

Knepp Bat Survey 2009

**A survey of the land within the proposed River Adur
restoration site and associated watercourses.**

Frank Greenaway.
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Noctule bat *Nyctalus noctula*

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Executive Summary

- Habitat changes have been driven by large herbivores since the inception of the Wildland Project in 2001. An additional 350ha in the southwest of Knepp was fenced in spring 2009. The 2km stretch of the River Adur that crosses Knepp is to be restored to its natural course.
- Baseline bat surveys in 2003 and 2005 showed considerable bat interest, enhanced by the discovery that female barbastelles were commuting from the nursery roost in The Mens, Petworth to forage over Knepp. 10 species had been recorded, some of which were possibly breeding on the Estate. A survey was needed to locate nursery roosts in and adjacent to the river restoration site.
- The aims were:
 - To evaluate bat foraging use of the River Adur corridor and Lancing Brook, Lay Brook and Hammer Pond plus adjacent habitat.
 - To identify any nursery roosts in this area or nearby.
 - To collect data that may in future enable more subtle indications of change over time.
 - To produce a report that will inform the river restoration project and form part of the biodiversity evaluation of the Wildland Project.
- Bats were trapped to identify species and sexual status in the most metabolically demanding time of year. Traps were placed across the river restoration area and further upstream of tributaries joining the river near Tenchford Bridge. Each site was visited May-August. 13 species of bat were recorded:

Common pipistrelle	Bechstein's bat
Soprano pipistrelle	Noctule
Nathusius' pipistrelle	Leisler's bat
Natterer's bat	Brown long-eared bat
Whiskered bat	Serotine
Daubenton's bat	Barbastelle
Brandt's bat	

- These 13 bat species have different roost, habitat and foraging requirements. Female bats forage in the most productive sites during summer, when they bear the physiological stress of pregnancy and lactation; males usually occupy sub-optimal areas. Therefore if predominantly males use a site, it will have a less favourable status in terms of foraging attributes.
- Bats need insect food from spring to early winter. Although becoming torpid in cold weather, in southern England most bats only really hibernate in January. In milder weather, many will emerge to drink and feed. Re-wilding will result in an increase in insect diversity and abundance, benefiting bats and other insectivores, indicating improvements in habitat quality and diversity.

- 10 bat species were captured or logged along the Adur corridor itself during this survey. The main foraging area for many of these was nearby woodland, but the River Adur was shown to be an important forage area for soprano pipistrelles, with a nursery roost close by, and a significant foraging area and commuting route for all other recorded species. The proposed river restoration should improve this area for foraging bats, and the male:female ratio, particularly of soprano pipistrelles, should be monitored.
- 10 breeding female bats were radio-tagged in order to locate nursery sites and foraging areas. Tagged bats were searched for on following days in daylight and roost locations recorded. Roost emergence counts were made using infrared floodlights and a video camera.
- 12 nursery roosts of 6 species, common and soprano pipistrelles, whiskered bat, Daubenton's bat, Natterer's bat and brown long-eared bat were located, 6 of which were in buildings and 6 in tree cavities. Noctule and Bechstein's bat were the only two species with a confirmed presence of adult males but no adult females. 33% of the trapped adult bats were male and 40% were female.
- Connectivity between the barbastelle breeding site at The Mens and Knepp foraging habitat is poor but functioning. Improvement may be necessary to increase the level of commuting bats between the roosts and Knepp.
- River restoration will cause some disturbance during the construction phase. Tree-felling could have a negative impact on bats. Trees lining the river are used as forage and commuting flightlines, and there may be bat roosts in the mature trees along this route. It is almost impossible to guarantee that there are no bats roosting in a tree. Trees that have to be felled must be assessed by a licensed bat worker and best practice followed; any known to be bat roosts will require a licence from Natural England. Medium and long-term effects on bats are likely to be positive.
- The optimum time for tree work as far as bats are concerned is September-early November and March-April. In May-August there may be nursery roosts present, in December – February bats may be hibernating.
- Post river restoration monitoring of soprano pipistrelles, as predators of the flying stages of aquatic insects, would be a cost-effective and direct way to obtain an indication of the positive effects of the river restoration.
- The Wildland Project area is already important for bats. Most species form nursery colonies close to productive habitats that match their foraging specialisations. Atypically in areas supporting nursery colonies, there are rather high numbers of male bats in the most numerous species recorded in 2009, suggesting that much of Knepp is coming out of a long period of being suitable for male bats only.
- Bats have slow reproduction rates and increases in population should not be expected in less than five years. Large decreases can happen very rapidly, for instance if there is a catastrophic loss of a nursery roost.

- The most successful species under the rewilding project are likely to be soprano and common pipistrelles, Natterer's bat, noctule bat, serotine bat, and brown long-eared bat. Species that will benefit particularly from the river restoration are whiskered bat, barbastelle, soprano pipistrelle and, to a lesser extent depending on the amount of open water, Daubenton's bat.
- Larger bat colonies may impact on people and Estate management:-
 - Increasing numbers of bats breeding in houses and other building on Knepp or in adjacent areas.
 - Increasing numbers of tree roosts.
 - Effect on remedial work on buildings.
 - Effect on tree felling and tree surgery.
 - Public relations! Not everyone appreciates having uninvited guests.
- The Wildland Project is not aimed at the conservation of any one species, group of species or specific habitat, but the presence of legally protected species will impose some constraints.
- Recommendations -
 - Built structures situated below the dam at the Millpond have potential for both restoration and adaptation as roost or hibernation sites for bats.
 - Potential for re-introductions of UK bat species lost or present in West Sussex at extremely low levels, such as greater horseshoe bat and mouse eared bat.
 - A repeat bat survey in (say 10 years time), using the methodology in this survey.

Knepp Bat Survey 2009 – a survey of the land within the proposed River Adur restoration site and associated watercourses.

1. Introduction

The Knepp Castle Estate has been the subject of a re-wilding project since the land was taken out of intensive farming starting in 2001. The overall ethic of the re-wilding project is to allow the landscape to develop a more natural dynamic driven by large herbivores. The project provides considerable scope for research, a significant component of which is to evaluate the changes in biodiversity that take place over time. A baseline survey took place in 2005 (Greenaway 2006) and additional surveys and some survey repeats have taken place subsequently.

A stretch of the River Adur approximately 2km in length crosses this land, entering at Capps Bridge in the west and flowing out under the A24 to the southeast. The river was canalised at some time in the past, and it is proposed to restore this stretch of the river to its original natural course.

In a further development of the Wildland Project, some 350ha of the Estate south and west of Countryman Lane and Swallows Lane (the New barn / Brookhouse area) was fenced in spring 2009. This area is largely made up of formerly arable fields together with small areas of woodland and woodland strips along watercourses and ditches. The Lay and Lancing Brooks traverse this area and Hammer Pond is its largest area of open water. With the completion of fencing it has now been possible to extend the grazing into this southwest part of the Estate, although at the time of this survey, only cattle had been released.

A limited bat survey of the Deer Park was carried out by Daniel Whitby in 2002. The survey was carried out using a bat detector, and six species were recorded (Table 1), with additional *Myotis* species that cannot be separated by echolocation alone. The sex of these bats was unknown. A more extensive baseline survey was carried out by Whitby across the Wildland Project area in 2005 (Greenaway 2006). These surveys focussed on the areas already being grazed and the River Adur corridor, together with Northern Wood in the New Barn / Brookhouse area (Table 1). In June 2008, a pregnant female barbastelle bat was radio-tagged in The Mens SAC SWT Reserve and tracked some 14km from The Mens to the southwest area of the Knepp Estate (Greenaway 2008), where she foraged before returning to her breeding roost site. This brought the total to ten species. Although limited in scope, these bat surveys revealed considerable bat interest on Knepp in the initial stages of the Wildland project. Excluding the barbastelle female, which was known to be breeding in The Mens near Petworth, females of four species were recorded in 2005, indicating that nursery roosts on or adjacent to the Estate were highly likely, and that a further survey should be undertaken in 2009 to locate at least some of these. This bat survey was funded by Natural England and Knepp Castle Estate.

Table 1. Bat species recorded on Knepp Castle Estate pre-2009.

Date	Species	Location	Method	Sex
Sept-Nov 2002	Common pipistrelle	Deer Park	Bat detector	Unknown
	Soprano pipistrelle	Deer Park	Bat detector	Unknown
	Daubenton's bat	Deer Park	Bat detector	Unknown
	Natterer's bat	Deer Park	Bat detector	Unknown
	<i>Myotis sp</i>	Deer Park	Bat detector	Unknown
	Brown long-eared bat	Deer Park	Bat detector	Unknown
	Noctule	Deer Park	Bat detector	Unknown
01/08/2005	Common pipistrelle	Northern Wood	Mist net/Harp trap	Male, juvenile
	Soprano pipistrelle	Northern Wood	Bat detector	Unknown
	Natterer's bat	Northern Wood	Mist net/Harp trap	Female, lactating
	Whiskered bat	Northern Wood	Mist net/Harp trap	Male, adult
	Bechstein's bat	Northern Wood	Mist net/Harp trap	Male, juvenile
	Serotine	Northern Wood	Mist net/Harp trap	Female, lactating
12/08/2005	Common pipistrelle	R. Adur area	Bat detector	Unknown
	Soprano pipistrelle	R. Adur area	Bat detector	Unknown
	Daubenton's bat	R. Adur area	Bat detector	Unknown
	Natterer's bat	R. Adur area	Bat detector	Unknown
	Serotine	R. Adur area	Bat detector	Unknown
29/08/2005	Common pipistrelle	Gt Cockshill Wood	Bat detector	Unknown
	Soprano pipistrelle	Gt Cockshill Wood	Bat detector	Unknown
	Bechstein's bat	Gt Cockshill Wood	Mist net/Harp trap	2 females
	Brandt's/whiskered	Gt Cockshill Wood	Mist net/Harp trap	Female, juvenile
	Brown long-eared bat	Gt Cockshill Wood	Mist net/Harp trap	Male, juvenile
	Serotine	Gt Cockshill Wood	Bat detector	Unknown
08/09/2005	Common pipistrelle	Renche's Wood	Mist net/Harp trap	Male, adult
	Natterer's bat	Renche's Wood	Mist net/Harp trap	Female, post-lactating
	Whiskered bat	Renche's Wood	Mist net/Harp trap	Female, post-lactating
	Brown long-eared bat	Renche's Wood	Mist net/Harp trap	Male, 1 adult, 1 juv; female adult
May-08	Barbastelle bat	Adur grassland & tribs	Radio-tracking	Female, pregnant

2. Aims

The overall aims of the survey were:

- To evaluate bat foraging use of the River Adur corridor and Lancing Brook, Lay Brook and Hammer Pond plus adjacent habitat.
- To identify any nursery roosts in this area or nearby.
- To collect data that may in future enable more subtle indications of change over time, such as roost distances from principle forage areas, or the numerical balance between species.
- To produce a comprehensive report on the above that will inform the river restoration project and that can be used by this project in any way that may be required, and form part of the wider biodiversity evaluation that is one of the aims of the Wildland Project.

2.1. Objectives to meet these aims

The objectives to meet the above aims were as follows:

- To ascertain the level of bat foraging on the Adur floodplain and its tributaries on the Knepp Castle Estate.
- To locate any nursery colonies of such foraging bats within approximately a 2km radius of the centre of the survey area.
- To obtain an estimate of the number of breeding females in any nursery colony identified.
- To identify species that were solely represented by male individuals
- To identify species breeding at some distance but still regularly utilising the site for foraging;

The few locally rarer species were not the main focus of attention. The purpose was to produce a reference document against which changes in bat species community composition and the number of colonies could be measured over time.

3. Legal issues

All bat species and their roosts are protected under Wildlife & Countryside Act 1981, together with significant amendments made under the Countryside and Rights of Way Act 2000. The Conservation (Natural Habitats, &c.) Regulations 1994 (better known as the Habitats Regulations) gives stronger protection for all UK bats and bat roosts. Barbastelle and Bechstein's bats are additionally protected under Schedule II of the Habitats Regulations. Barbastelle, Bechstein's bat, soprano pipistrelle, noctule and brown long-eared bat are all UKBAP Priority species.

Permission and in some instances licences are needed from Natural England before work can proceed in areas known to be bat roosts, or in some instances, known to be bat foraging habitat. For further clarification, consult Natural England or the Bat Conservation Trust¹. This bat survey was carried out under licence from NE.

4. Methodology

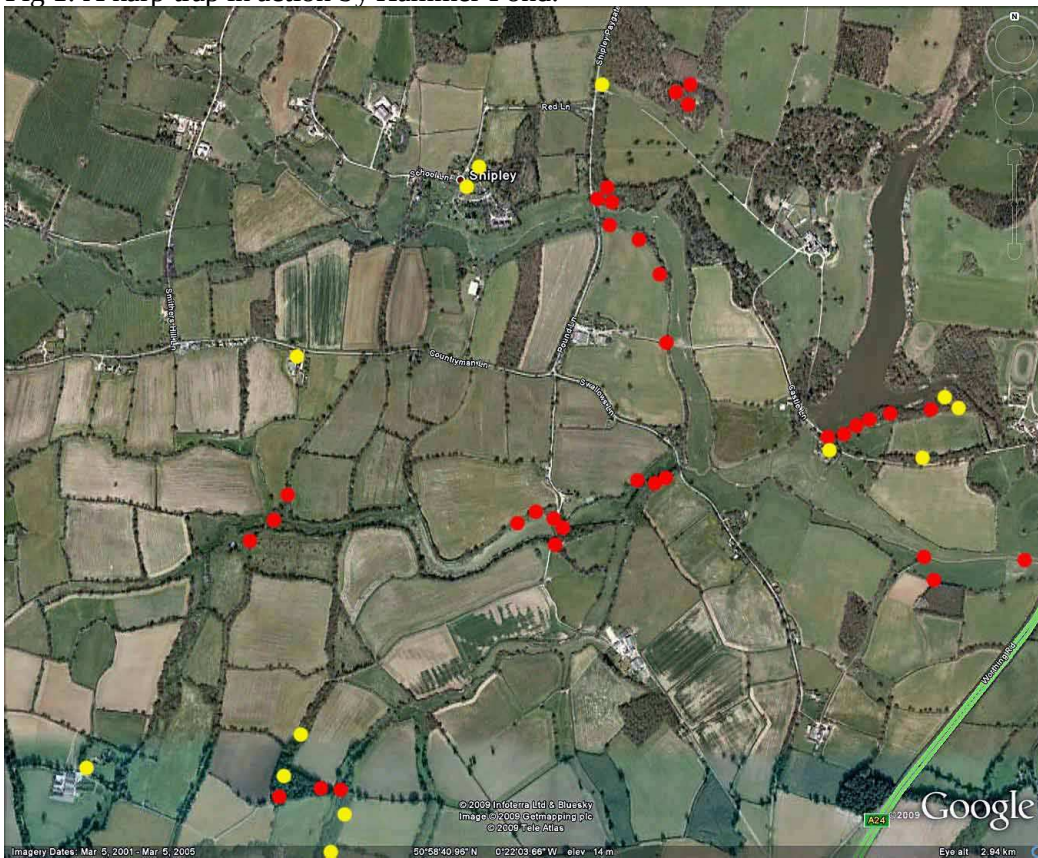
The methodology was aimed at catching bats in order to identify species and sexual status throughout the most metabolically demanding time of year, May to August. Bats were trapped using harp traps (Fig. 1) or occasionally mist nets. Although every effort is made to site traps on 'pinch points' along bat flightlines, bats are extremely efficient at detecting and avoiding traps. To increase the chances of capture, acoustic lures were used. These play back the simulated social calls of each species and investigating bats fly into the traps.

Trapping was sequentially targeted at a range of habitats across the area that will be affected by the river restoration and further upstream of tributaries joining the river

¹ NE website www.naturalengland.org.uk ; BCT website www.bats.org.uk



Fig 1. A harp trap in action by Hammer Pond.



Map 1. Trap sites, red dots and roost sites, yellow dots.

near Tenchford Bridge (Map 1). A maximum of three harp traps was utilised at any one time at approximately 100m apart across an area of homogeneous habitat. Traps were visited about each half hour from dusk until activity slowed at around 1am. The aim was to visit each site in different months to record changes in bat use but low activity caused by fog forced a few deviations from the initial plan. Captured bats were identified, sexed, aged and their reproductive status examined. Male bats were recorded and released. Selected pregnant or lactating female bats were tagged by securing a Biotrack radio transmitter to each bat's back with surgical glue if it was considered that by radio-racking a particular female there was a good chance of locating a nursery roost or roosts. Ten such female bats were radio-tagged. Each tag weighed 0.29g.

Tracking was carried out using directional antennae on a radio receiver. Radio-tagged bats were searched for on following days in the daylight hours and roost locations recorded. Where possible bats were filmed out of any nursery roost located using infrared floodlights and a video camera. This enables a roost emergence count to be made subsequently by playing back the video. Very general indications of the foraging areas were made of most tagged bats but this was not the prime aim during this survey.

Two Petterson D1000 time-expansion logging bat detectors were used on each trapping night until the number of singing crickets prohibited further use. Sonograms were identified on Batsound software and a record kept of species presence and general abundance.

5. Weather

The months of May and June were essentially fine and warm but with quite a few clear and rather cold nights at the start. It became rainy at the end of June, and this lasted well into July. By August the dry weather returned and this continued into September. During July and early August fog was frequently a feature affecting bat activity, especially in late evening and into the early hours. Bats avoid fog filled areas as it both restricts insect activity and hampers their echolocation. Valley bottoms can have extremes of bat activity for this reason.

Dammed lakes and reservoirs often produce local airflow patterns that allow cold air to spill over the dam to a lower level keeping the upstream area largely fog free. Such dammed areas of open water are frequently preferred as forage grounds by nursery colonies of several species because of this partial immunity to cold foggy conditions. The prevailing conditions over Knepp Mill pond are a fine example of this.

6. Constraints

The most influential constraint on this survey was the amount of time allocated. Clearly, the larger the number of survey nights and radio-tagged bats, the larger the amount of data it is possible to gather. The time allocated to this bat survey allowed a realistic sample of foraging and breeding use of a number of bat species that will

enable meaningful comparisons in years to come and also enable the protection of nursery roosts on the Estate.

A further constraint in August was the fog that descended abruptly in many parts of the survey area, causing complete cessation of invertebrate and bat activity.

7. Results

Tables 2,3,4 and 5 summarise the trapping, tagging and radio-tracking data. The full data of trapped and logged bats on each field night are given in the Appendix. All locations, trees and buildings, to which tagged bats were radio-tracked are shown on Map 1. The four Bechstein's bats captured were all ringed as part of a wider survey on that species.

Table 2. Total numbers of trapped bats, summer 2009

Common name	Scientific name	Total	Adult male	Adult female	Juv. Male	Juv. Female
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>	81	11	38	13	19
Common pipistrelle	<i>Pipistrellus pipistrellus</i>	17	7	8	1	1
Bechstein's bat	<i>Myotis bechsteinii</i>	4	3	0	0	1
Daubenton's bat	<i>Myotis daubentoni</i>	6	2	2	0	2
Whiskered bat	<i>Myotis mystacinus</i>	33	13	12	5	3
Natterer's bat	<i>Myotis nattereri</i>	37	17	11	7	2
Brandt's bat	<i>Myotis brandtii</i>	1	0	1	0	0
Noctule	<i>Nyctalus noctula</i>	4	4	0	0	0
Brown long-eared bat	<i>Plecotus auritus</i>	19	9	9	1	0
Total captures		202	66	81	27	28

Table 3. Additional species recorded on a hand held bat detector or data loggers.

Common name	Scientific name	Occasionally recorded	Hammer Pond only
Barbastelle	<i>Barbastella barbastellus</i>	X	
Leisler's bat	<i>Nyctalus leisleri</i>	X	
Nathusius' pipistrelle	<i>Pipistrellus nathusii</i>		X
Serotine bat	<i>Eptesicus serotinus</i>	X	

Table 4. Radio tracking results (for nursery roost location see Table 5 below).

Species	State	Date	Trap location
Soprano pipistrelle	Pregnant	18/05/2009	River Adur, Pound Farm
Whiskered bat	Pregnant	19/05/2009	Wagstaffs wood
Natterer's bat	Pregnant	20/05/2009	Wagstaffs wood
Common pipistrelle	Lactating	27/06/2009	River Adur close Pound farm
Daubenton's bat	Lactating	29/06/2009	Woodland by Knepp mill pond
Whiskered bat	Lactating	05/07/2009	Wagstaffs wood
Brown long-eared bat	Lactating	07/07/2009	Lancing brook
Natterer's bat	Lactating	07/07/2009	Lancing brook
Brown long-eared bat	Post-lactating	07/08/2009	Woodland close to Bothy
Bechstein's bat	Juvenile female	08/08/2009	Woodland by Adur and road

Table 5. Location and size of nursery roosts.

Species	Location	Grid ref	colony count	Main forage area
Soprano pipistrelle	Knepp mill house	TQ1565 2110	80+	Over Adur and Hammer pond
Whiskered bar	Brookhouse cottages	TQ1335 2005	58	Over stream by Hammer pond
Natterer's bat	Shipley church	TQ1450 2180	10+ minimum	Lancing & Adur woods, Hammer pond
Common pipistrelle	Kings Platt Shipley	TQ1450 2195	Small number 10+	Knepp Mill pond woods
Daubenton's bat	Mill pond woods x 2	TQ1610 2125	47+	Knepp Mill pond
Whiskered bat	Hampshire Barn, roof	TQ1395 2130	22	Wagstaffs wood
Brown long-eared bat	Northern Wood	TQ1398 2012	Large roost*	Lancing Brook woodlands
<i>ditto - same bat</i>	W. of New Barn 4	TQ1408 1972	not counted	Lancing Brook woodlands
Natterer's bat	Northern Wood	TQ1393 2000	Small no., 5 or 6	Lancing Brook upstream
<i>ditto - same bat</i>	Northern Wood	TQ1398 2012	not counted	Lancing Brook upstream
Brown long-eared bat	West Lodge house loft	TQ1425 2225	not counted	Woodland nr the Bothy
Bechstein's bat	Mill pond woods	TQ1600 2105	circa 10	Woodland nr the Bothy & R.Adur.

* count difficult

8. Local species status

Soprano pipistrelle.

The soprano pipistrelle is numerous around all the water bodies on the estate, outnumbering all other species captured by a considerable margin. The preferred habitat of this bat is known to be wet woodland adjacent to open water, where they forage extensively on chironomid midges that can be present in quantities sufficient to support very large bat colonies. This predator-prey relationship may change over the years if chironomid abundance is affected by changes in the aquatic environment caused by silting, pollution or water level fluctuation.



Soprano pipistrelle *Pipistrellus pygmaeus*

Nursery colonies are usually located close to lakes and rivers and can grow to considerable size. Over 1,000 breeding females have been recorded at many locations. Significant populations of soprano pipistrelle were anticipated at Knepp but it is very satisfactory to have the presence of a nursery colony confirmed. Currently the pre parturition roost at Knepp is in 64 Kneppmill Cottage. This June over 80 bats were counted (by the tenants) leaving this roost.

The single radio-tagged animal foraged extensively around Kneppmill pond, along the Adur towards Shipley and over Hammer pond. Such a wide range of forage areas implies that this colony is the major one in the area of the proposed river restoration and should be the colony to monitor for future population changes.

Common pipistrelle

Unlike its relative, the common pipistrelle has currently a rather low population at Knepp with rather less than a quarter of the number of soprano pipistrelles trapped. The preferred foraging habitat of common pipistrelles is woodland margins, hedgerows and marginal foliage clutter, feeding on any of the smaller insects found in these habitats. As a more 'generalist' bat, its pattern of roosts and foraging areas matches the patchy distribution of its prey and vegetated habitats within the countryside.

Common pipistrelles form much smaller nursery colonies than sopranos, often frequently switching roosts. To make life more difficult these colonies also subdivide or recombine at different periods as well. This means that they are difficult to keep track of or to obtain accurate counts. At Knepp, the trapped numbers are probably the best guide available of the local relative balance between common and soprano pipistrelles. This species balance would form an effective monitor of change in the habitat balance between the wetland habitats required by soprano pipistrelles and the woodlands and hedgerows required by common pipistrelles. Such wetland changes could be pronounced if the river restoration proceeds. The single common pipistrelle radio-tagged foraged in the woodland strip between Kneppmill pond dam and Floodgate Farm, however its roost was in a house in Kings Platt, Shipley.

Whiskered bat

Whiskered bats forage within habitats similar to those of common pipistrelles but prefer rather wetter woodland. They forage for small flying moths and insects in a 'cluttered' environment of tree canopy and understorey.

In the southeast, whiskered bat nursery roosts are located almost exclusively behind hanging tiles or weatherboards, and this is the case at Knepp. Both the radio-tracked bats were in sunny locations at Hampshire Barn and Brookhouse cottages. These roosts are close to the forage grounds of the radio-tracked animals, which suggests that there is a large population of whiskered bats on the Estate with most available habitat occupied. Whiskered bat nursery roosts are small in comparison with many other species, so the roost from which 58 were counted is large by the standards of other whiskered bat roosts in the southeast. Almost every building in the area with hanging tiles and a southerly aspect will have occasional small numbers of roosting whiskered bats.

Many other bat species also breed in similar places and being certain that all the bats emerging are the same species can be problematic. In this survey a logging bat detector was run close to the roost to separate any non-target species from the counts of whiskered bats.

Brandt's bat

Brandt's bat is superficially extremely similar to whiskered bat. There are diagnostic differences in the dentition, which indicates that there are likely to be differences in the diet of these two species. Unfortunately this animal is little studied in England and the ecological differences between whiskered and Brandt's bats are yet to be investigated. Brandt's bat is certainly the rarer of the two in southeast England, and tends to appear in late summer.

The single female captured by Kneppmill pond was an adult that had not bred this year. There is no evidence as yet that it is breeding at Knepp but if there was a nursery roost in the north of the Estate it would probably not have been trapped in the survey area while it was breeding.

Natterer's bat

Natterer's bats are closely associated with pasture and cattle, indeed the rewilding at Knepp is almost certainly producing a Natterer's bat heaven! This bat captures prey by both gleaning insects from foliage and aerial hawking. During the summer and autumn months it hunts over pasture taking dung flies, moths and small beetles but during rough weather and the milder winter months it forages in the shelter of woodland areas.

Roosts are frequently in tree holes but old established roosts are often in stone buildings, such as the nursery roost in Shipley church. The second nursery roost discovered later in the summer in an oak tree in Northern Wood was also a typical small woodland roost.

Numerically this is the second most abundant bat at Knepp. Its population is likely to increase considerably in future as insect abundance increases and becomes more evenly available throughout the year and areas of scrub and more varied grassland develop. All species of bat respond slowly to change but on the Estate it would appear that this process is already well under way as far as Natterer's bat is concerned. The evidence for this is the high proportion of adult male bats trapped over the summer. The proportion of male animals is usually low close to nursery roosts until late summer, as they are dispersed in more distant countryside in less productive habitats. At Knepp it appears that there is a transition occurring, and it is likely that increasingly large colonies of female bats will build up, with ultimately the male bats being banished to less favourable sites.

Daubenton's bat

Daubenton's bats forage extensively but not exclusively over water. The combination of large areas of open water surface linked to a river catchment with undisturbed woodland close by describes their preferred habitat, which is exactly that of the river Adur, Hammer Pond and Kneppmill pond. These bats snatch insects trapped by or resting upon the surface tension. It is a very productive habitat with a number of species around the world exploiting similar niches in a like manner.

Daubenton's bats are usually part of the catch in any trapping session close to water. They form large nursery colonies that may be at some considerable distance from the trapping point and which are typically subdivided into groups that may be many kilometres apart at times. For these reasons, Daubenton's bats were not a specific target in this survey and in consequence the species is probably quite heavily under-represented in the capture lists. One lactating female was radio-tagged as it was captured early in the evening, which indicated that the nursery roost was nearby. It was tracked to a roost in a tree in woodland at the southeast 'dog-leg' of Kneppmill pond near Floodgates farm. During late June there were over a hundred Daubenton's bats hunting over Kneppmill pond but only 47 were counted out of the nursery roost located. Another tree was also used as a roost and it is highly likely that these woodlands to the north of the 'dog-leg' will contain yet more roosts.

Daubenton's bats are long-distance travellers following rivers for many miles in a single night so although the Adur river restoration will be likely to benefit them, monitoring that benefit and change may prove extremely difficult.

Bechstein's bat



Bechstein's bat *Myotis bechsteinii*.

Bechstein's bat is a rare species that depends on deciduous, preferably oak, woodland with a good canopy and well-developed understorey. Its numbers have been seriously reduced by habitat loss right across Europe. Southern Britain is the northern edge of its distribution, which makes Bechstein's bats vulnerable. In many years, particularly years with cold springs, its breeding success here is extremely low. This is a specialist canopy foraging species and in such cold years the canopy opens so late that the bat is forced to forage in sub-optimal habitats. In response its condition is affected and it fails to breed. Synchronised clear felling of oak woodlands when timber prices are high is a further serious problem for this animal as it both roosts in these trees and forages in their canopy.

As female Bechstein's bats were recorded in Great Cockshill Woods in 2005, there is certainly a nursery colony in or close to these woods. This is further to the north of the area that was surveyed in 2009, where the Bechstein's bats caught were males and a wandering female juvenile. This is a clear indication of a nearby nursery colony. The female juvenile was radio-tracked and a roost site in an oak tree beside the road between Kneppmill pond and Floodgate farm road was filmed at emergence time. About 10 Bechstein's bats were seen around this roost tree, but unfortunately a true count was not obtained because the actual entrance was obscured by foliage. It is probable that given the date of this count, in early August, the group counted was a small splinter of juveniles from the main colony.

Brown long-eared bat

Brown long-eared bats are probably the UK's most numerous bat species. It occupies a wide range of habitats from open country to dense woodland. This wide distribution coupled with the ability to survive in quite small nursery roosts makes the species extremely successful under a range of prevailing conditions.

Brown long-eared bats feed chiefly by 'gleaning' – they pick their prey items directly off foliage or from the ground. As ground dwelling invertebrates are active much later into winter than flying ones, this allows brown long-eared bats to remain active well into winter when most bats are in hibernation.

At Knepp there are a minimum of two nursery colonies, one in the northern West Lodge roof and another in trees and possibly a house close to Northern wood. The two groups of females could well be part of one larger colony that is subdivided across the Estate. The changes taking place to Estate habitats will almost certainly be reflected in an increase of this species. This may be sufficient to cause several new nursery roosts to form in Estate properties and trees as the forage possibilities become richer.

Barbastelle

Barbastelle bats were recorded on six separate trap nights, all in close proximity to either the Adur or its tributary streams. Mostly these passes were late in the night but on one occasion in June a bat passed shortly after sunset. This pattern of passes is consistent with use of the site by both occasional resident male animals and female bats commuting from distant nursery roosts in The Mens woodlands near Pulborough. Unfortunately none were trapped so this was not confirmed.

The overall number of barbastelles recorded was low but this is quite normal for this rare species. Barbastelles feed in suitable foraging sites that can be spaced along commuting routes up to twenty kilometres long.

Female barbastelle bats utilise a variety of habitats according to season and the productivity of the individual sites. They have a specialist diet consisting of lepidopteran (moth) species. Habitats utilised in spring are chiefly wet woodland areas but during the period from May until July or August they forage over open watermeadows, marshlands and waterways. After August they return to the more protected woodland sites. The water meadows and ponds at Knepp therefore provide female barbastelles with ideal foraging habitat at the time of year they need it most – during pregnancy and lactation. The proposed river restoration will increase this resource still further, providing extensive and extremely attractive foraging habitats.

Noctule bat

Occasional noctule bats were present at all trap sites over the summer but none were actually caught until the latter stages of survey. This is due to changing seasonal responses to the calls being played on the acoustic lure. All four captured animals were male. Over the entire summer the pattern of use recorded by logging bat detectors did not greatly alter so it seems unlikely that there is a nursery colony nearby. This is probably related to the agricultural history of the site. The preferred prey items of noctules are the larger insects, numbers of which would have been low over Knepp during the years of arable and conventional stock rearing. Larger insects such as cockchafers, dung and burying beetles are projected to increase on Knepp because of the untreated grassland and dung from grazing animals that have not been dosed with ivermectins. Noctules breed in tree holes, and with an improvement in foraging, a nursery colony would be expected to establish in the near future.

Leisler's bat

No Leisler's bats were caught during 2009 however recordings suggest they are occasionally present. Leisler's bats produce vocalisations that can be easily mistaken for slightly atypical serotine or noctule bat calls so identification on calls alone is not reliable. As this species is known to travel large distances and has been recorded by capture not too far away, it should be regarded as a probable visitor that may become regular. Leisler's bat is rare in the south east of England but has been shown to forage over very large areas. The nearest known colonies are in Kent and the London area.

Nathusius' pipistrelle

Nathusius' pipistrelles were recorded over Hammer pond fairly regularly over the summer. Both the species-specific social calls and echolocation calls were heard. None were captured, and it could be that trapping later into the autumn mating season would have produced results when the acoustic lure would have been more effective.

As the bats were present during June, the presence of a maternity colony cannot be ruled out although the low numbers recorded and the occurrence only at Hammer pond would rather suggest that this is not the case. Nathusius' pipistrelle in England is quite a rare bat and is usually found near larger water features such as major rivers and lakes. It could be that the bats recorded at Knepp are outliers of a larger population down river and closer to the coast.

Serotine bats

Serotine bats have declined across the southeast in the last fifteen years and have disappeared from many of their former roosts. Shipley church used to be a nursery roost but seems to have now lost its colony of this species. None were caught on this survey although several were recorded and seen at all locations. One female was caught in the baseline previous survey in Northern wood in 2005. Serotine bats are specialist foragers on large beetles and moths and almost certainly declined in response to a dramatic fall in the numbers of available insects in the last twenty years. This situation seems to be slowly improving and the rewilding of Knepp is likely to play a part in the reestablishment of this species locally. However, serotines almost always breed in buildings. Loft conversions, timber treatments and other remedial work on roofs have in the past either destroyed nursery colonies or made nursery roosts unsuitable for further use.

9. Discussion

9.1. Bat habitat requirements.

The 13 species now known to occur on Knepp each have different roost, habitat and foraging requirements. It is only by identifying the sex of bats that the ecological importance of a site for bats can be assessed. In general, female bats forage in the most productive sites in the summer months, as they have to bear the physiological stress of pregnancy and lactation, and males usually occupy sub-optimal areas. Females return to nursery roosts during May. Typically there are a number of roosts within a nursery territory, and the bats move between them depending on the weather. Because of the distinction between male and female foraging territories, the status of a foraging area for bats can be assessed according to its use by female bats. If predominantly males use a site, it can be considered to have a less favourable status in terms of foraging attributes than one that is used largely by female bats.

The distance travelled by breeding female bats from roost to foraging area varies according to species. Some, such as barbastelles and noctule will travel 15km or more, pipistrelles will commute up to 5km, whereas Bechstein's bats travel far shorter distances, about 1.5km, but only in well-wooded landscape.

All British bats are insectivores and their continued presence in an area requires a supply of available insect food through the seasons from early spring to early winter. Although bats become torpid in cold weather, in southern England most bats only really hibernate in January. In milder weather bats of many species will emerge to drink and feed, albeit for brief periods. The adult stage of most insects is short and frequently highly seasonal, so for insects to be available for almost all of the year, a very wide range of insect species with overlapping adult flying stages is necessary. Such insect communities are only characteristic of diverse or near pristine habitats.

Bat communities are typically composed of generalist species that can utilise a wide range of habitats and others whose ecological requirements are far more specialised. Brown long-eared bat is an example of a species with more general ecological requirements, whereas Bechstein's bat is one example of a niche-specialist. Breeding females of Bechstein's bat are restricted to foraging in oak canopy within a short distance of their nursery roosts that are in old woodpecker holes also in oak

woodland. This species is on the northern edge of their range in the UK, where not only is the preferred habitat frequently limited due to commercial forestry, but also the productive foraging season is shorter, which has resulted in this being one of our rarest mammals.

At Knepp the major part of the Estate was under intensive agriculture until 2000. As in other low-lying areas of England, much of its wetland habitat of floodplain grassland and wet scrub were lost when fields were drained. One of the changes brought about by re-wilding and more naturalistic grazing has been to reverse this trend, so that these wetlands, together with adjacent areas of woodland, again comprise a rich habitat mosaic. This is likely to result in a continuing increase in insect diversity and abundance throughout the year, which will benefit bats and other insectivores (for example birds, shrews and hedgehogs). Thus any increase in bats and insectivorous birds will indicate that there is an abundant invertebrate prey resource and an overall improvement in habitat quality and diversity.

9.2. Use of the Adur floodplain and tributaries as foraging habitat for bats.

The area likely to be affected by the river restoration extends roughly from Pound Lane in the west to the A24 in the east, following the track to the northeast and Swallows Lane to the southwest (Sykes and Lewis, 2009). This area encloses mostly grassland with a few pockets of woodland, including Charlwood, Swallows Furzefield and part of Jackson's Wood. In addition, the Adur is fringed by scrub and woodland from Capps Bridge to Tenchford Bridge. Pockets of coarse herbaceous vegetation and scrub are developing in places as succession proceeds away from its previous arable land use, and the hedges leading down from the track in the northeast are spreading into the fields.

As far as bats are concerned, this area cannot be considered in exclusion, and the Lay and Lancing Brook tributaries entering the Adur from the west, plus the large expanse of the Knepp mill pond and its adjacent woodland to the north all impact on the bat use of the Adur corridor itself, and *vice versa*.

Ten out of the thirteen species recorded during this survey were either captured or logged along the river Adur corridor (see Appendix). This includes 59 bats that were captured, enabling the sex to be ascertained and for two nursery roosts to be identified. The main foraging area for many of these bats was nearby woodland, but without doubt the River Adur is an important forage area for soprano pipistrelles. One of the nursery colonies identified was a roost of soprano pipistrelles close by in Kneppmill cottages, the other was a common pipistrelle colony that was tracked back to a house in King's Platt, Shipley. The main forage area of this bat was woodlands adjacent to Knepp Mill pond. No nursery roosts were identified within the river restoration site, but this does not mean that there were none – tagging and radio-tracking all female bats would have been prohibitively expensive and time-consuming.

Both male and female bats were caught, which, given that in general females have almost exclusive rights to the best foraging habitat would indicate that the bat species community is in a state of flux between optimal conditions and the suboptimal which previously existed. It will be interesting to monitor what happens as the wildland project proceeds. The proposed river restoration should improve this area for foraging

bats still further. Monitoring this male / female balance, particularly of Natterer's bats and soprano pipistrelles, should be a feature of future surveys but needs to be carried out from May to mid-July. After this period, males begin to move around with the onset of the mating season.

The pre-restoration status of the Adur and river corridor site can thus be summarised as a key foraging area for breeding soprano pipistrelles and as a significant foraging area and commuting route for all other recorded species. As stated, although no nursery roost was identified on the proposed restoration area, the area of woodland at the western end of the stretch of the Adur may well support such roosts. As well as bats recorded in the restoration area, all thirteen species were captured or logged just outside but adjacent to the site. It is thus reasonable to state that this whole complex of river, brooks, open water, wet grassland and mature woodland, together with Estate buildings, will be utilised by foraging, breeding and hibernating bats all year round.

Bats are free ranging animals that are only constrained by the presence of rival conspecific colonies or lack of suitable habitat. In the case of Knepp, changes are happening to habitats and colony numbers and will eventually to territory boundaries. This is a dynamic situation and likely to remain so for at least the next decade.

9.3. Location of nursery colonies on or near the southern part of the Knepp Estate.

Twelve nursery roosts of six species (Table 5) were located as a result of this survey, with a further roost of an additional species, Bechstein's bat, in late summer. The status of this roost is unconfirmed, but as it was located late in the season it is probable that it was a small splinter group of juvenile females, as juveniles remain in groups long after the adults have dispersed to mate in late summer. This group is likely to be within 1.5km to 2km from their nursery roost area. Of the 12 nursery roosts, six were in buildings and six in tree cavities. With the exception of two roosts in Shipley village, all roosts were on or adjacent to Knepp.

Given the presence of Knepp Mill Pond, as well as the Adur and its tributaries, a soprano pipistrelle nursery colony was anticipated, and the confirmation that it was this species breeding in one of the Kneppmill cottages was very satisfactory. The river restoration will improve Knepp still further as a breeding site for this UK BAP Priority species. It is certain that both buildings on the Estate and pockets of mature broadleaved woodland will house alternative roosts including mating roosts of this species. It is apparent walking through these woods that there is a good supply of woodpecker holes, splits and cracks that bats of most of the species recorded would use as places of shelter, especially Daubenton's bats, brown long-eared bats and Natterer's bats. The vernacular style of Estate houses renders them suitable for breeding soprano and common pipistrelles and whiskered bats.

9.4. Number of breeding females in each nursery colony.

With over 80 females counted out of the soprano pipistrelle nursery roost by the tenants, this is by far the largest roost identified in this survey. Soprano pipistrelles are known to breed in colonies that can exceed 1000 – this colony will almost certainly increase substantially! The whiskered bat nursery in Brookhouse cottage is large at 58 bats, with the 22 counted out of Hampshire barn a more typical number for this species. The size of the entire nursery colonies of Daubenton's, Natterer's and brown

long-eared bats is also likely to be larger than the counts indicate. The numbers of breeding females in tree roosts tend to be limited by the size of the tree hole, so any woodland colony divides up to utilise suitable tree cavities within each colony's breeding territory. Buildings generally offer larger areas, and individual nursery roosts thus have the potential to support large numbers of breeding females.

9.5. Species represented only by male bats

Noctule and Bechstein's bat were the only two species with a confirmed presence of adult males but no adult females. The numbers of adult males and adult females of common pipistrelle, Daubenton's bat, whiskered bat and brown long eared bat were roughly the same; but there were considerably more adult female soprano pipistrelles than adult males. Overall, 33% of the trapped adult bats were male and 40% were female.

During future summers, numbers of adult male bats of most species should be expected to fall as the Estate develops a greater importance as a breeding site for species such as Natterer's bat and soprano pipistrelles. It seems probable that this percentage indication will be an effective monitor of a change in the breeding / non breeding ratio. An alternative scenario might be that, at least in the case of some species, the Estate itself is large enough to be divided into optimum and sub-optimum areas, with males relegated to the less productive, sub-optimum areas. In winter bats travel more freely and any monitoring of this balance should be confined to the summer months.

9.6. Species breeding distant from KCE but foraging on the Estate.

There is no evidence that five of the species recorded, barbastelles, Leisler's bats, Nathusius' pipistrelles, noctules and serotine bats, are currently breeding on the Estate. The last two of these species may possibly have nursery roosts situated well to the north of Knepp or a kilometre or so beyond the boundaries. The first three are much more likely to be breeding at some distance. In the case of the barbastelle the nursery roost area is known to be located in The Mens SAC north west of Pulborough. The Adur corridor and the southern area of Knepp is thus utilised as a foraging habitat only for these five species. However, all of these are likely to increase their use of the Estate over time as habitats diversify and insect biomass increases.

The high-flying noctules and Leisler's bats do not rely on landscape features for flightlines and may eventually establish new or additional breeding colonies, so too may Nathusius' pipistrelle although this is rather less likely. Serotine bats have been declining markedly in the southeast for a number of years and it may take some while to reverse this locally before any recovery will be seen on Knepp.

Barbastelles are heavily reliant on landscape connectivity between the woodland roosts and the wetland forage areas. Currently this connectivity between the breeding site at The Mens and the foraging habitat of some of this colony on Knepp is somewhat degraded although still functioning. Further improvement may be necessary to increase the level of commuting bats between its roosts and Knepp.

9.7. Impacts of the river restoration project on bats.

At the time of writing this report it was unknown which of the options for river restoration (Sykes & Lewis, 2009) would go ahead, although full restoration of the

river form, meander and floodplain was the preferred option. There would clearly be a certain amount of disturbance during the construction phase although the exact location and extent was not identified.

Short-term, negative impacts on bats. The two main issues that could negatively impact on bats would be during the construction phase of the river restoration. These are tree felling and possibly the destruction of any built structures. Trapping points along the Adur showed that bats were using the trees lining the river banks as forage and commuting flightlines. There are a number of mature trees along this route and bat roosts, although not identified in this survey, are likely. Trees and associated undergrowth should be retained if at all possible. It is almost impossible to guarantee that there are no bats roosting in a tree. Therefore each tree that has to be felled must be assessed by a licensed bat worker. Any tree known to be a bat roost will require a licence (contact Natural England).

In principle, the optimum time for tree work as far as bats are concerned is September-early November (provided that the weather is mild) and March-April. Tree work should not take place May-August, when there may be nursery roosts present, or December – February, when bats may be hibernating. Similarly, should it be relevant, the demolition of any built structures should only proceed after advice has been taken from a licensed bat worker, and the winter months should be avoided. Daubenton's and Natterer's bats in particular may use crevices in such structures in which to hibernate. Again, a licence from Natural England may be necessary.

Another possible short-term effect of restoration works will be heavily dependent upon the amount of earth works required. There is likely to be a period of lowered insect biomass while the vegetation recovers or changes and new habitats establish. Given the extent of foraging habitat on Knepp adjacent to the restoration site, this is not anticipated to be severe.

Medium and long-term effects on bats.

All bat colony territories usually have long histories and only change slowly. Sudden major habitat change, positive or negative, can destabilise the balance between the component species of bat communities. Changing just one aspect of a species' habitat requirement can make it peculiarly vulnerable or remarkably successful. However, once the construction phase has been completed, the medium and long-term effects on bats are likely to be very positive. Particular species benefiting in the long term will be soprano pipistrelle, barbastelle bat, whiskered bat, Daubenton's bat and to a lesser extent Natterer's bat although this latter species will be already benefiting from re-wilding elsewhere on the estate.

Post-restoration monitoring of soprano pipistrelles, as predators of the flying stages of aquatic insects, would be a cost-effective and direct way to obtain an indication of the positive effects of the river restoration.

9.8. Current and future importance of Knepp to bats.

With thirteen species recorded to date at Knepp including healthy breeding populations of at least four species on site and two more either on or very close to the estate, the Wildland Project area is already of some considerable importance to bats. Bats form nursery colonies in close proximity to reliable productive habitats that

match their foraging specialisations. Males of most species are spread thinly across the wider landscape away from direct competition with the females and juveniles, but somewhat atypically in areas supporting nursery colonies, in Knepp there are rather high numbers of male bats in the most numerous species recorded in 2009. A generalisation would put much of Knepp as currently coming out of a long period of being suitable for male bats only. Of course there are exceptions to this, such as Kneppmill pond and its woods, but these are small in comparison to the wider estate. The net result of these changes is likely to be revival of several lingering small nursery roosts. As these colonies start to thrive the establishment of new colonies by division will occur. Such ongoing changes in the numbers of individuals within a colony or in the number of species within a bat community are almost impossible to assess at one point in time. Thus much of the information in this report forms the database for comparative work to be done in future years.

However it is possible to make a broad assessment of the health of each colony based upon the number of breeding females within it and to a lesser degree upon the size, suitability and distance to current forage areas. The firmest indicators of change are obtained by examining the data collected on soprano pipistrelles, whiskered and Natterer's bats, the three most numerous species recorded. There were far more adult females than adult male soprano pipistrelles trapped, a clear demonstration that the combination of Kneppmill pond, the River Adur and ideally situated nursery site in buildings between the two is just about ideal for this species. This area is likely to have been well-suited to soprano pipistrelles for very many years, and the cessation of arable along the floodplain could only have improved the suitability further.

The ratio of males to females in whiskered and Natterer's bats is far closer, indicating that the changes taking place are having a positive effect on the breeding success of these two species. Natterer's bats in particular will have benefited from the grazing regime; whiskered bats will be benefiting from the increase in wet scrub and woodland. All these three species breed close to their foraging grounds. Noctules and serotines, not shown to be breeding on the Estate, may fly many kilometres from their nursery roosts to forage in productive habitats. Unfortunately in the UK both these species have been severely affected by the dramatic declines in the abundance of large insects such as dung beetles, burying beetles and cockchafer. The populations of such insects may be slow to build up, even within the Wildland Project area. Predators that depend on them for successful breeding would be expected to show an even slower rate of increase.

All bats have slow reproduction rates and marked positive differences in population should not be expected in less than a minimum of five years. However, large negative changes can occasionally happen very rapidly, for instance if there is a catastrophic loss of a nursery roost. Such losses may occur due to tree fall during the breeding season or the destruction of a roost within a building. But albeit slow, future changes in the breeding bat community at Knepp are likely to be profound. The most successful species under the rewilding project are likely to be soprano pipistrelle, common pipistrelle, Natterer's bat, noctule bat, serotine bat, and brown long-eared bat, as well as benefits arising from the river restoration for whiskered bat, barbastelle, soprano pipistrelle and, to a lesser extent depending on the amount of open water, Daubenton's bat.

9.9. Implications of increasing bat populations.

The long-term term effects of both the Wildland project in general and the river restoration in particular will be positive, with negligible or non-existent negative effects. What must not be overlooked are the effects of bats on people. Sustained increases in bat numbers at roosts on or near Knepp should be expected and it would be advisable for Knepp to be ready for this.

Such effects include:

- Increasing numbers of bats breeding in houses and other building on Knepp or in adjacent areas.
- Increasing numbers of tree roosts.
- Effect on remedial work on buildings.
- Effect on tree felling and tree surgery.
- Public relations! Not everyone appreciates having uninvited guests.

The Wildland Project is not aimed at the conservation of any one species, group of species or specific habitat. Nevertheless, the presence of legally protected species does confer some constraints. In practice, it is almost always possible for people to do what they require provided that the permitted procedure, once sanctioned by Natural England, is followed. For work on buildings on the Estate, this will largely involve timing.

As far as tree felling is concerned, the situation is rather more complex. Urgent tree work will always create problems with bat roosts but work planned well in advance can follow best practice and avoid serious impacts. Combining forestry and bat conservation will entail compromises. Commercial forestry is of the main reasons for the decline in bat numbers. A clean forestry crop is a uniform monoculture. Structural uniformity and lack of vegetation diversity are the two major reasons for a lack of insect diversity and this in consequence reduces insectivore numbers and diversity. The young age of the trees at felling also reduces or eliminates roosting possibilities. There are ways of overcoming many of these problems and they should not be seen as an obstacle to future forestry.

More detailed advice and information about these issues is to be found in *Handbook of Advice and Information on Bats for Knepp Castle Estate* (Greenaway 2009), which can be downloaded from the Knepp Castle Estate website.

10. Recommendations

Additional roost sites - The built structures situated below the dam at Kneppmill pond have potential for both restoration and adaptation as roost or hibernation sites for bats. This may have advantages if bat colonies currently in nearby houses do become much larger. Should such restoration be contemplated it would be possible to build in structures attractive as roost sites at comparatively little extra cost.

Re-introductions - The report so far has been concerned with species that already exist on site, but there are other species that once flourished in Sussex but which have now all but disappeared. One is the greater horseshoe bat, which is present in West Sussex at very low levels but gradually appearing more frequently. The other is the mouse-

eared bat. The last known surviving colony of this species in the UK suffered a catastrophe in the 1970s, and was eventually declared extinct after the last known male died, but a young male mouse-eared bat has since been recorded in a tunnel in West Sussex. There is scope for a re-introduction programme for both these species. Knepp is amply large enough and should provide ideal foraging habitat for both these species – and for at least two more that are poised to cross the Channel.

Future surveillance – As prime indicator species, monitoring bat communities and populations is highly effective. There should be a repeat bat survey in (say) ten years time, using the methodology used for this survey as far as possible.

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Appendix

Individual trap site capture data

18.5.09

Three harp traps and lures along the Adur by Pound farm, TQ15050 21786 and south to the bridge.

A cold evening.

Trapped bats

2x Soprano Pipistrelle *Pipistrellus pygmaeus* female,
2x Common Pipistrelle *Pipistrellus pipistrellus* male
2x Whiskered bat *Myotis mystacinus* male

Radio-tagged bats.

Soprano Pipistrelle *Pipistrellus pygmaeus* female.

Recorded bat species on loggers.

Soprano Pipistrelle *Pipistrellus pygmaeus*
Common Pipistrelle *Pipistrellus pipistrellus*
Myotis species
Daubentons bat *Myotis daubentonii*
Brown long-eared bat *Plecotus auritus*
Barbastelle *Barbastella barbastellus*

19.5.09

Hammer pond. Three harp traps and lures around the northern end of the pond.

Captured bats

4x Soprano Pipistrelle *Pipistrellus pygmaeus* male
5x Soprano Pipistrelle *Pipistrellus pygmaeus* female
1x Whiskered bat *Myotis mystacinus* female

Radio-tagged bats.

1x Whiskered bat *Myotis mystacinus* female

Recorded bat species on loggers

Loggers showed a massive Soprano Pipistrelle, *Pipistrellus pygmaeus* presence.

20.5.09

Track by Wagstaffs wood. Two harp traps and a mist net.

Captured bats

1x Soprano Pipistrelle *Pipistrellus pygmaeus* female, pregnant.
1x Common Pipistrelle *Pipistrellus pipistrellus* male.
3x Whiskered bat *Myotis mystacinus* male
1x Whiskered bat *Myotis mystacinus* female pregnant
1x Brown long-eared bat *Plecotus auritus* male
1x Brown long-eared bat *Plecotus auritus* female.
1x Natterer's bat *Myotis nattereri* female pregnant

Radio tagged bats

1x Natterers bat *Myotis nattereri* female pregnant

21.5.09

In woodland by Adur at the west end of the deer park.

Three harp traps.

Captured bats

1x Soprano Pipistrelle *Pipistrellus pygmaeus* female, pregnant.

2x Soprano Pipistrelle *Pipistrellus pygmaeus* male

3x Whiskered bat *Myotis mystacinus* female pregnant

1x Whiskered bat *Myotis mystacinus* male

1x Natterer's bat *Myotis nattereri* male

2x Brown long-eared bat *Plecotus auritus* male

Bat detector loggers.

Soprano Pipistrelle *Pipistrellus pygmaeus*

Common Pipistrelle *Pipistrellus pipistrellus*

Myotis species

Brown long-eared bat *Plecotus auritus*

Noctule bat *Nyctalus noctula*

23.5.09

By the Adur as on 19th May.

Two traps and a mistnet

Rapidly cold with fog later. No activity by 21.30.

Captured bats

1x Common Pipistrelle *Pipistrellus pipistrellus* male.

1x Daubenton's bat *Myotis daubentoni* male.

Bat detector loggers

Nyctalus species, probably Leislars bat *Nyctalus leisleri*

Soprano Pipistrelle *Pipistrellus pygmaeus*

Common Pipistrelle *Pipistrellus pipistrellus*

Myotis species

Daubenton's bat *Myotis daubentoni*

24.5.09

Wagstaffs wood.

Two harp traps and a mistnet over the stream.

Captured bats

1x Soprano Pipistrelle *Pipistrellus pygmaeus* female pregnant

2x Common Pipistrelle *Pipistrellus pipistrellus* female pregnant

1x Daubentons bat *Myotis daubentoni* male

1x Whiskered bat *Myotis mystacinus* female pregnant

2x Whiskered bat *Myotis mystacinus* male

1x Brown long-eared bat *Plecotus auritus* male

Bats recorded on bat detector loggers.

Soprano Pipistrelle *Pipistrellus pygmaeus*
Common Pipistrelle *Pipistrellus pipistrellus*
Myotis species
Brown long-eared bat, *Plecotus auritus*
Noctule bat *Nyctalus noctula*
Barbastelle *Barbastella barbastellus*

27.6.09

Three harp traps and lures along the Adur by Pound farm, TQ15050 21786 and eastwards to the bridge.

Fog after midnight and hence no activity after this time.

Captured bats.

5x Soprano Pipistrelle *Pipistrellus pygmaeus* lactating females
1x Soprano Pipistrelle *Pipistrellus pygmaeus* nulliparus female
1x Common Pipistrelle *Pipistrellus pipistrellus* lactating female
1x Common Pipistrelle *Pipistrellus pipistrellus* male
3x Natterer's bat *Myotis nattereri* adult males
1x Natterer's bat *Myotis nattereri* juvenile male
1x Natterer's bat *Myotis nattereri* juvenile female

Radio tagged bats

1x Common Pipistrelle *Pipistrellus pipistrellus* lactating female

Bats recorded on bat detector loggers

Soprano Pipistrelle *Pipistrellus pygmaeus*
Common Pipistrelle *Pipistrellus pipistrellus*
Myotis bat species
Daubenton's bat *Myotis daubentoni*
Brown long-eared bat *Plecotus auritus*
Noctule bat *Nyctalus noctula*

28.6.09

Three harp traps at the north end of Hammer pond

Captured bats

5x Soprano Pipistrelle *Pipistrellus pygmaeus* lactating females
1x Soprano Pipistrelle *Pipistrellus pygmaeus* nulliparus female
1x Soprano Pipistrelle *Pipistrellus pygmaeus* juvenile female
1x Soprano Pipistrelle *Pipistrellus pygmaeus* juvenile male
1x Common Pipistrelle *Pipistrellus pipistrellus* nulliparus female
1x Common Pipistrelle *Pipistrellus pipistrellus* adult male
1x Common Pipistrelle *Pipistrellus pipistrellus* juvenile female

Bats recorded on bat detector loggers

Soprano Pipistrelle *Pipistrellus pygmaeus*
Common Pipistrelle *Pipistrellus pipistrellus*

Nathusius' Pipistrelle *Pipistrellus nathusii*
Myotis species
Noctule bat *Nyctalus noctula*

29.6.09

In the woodland strip on the eastern side of the main Knepp lake.

Captured bats.

4x Soprano Pipistrelle *Pipistrellus pygmaeus* female, lactating.
1x Soprano Pipistrelle *Pipistrellus pygmaeus* male
1x Common Pipistrelle *Pipistrellus pipistrellus* female lactating
1x Whiskered bat *Myotis mystacinus* male adult
1x Natterer's bat *Myotis nattereri* female lactating
1x Daubenton's bat, *Myotis daubentoni* female lactating.
1x Brown long-eared bat *Plecotus auritus* male adult

Radio tagged bats

1x Daubenton's bat *Myotis daubentoni*. Female lactating

Bats recorded on bat detector data loggers.

Soprano Pipistrelle, *Pipistrellus pygmaeus*
Common Pipistrelle, *Pipistrellus pipistrellus*
Myotis bat species
Natterers bat *Myotis nattererii*.
Daubentons bat, *Myotis daubentoni*
Brown long eared bat, *Plecotus auritus*
Serotine bat, *Eptesicus serotinus*.
Noctule bat, *Nyctalus noctula*.

30.6.09

Woodland on east side of large east lake but further north than on the 29.6.09

Two harp traps.

Captured bats.

1x Whiskered bat *Myotis mystacinus* female lactating
1x Natterer's bat *Myotis nattereri* male adult
1x Natterer's bat *Myotis nattereri* male juvenile
1x Bechstein's bat *Myotis bechsteinii* male Ring no. Y9628

Bats recorded on bat detector data loggers.

Soprano Pipistrelle *Pipistrellus pygmaeus*
Common Pipistrelle *Pipistrellus pipistrellus*
Myotis species
Natterer's bat *Myotis nattereri*.
Daubenton's bat, *Myotis daubentoni*
Serotine bat *Eptesicus serotinus*.
Noctule bat *Nyctalus noctula*.
Leisler's bat *Nyctalus leisleri*

1.7.09

Embankment of main pond.
Three harp traps

Captured bats

2x Soprano Pipistrelle *Pipistrellus pygmaeus* female, lactating.
1x Common Pipistrelle, *Pipistrellus pipistrellus* female nulliparus
1x Bechstein's bat *Myotis bechsteinii*, male retrap.
1x Brown long-eared bat *Plecotus auritus* male adult.

2.7.09

Hammer pond on the western shore line.
Two harp traps.

Captured bats

2x Soprano Pipistrelle *Pipistrellus pygmaeus* female, lactating.
6x Soprano Pipistrelle *Pipistrellus pygmaeus* female juvenile
1x Soprano Pipistrelle *Pipistrellus pygmaeus* male, juvenile.
1x Whiskered bat *Myotis mystacinus* male adult
1x Natterer's bat, *Myotis nattereri*. male adult

Bat detector loggers ineffective due to cricket noise.

5.7.09

Wagstaffs wood
Two harp traps and a mistnet.

Captured bats

5x Soprano Pipistrelle *Pipistrellus pygmaeus* female, lactating.
4x Soprano Pipistrelle *Pipistrellus pygmaeus* female, juvenile.
1x Common Pipistrelle *Pipistrellus pipistrellus* female post lactating
1x Common Pipistrelle *Pipistrellus pipistrellus* male
1x Whiskered bat *Myotis mystacinus* female adult lactating
1x Whiskered bat *Myotis mystacinus* female juvenile

Radio tagged bats

1x Whiskered bat *Myotis mystacinus* female lactating.

8.7.09

Lancing Brook and Northern wood. Three harp traps, two in the wood and one by the stream.

Captured bats

2x Soprano Pipistrelle *Pipistrellus pygmaeus* male, adult.
3x Soprano Pipistrelle *Pipistrellus pygmaeus* male, juvenile.
1x Soprano Pipistrelle *Pipistrellus pygmaeus* female, post lactating.
1x Soprano Pipistrelle *Pipistrellus pygmaeus* female, juvenile.
1x Common Pipistrelle *Pipistrellus pipistrellus* male juvenile.
1x Whiskered bat *Myotis mystacinus* female nulliparus
1x Whiskered bat *Myotis mystacinus* male juvenile

1x Whiskered bat *Myotis mystacinus* male adult.
4x Natterer's bat *Myotis nattereri*. female post lactating
1x Natterer's bat *Myotis nattereri*. female juvenile
2x Brown long-eared bat *Plecotus auritus* male adult.
6x Brown long-eared bat *Plecotus auritus* female post lactation.

Radio tagged bats.

1x Natterer's bat *Myotis nattereri*. female post lactating.

9.7.09

Lower end Lancing brook near the junction with the Adur.

Captured bats

3x Soprano Pipistrelle *Pipistrellus pygmaeus* male, juvenile.
2x Soprano Pipistrelle *Pipistrellus pygmaeus* female, post lactating.
1x Soprano Pipistrelle *Pipistrellus pygmaeus* female, juvenile.
1x Daubenton's bat *Myotis daubentoni* female juvenile

Bat detector loggers

Mostly lost to crickets noise but Serotine, *Eptesicus serotinus* present and seen.

2.8.09

By the Adur in the deer park close to pound farm.

Three harp traps

Foggy later.

Captured bats

1x Soprano Pipistrelle *Pipistrellus pygmaeus* female, juvenile.
1x Soprano Pipistrelle *Pipistrellus pygmaeus* female, nulliparus
1x Whiskered bat *Myotis mystacinus* male juvenile
1x Natterer's bat *Myotis nattereri*. female post lactating
2x Natterer's bat *Myotis nattereri* male juveniles

Bat detector loggers, and seen.

Many Daubenton's bats over the river.

3.8.09

Northern wood and Lancing Brook.

Three harp traps.

Warm and damp.

Captured bats

5x Soprano Pipistrelle *Pipistrellus pygmaeus* female, juvenile.
1x Soprano Pipistrelle *Pipistrellus pygmaeus* female, nulliparus
1x Soprano Pipistrelle *Pipistrellus pygmaeus* male, juvenile
1x Soprano Pipistrelle *Pipistrellus pygmaeus* male, adult.
2x Whiskered bat *Myotis mystacinus* male juvenile
1x Whiskered bat *Myotis mystacinus* female juvenile
1x Whiskered bat *Myotis mystacinus* female adult

2x Natterer's bat *Myotis nattereri* male adults
1x Daubenton's bat *Myotis daubentoni* female nulliparus

5.8.09

On the floodplain by the old castle.

Three harp traps by the river.

Became very foggy early on and activity ceased. Also a very bright full moon

Captured bats

2x Soprano Pipistrelle *Pipistrellus pygmaeus* male, juveniles.
1x Soprano Pipistrelle *Pipistrellus pygmaeus* female, post lactation.
1x Whiskered bat, *Myotis mystacinus* male adult

7.8.09

Close to the Bothy in woodland.

Three harp traps.

Fog again in all the open areas quite early on.

Captured bats

1x Soprano Pipistrelle, *Pipistrellus pygmaeus* female post lactation
1x Common Pipistrelle, *Pipistrellus pipistrellus* female post lactation
1x Bechsteins bat, *Myotis Bechsteinii*, male adult.
4x Natterers bat, *Myotis nattererii*. male adult
2x Natterers bat, *Myotis nattererii*. female post lactation
3x Natterers bat, *Myotis nattererii*. male juvenile
1x whiskered bat *Myotis mystacinus* female juvenile
1x Brown long eared bat, *Plecotus auritus* female post lactation
1x Brown long eared bat, *Plecotus auritus* male adult
2x Noctule *Nyctalus noctula* male adult

Radio tagged bats

1x Brown long-eared bat, *Plecotus auritus* female post lactation

8.8.09

In woodland by the Adur at the Shipley end of the deer park.

Three harp traps.

Captured bats

1x Soprano Pipistrelle, *Pipistrellus pygmaeus* female post lactation
1x Bechstein's bat, *Myotis bechsteinii*, male adult. Y9635
1x Bechstein's bat, *Myotis bechsteinii*, female juvenile. Y9634
3x Natterer's bat, *Myotis nattereri*. male adult
2x Natterer's bat, *Myotis nattereri*. female post lactation
1x Whiskered bat *Myotis mystacinus* female post lactation
1x Whiskered bat *Myotis mystacinus* male adult
1x Noctule *Nyctalus noctula* male adult

Radio tagged bats

1x Bechsteins bat, *Myotis bechsteinii*, female juvenile. Y9634

9.8.09

Main lake side woodlands

Three harp traps.

Capture lists

1x Soprano pipistrelle, *Pipistrellus pygmaeus* female post lactation

1x Soprano pipistrelle, *Pipistrellus pygmaeus* female juvenile

3x Soprano pipistrelle, *Pipistrellus pygmaeus* male juvenile

1x Soprano pipistrelle, *Pipistrellus pygmaeus* male adult

1x Common pipistrelle, *Pipistrellus pipistrellus* female juvenile

2x Natterer's bat, *Myotis nattererii*. male adult

3x Natterer's bat, *Myotis nattererii*. female post lactation

1x Whiskered bat *Myotis mystacinus* female post lactation

1x Whiskered bat *Myotis mystacinus* male juvenile

1x Brandt's bat *Myotis brandtii* female adult

1x Daubenton's bat, *Myotis daubentoni* female juvenile

1x Noctule *Nyctalus noctula* male adult

3x Brown long-eared bat, *Plecotus auritus* female post lactation

1x Brown long-eared bat, *Plecotus auritus* male juvenile

1x Brown long-eared bat, *Plecotus auritus* male adult