRT = Bradley Hill Rlwy Tunnel

Bullo = Bullo Railway Tunnel

No bats were found to have any ring damage on wings or forearms.

RF = Re-find

TG = Tapered finger joints, grey fur (i.e. a juvenile)

KB = Knobbly finger joints, brown fur (i.e. > 1 year)

No T = No testes (< about 3 or 4 years old, immature male)

No ft = No false teats (< about 3 or 4 years old, immature female)

Ftx2 = False teats twice as long as they are wide (i.e. breeding female)

RCO = Ring changed over (to other arm due to ring damage)

Foraging

Foraging areas

3.4 The location and descriptions of the foraging areas of the Greater Horseshoe bats from Dean Hall identified during this study are given below and on Figures A, B, C, D, E and F in Appendix 1. The numbering system used does not denote any particular significance in terms of the importance of an individual foraging area.

Figure A - Dean Hall

3.5 This area encompasses the area near to Dean Hall which is situated on the outskirts of Littledean, close to Cinderford. Orchards and gardens in Littledean village are situated close to the west of Dean Hall whilst cattle and horse grazed fields are immediately to the south and north

east. These fields, orchards and gardens all serve to provide a good network of high hedgerows and mature trees, which are interspersed with hedged tracks, bridleways and paths.

3.6 Bats radio tagged with numbers 1 and 2 (juvenile females) foraged in the area east and south of Dean Hall in gardens of Littledean and the orchards and fields. Bat number 1 was also found foraging to the North West of the Hall at an area south of Popes Hill. The ten radio tagged bats from the roost generally left Dean Hall very rapidly however and the majority spent very little time foraging here during the study period.

Figure B - Newnham

3.7 This area shows the area to the south and south east of the roost at Dean Hall. To the south there are extensive forested areas forming part of the Forest of Dean. To the east lies the river Severn, (within approx 2.5k). The land between the roost and the Severn consists of field systems interspersed with streams small copses. Bat 1 (juvenile female) was recorded foraging in an area close to the school on the north side of Newnham. Bat 10 (juvenile female) foraged in field systems south of Round Wood and bat 2 (juvenile female) spent some time foraging in Dry wood and Blaize Bailey.

Figure C - Flaxley Map

3.8 This map is included to show the night roost site found occupied by bat 3 (juvenile male). The small village of Flaxley which is approx 3km from Dean Hall, has very good habitat, both surrounding and within the village, making it likely that this is a regular route via Popes Hill, taken by some of the bats from the roost at Dean Hall to foraging grounds further afield, using the church porch in Flaxley as a night roosting site. There were 3 Greater Horseshoe bats found to be using this as a night roost together with bat 3 making the fourth bat present. This porch has been known to be used by Greater Horseshoe bats since 1993 when on 10th April a (starved?) male bat was found dead there (D. Priddis pers comm.)

Figure D - Hinders Farm Area

3.9 This area is sited approximately 8km to the north east of the roost site at Dean Hall and comprises mainly of field systems and small copses, with high hedgerows providing good connectivity. The fields were either grazed by horses or were not being grazed at the time of the study. This was the area where the greatest number of radio tagged bats spent the most time during the study period. Bats numbered 7 (mature female), 10 (juvenile female), 3 (juvenile male), 6 (mature female), 9 (mature female), and 5 (mature female), were found to be foraging here regularly at various times during the study. The area is intersected by the A4136 and to the north of the foraging area is bounded by the A40. The bats were found to be crossing both of these A roads. Bat 10 (juvenile female) was found to be foraging in woodland known as Ley Park, south of the main foraging area but the area where the majority of time was spent was in the field systems which were very close to both the A4136 and A40.

3.10 Two separate bats - bat 3, (juvenile male) and bat 9 (mature female), were found to be night roosting in two separate buildings in this area. One of these night roosts is also being used as a day roost.

Figure E - Ganders Green

3.11 Ganders Green is situated to the north of the A40 and is approximately 9km from the roost at Dean Hall. It was found to be used by bat 7 (adult female), who foraged here extensively during one night and was also found to be night roosting in an unidentified position within a private garden at Ganders Green.

Figure F - Bagley Farm

3.12 The small roads and tracks close to Bagley Farm were found to be being used for foraging by bat 10 (juvenile female). This area is situated approx 9km to the east from Dean Hall and is very close to the river Severn.

Foraging area usage

3.13 The most significant foraging area, in terms of both time spent in the area and number of bats using the area was the Hinders Farm area with bats 7, 10, 3, 6, 9 and 5 foraging here repeatedly over the courses of the 5 days radio tracking. This area was usually visited by more than one bat at one time with the bats spending long periods in the area.

3.14 The gardens and orchards on the outskirts of Littledean and very close to the roost were visited by bats 1 and 2 though for limited periods; bat 2 was found to also be foraging in Dry Wood/ Blaize Bailey. Both were juvenile females.

3.15 Bat 10 (a juvenile female) visited an area approx 9km to the east of the roost at Bagley Farm, which is close to the river Severn. Bat 10 also foraged closer to home to the south of the roost in fields bordered by Blaize Bailey and Long Wood.

3.16 Bat 7 (a mature female) was found to be travelling the furthest north during the study, travelling approx 9km for foraging and night roosting in gardens at Ganders Green, crossing the A40 and possibly the A4136 as well.

Flight corridors

3.17 Flight routes used by the bats are shown in the over view Figure G in Appendix 1.

3.18 Bats were recorded commuting:

1) From the roost site, heading east along a track, to the south east of Dean Hall, then dispersing across the open fields, crossing the A4151 heading past Popes Hill area towards Flaxley, and then heading north east towards the foraging grounds near to Hinders Farm and Ganders Green.
2) From the roost site heading south east to Newnham, with a night roost site at Westbury on Severn and foraging grounds further north east at the Bagley Farm area, crossing the A48 at some unknown point.

3.19 Along the Blaisdon road between Blaisdon and the A4136.

3.20 Bats are crossing the A40 probably quite close to the area known as Deep Filling and are also crossing the A4136 at an unknown point.

Daytime roost sites

3.21 Hinders Farm Garage SO 7104 1840 was identified as both a night roost and a day roost during this survey, with 7 bats seen to be using the garage as a night roost during the survey. The owner reports that the bats are often there during the daytime too.

Night roost sites

3.22 Night roosts are temporary roosts, used between and during bouts of foraging for resting, feeding and socialising. They may be used as stopping off points to rest before the bats to continue to forage further from the day roost, or possibly interact with individuals from their own or from another day roost.

3.23 Six night roosts were found during the study and they are listed in the table below together with the details of whether they were identified by droppings or by bats present and how long bats were present if known or applicable. Most are shown on Figure G in Appendix 1.

Table 4 Dean Hall radio tracking night roost table

Date	Bats - seen roosting or droppings only	Radio tag number	Location/ Grid Reference	Approx duration night roost used
25/08/07	1 x GH bat dropping		Westbury on Seven Church Porch***	
27/08/07	4 x GH bats seen night roosting in church porch	3 (juvenile male)	Flaxley Church Porch***	Unknown
28/08/07	1 x GH	9 (mature Female)	Brickhouse Farm outbuilding GR 7091 1804	Approx 50 minutes (minimum)
28/08/07	1 x GH	7 (mature female)	Ganders Green area GR 705 203	Approx 25 minutes (minimum)
28/08/07	6 x GH droppings		**Redundant church porch at Welsh Bicknor GR 593 177	
29/08/07	1 x GH	9 (mature female)	Brickhouse Farm outbuilding GR 7091 1804	Approx 25 minutes (minimum)
29/08/07	7 x GH *	3 (juvenile male)	Hinders Farm Garage GR 7104 1840	Approx 30 minutes (minimum)

* Also a day roost site

** The redundant church porch found used as a night roost at Welsh Bicknor may not be being used by the bats from Dean Hall

*** Already known as night roosts by Dave Priddis local batworker

4 Discussion

Study aims and objectives

4.1 The study was successful in achieving the primary objective of identifying the principal foraging areas and commuting routes used by Greater Horseshoe bats roosting at Dean Hall, Littledean, Cinderford during a 5 day period in August 2007. A total of 6 night roosts were identified with 5 of these previously being unknown. In addition, 1 previously unknown day roost was also identified.

Foraging distances

4.2 The foraging areas identified during this August study lay within circa 9 km north and 9 km east of Dean Hall roost (see Figures A-F in Appendix 1).

Table 5 Maximum foraging distances and area of foraging from two radio-tracking studies of Greater Horseshoe bats at Dean Hall

Maximum foraging radius from roost (km)	Number of 1km squares with bat fixes
9	18

Primary foraging habitat

4.3 The foraging habitat was found to be primarily along hedgerows with mature trees next to grassland, with copses and woodland edge also featuring heavily. Two bats were found to be foraging in larger areas of woodland, but all the rest were foraging mainly in fields, tracks, gardens, orchards, and along hedgerows and woodland edges. It cannot be ruled out that the bats may forage in entirely different locations at other times of the year.

4.4 Jones et al (1995) have previously reported the importance of grassland, hedgerow and woodland mosaics as foraging areas for Greater Horseshoe bats. Ransome (1996) has linked these landscape features to the availability and abundance of key prey species.

Flight corridors

4.5 Some of the key flight corridors linking Dean Hall with foraging areas were identified and were found to be heading mostly approx 8km to the north east during this study period, with one bat heading still further north travelling 9km from the roost. There was also a long ‘round trip’ journey being undertaken by another individual bat heading 9km in a more easterly direction. Many A roads were crossed by the bats in order to accomplish this, but it is as yet unclear exactly where the precise crossing points are and identifying this is beyond the remit and time of this study. The positions and accessibility of the night roosts may be key to the foraging grounds remaining viable (see Figure G in Appendix 1).

Roosts

4.6 A Greater Horseshoe day roost was discovered at Hinders Farm Garage during this study and six night roosts, five of which were new records, were found to be being used during this study. Four of the night roosts were used by radio tagged bats during the study period (see Figure G).

5 Recommendations

Foraging areas

5.1 The importance during August of the foraging area in the field systems near to Hinders Farm is clear, with a large amount of radio tagged bats using it repeatedly for prolonged periods. The routes the bats are taking to arrive at this area are not yet fully understood, though during this brief study, the Popes Hill area seems to be on the main flight route from the roost, as does Flaxley with a night roost situated in Flaxley church porch.

5.2 It is possible that Blaisdon Hall, (with its known colony of Lesser Horseshoes) is also being used as an occasional night roost by the Greater Horseshoes from Dean Hall for this important foraging area too, but there is no definite confirmation of this.

5.3 The Ganders Green area was used by a radio tagged bat for foraging and with two night roosts just south of Ganders Green, (at Hinders Farm and Brickhouse farm) and a night roost in Ganders Green itself, the rich foraging habitat in Ganders Green is likely to be accessed by Dean Hall bats more often than was recorded during the survey in August.

5.4 Likewise, the Bagley Farm area may well be used for foraging more often than was recorded during this brief August survey. It should also be noted that there is a night roost in Westbury on Severn church porch which makes a convenient rest place en route to Bagley Farm from the roost at Dean Hall.

5.5 Bats did not spend much time foraging in the forested areas to the South of the roost during this August study, but may well do so at other times of the year possibly when insects may not be so available in open areas.

5.6 Some of the foraging areas were accessed by crossing two and up to three separate major A roads (the A 4151, A 4163 and the A 40) though all of these only consist of two carriageways and are unlit (or dimly lit) where bats cross. More time would have to be spent radio tracking bats in order to discover more precisely where those crossing points are if road improvement schemes were required on these A roads. Similarly a better understanding of the crossing places should be sought for any road scheme involving the A48 to the east of the roost at least as far as Bagley Farm and to the south of the roost too, but it is uncertain from the results from this study how far south should be surveyed if future road improvement schemes become necessary for the A48.

5.7 It must be born in mind that it is very likely that the bats will be using different areas at other times of the year, and it is also likely that the bats do spread further north, west, east and south than were recorded during the brief study which was undertaken. This study can only be regarded as a snapshot of bat activity during the month of August when it was conducted.

Roosts

5.8 The garage at Hinders Farm is a day roost which was discovered during this study.

5.9 The remaining roosts found were night roosts, and these were Flaxley church porch, Hinders Farm Garage, Brickhouse Farm barn, Ganders Green garden area, Westbury on Severn church porch, and Welsh Bicknor church porch. However, it is not certain whether the Greater Horseshoe bats using the Welsh Bicknor church porch actually come from the Dean Hall roost.

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Appendix 1 - Maps

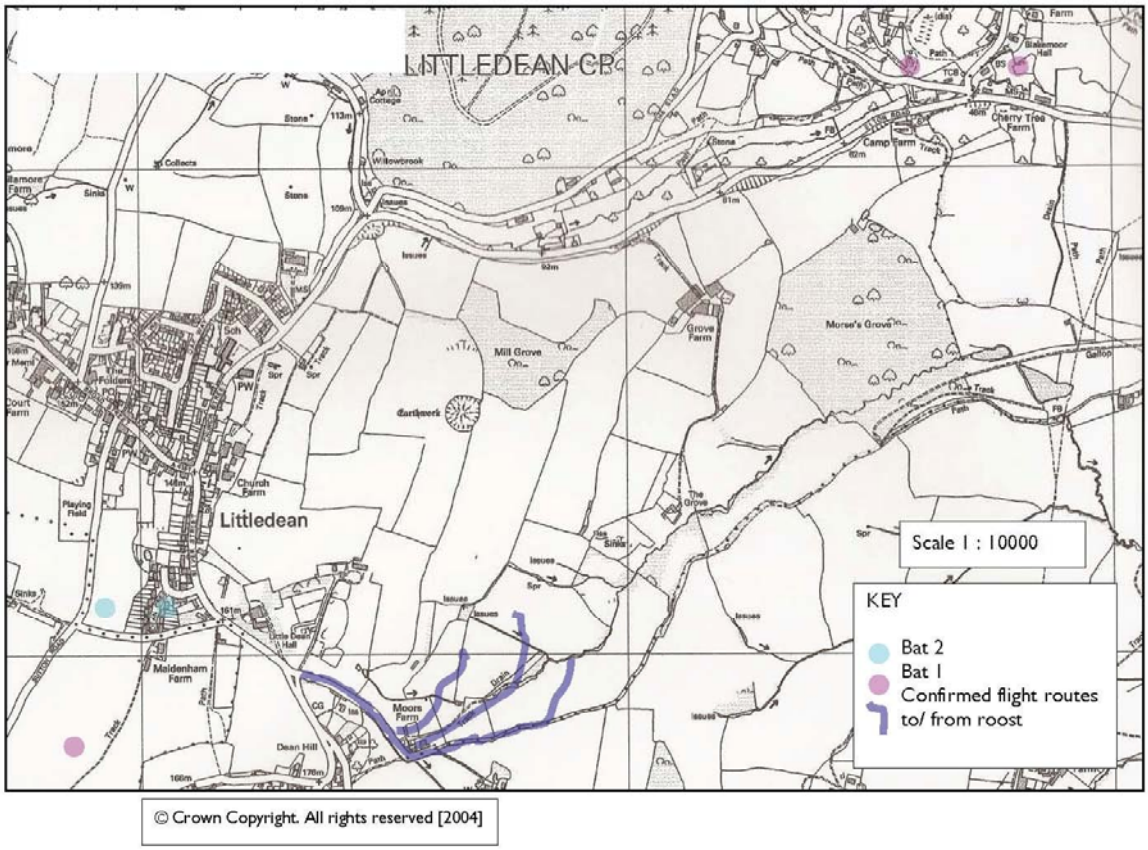

Figure A Little Dean

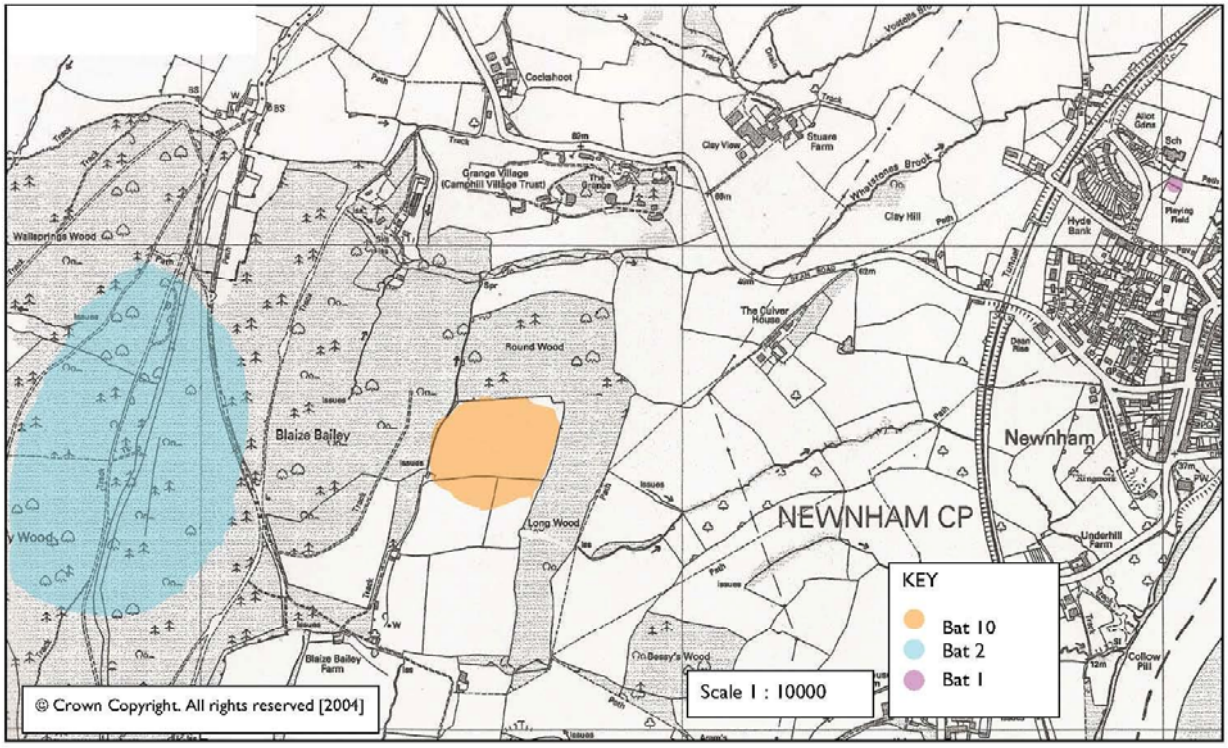

Figure B Newnham

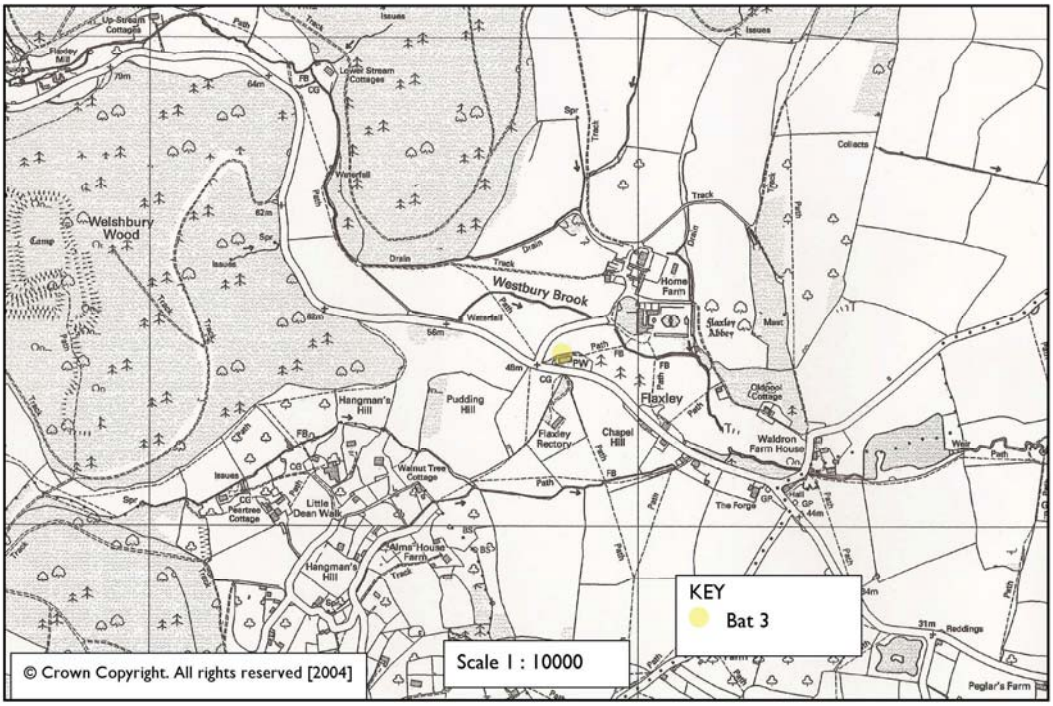

Figure C Flaxley

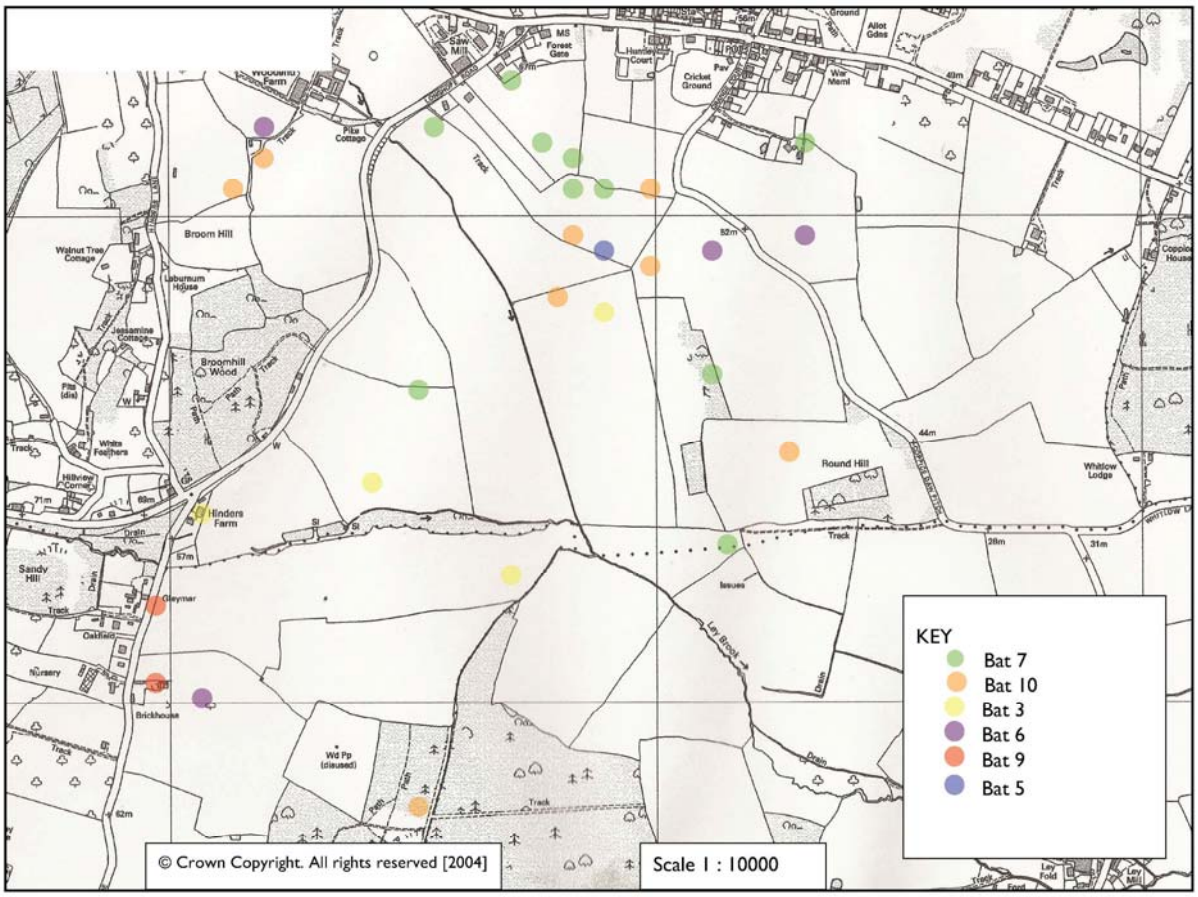

Figure D Hinders Farm

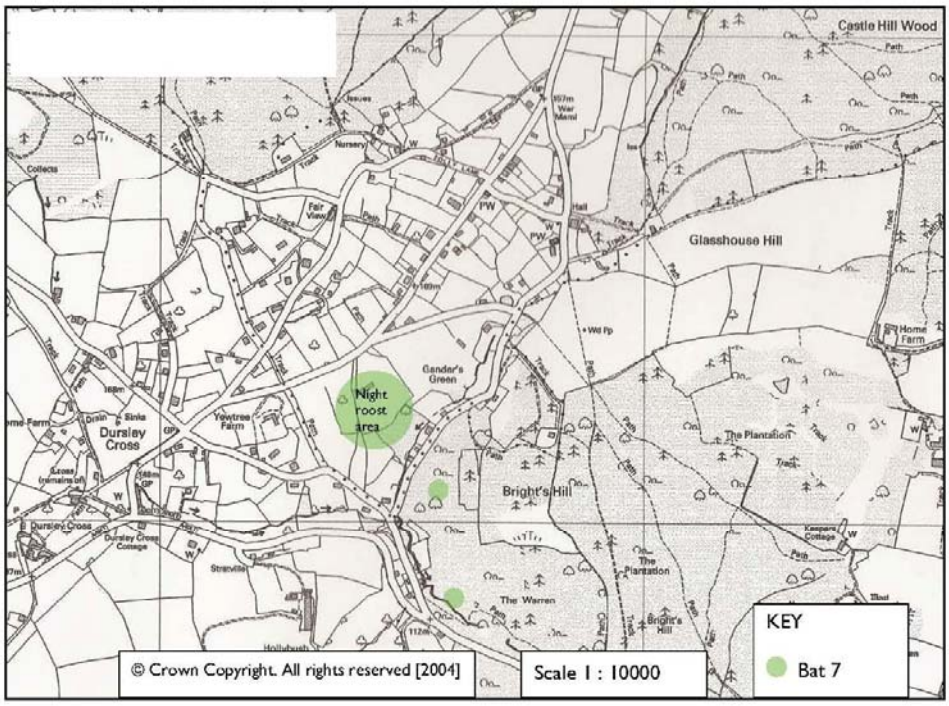

Figure E Ganders Green

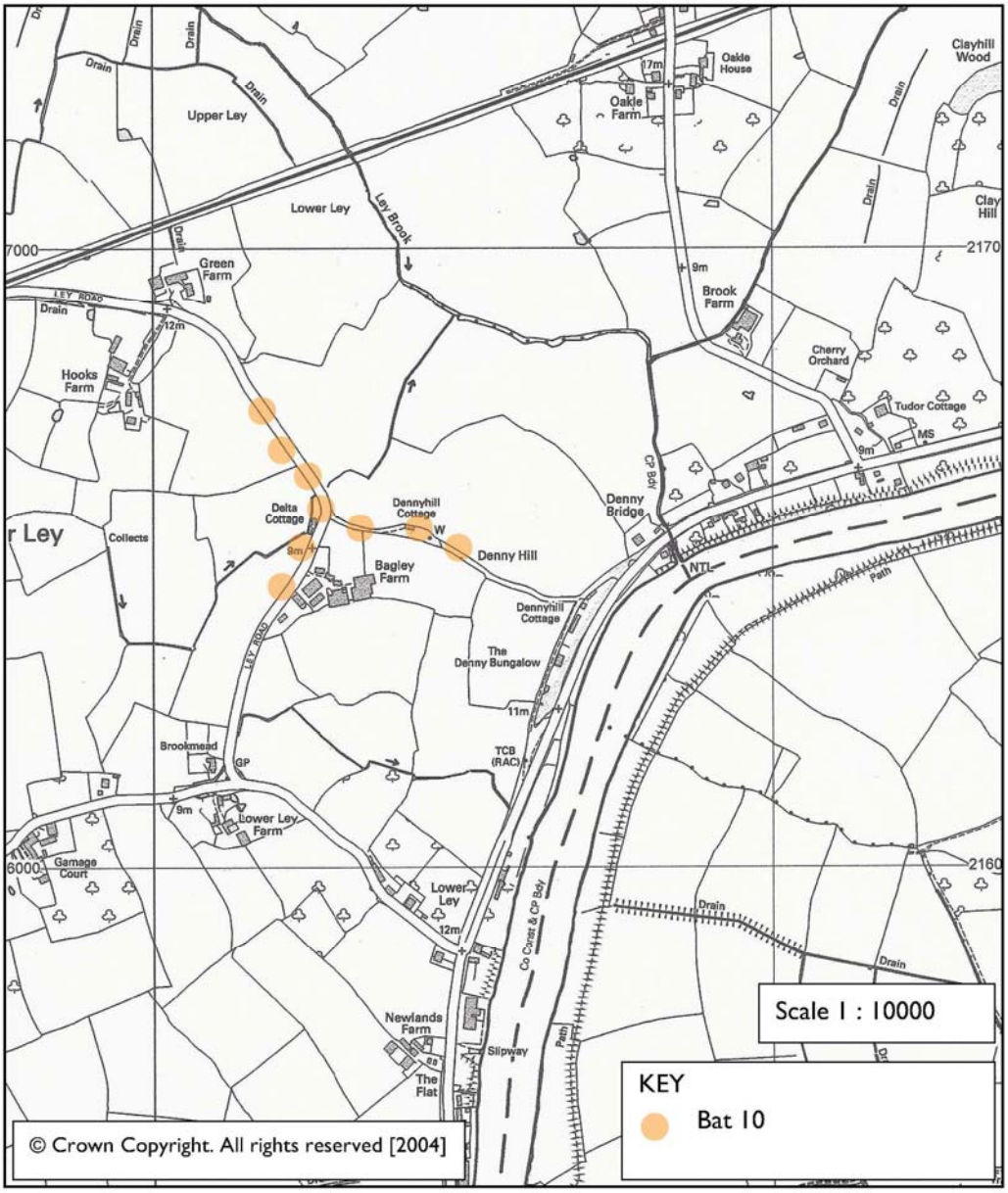

Figure F Bagley Farm

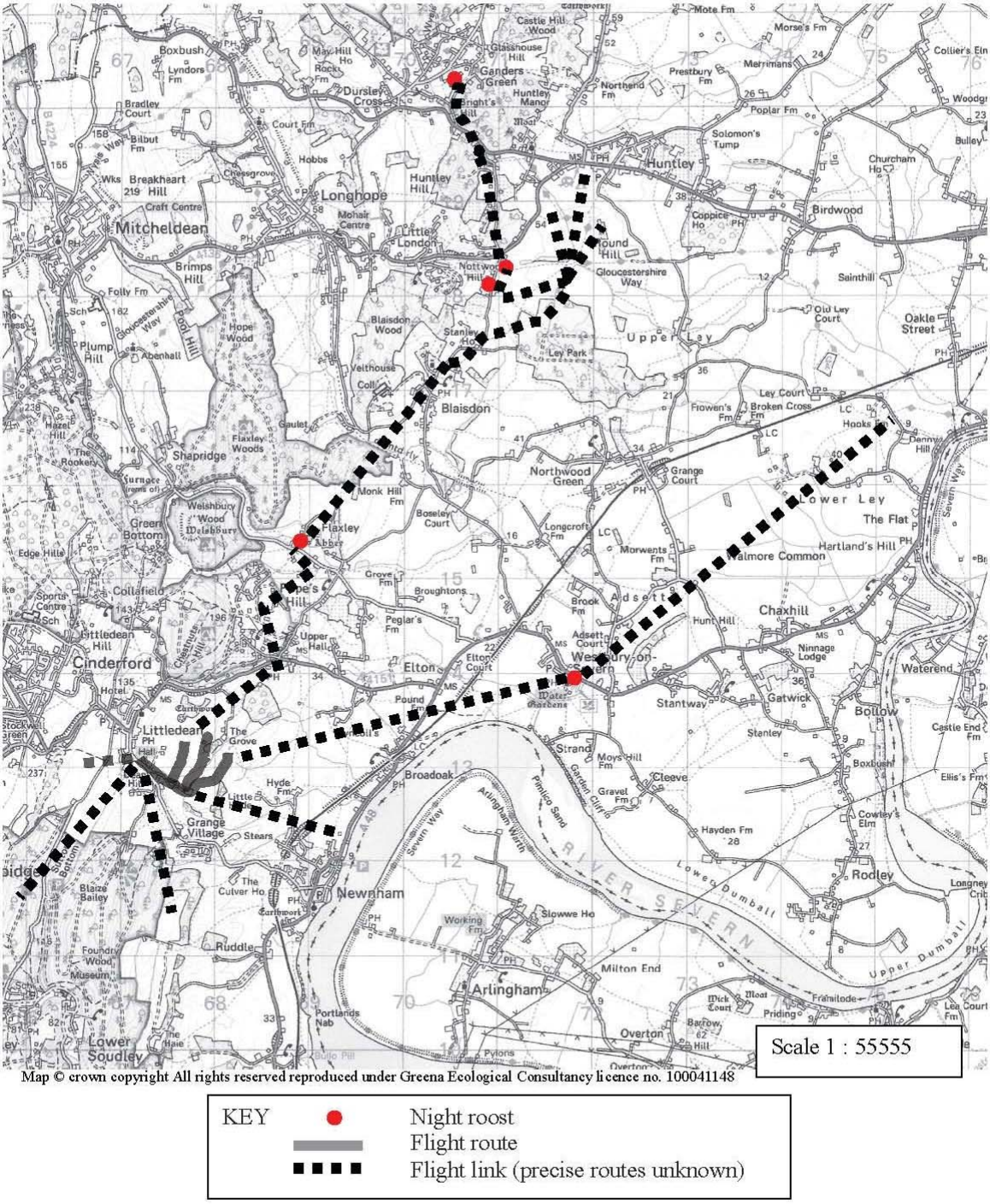

Figure G Flight Routes and Night Roosts

Natural England works for people, places and nature to conserve and enhance biodiversity, landscapes and wildlife in rural, urban, coastal and marine areas.

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