

Habitat management for bats

A guide for land managers, land owners and their advisors



Habitat management for bats



Cover cartoon by Neil Bennett
Other cartoons by Neil Bennett
and illustrations by Barry Larking
© JNCC 2001



Habitat management for bats

A guide for land managers, land owners and their advisors

Abigail C Entwistle, Stephen Harris, Anthony M Hutson, Paul A Racey,
Allyson Walsh, Stephen D Gibson, Ian Hepburn and Jacklyn Johnston

Illustrations by Barry Larking, cartoons by Neil Bennett

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough
PE1 1JY
UK

ISBN 1 86107 528 6

© JNCC 2001

Contents

Acknowledgements	6
1 Introduction	7
Key threats to foraging bats	7
Why do bats need our help?	7
Bat biology	9
2 Managing habitats for bats	11
Key habitats for bats	11
Freshwater	15
Woodland	17
Grassland	19
Linear	20
Other habitats	21
Additional features valuable to foraging bats	23
Management decision tree	24
3 Habitat management for individual bat species	25
Greater horseshoe bat	26
Lesser horseshoe bat	27
Daubenton's bat	28
Brandt's bat	29
Whiskered bat	30
Natterer's bat	31
Bechstein's bat	32
Pipistrelle	33
Nathusius' pipistrelle	34
Serotine	35
Noctule	36
Leisler's bat	37
Barbastelle	38
Brown long-eared bat	39
Grey long-eared bat	40
4 References	41
5 Further reading	42
Annexes	
I Legislation protecting bats	43
II Financial support for habitat management	45
III Key contacts	46

Acknowledgements

JNCC would like to thank all those who provided information about the habitat use of individual species including Gareth Jones, Laurent Duvergé (of the Vincent Wildlife Trust), Roger Ransome, Kate MacAney (for information on Leisler's bats), Frank Greenaway, Peter Smith, Colin Catto and

Phil Richardson. Tony Mitchell-Jones and Peter Spencer of English Nature and Jessa Battersby of JNCC provided invaluable comments on the manuscript. JNCC would also like to thank Phil Richardson and the Bat Conservation Trust for the individual species distribution maps. British Isles map outline provided courtesy of USGS.

1 Introduction

Bats are intriguing animals – the world's only true flying mammals and one of the most diverse mammal groups on Earth – second only to the rodents in number of species, they occur on every continent except Antarctica. There are more native species of bat in the UK – 16 breeding¹ and several vagrant visitors – than any other group of mammals.

Throughout Great Britain and Northern Ireland – as elsewhere in western Europe – bat populations have declined dramatically in recent years. Conservation of bats is complex and needs to take account of several factors, including the protection of summer roost sites, the protection of winter hibernation sites, and the protection and appropriate management of habitats where bats feed. *The bat workers' manual* (see page 41) deals with roost site protection.

The aim of this manual is to provide land owners, land managers and their advisors with both general and specific guidance on how to manage areas to benefit foraging bats.

Research is increasing our understanding of bat biology and behaviour. Recently, new information has been uncovered about where bats feed and how to best maintain or enhance their favoured habitats. This book is divided into three main parts after this general introduction: the first (Managing habitats

Key threats to foraging bats



Loss of habitat, including isolation through fragmentation.



Decline in insect availability through the use of insecticides.



Pesticide build-up through the food-chain.

for bats) deals with general habitat management advice to assist foraging bats; the second part (Habitat management for bat species) provides specific habitat management advice for each of the 16 breeding bat species found in the UK. The final section and the annexes provide details of the law protecting bats in the UK, how and where to find more information and some sources of financial assistance for habitat management that can help bats.

Why do bats need our help?

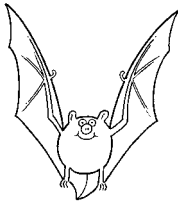
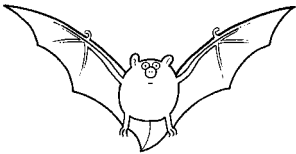

















During the 20th century, bat numbers have plummeted in parallel with dramatic changes in the countryside. Several species of bats are now seriously threatened, and in the last decade one species – the greater mouse-eared bat – became extinct as a UK breeding species. Even the more common bats have suffered dramatic declines. Pipistrelle numbers, for example, are estimated to have dropped by about 70% during the 15-year period 1978-1993.

In the UK, bats eat only insects and changes in agricultural practices appear to be an important factor in declining bat numbers. The change from hay making to silage, for instance, has resulted in fewer insects surviving to reach their adult (flying) stage, and hence less food available for foraging bats. Hedgerows and ponds, both widely used by bats, have been lost from the countryside at an alarming rate – even in recent years. For example 23% of hedgerows and 75% of ponds were lost during the period 1984 to 1990. Woodland habitats, including old trees, have declined also. While the overall extent of suitable habitat has been greatly reduced, habitats which remain are



¹ There are 16 recognised species of bats breeding in the UK. Two distinct forms of the pipistrelle bat are characterised by the frequencies of their echolocation emissions and DNA. They are now regarded as two separate species, the common pipistrelle, *Pipistrellus pipistrellus*, with an echolocation frequency of 45 kHz, and the soprano pipistrelle, *Pipistrellus pygmaeus*, with an echolocation frequency of 55 kHz.

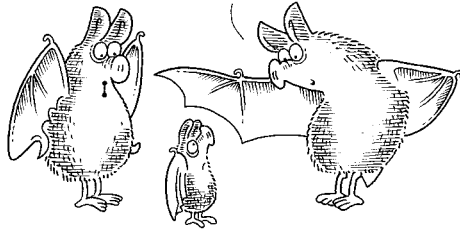
Table 1 The distribution and status of bat species in the UK.

Guide to status symbols:			
			
Common	Frequent	Scarce	Rare
Species name	Distribution	Status	
Greater Horseshoe	Restricted		
Lesser Horseshoe	Restricted		
Daubenton's	Widespread		
Brandt's	Widespread		
Whiskered	Widespread		
Natterer's ¹	Widespread		
Bechstein's	Restricted		
Pipistrelle	Widespread		
Nathusius's pipistrelle	Restricted		
Serotine	Restricted		
Noctule	Widespread		
Leisler's ²	Widespread		
Barbastelle	Widespread		
Brown long-eared	Widespread		
Grey long-eared	Restricted		

¹ Natterer's is less widespread and less frequent in Northern Ireland than in Great Britain

² Leisler's is widespread and common in Northern Ireland

BUT BATS **DON'T**
BECOME VEGETARIANS!

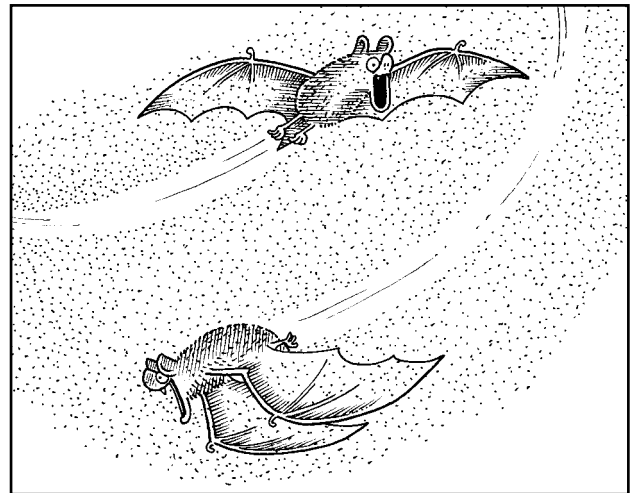


becoming more fragmented, and insect availability is falling. Favoured habitats which offer the appropriate conditions where bats can find and hunt their insect prey are essential for maintaining our bat populations. Habitat creation and enhanced habitat management can provide the right conditions to help the recovery of bat populations.

All bats are now protected by law (see Annex I). It is illegal intentionally to kill bats, to disturb them, or to damage their roost sites. Several European wildlife treaties give additional protection to important bat feeding areas. In addition, specific action plans have been prepared for some bats by the UK Biodiversity Group. These 'Species Action Plans' set out how the Government seeks, through partnerships between statutory agencies and voluntary organisations, to reverse the declines and help the recovery of bat populations (see page 41, *Biodiversity: The UK steering group report*).

Declining numbers is an obvious reason for conserving those bats that remain. But there are other compelling reasons to be concerned about bat conservation. The well being of bat populations mirrors the health of the environment generally. It is our responsibility and in our self-interest to look after the environment now and for future generations, and the conservation of habitats for bats will also benefit a wide spectrum of other wildlife.

Bats are also of direct benefit to land managers. During summer they eat vast numbers of insects each night, many of which are pests that damage growing crops. Pipistrelles, for instance, are estimated to each consume up to 3,000 midges or other small flies a night and bats generally feed on the adults of various pest moths including cutworms, chafers, wireworms and flies such as fever fly and crane fly.



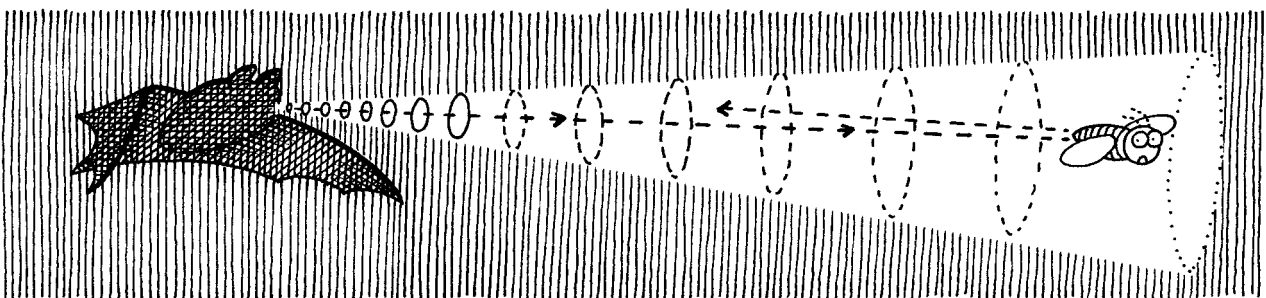
Pipistrelles can catch up to 3,000 insects a night.

Bat biology

Bats are intelligent, social mammals that can live for up to 30 years. All bats in the UK are relatively small – ranging from our smallest, the pipistrelle, which weighs around 4-5 g (0.18 oz) and has a wingspan of 20 cm (8 in), to the 40 g (1.4 oz) noctule with a 40 cm (16 in) wingspan. Bats sleep in the day and feed during the night, locating their prey by echolocation.

Echolocation

Bats can navigate and detect tiny insect prey in complete darkness by using a sophisticated echolocation system. They produce high frequency calls – outside the range of human hearing. They listen for returning echoes to produce a 'sound picture' of their surroundings. In this way they can navigate through their environment and locate their prey. Each species emits a unique sound that will work best in different types of environments and in locating types of insect. These differences between species mean that bats will forage differently and will use distinct types of habitat. Bat sound detectors can be used to identify some individual species or groups of species by their echolocation call.



Bats can locate tiny prey in complete darkness using echolocation.

Summer roosts

During the summer, bats group together to form colonies in roost sites. In most species, the summer roosts are mainly females gathered into 'maternity colonies' to have their young – bats usually have one young a year. They spend the day in their roosts, which can be found in a variety of buildings, under bridges, in caves or hollow trees, depending on the species (see page 41, *Bats in houses*). Bats are very loyal to particular roost sites and tend to return to the same sites each year. Most summer colonies disperse in September and October, once the young bats are old enough to fly, and many of the bats hibernate at an alternative site from November to April. All bat roosts are protected by law, even when they are unoccupied.

Feeding

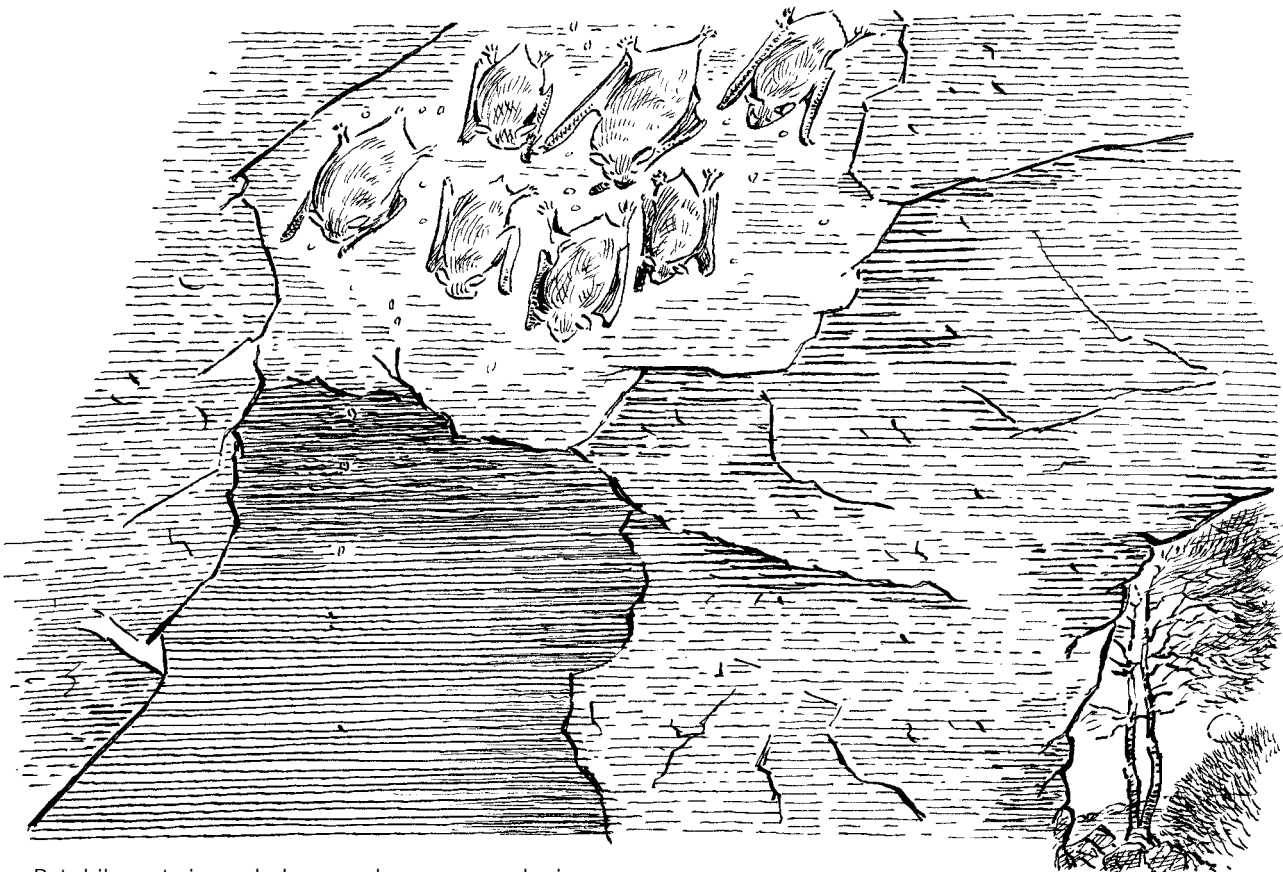
In the UK, bats feed exclusively on insects. Different species have different feeding behaviours. They may catch insects in flight, or pick them off the surface of open water, or from the ground or foliage. In summer, bats emerge from their roosts at dusk to feed. The distances travelled to feeding sites vary considerably, both within and between species. While some species feed close to their roost site, like brown long-eared bats, which normally forage within 1 km of their

roost, others fly long distances – noctules have been recorded flying more than 26 km to feeding areas. Bats use a number of foraging sites every night, moving between them to locate areas with high insect densities.

Bats frequently return to the same foraging sites on a regular basis, sometimes visiting the same site at the same time each night. However, a large number of feeding areas are needed throughout the year as feeding patterns change in response to insect availability, which, in turn, alters both seasonally and with local weather conditions. Particular foraging sites may be very important to a large number of bats and used by several species at the same time.

Hibernation

Bats generally select undisturbed, cool places with an even temperature in which to hibernate, such as caves, mines, tunnels or unoccupied buildings. They are seldom seen in the winter, although they may occasionally wake up to drink and feed on available insects. Some species hibernate near their summer roost or foraging grounds, while others migrate some distance to find a suitable hibernation site (see chapter 4, *Bats underground – A conservation code*).



Bats hibernate in cool places such as caves and mines.

2 Managing habitats for bats

Several habitats are particularly important for foraging bats: freshwater, woodland, grassland and linear habitats (see box below, *Habitats of importance to particular bat species*). This holds true throughout a range of landscape types and across the regions of the UK. There are a few key characteristics that make good bat foraging habitats:

- **Suitable habitat structure**
This varies for different bat species and needs to match the particular flight capabilities and echolocation calls they use;
- **High densities of insects**
Different groups of insects are important to different types of bats; and
- **Habitat corridor**
These provide both foraging areas and routes that allow bats to move freely between their roosts and feeding areas.

Other habitats are less favoured but may still provide suitable foraging sites: arable farmland habitats, parkland, moorland, coastal and urban or other built-up areas all attract some foraging bats. In addition, some features or artefacts found in association with feeding grounds, such as buildings, bridges, bat boxes, single trees, and white street lighting, can be of considerable importance.

Bat activity in an area can be positively determined by use of a bat detector. However, it is very difficult to establish that an area is *not* important to bats; sites currently unused may become important feeding grounds at other times. Management decisions should be based on the potential of the area to support bats, the availability of other suitable bat habitats nearby, and the location of local roosts. The illustration on the following page gives a schematic indication of the kinds of actions that land managers can take to help provide good feeding areas for bats.

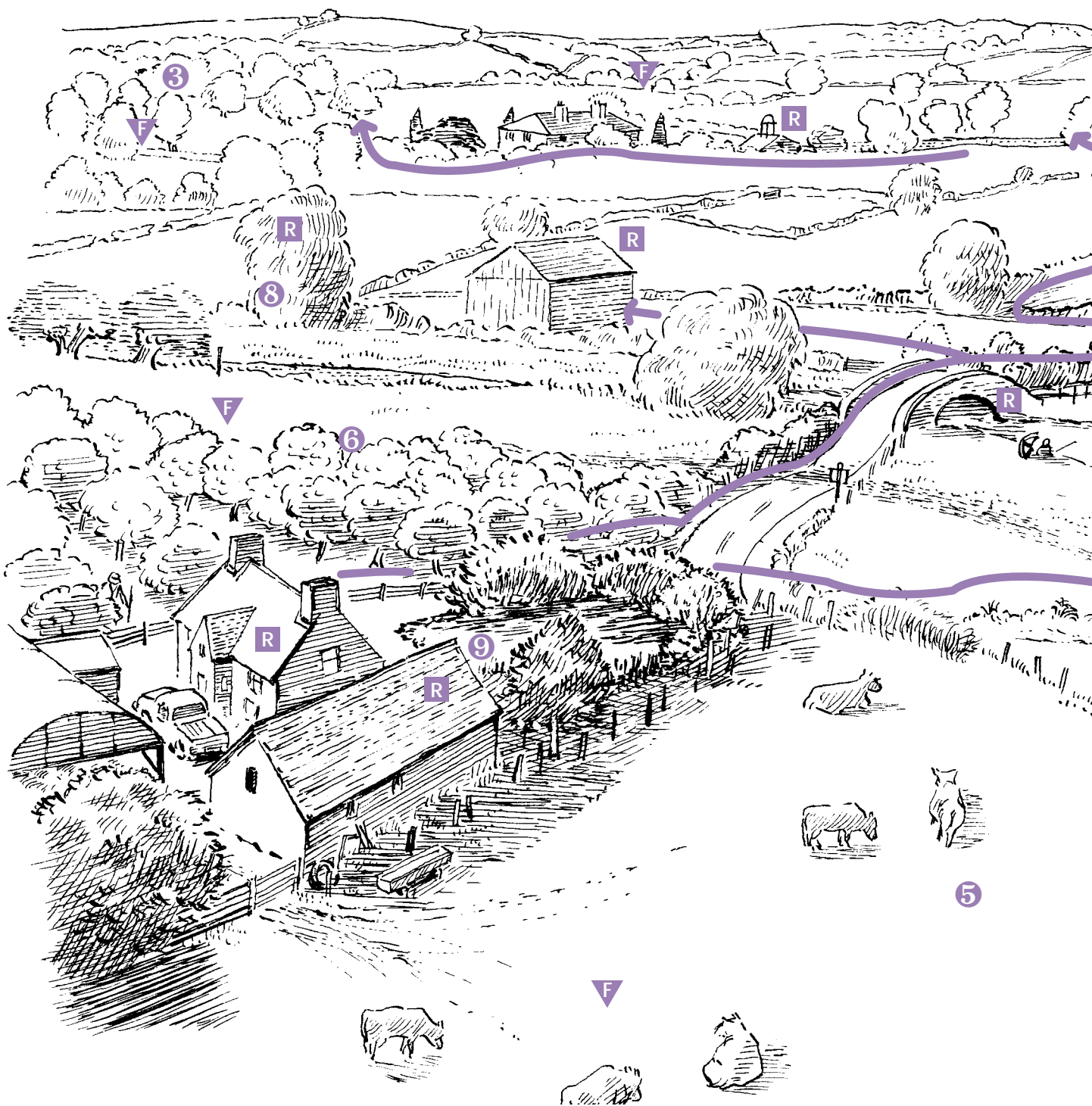
Key habitats for bats

This part of the manual provides management guidelines for the principal habitats used by foraging bats – freshwater, woodland, grassland and linear features. Suggestions for enhancement and creation of new habitat are also included. The guidelines are appropriate for a range of bat species and will also benefit other wildlife in the vicinity. However, changing the management of sites should be undertaken with care because there may be other conservation interests or priorities that are important.

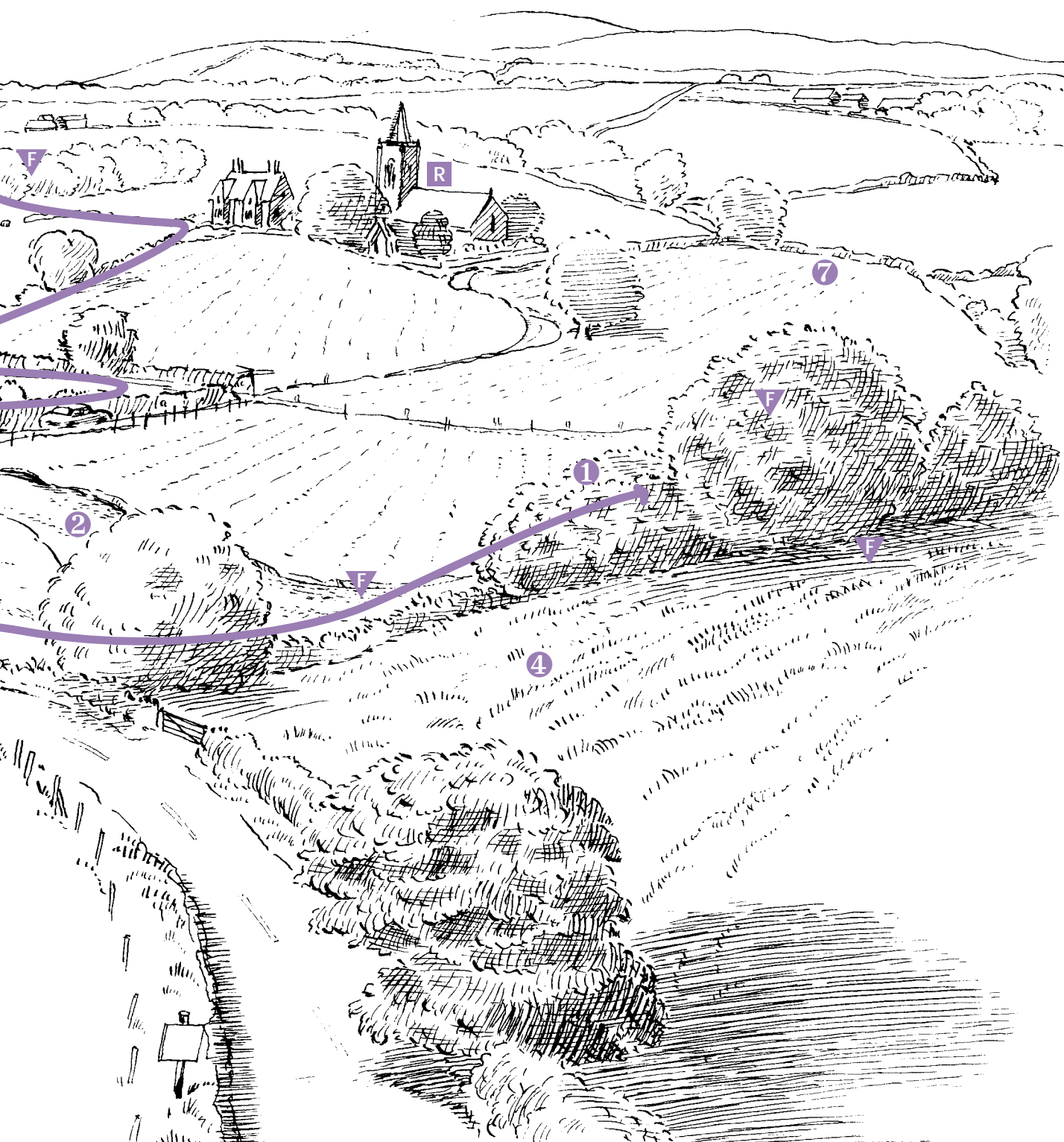
Table 2 Habitats of importance to particular bat species.

	Woodland edge	Riparian vegetation	Broad-leaved woodland	Treeline	Parkland	Mixed woodland	Hedgerows	River/canal	Woodland ride	Lake/reservoir	Pond	Wet woodland	Woodland clearing	Pasture	Suburban	Single trees	White lighting	Meadow	Coniferous woodland	Ditches	Urban	Coastal areas	Arable
Pipistrelles 45 & 55 kHz	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆
Serotine	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		
Greater Horseshoe	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	◆			
Daubenton's	◆	◆	◆	◆		◆	◆	◆	◆	◆	◆	◆	◆		◆	◆			◆	◆		◆	
Natterer's	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆	◆		◆			◆					◆	
Bechstein's	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆		◆		◆				◆				
Leisler's			◆		◆	◆		◆		◆	◆		◆	◆			◆	◆	◆		◆	◆	
Noctule	◆	◆			◆			◆		◆	◆		◆	◆	◆		◆	◆			◆		
Brown long-eared	◆	◆	◆	◆	◆	◆	◆		◆				◆			◆			◆				
Whiskered	◆	◆	◆		◆	◆		◆		◆	◆		◆						◆				
Grey long-eared	◆		◆	◆	◆	◆								◆	◆	◆	◆		◆				
Barbastelle	◆	◆	◆			◆		◆	◆	◆	◆		◆										
Nathusius' pipistrelle	◆	◆	◆	◆	◆			◆	◆						◆								
Brandt's	◆	◆	◆			◆	◆						◆						◆				
Lesser horseshoe		◆	◆	◆	◆	◆	◆																

Habitat features important for bats. Roosts, foraging sites and flyways in the landscape.



- ❶ Continuous treeline and hedgerow provides connectivity of the landscape for bats commuting between foraging sites. Even gaps as small as 10m may prevent bats using hedgerows and treelines.
- ❷ Rivers and streams provide excellent feeding grounds for bats. Bats need open water to drink and bankside vegetation provides habitats for insect prey and valuable cover whilst foraging.
- ❸ Woodland is more sheltered and often warmer than the surrounding open areas. It provides many different types of insects and a high degree of cover for bats.
- ❹ Unimproved pasture, grazed by cattle provides insects associated with dung, which are important food for some species.
- ❺ More intensively managed grassland may still have large numbers of insects but fewer species, which could lead to food shortages at certain times of year.



⑥ Orchards and parkland provide additional feeding opportunities for species that feed in semi-open habitats such as woodland edges and glades.

⑦ Arable land can be improved for bats by expanding field margins, maintaining treelines, hedgerows and ditches and reducing pesticide use.

⑧ Mature single trees can provide important foraging and roosting opportunities if they form part of a connecting framework of hedgerows.

⑨ Open ponds and pools provide good foraging areas. Insects will even breed in small and temporary areas of water.

R Possible roost sites

F Possible foraging sites

 Flyway

Bat feeding habitats: Some basic management principles

Several basic principles are relevant to the management of habitats for bats:

Avoid loss of suitable habitat

This has a direct effect on the number of bats that can survive in an area, and is an important factor in the recent decline of some bat populations.

Avoid fragmentation and isolation of habitats

Dividing habitats into smaller areas, or isolating them through loss of connecting features such as hedgerows, may prevent them from being used by some bats. For example, even gaps as small as 10 m may prevent bats – especially the smaller species – from using hedgerows as a route to fly between roosts and foraging areas.

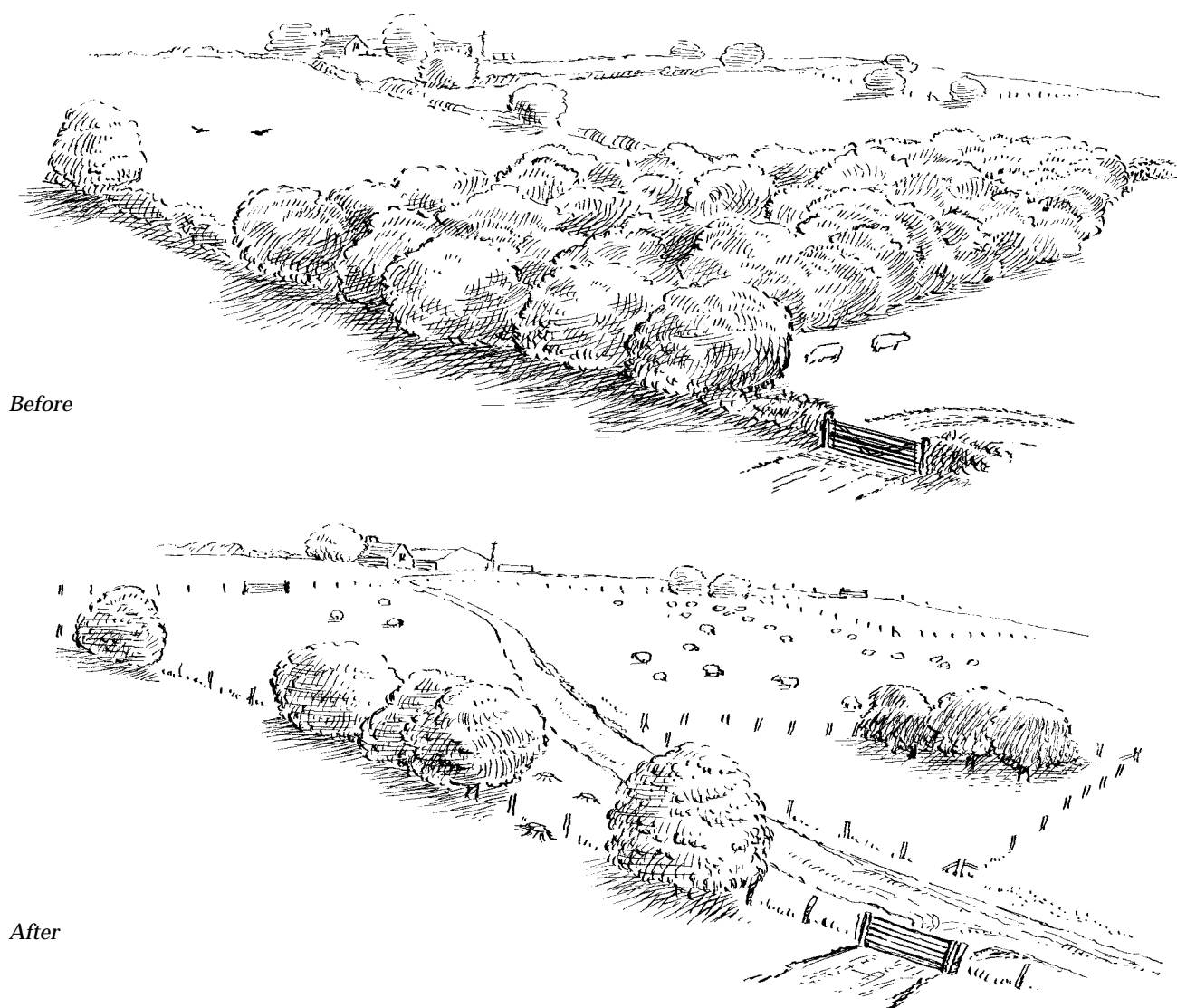
Minimise the use of pesticides

Herbicides and insecticides can both affect the abundance of insect prey available to bats. Reduce spray drift by expanding unsprayed field margins, create buffer zones around hedgerows, ditches and water bodies, and spray only in still conditions (see chapter 4, *Code of Practice for the safe use of pesticides on farms and holdings*).

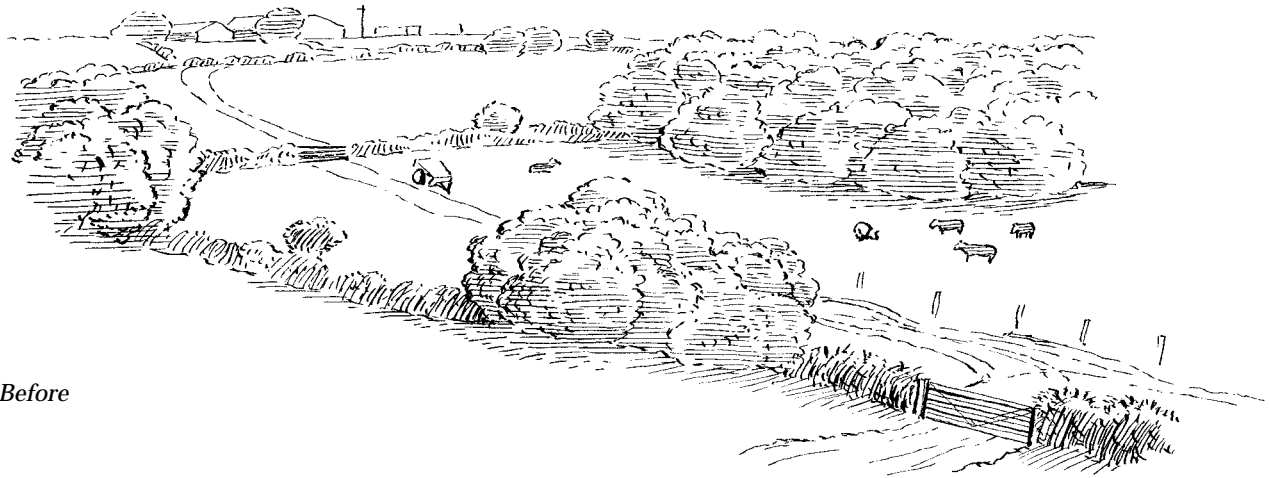
Prioritise protection of suitable habitat in the vicinity of bat roosts

If a roost is known about and the species using it can be determined, then appropriate management can be undertaken to benefit the bats (see chapter 3 for guidance). Conversely, it is also important to protect *potential* roost sites such as old trees, buildings and bridges, near suitable foraging habitats.

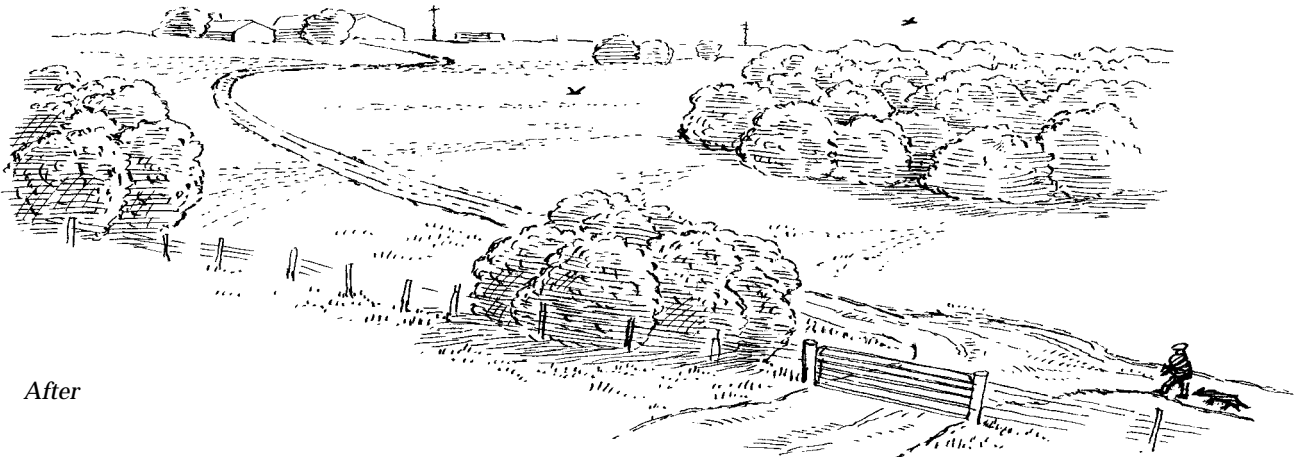
Landscape before and after tree removal, resulting in a reduction of suitable habitat.



Landscape before and after hedgerow removal, resulting in loss of connectivity between habitats.



Before



After

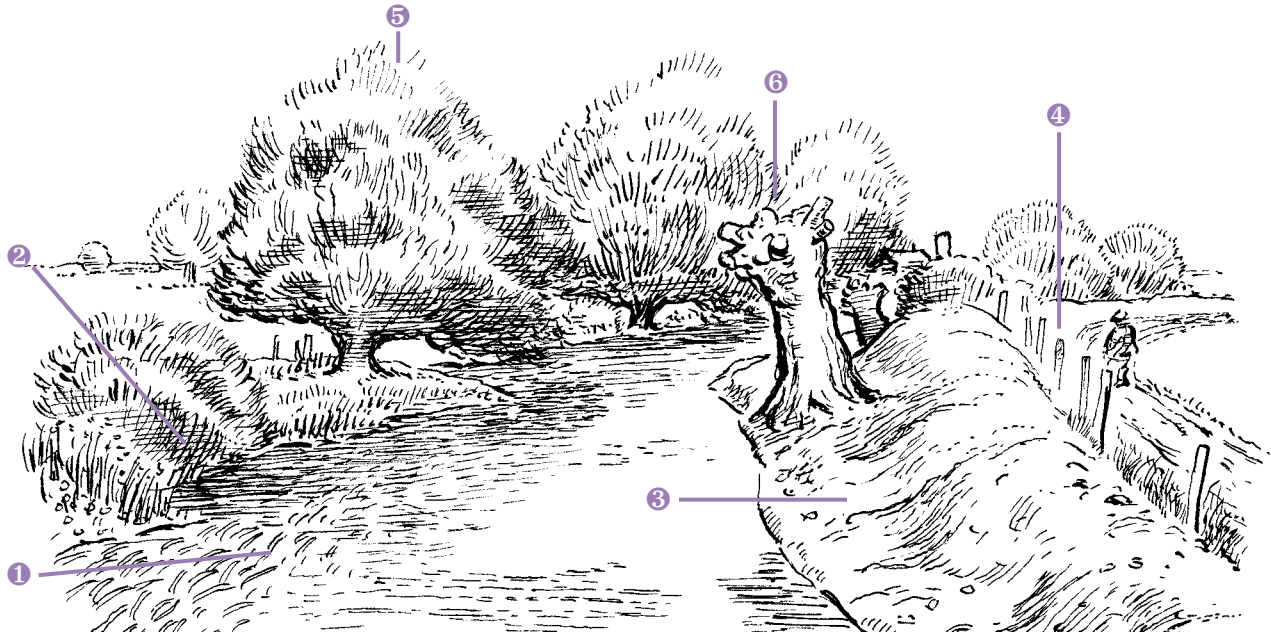
Freshwater habitats

Water and wetlands can be excellent feeding grounds for bats. Many insects have aquatic larval stages and bats take advantage of the emerging insects. Bats need open water to drink, and bank-side vegetation provides food and valuable cover for foraging. Some species preferentially select roost sites close to water.

Management guidelines

Conservation measures should focus on conserving insect populations and providing a varied habitat structure in the vicinity of open water.

- Retain natural features of water bodies – Features in open water such as natural meanders, shingle beaches, spits, shallows, pools and riffles promote high insect diversity. At the water's edge, aquatic plants and gently shelving banks are also important.
- Conserve open ponds and pools – Insects will even breed in small and temporary areas of water. If several ponds or pools are present, they should be managed as a whole system; promote variation in depth and type of bankside vegetation between ponds.
- Retain natural variation in vegetation – Variation along the banks of rivers and lakes favours high insect and structural diversity. Grassy margins, scrub and overhanging vegetation provide excellent conditions for insects and foraging bats. Habitat diversity can often be achieved simply through allowing growth of taller vegetation. Where bank management is necessary, restrict it to a small area and work on one bank at a time. Carry out management sensitively, aiming to enhance variation in vegetation. Use fencing to prevent livestock from causing excessive damage to water margins.



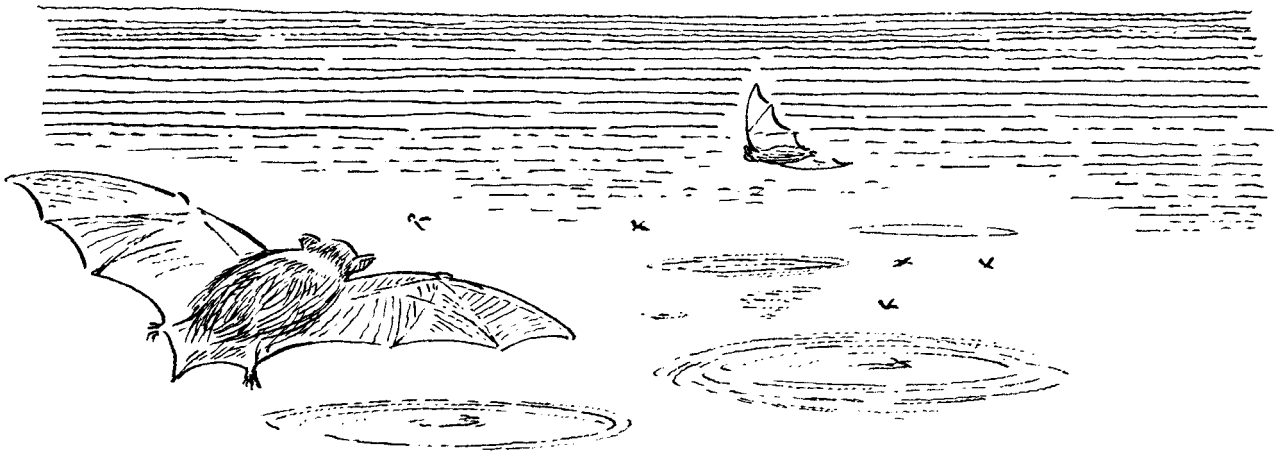
Managing river-bank habitats key

- | | |
|--|---|
| <ul style="list-style-type: none"> ❶ Retain natural features such as shallows and riffles to promote high insect diversity. ❷ Gently shelving banks and aquatic plants are important at the water's edge. ❸ Restrict bank management to small areas and work on one bank at a time. | <ul style="list-style-type: none"> ❹ Limit access to water margins by livestock through fencing. ❺ Retain bankside trees. If trees have to be removed, gaps should be replanted. ❻ Pollarding extends the life of a tree, benefiting insect diversity and roosting opportunities for bats. |
|--|---|

- Retain variation in water depth – Dredging should be kept to the minimum as it destroys vegetation and natural variations in depth. Where dredging is necessary, restrict it to the middle of the channel and carry it out on different portions of the water body in rotation. Avoid any management upstream, which affects natural fluctuations in water levels.
- Retain bankside trees – Don't remove bankside trees unless absolutely necessary for pond restoration. Overhanging branches and leaves provide shelter and food for insects, cover for bats, and cast shade on open water further enhancing the range of conditions available for insects. Where trees must be removed, for temporary access or where they are dangerous, replant gaps with suitable species such as willow or alder. Permission from the Environment Agency (or equivalent) may be needed to fell or plant trees near waterways. Maintain traditional management practices such as pollarding on a long-rotation. Pollarding extends the life of the tree, benefiting insect diversity and roosting opportunities for bats.
- Avoid overstocking with fish – Fish can severely deplete insect numbers and their waste products can lead to eutrophication² of the water. Ensure that any discarded fishing lines and hooks are removed as they pose a threat to wildlife.
- Avoid pollution and nutrient enrichment – Chemical waste, heated water, oil, heavy metals, pesticides, slurry and sewage cause pollution and severely reduce insect populations. Pesticides should be strictly avoided near water. A buffer zone will reduce the risk of spray drift from agricultural areas. Agricultural run-off and inadequately treated sewage effluent lead to eutrophication (see footnote 2 below), which has a severe impact on insect diversity. Reedbeds can help to filter water from farmland to reduce the risk of eutrophication. On a positive note, a few bat species – especially Daubenton's bat – may be able to exploit the increased numbers of a few species of midges associated with slightly eutrophic water. However, the majority cannot.

² Eutrophication is the process of nutrient enrichment of water that can cause excessive growth of plant material and a reduction in the oxygen level in the water. This can result in a reduction in insect diversity because the larvae of several insect species require high oxygen levels in the water they inhabit.

Water and wetlands can be excellent feeding grounds for bats.



Habitat enhancement and creation

A number of measures can be taken to improve man-made or overly managed water bodies for bats.

- Create natural features – Change the profile of a river to provide shallows and riffles and reinstate bends, loops and oxbow lakes. Encourage the growth of aquatic plants and design gently sloping grassy margins. Banksides can be improved by providing a range of vegetation and erecting bat boxes (manmade structures that can be attached to trees and buildings to provide artificial roost sites, see page 23) on bankside trees.
- Create ponds – Locate ponds near other favoured bat habitats such as woodland or hedgerows. Take care not to destroy or detract from currently important conservation areas. Large shallow ponds or a series of smaller ones will be most effective. Design in as many natural features as possible, including varied depths, diverse aquatic and bankside vegetation, and overhanging trees.
- Fill in gaps in lines of bankside trees – Plant suitable species such as willow or alder to provide a continuous corridor for bats to move between foraging sites. Link to other hedgerows and tree lines to provide a network of routes.

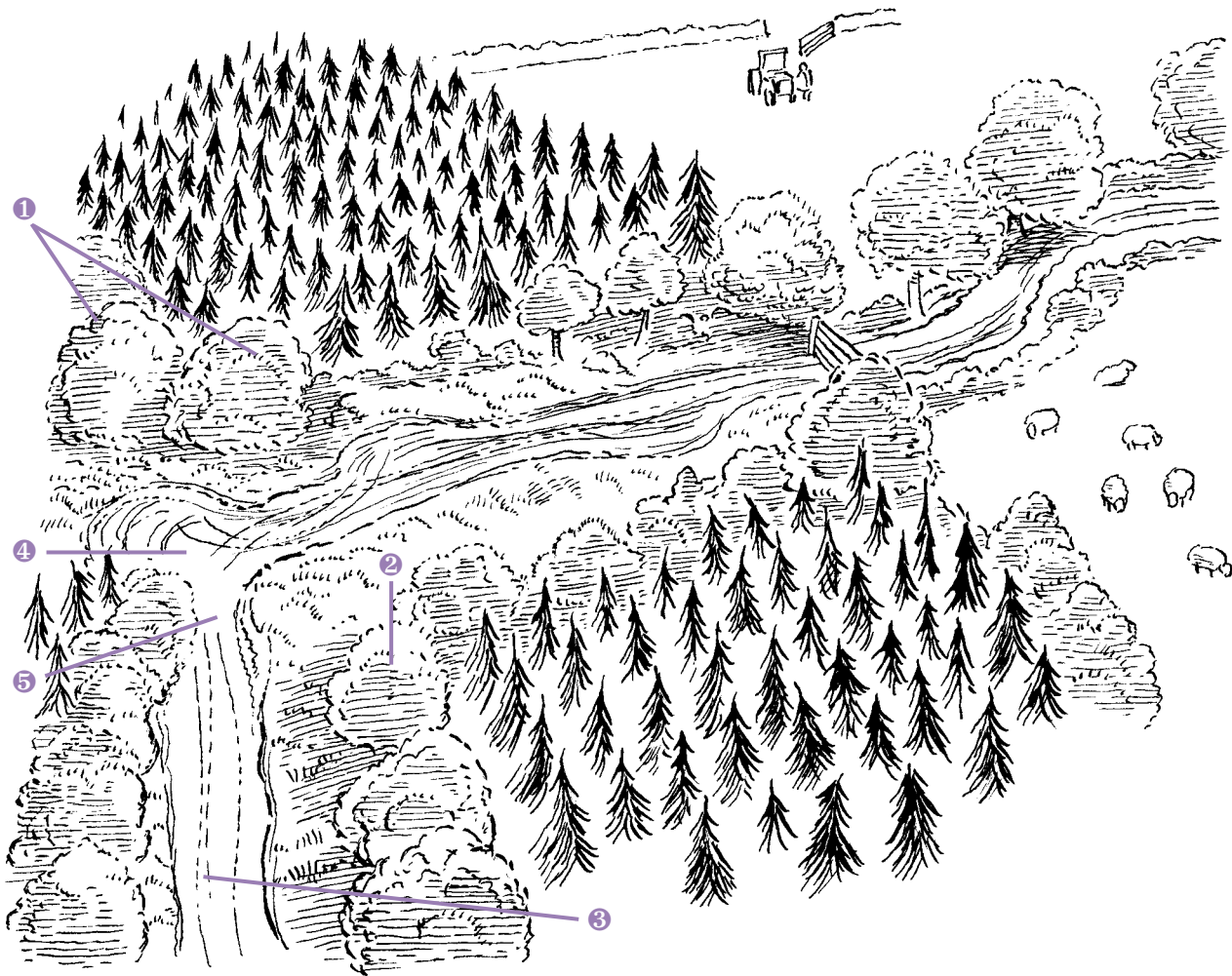
Species particularly attracted to freshwater habitats are whiskered, Leisler's, Daubenton's, pipistrelle, Nathusius's pipistrelle and noctule.

Woodland habitats

Woodland provides a wide diversity of insect food and a high degree of cover for bats. Woodland is favoured by bats that take prey directly from the surface of leaves. It is also more sheltered and often warmer than open environments, giving valuable cover to foraging bats that avoid open areas.

Management guidelines

- Protect ancient, semi-natural woodland – For example, by continuing traditional management regimens or following a policy of non-intervention.
- Pollarding can help to maintain ancient trees which support many insects and provide roosting sites. Additional trees can be planted to offer continuity as older trees die. More detail on managing old trees is given in *The veteran trees management handbook* (see page 41).
- Coppicing temporarily removes tree cover and tends to favour woodland edge species (such as pipistrelles) over woodland bats (such as lesser horseshoes and brown long-eared bats). Coppicing should only be considered where it has been the historic method of management, and long rotations are preferable for bats. Leave mature trees as potential roost-sites.
- In native Scots pine and birch forests, reduce grazing to encourage regeneration and a more diverse herb layer.
- Protect wet woodland (carr) – This habitat supports a particularly high insect diversity and is very important foraging ground for many bat species. Avoid drainage, maintain water quality and do not remove trees.
- Increase the value of other woodland – Actively manage plantations to diversify woodland structure, age and species of trees. Consider planting a mixture of native broad-leaved trees, such as oak and birch, in clearings and along woodland edges; this will support a high diversity of insects and increase foraging opportunities.
- Avoid clear-felling – Sudden removal of trees may destroy an important foraging area. Felling regimens such as group-cutting on rotation and



Sympathetic woodland management key

- ① Leave mature trees as potential roost sites.
- ② Plant a mixture of native broadleaved trees along woodland edges.
- ③ Maintain woodland rides that vary in width along their length and include grassy verges.
- ④ Maintain woodland clearings and glades. Clearings can be created at the junction of rides by removing a few corner trees.
- ⑤ Curve rides to provide shelter and more variation for insects.

selective logging are less disruptive. Leave groups of trees standing, particularly where broadleaved trees have been planted or survive within conifer plantations. After felling, consider natural regeneration rather than replanting. This will favour structural variety which is more attractive to bats. Note that most tree felling requires prior permission from the Forestry Commission.

- Leave dead trees – Deadwood supports a large number of woodland insects. Leave trees and branches where they fall or, if necessary, move to a semi-shaded area nearby. Standing trees that are dead or moribund should be left in place as food for insects and as potential roost sites (holes, crevices and space under bark in mature and decaying trees). Tree surgery to

remove branches is preferable to completely felling a dead tree. When undertaking surgery, examine the tree for evidence of bats and seek specialist advice from your local Statutory Nature Conservation Organisation (SNCO) (see Key Contacts). Further information can be obtained from the leaflet *Bats and trees* (see page 41).

- Retain ponds and streams – Waterways within woodland are used as flight paths and also provide important foraging grounds.
- Maintain woodland rides – To maximise insect diversity, maintain rides that vary in width along their length and include grassy verges with a variety of shrubs and trees. In coniferous forest, plant broadleaved trees along rides to

provide additional foraging grounds. Create bays or scalloped edges along rides, and curve rides at the ends to provide shelter and more variation for insects. Link rides to a series of clearings or glades inside the wood and a network of hedgerows outside.

- Maintain woodland clearings and glades – In larger woods, clearings provide foraging areas for bats that prefer to feed in open spaces. Leave them free from planting and maintain current grazing regimens if applicable. Clearings can be created at the junction of rides by removing a few corner trees. In large conifer plantations, the edges of clearings can be planted with shrubs and broadleaved trees to promote insect diversity.
- Diversify woodland edges – Scalloped edges and bays will provide sheltered areas with higher insect concentrations. Provide a variety of types of vegetation from trees to shrubs and rough grass. Overhanging branches and bushy shrubs should be left to provide cover. Woodland edges can be used both by bats that fly in woodland and in the open.

Habitat enhancement and creation

- Create new woodland – Allow natural regeneration of an enclosed area. This 'non intervention' method should result in a diverse woodland. Woodlands can also be established by seeding or planting appropriate broadleaved native trees such as oak, willow or birch. Whatever method is used, carefully select the site to ensure that other important habitats are not destroyed. Position new woods to adjoin existing blocks or as 'stepping stones' between neighbouring woodlands. If possible, connect with hedgerows or tree lines.

- Establish a pond – Ponds can improve the value of a woodland for bats. However ensure that they are sited carefully and enhance rather than detract from the value of the habitat. Conifer plantations may be particularly suitable for establishing new ponds.
- Erect bat boxes – Woodland rides, clearings and edges are particularly good places to increase roosting opportunities.

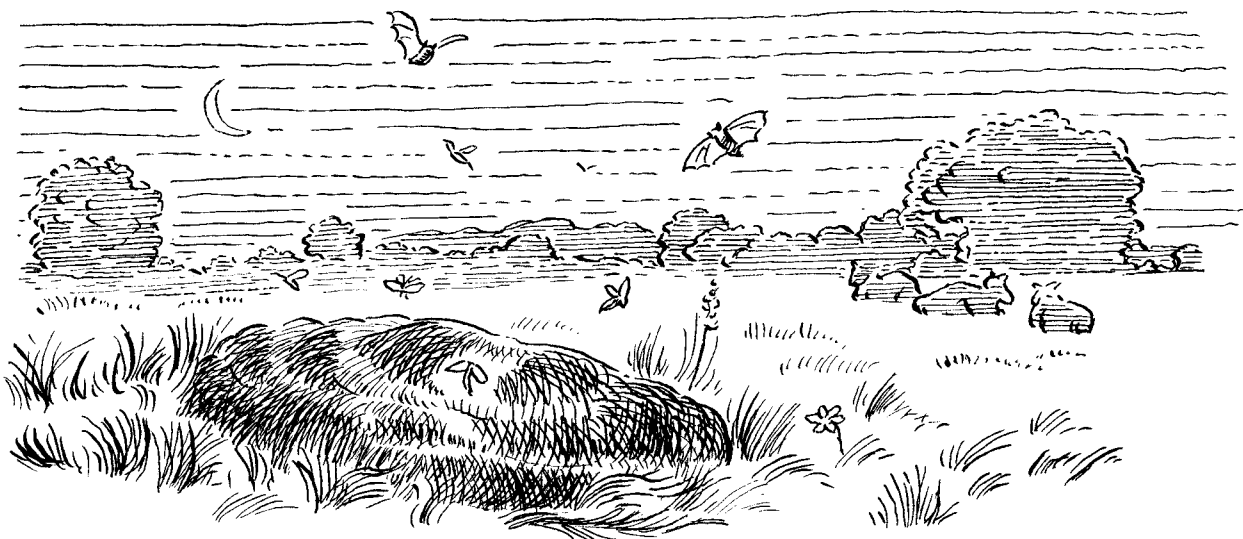
Species particularly attracted to woodland habitats include lesser horseshoe, Bechstein's, brown-long-eared and barbastelle. Greater horseshoe, Natterer's, Brandt's, noctule and grey long-eared also make use of woodland.

Grassland habitats

Grasslands support a range of insects suitable for foraging bats.

Management guidelines

- Management of pasture – Permanent unimproved pasture should be maintained by grazing, preferably by cattle, because dung beetles and other insects associated with cattle dung are important food for some species, particularly greater horseshoe bats and serotines. Persistent cattle wormers may cause a reduction in insect populations on permanent pastures by remaining active in the dung and killing insects on which bats feed. However, different products differ in their persistence and in the insect species they affect, so the potential effects on bat species can be reduced or removed by selecting an appropriate product. Altering the timing of use can also mitigate the undesirable effects on the insects. Given the permutations possible, advice should be sought



Some bat species feed on dung beetles and other insects associated with cattle dung.

on how best to worm cattle that graze pasture foraged over by bats. Minimise insecticide use generally to avoid disrupting insect life cycles. More detailed information is available in the leaflet *Managing landscapes for the greater horseshoe bat* (see page 41).

- Management of meadow – Unimproved meadows have a wide variety of plants and hence support many different insects. Varying the grass height through selective cutting, and avoiding fertilisers and pesticides, will assist insect diversity, though the management of sites of high nature conservation value should not be altered. More intensively managed and improved meadows may still have large numbers of insects, but fewer species, which can lead to food shortages at certain times of the year.
- Retain trees and hedgerows – Trees and hedgerows associated with pastures and meadows provide additional important foraging sites. Plant new trees to fill gaps and provide a variation in age and structure.

Habitat enhancement and creation

- Develop natural grasslands through planting/seeding or the introduction of specific management regimens.
- Vary the management regimen between fields to provide diversity, where this is compatible with other conservation objectives.
- Develop specific cutting or grazing regimens for particular fields/meadows.
- Maintain or reinstate natural flooding or wetting of grassland areas.

Species particularly attracted to grasslands include greater horseshoe, serotine, pipistrelle, noctule, Natterer's and Leisler's.

Linear habitats

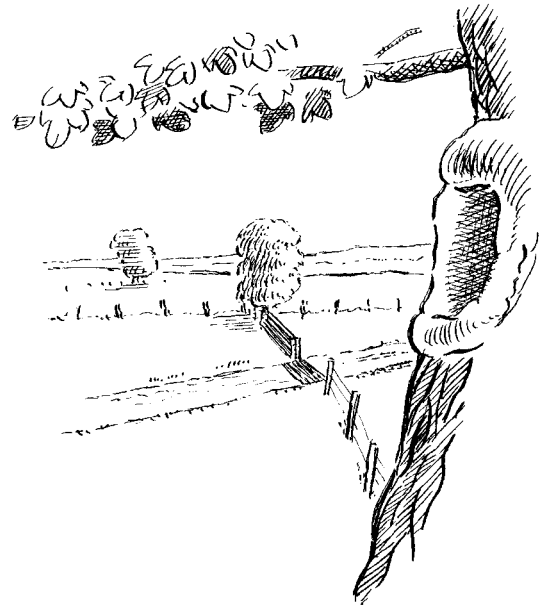
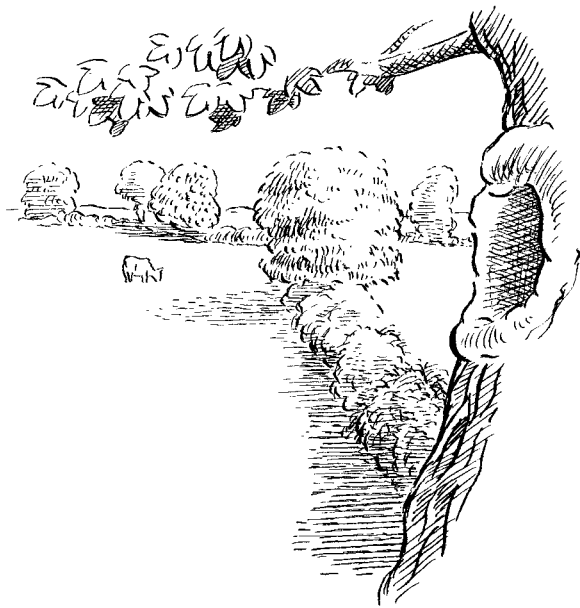
Linear habitats such as hedgerows, tree lines, overgrown banks, ditches and the edges of water courses are important foraging habitats that provide an abundance of insects. Linear features are also important to bats as they move between different foraging sites. Many species will not fly across open areas and instead follow these features that provide shelter from wind for both the bats and their insect prey, as well as cover from predators. Bats may travel significant distances to circumnavigate open areas rather than cross them by the most direct route.

Management guidelines: Hedgerows

- Retain existing hedgerows – Hedgerows provide valuable shelter and links between feeding areas. Insect diversity around hedgerows themselves can be enhanced through associated ditches, long grass verges, tall herbs, shrubs and standard trees.
- Manage hedgerows – Cutting should be restricted to the minimum needed to ensure visibility or retain hedgerow structure. Hedgerows are best cut every 2-3 years, working on only one part or side at any time. Saplings should be left to grow to maturity every 20 m. Cut hedgerows in late winter unless it is snowing or frozen.
- Fill gaps in hedgerows – Some bats may not cross gaps in hedgerows as small as 10 m. Gaps should be replanted to ensure that the hedge can be used as a flight route. Where existing hedgerows are very overgrown, laying or coppicing should be considered; however, such extensive management should only be undertaken on one hedgerow at a time to ensure that alternative routes for bats are available.



Hedgerows with trees provide foraging sites and act as corridors, linking foraging habitats together.



Avoid removal of hedgerows and old trees with holes and crevices.

- Establish new hedges – If possible, plant hedgerows to link isolated feeding grounds, or to provide a short cut across open fields. Plant appropriate native species such as hawthorn, blackthorn, hazel and field maple between October and March. Saplings can be planted in single rows 15-25 cm apart, or staggered double rows 30 cm apart. Aftercare such as weed control and fencing may be needed. Further detail is available from *An introduction to wildlife conservation* (see page 41).
- Avoid spray drift since it reduces insect food available for bats. Leave a buffer zone between fields and hedgerows and, if necessary, turn off the outermost sprayer of the boom.

Management guidelines: Tree lines

- Avoid removal of trees – Trees can support vast numbers of insects and also provide a flight route for bats. If a tree is lost, replant with a tree of the same species to maintain continuity. Old trees should be left unless felling is absolutely necessary; if so, check for roost sites in holes and crevices prior to felling. If a roost is found, or if in any doubt, consult the local SNCO.
- Establish new tree lines – Avenues of trees can be planted or allowed to establish naturally, along edges of roads, pathways and other features. A dense shrub layer below the tree canopy will increase shelter for insects and bats. Link to hedgerows and other habitats.

Management guidelines: Ditches and dykes

- Manage for insect diversity – Ditches support higher insect numbers if they have shallow edges, a varied depth and are part of a network

of ditches. Associated vegetation such as tree lines, hedgerows, shrubs and grassy banks, also makes ditches more attractive to bats. Management of ditches should be carried out in small areas; clear vegetation and silt from one part at a time and restrict grazing by appropriate fencing.

- Avoid spray drift – Spraying of pesticides should be avoided near ditches; use a buffer zone or expanded field margins. Be particularly careful to avoid pesticides where water drains into ponds and rivers.

Other habitats

Habitats other than the key habitats already discussed can provide suitable foraging grounds for bats.

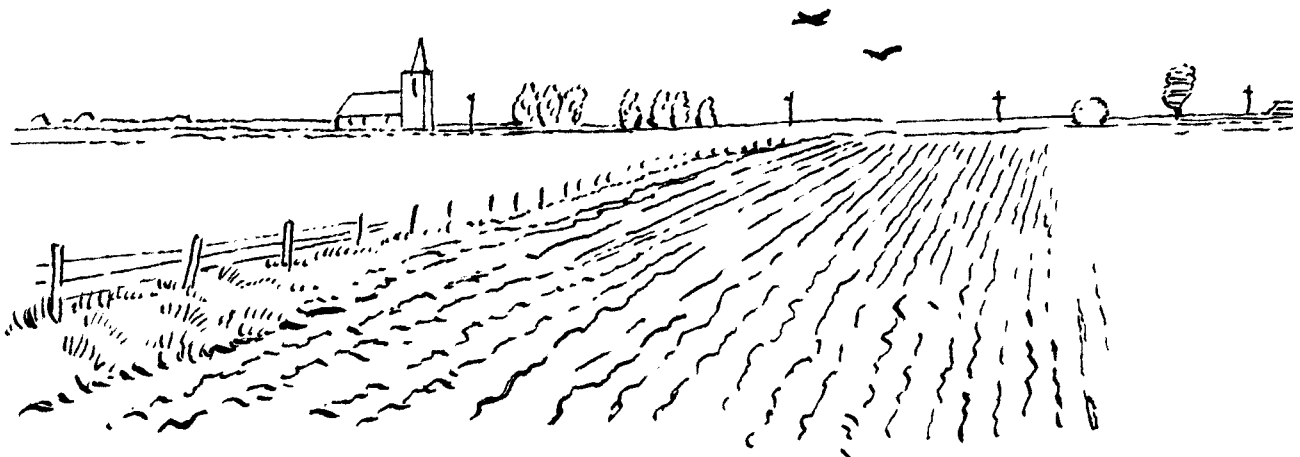
Arable farmland

The amount of arable land has increased dramatically in recent years at the expense of a range of other habitats. Arable land is generally poor for bats, but can be improved by expanding unsprayed field margins, by maintaining hedgerows, tree lines and ditches, and by minimising pesticide use.

Reclamation of arable land to former habitats such as meadow and pasture will usually benefit bats. With the help of set-aside and farm woodland schemes (see Annex II) important foraging habitats can be provided.

Planting hedgerows and groups of trees at field corners will also provide valuable habitats, particularly if linked together to form a network of woodland cover.

Arable farmland before and after conservation management.



Before



After

Arable farmland before and after conservation management key

① Arable land can be improved by expanding field margins and maintaining treelines, hedgerows and ditches.

② Planting hedgerows and groups of trees at field corners will provide valuable habitats.

Parkland

Amenity grassland and recreational areas can be valuable to foraging bats. Insect diversity can be enhanced by varying grass height through selective mowing or grazing.

Feeding opportunities are also increased by the presence of other vegetation types such as flower-rich meadows, scrub and groups of trees. Old pollards and other mature trees are particularly valuable, and additional native trees could be planted

to expand tree cover. Ponds are also very valuable as they provide food and water for bats to drink.

Moorland and heathland

Open moorland and heathland habitats are generally poor for bats. Areas of birch or pine woodland will provide suitable foraging habitat and should be retained, especially if associated with damp or boggy areas. Note though, that this may contradict management requirements for important moor and

heathland species so the local SNCO should be contacted for further advice.

Coastal habitats

Most insects on beaches are associated with rotting seaweed and driftwood. This material, and beaches generally, should be left undisturbed. Reclamation poses a major threat to saltmarsh and other coastal habitats with their associated insects.

Urban habitats

In urban areas, gardens, parks and recreation grounds can provide good foraging grounds. Green areas can be improved by growing night-scented flowers and other flowers particularly favoured by insects. Leaving areas of grass uncut and providing open water will also attract insects. Trees and shrubs in gardens and parks or on waste ground will provide cover and additional feeding sites. More detailed advice is given in *Bats in the garden* (see page 41).

Additional features valuable to foraging bats

Buildings and bridges

Buildings, bridges and other structures can be important roosting sites for bats. These features can be particularly valuable in the vicinity of water, or on the edge of woodland or other key foraging grounds. Maintenance work to buildings, such as re-pointing, should leave some crevices for bats. Skimming bridges with concrete can destroy bat roosts so these should be checked carefully before this or other repair work is undertaken. Buildings can be positively improved to accommodate roosting bats – more information can be found in *The bat workers' manual* and *Bats in houses* (see page 41). The local SNCO should be contacted for advice if there is any evidence of bats in a building. It is illegal to damage or destroy a roost site even when bats are not present.

Bat boxes

Bat boxes are artificial roost sites, usually made from wood. They are similar in design to bird boxes but have an entrance gap underneath rather than a hole in front. Boxes should be erected on trees or buildings at a height of 2-3m, ideally erecting several boxes to face different directions. Further details can be found in *Bat boxes* (see page 41).

Single Trees

Even single trees provide important foraging and roosting opportunities. Holes and crevices in mature trees and spaces under bark can be used as roosts. Trees can be incorporated into a network of feeding sites by connecting them to linear features such as hedgerows.



Holes and crevices in mature trees can be used as roosts.

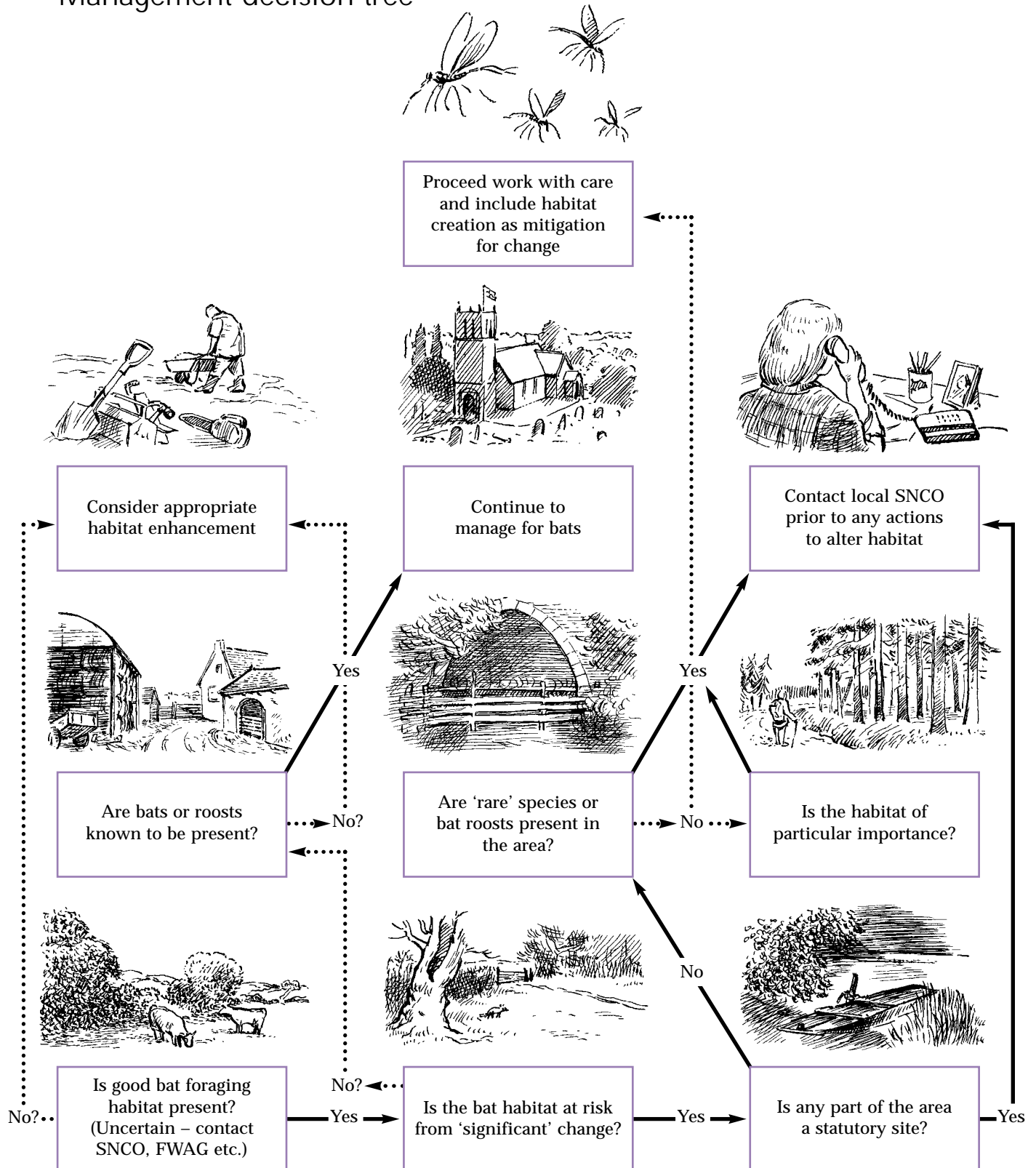
White lighting

White street lighting attracts insects that can be exploited by some of the less threatened species of bat. These foraging sites are most relevant in built-up areas where many other suitable habitats do not exist. White lighting should be avoided near the edges of woodlands and ponds as common bat species may be attracted at the expense of more specialised and rarer species.

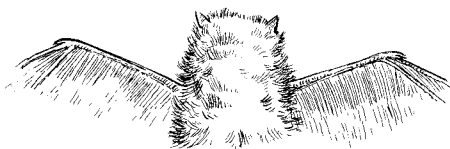
Caves and mines

Underground places such as caves, mines and tunnels are often used as hibernation sites. Any management nearby should be carried out with care, and no material should be dumped in disused caves or mines. While it may be necessary to consider closure of entrances to underground structures, consult the local SNCO before doing so. Safe closure can be achieved while enabling bats to continue using it as a roost.

Management decision tree



START HERE



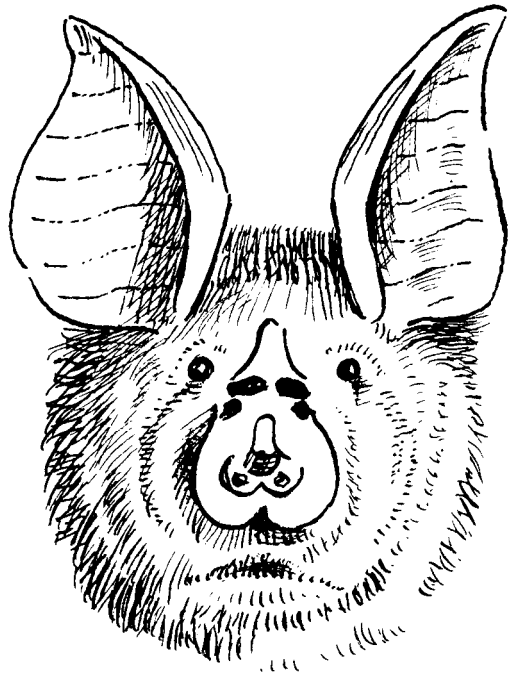
3 Habitat management for individual bat species

Each species of bat has very particular habitat requirements. Differences in wing shape and echolocation call result in differences in habitat use and the types of insect caught. For example, species with long narrow wings such as noctules cannot manoeuvre easily in woodland and prefer to fly in the open. Species with short broad wings such as brown long-eared bats, can turn very tightly in the spaces between trees, but avoid open areas where their slow flight may make them vulnerable to predators.

Habitat requirements and basic management recommendations for each of the 16 bat species in the UK are presented in this section. As a general rule, advice and help should always be sought from the local SNCO, Wildlife Trust or specialist

bat group in the area prior to embarking on species-specific management actions. Chapter 2 of this manual provides a cross-reference to guide management activities for particular habitats – and further references are given at the end. Some background information on each species, including generalised distribution maps showing the main areas they are found, is summarised in these species management accounts. The local SNCO may also be able to provide information on the location of known roosts.

The data for the distribution maps have been provided from the *Distribution atlas of bats in Britain and Ireland 1980-1999*, produced by the Bat Conservation Trust and compiled by Phil Richardson. Recording was based on 10km squares of the National Grid.



Greater horseshoe bat

Distribution: Restricted

Status: Rare

Summer roosts: Old buildings, caves and abandoned mines

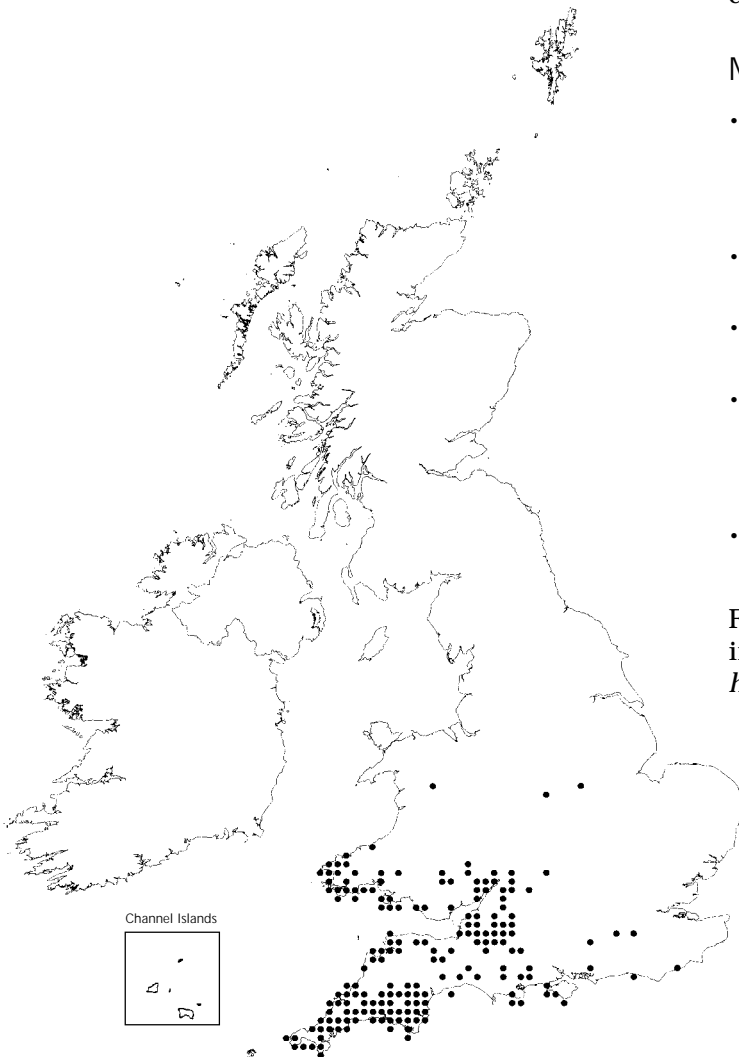
The greater horseshoe bat is one of the rarest bats in the UK. The few surviving populations are centred around summer maternity roosts in south-west England and south Wales.

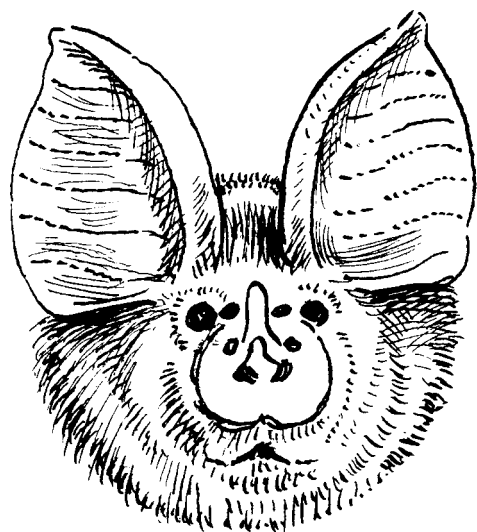
Ancient woodland and permanent pasture are the most important habitats for this species. They provide the bats with insect food and the linear features such as woodland edges and hedges which they use as flight paths. Greater horseshoe bats feed on a variety of insects, but cockchafers (maybugs), dung beetles and moths are particular favourites. Dung beetles are an especially important food source for young bats in early August when they begin their first feeding flights. Feeding areas within a radius of about 4 km of maternity roost are critical for the long-term survival of this endangered species.

Management recommendations

- Retain existing ancient woodland, old orchards and large old trees, particularly adjacent to grazed pasture. Woodland should contain grassy rides and glades at least 10-15 m across.
- Maintain grazed permanent pasture, particularly as small fields with large hedges.
- Do not use persistent wormers such as avermectins and minimise insecticide use generally.
- Maintain all hedges and manage as tall, bushy structures with mature trees. Create new hedgerows and tree lines across open pasture, linking with existing hedges and woodland blocks.
- Give priority to protecting foraging areas within 4 km of maternity roosts.

Further detailed management advice is available in the leaflet *Managing landscapes for the greater horseshoe bat* (see page 41).





Lesser horseshoe bat

Distribution: Restricted

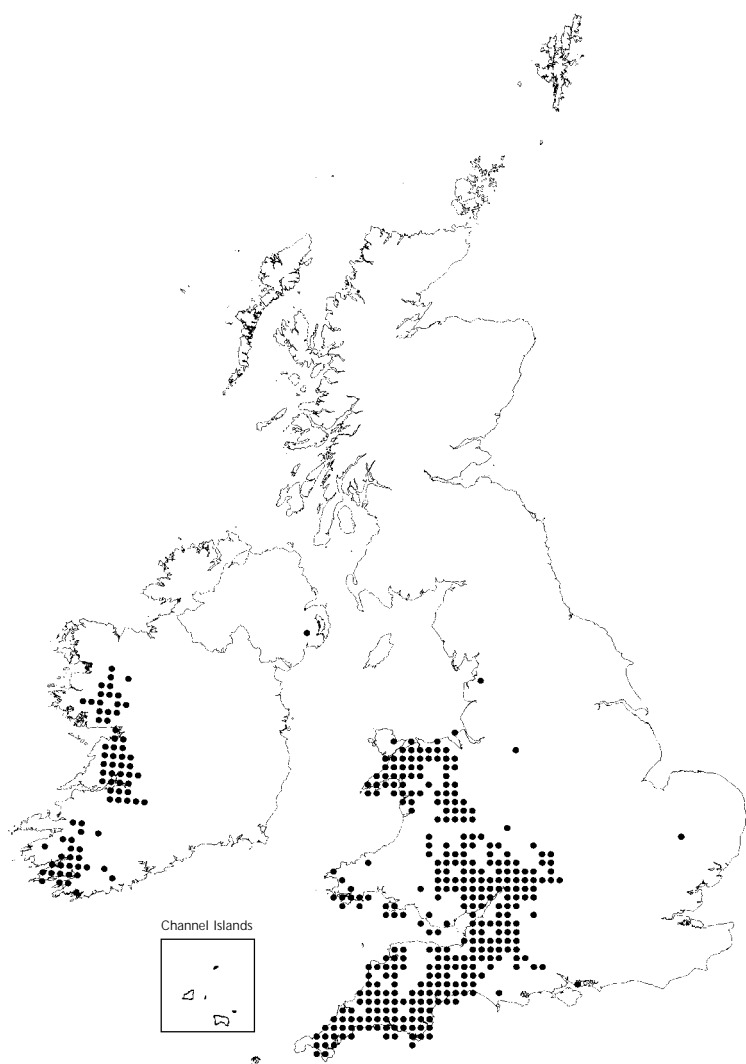
Status: Rare

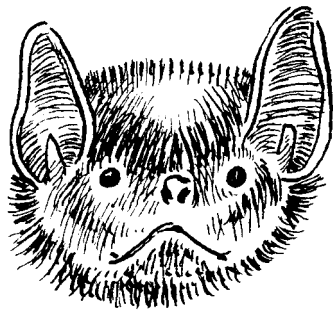
Summer roosts: Old buildings, caves and mines

Lesser horseshoe bats feed mainly in dense broadleaved woodland and areas of wet woodland, and less often in bankside vegetation and parkland. They generally forage within 2-3 km of their roost. This species avoids open areas and instead uses tree lines, woodland edges, overgrown hedges and vegetated banks of streams to move between their roost and woodland feeding grounds. Loss of these connecting features results in lesser horseshoe bats being isolated from, and unable to exploit, their preferred feeding grounds.

Management recommendations

- Maintenance and sensitive management of hedges and tree lines is of key importance. Hedges should not be excessively cut and may be improved by replanting any gaps and allowing some hedgerow trees to mature.
- Conserve broadleaved woodland, particularly in the vicinity of water. To promote dense vegetation, avoid grazing or cutting of the understorey.
- Give priority to protecting woodland and linear habitats within 2-3 km of the roost.





Daubenton's bat

Distribution: Widespread

Status: Common

Summer roosts: Buildings, bridges and trees close to open water

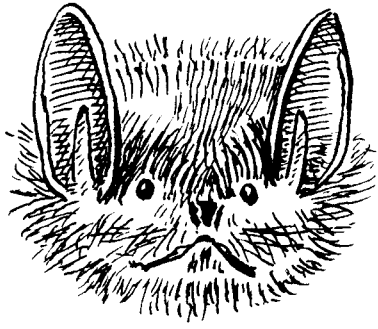
Daubenton's bats feed mainly on insects with aquatic larval stages such as non-biting midges. The bats forage over the surface of rivers, canals, lakes, reservoirs and flooded gravel pits, and also occasionally use ponds, pools and drainage ditches. Of particular importance are slow flowing rivers and canals, and sheltered parts of lakes and other water bodies. Areas of smooth (sheltered) water with trees and vegetation on both banks are ideal habitat for this species.

However, at some times of the year and in the early evening, Daubenton's bats may forage in broadleaved woodland. The bats use hedges, overgrown bankside vegetation, and linear waterways to move between roosts and foraging sites. Changes in water quality may be tolerated to some extent – there is some evidence that this species can benefit from eutrophication (see page 16).

Management recommendations

- Maintain rivers, open water, ponds and ditches. Conserve freshwater insects by maintaining aquatic plants and controlling fish stocks. Avoid spraying pesticides near water.
- Protect trees, hedges and bankside vegetation and manage sensitively.
- Establish trees on both banks.





Brandt's bat

Distribution: Widespread

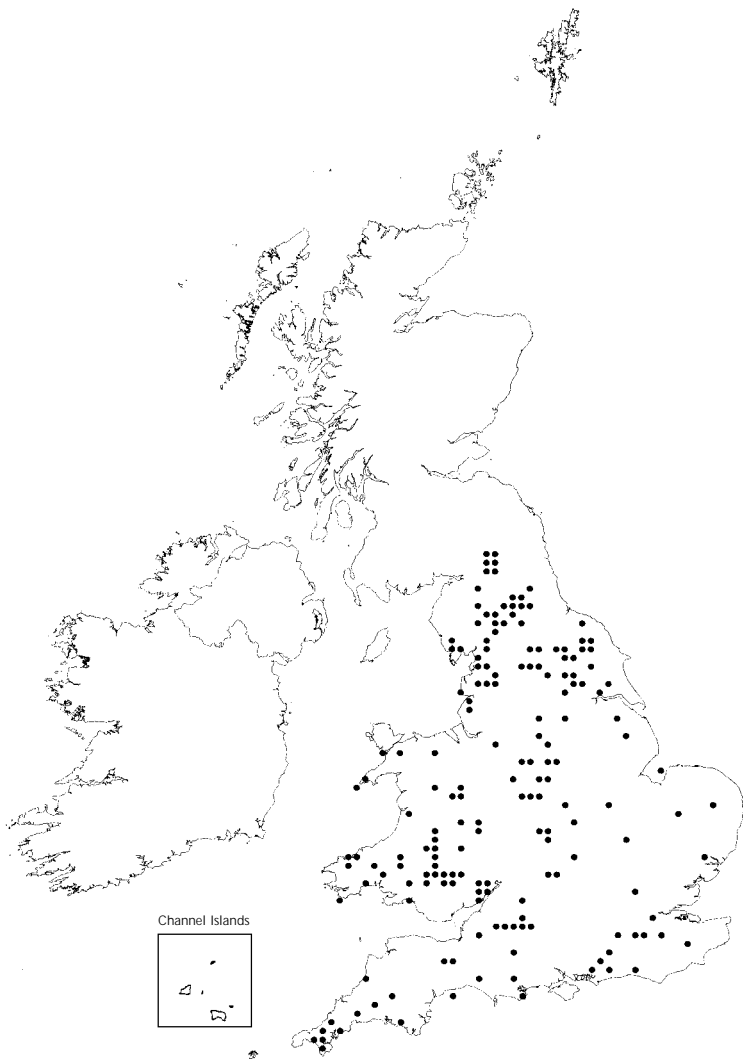
Status: Scarce

Summer roosts: Buildings and possibly tree holes

Brandt's bats feed mainly on flies, especially crane flies, and occasionally on moths. The main foraging habitat for this species is woodland, particularly damp areas or drier areas close to water. Brandt's bats use both broadleaved and coniferous woodland, forest edges and clear felled areas. Generally exposed spaces are avoided and hedges and tree lines are used as flight paths. Loss of such linear features can result in isolation and effective loss of feeding grounds.

Management recommendations

- Retain woodland, particularly wet woodland and broadleaved woodland near water. Woodland may be enhanced by creating ponds or other damp areas.
- Conserve freshwater habitats, particularly near woodland.





Whiskered bat

Distribution: Widespread

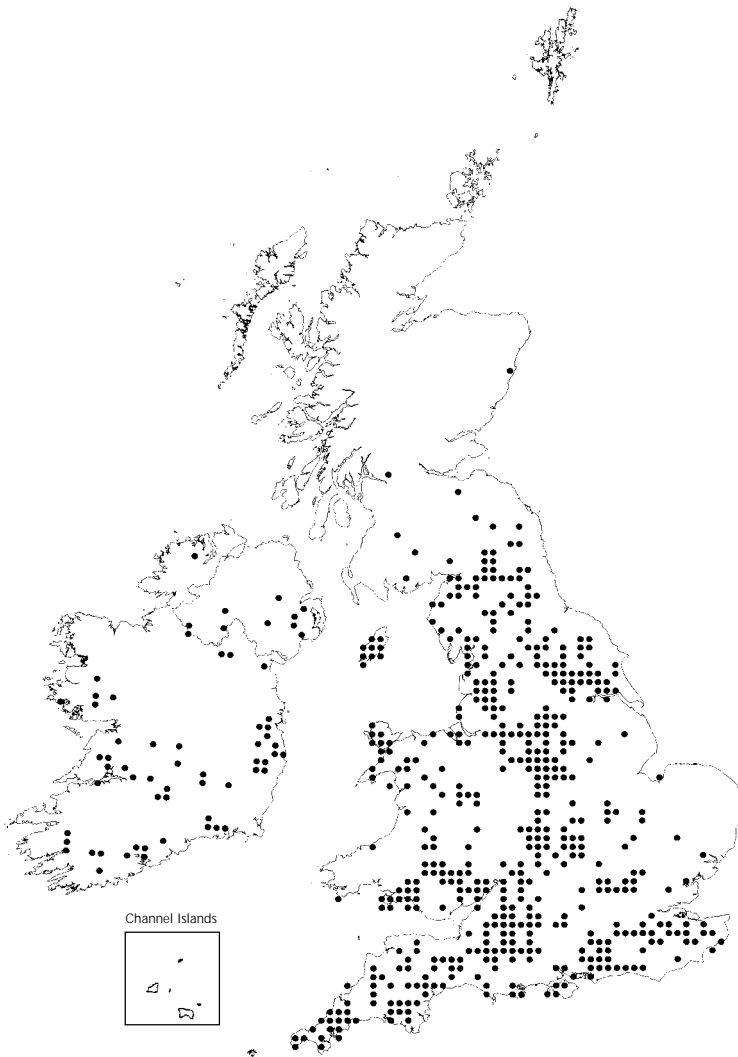
Status: Scarce

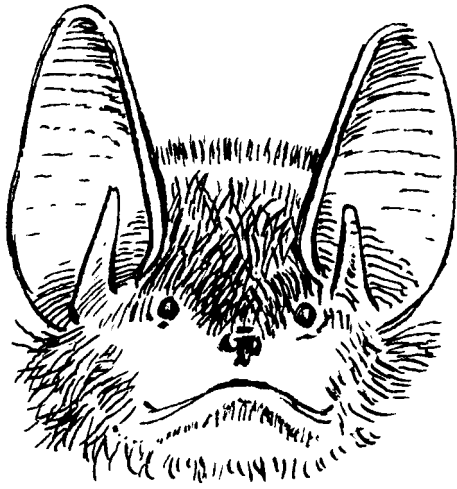
Summer roosts: Buildings and probably tree holes

Whiskered bats are very similar to Brandt's bat in appearance and diet. However, whiskered bats are thought to be more generally associated with rivers and woodland edges than Brandt's bat; narrow rivers with dense bankside vegetation provide suitable habitat and woodland rides are sometimes used. Whiskered bats also forage in more open areas such as parks and hedges by fields.

Management recommendations

- Maintain freshwater habitats, particularly bankside trees and other vegetation.
- Conserve woodland. Maintain open rides and glades and woodland ponds.
- Maintain hedgerows and tree lines.





Natterer's bat

Distribution: Widespread

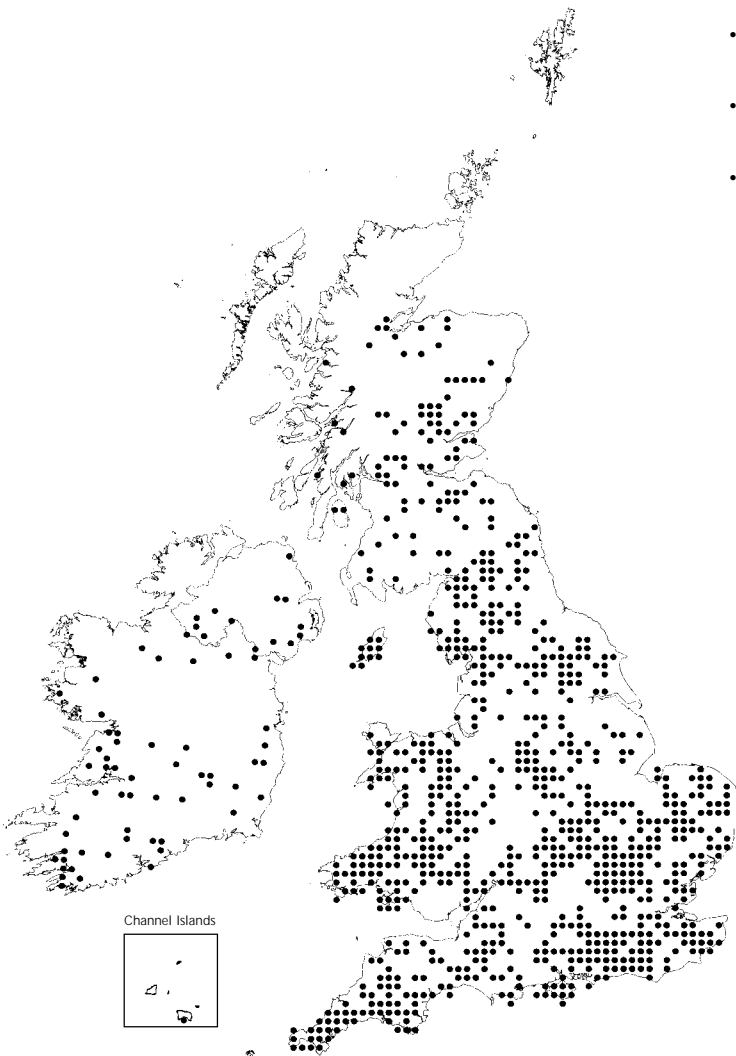
Status: Frequent (except in northern Scotland)

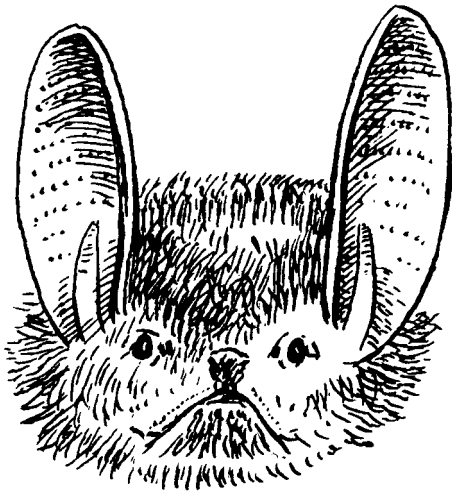
Summer roosts: Old buildings, bridges, tree crevices

Natterer's bat is usually associated with broadleaved and wet woodland. It is often found along woodland edges and tree lines, but has also been recorded in undergrowth inside hedges, over grass, over water and foraging around single trees or bushes. It appears to forage more than 2-3 km from roosts, and some males have been recorded travelling up to 6 km to find good feeding grounds. Damp habitats and bankside vegetation may be particularly important feeding grounds. The diet consists mainly of flies and spiders.

Management recommendations

- Maintain broadleaved woodland, particularly damp woodland and woodland adjacent to waterways.
- Maintain hedgerows and tree lines to provide flight paths and sheltered areas for foraging.
- Maintain pasture, meadow and freshwater habitats and avoid pesticide use there.
- Protect mature trees as possible roost sites.





Bechstein's bat

Distribution: Restricted

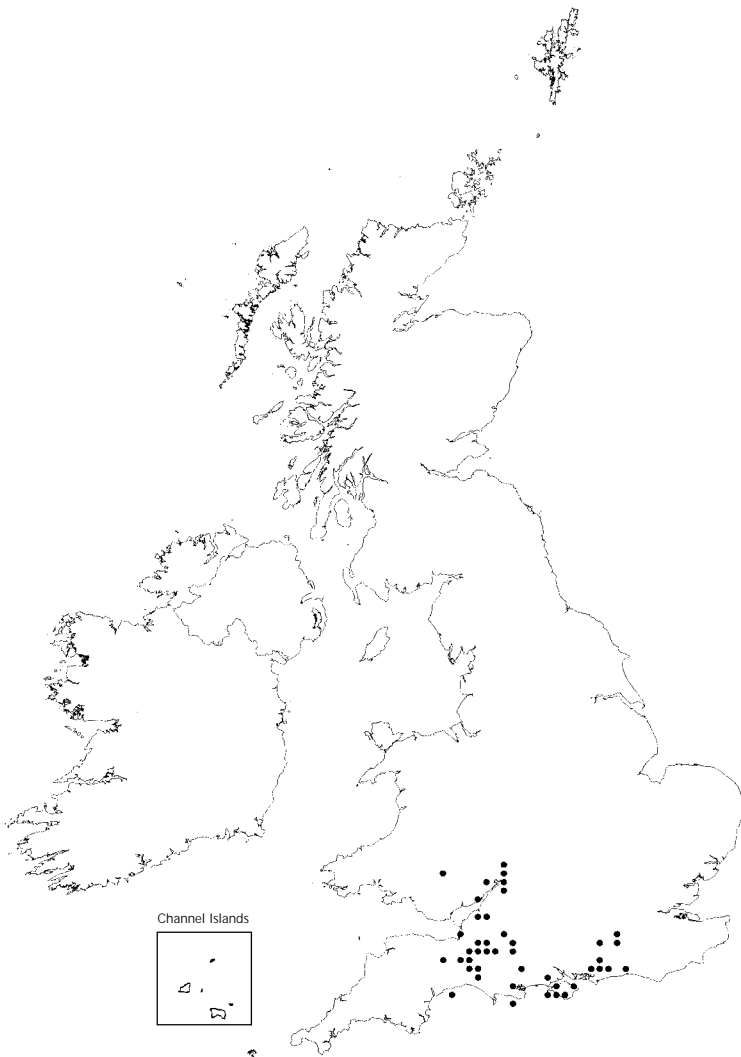
Status: Rare

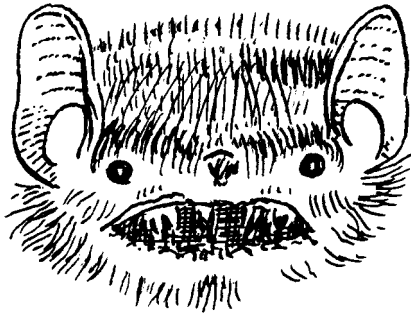
Summer roosts: Tree holes and bat boxes

Bechstein's bat is a woodland species. It feeds on moths, spiders and flies taken from foliage and other surfaces. It prefers broadleaved woodland with mature trees, but will also forage in areas of younger trees or exotic shrubs. Little is known of the wider habitat requirements of this species.

Management recommendations

- Maintain broadleaved woodland. If trees must be removed, fell selectively.
- Maintain tree lines and hedgerows to link woodland blocks. Enhance links between woodland and any known hibernation sites.
- Retain old trees in woodland to provide potential roost sites.





Pipistrelle

Distribution: Widespread

Status: Common

Summer roosts: Buildings (mainly houses), often in semi-urban areas

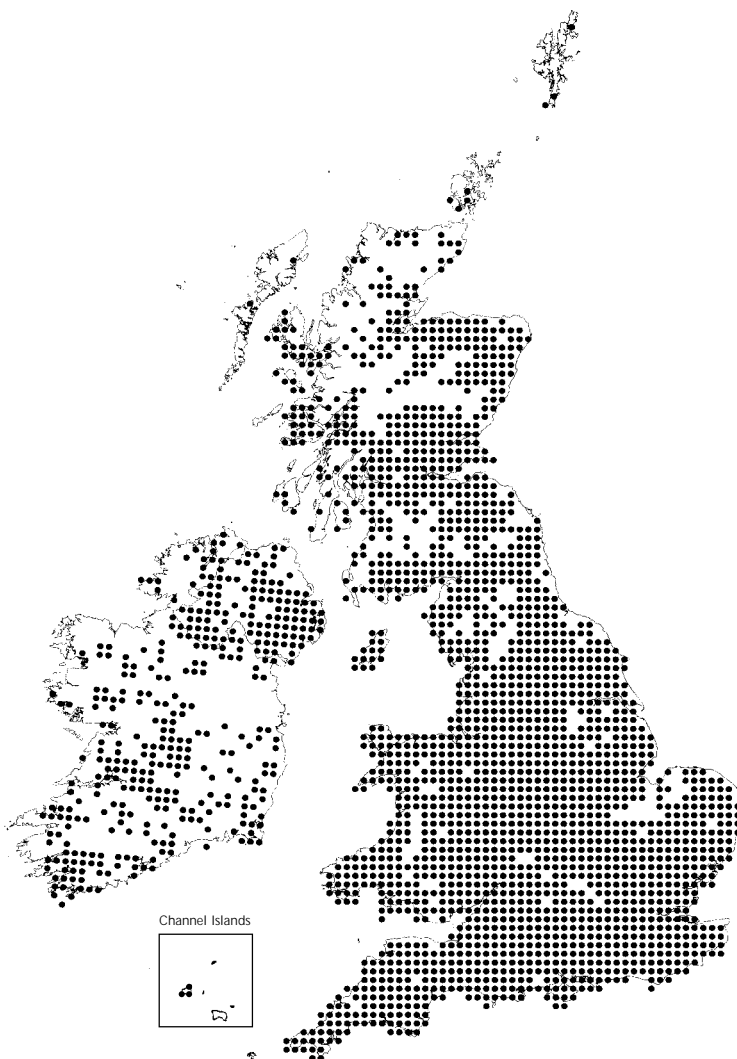
The pipistrelle is the most common bat in the UK. Key feeding habitats include bankside habitats (particularly lakes, wide rivers and large ponds), parks, broadleaved woodland, hedges, tree lines, and beneath white lighting in towns and villages. Pipistrelles eat mainly flies, often those associated with freshwater habitats.

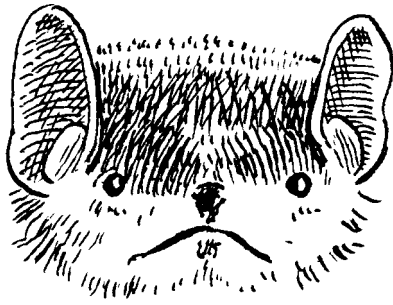
Pipistrelles are generally associated with semi-open vegetation found at the boundary between different habitats. Tree lines and bankside vegetation are used as flight paths, although this species will also cross open areas.

It is now accepted that there are two separate species of pipistrelle based on differences in frequency of their echolocation calls. Pipistrelles with calls of higher frequency (55 kHz – the soprano pipistrelle) are more commonly associated with rivers and lakes, and those with lower calls (45 kHz – the common pipistrelle) have more varied foraging patterns.

Management recommendations

- Maintain freshwater habitats and management practices that favour high densities of aquatic insects.
- Maintain bankside trees and other vegetation as flight routes and feeding grounds.
- Manage woodland edges and hedgerows appropriately, including the prevention of spray drift.





Nathusius' pipistrelle

Distribution: Restricted

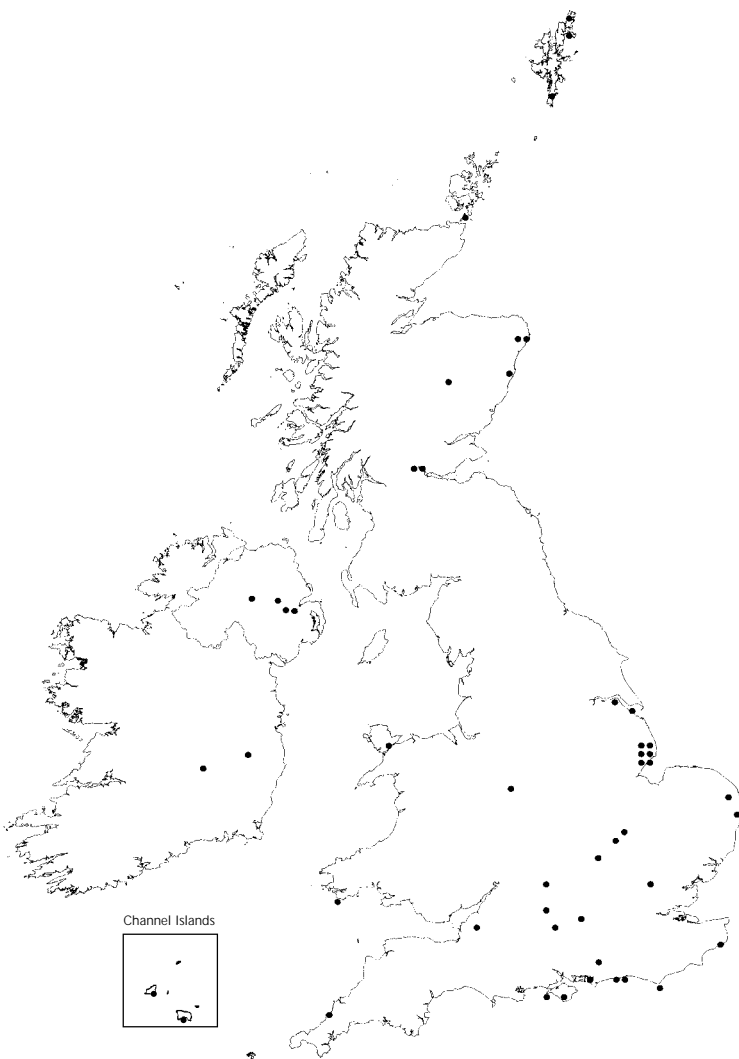
Status: Rare

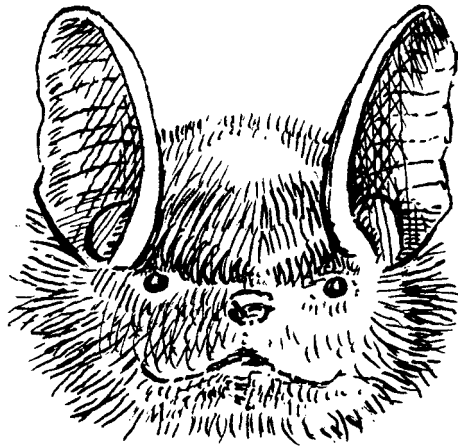
Summer roosts: Tree holes and bat boxes

Until recently Nathusius' pipistrelle was regarded as a winter migrant, but now there is evidence of its presence in the UK throughout the year and nursery colonies have been discovered. Generally, this species forages by rivers, eating mostly flies. They have also been recorded in woodland and along tree lines.

Management recommendations

- Conserve freshwater habitats and maintain water quality.
- Maintain and enhance tree lines, particularly in open farmland.





Serotine

Distribution: Restricted

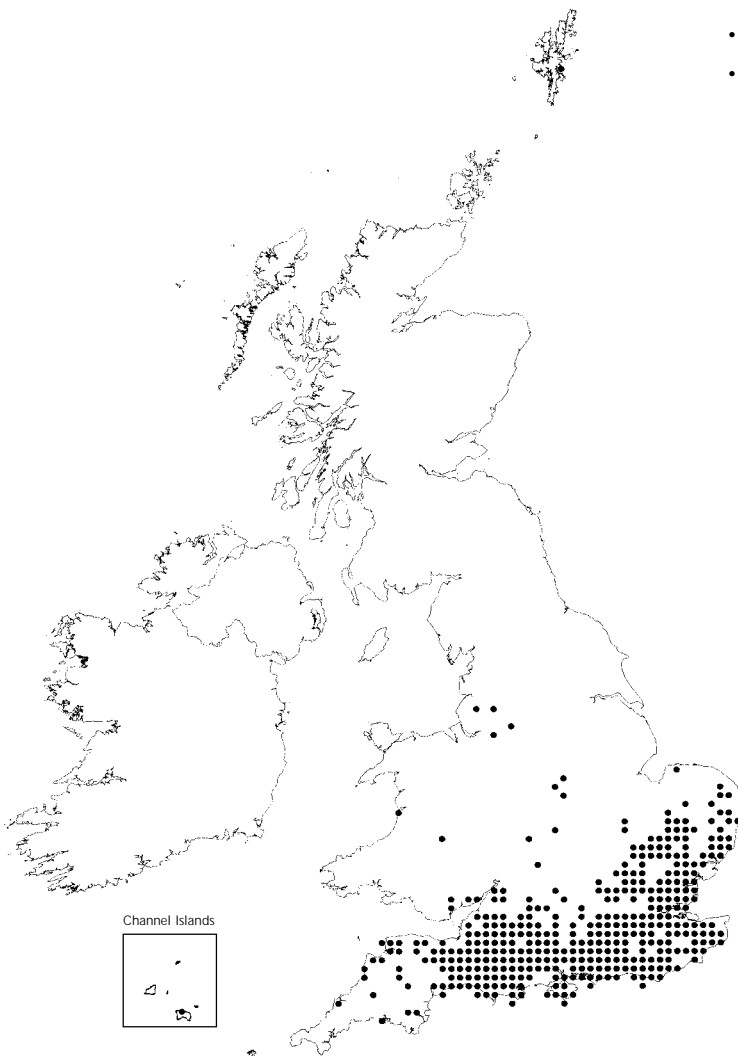
Status: Frequent

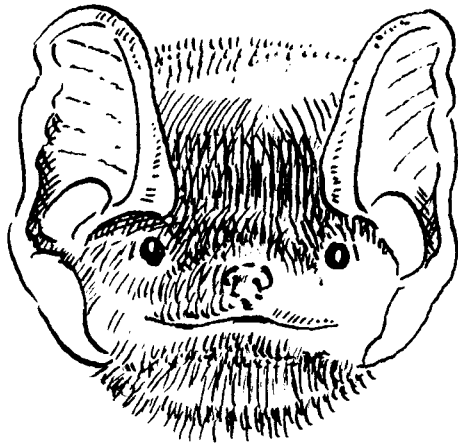
Summer roosts: Generally buildings in rural and semi-urban areas

The serotine eats mainly beetles, including chafers and dung beetles, but will also eat flies and moths. Feeding grounds include unimproved cattle pasture, and areas of unimproved grassland such as meadows, parkland, cemeteries, village greens, golf courses and playing fields. Woodland edges, hedgerows, tree lines, single trees and areas of calm water are also used regularly. White streetlights and sewage treatment works also attract foraging serotines.

Management recommendations

- Maintain permanent pasture through regular grazing. Do not use persistent cattle wormers such as avermectins, especially in the vicinity of summer roosts.
- Minimise use of pesticides.
- Widen field margins and leave fallow or unsprayed.





Noctule

Distribution: Widespread

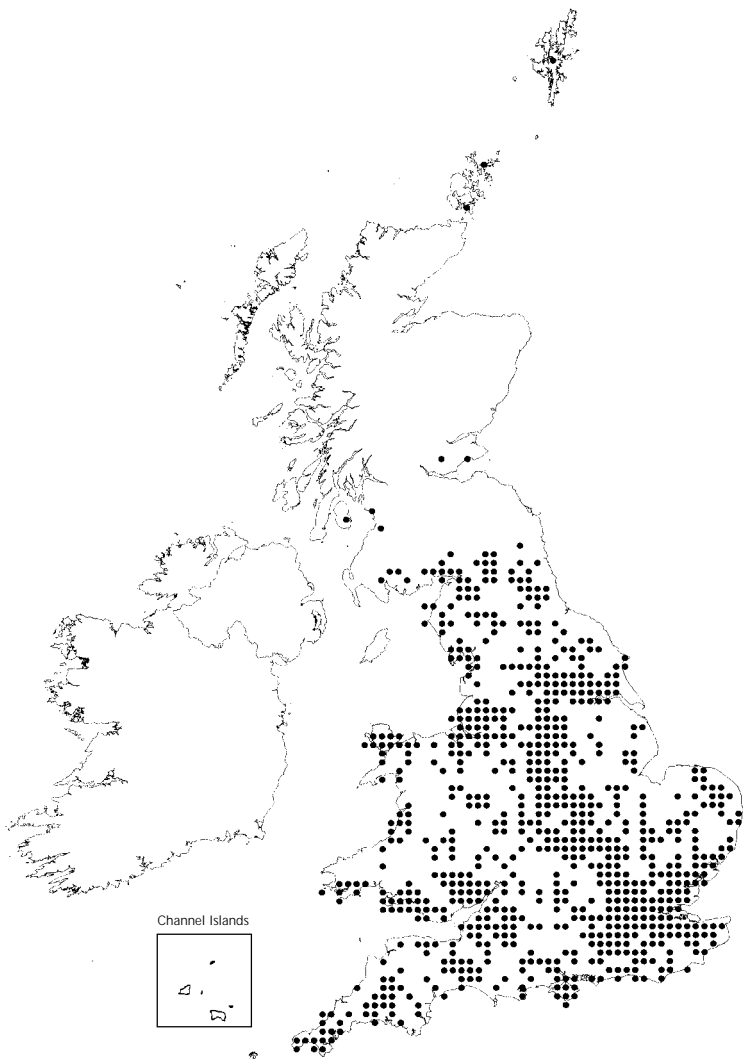
Status: Frequent (except in Scotland)

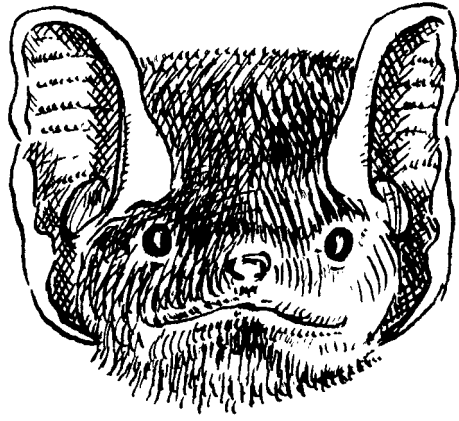
Summer roosts: Tree holes, often in open woodland

The noctule is a fast flying species which eats flies, beetles and moths. Noctules forage over open areas such as open water and wetlands, often at considerable distances – up to 26 km – from their roosts. Other feeding areas include improved cattle pasture, open parts of woodland, woodland edges, parks and open farmland near lakes. Noctules also feed by white street lamps in villages and on the outskirts of towns.

Management recommendations

- Conserve freshwater habitats and maintain water quality.
- Avoid felling mature trees. Use tree surgery instead to ensure that roosts are retained.
- Leave dead wood standing to attract woodpeckers.
- Maintain open areas in woodlands.





Leisler's bat

Distribution: Widespread

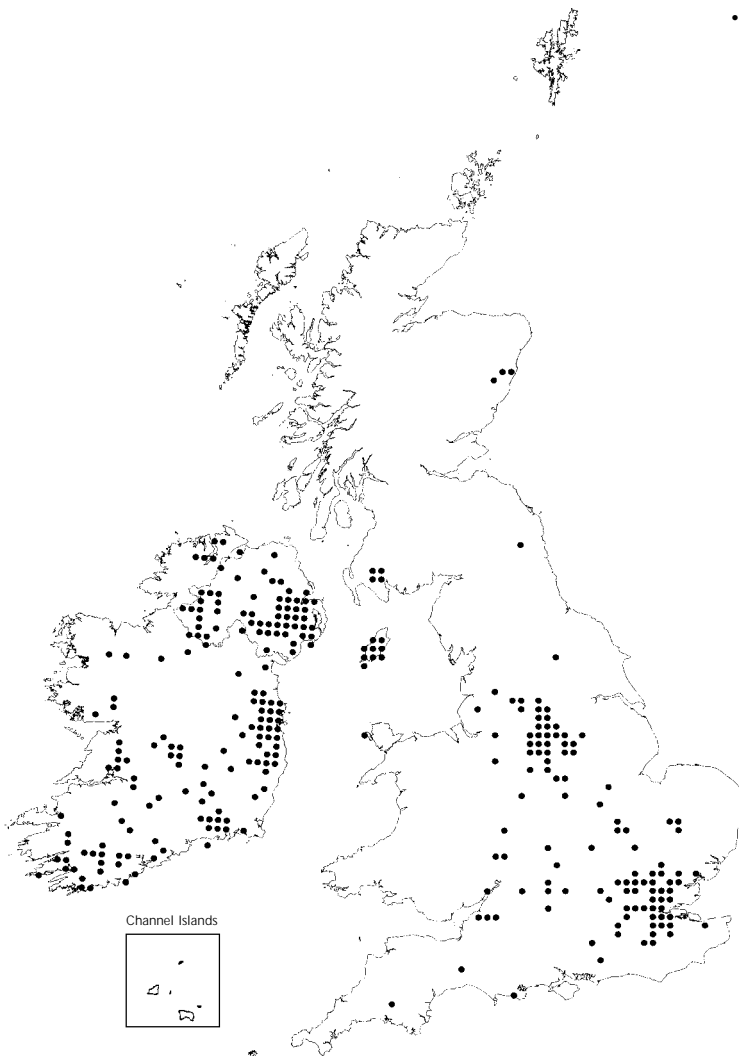
Status: Rare

Summer roosts: Buildings and tree holes

Leisler's bats generally forage over open environments catching flies and beetles. This species uses a wide range of habitats: rivers, lakes, ponds, coastal marshes, beaches, pasture, meadow, hedgerows and woodland clearings, over woodland canopies and along woodland edges. Leisler's bats also forage around white lighting in rural and urban areas.

Management recommendations

- Maintain pasture by grazing. Avoid persistent wormers for livestock.
- Minimise use of pesticides and avoid drift over meadow and pasture.
- Maintain open freshwater habitats and water quality.
- Avoid felling mature trees, particularly in parkland, as these offer roosting opportunities.





Barbastelle

Distribution: Widespread

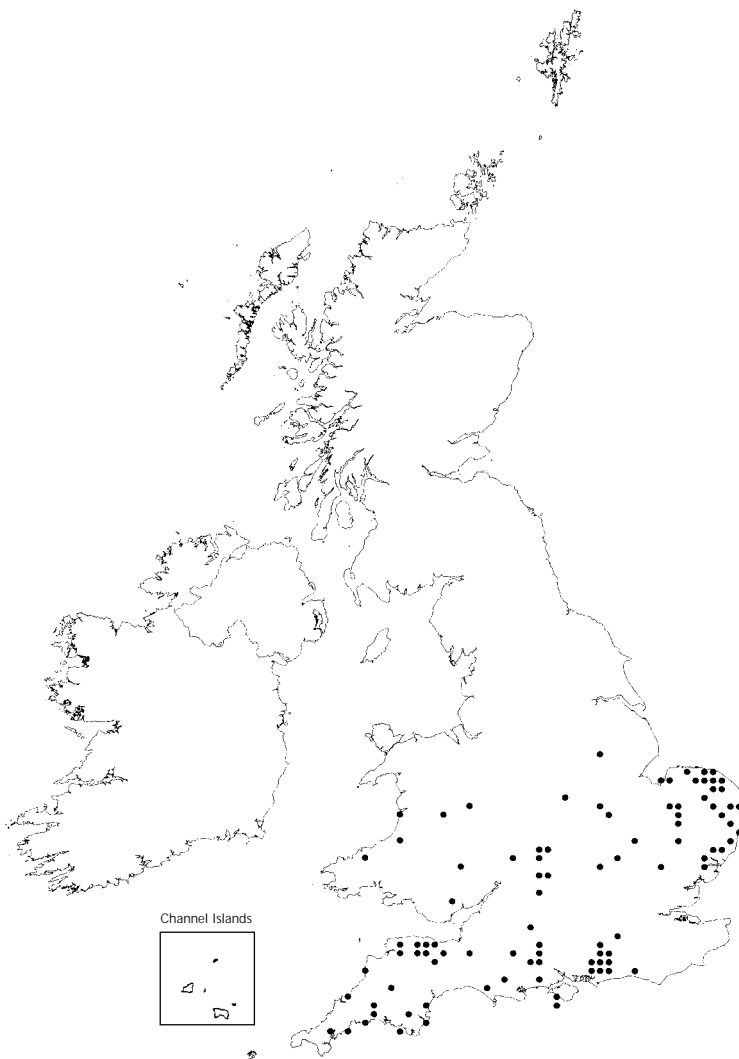
Status: Rare

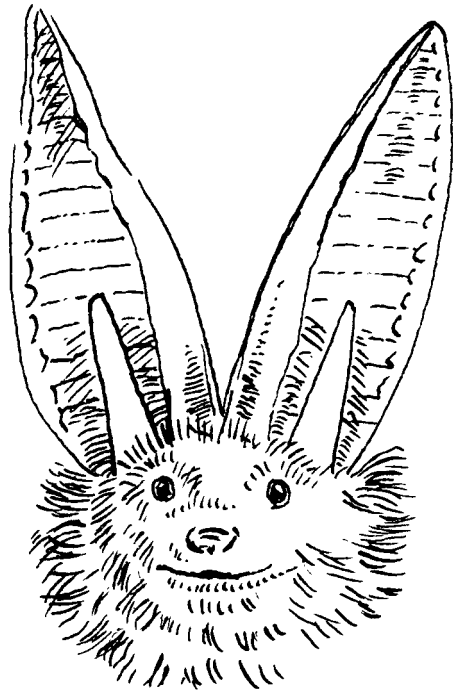
Summer roosts: Buildings, tree holes and spaces under bark

The barbastelle is one of the UK's rarest bats and only a few are recorded each year. This is mainly a woodland species. It feeds almost exclusively on moths taken in flight but may also glean insects and spiders from vegetation. In mainland Europe, barbastelles are found in deciduous woodland, woodland rides and glades, bankside woodland, woodland edges and even over open water. In the UK barbastelles have been recorded in woodland but also in suburban parks and orchards.

Management recommendations

- Retain woodlands and manage them to favour moths. Consider planting night-flowering species and a diversity of native trees and shrubs.
- Protect water quality
- Minimise pesticide use, particularly near bankside vegetation and woodland edges.





Brown long-eared bat

Distribution: Widespread

Status: Common

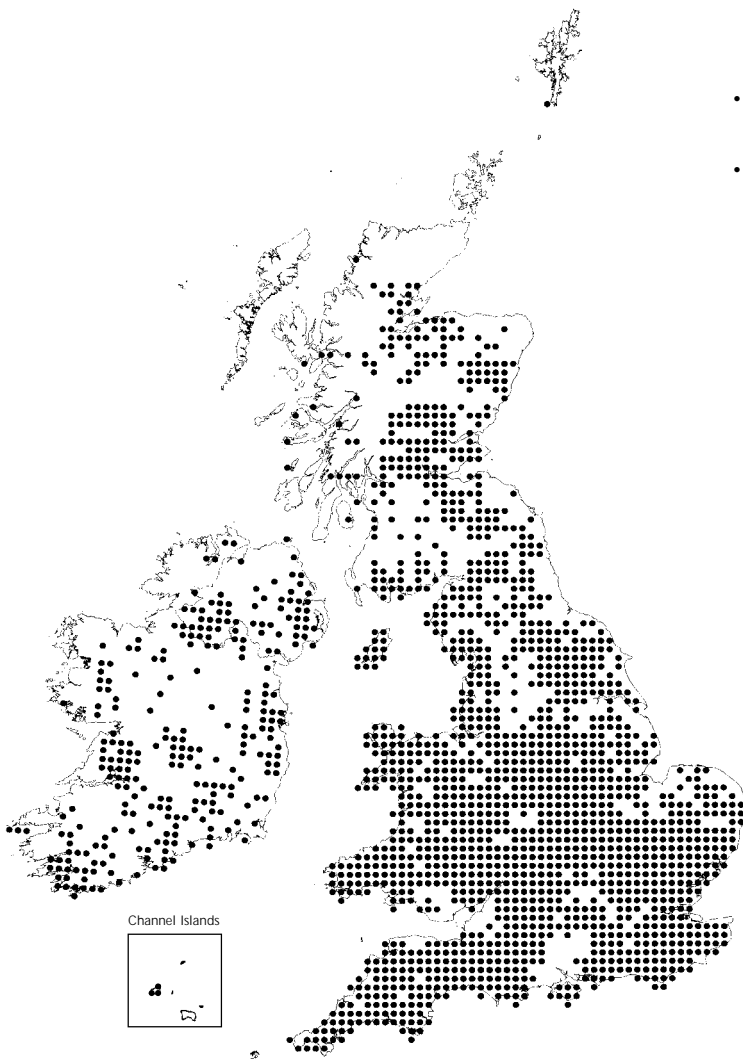
Summer roosts: Houses, other buildings, trees and bat boxes

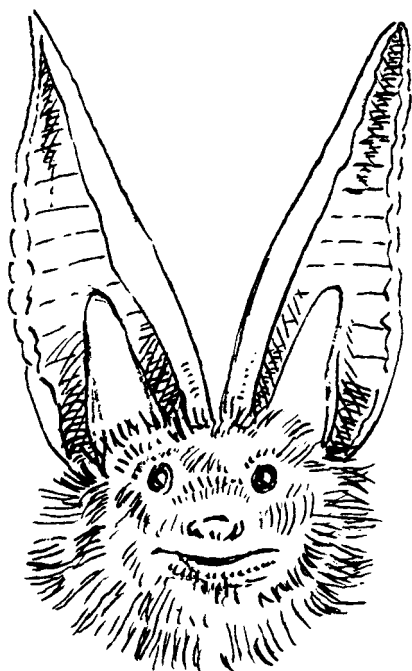
Brown long-eared bats feed by taking insects, generally moths, directly from foliage or other surfaces. Their favoured foraging ground is deciduous woodland within 1-2 km of roost sites. Other feeding areas include coniferous woodland, wet woodland, small groups of trees, woodland edge, garden shrubs, bankside vegetation and parkland with scattered trees.

Brown long-eared bats rarely cross open areas and follow hedgerows, tree lines and grassy banks when moving between roosts and foraging sites. Loss of such features may isolate feeding grounds from roost sites, making them unusable.

Management recommendations

- Protect broadleaved woodland, trees and woodland edge. Manage to favour moth populations.
- Maintain linear features such as hedges and tree lines, especially close to roost sites.
- Prioritise management of woodland, woodland edge and hedgerows within 1 km of roosts.





Grey long-eared bat

Distribution: Restricted

Status: Rare

Summer roosts: Houses in rural and suburban areas

Grey long-eared bats eat mainly moths and flies associated with woodland habitats. Information on habitat requirements for this species in the UK is still sketchy. However, in mainland Europe these bats forage in a range of habitats including woodland, woodland edges, parkland, orchards and gardens on own outskirts. They also forage around tree lines, single trees, and even in relatively open areas over meadows. There is some indication that this species forages predominantly within 2 km of the roost.

Management recommendations

- Protect woodland, particularly damp broad-leaved woodland.
- Maintain woodland edges that merge with grassland.
- Prioritise management within 2 km of known roosts. Avoid pesticides that may affect moths.



4 References

- Mitchell-Jones, A J and McLeish, A P (eds) (1999) *The bat workers' manual*. JNCC, Peterborough
- HMSO (1995) *Biodiversity: The UK steering group report, volumes 1 and 2*. HMSO Some action plans for individual bat species are included in volume 2. Others are included in *UK Biodiversity Group tranche 2 action plans - volume 1*. English Nature, Peterborough.
- Hutson, A M (1987) *Bats in houses*. The Bat Conservation Trust, London. Detailed information on bat roosts.
- Hutson, A M, Mickleburgh, S P and Mitchell Jones, A J (1995) *Bats underground - a conservation code*. The Bat Conservation Trust, London. Discusses hibernation in detail.
- MAFF (1998) *Code of Practice for the safe use of pesticides on farms and holdings*. Ministry of Agriculture, Fisheries and Food, London.
- Read, H (2000) *Veteran Trees: A guide to good management*. English Nature, Peterborough. Provides information on English Nature's Veteran Trees Initiative.
- The Bat Conservation Trust (1997) *Bats and trees*. The Bat Conservation Trust, London.
- Hopkins, E (1998) Guidance note 1: *Trees and bats*. Arboricultural Association, Romsey. Both contain information about how to identify roosts in trees. *Bats and trees* also includes management advice on minimising disturbance to bats during tree surgery.
- English Nature (1998) *Managing landscapes for the greater horseshoe bat*, English Nature. Contains detailed recommendations on the requirements of this species.
- Knowles, M (1995) *An introduction to wildlife conservation*. Smallholder Practical Series, Kings Lynn. Includes detailed advice on suitable management techniques for wildlife. Particularly relevant to small farms and smallholdings.
- Thompson, S (1989) *Bats in the garden*. School Garden Company. Includes detailed advice on how to improve the attractiveness of gardens to bats.
- Stebbings, R and Walsh, S (1991) *Bat boxes*. The Bat Conservation Trust/Fauna and Flora Preservation Society, London. Details of the construction and siting of bat boxes. A summary leaflet is also available from the Bat Conservation Trust.

5 Further reading

- Drake, M, Williams, P, Biggs, J and Whitfield, M (1996) *Managing ponds for wildlife*. English Nature, Peterborough. Management techniques for enhancing the value of ponds for wildlife.
- English Nature (1999) *Managing landscapes for the serotine bat*. English Nature, Peterborough.
- Fuller, R J and Warren, M S (1993) *Coppice woodlands: their management for wildlife* (2nd ed.) JNCC.
- Greenaway, F and Hutson, A M (1990) *A field guide to British bats*. Bruce Coleman Books, Uxbridge.
- Hutson, A M (1993) *Action plan for the conservation of bats in the United Kingdom*. The Bat Conservation Trust, London. Includes the status of each British bat species, an indication of likely threats to their populations, and conservation action needed to protect them.
- Hutson, A M (1999) *Bats and dung* in Cox, J *The biodiversity of animal dung*. Hampshire and Isle of Wight Wildlife Trust, Eastleigh.
- Hutson, A M, Mickleburgh, S P and Mitchell-Jones, A J (1995) *Bats underground – a conservation code*. The Bat Conservation Trust, London. Provides advice on the conservation of bats roosting in caves, mines and other underground sites.
- Kirby, P (1992) *Habitat management for invertebrates: A practical handbook*. JNCC/RSPB, Sandy. Detailed information on how habitats can be managed to favour insect diversity and numbers.
- Mitchell-Jones, A J (1992) *Focus on bats*. English Nature, Peterborough. A summary of bat biology, roosting and hibernation, with more detailed advice on helping bats that roost in buildings.
- Richardson, P (1985) *Bats*. Whittet Books, London.
- Robertson, J (1990) *The complete bat*. Chatto & Windus, London (out of print).
- Russ, J (1999) *The bats of Britain and Ireland: Echolocation calls, sound analysis and species identification*. Alana Books, Newtown.
- Briggs, B and King, D (1998) *The bat detective – a field guide for bat detection*. Stag Electronics, Shoreham-by-Sea. More information on echolocation.
- Swift, S M (1998) *Long-eared bats*. Poyser, London.
- Warren, M S and Fuller, R J (1993) *Woodland rides and glades: Their management for wildlife*. JNCC.

Annex I: Legislation protecting bats

The Bern Convention

Bats receive protected status by their listing on Appendix II of the Council of Europe Bern Convention. This listing and the UK's Accession to the Convention resulted in the Wildlife and Countryside Act being passed into UK law.

Wildlife and Countryside Act 1981 (as amended)

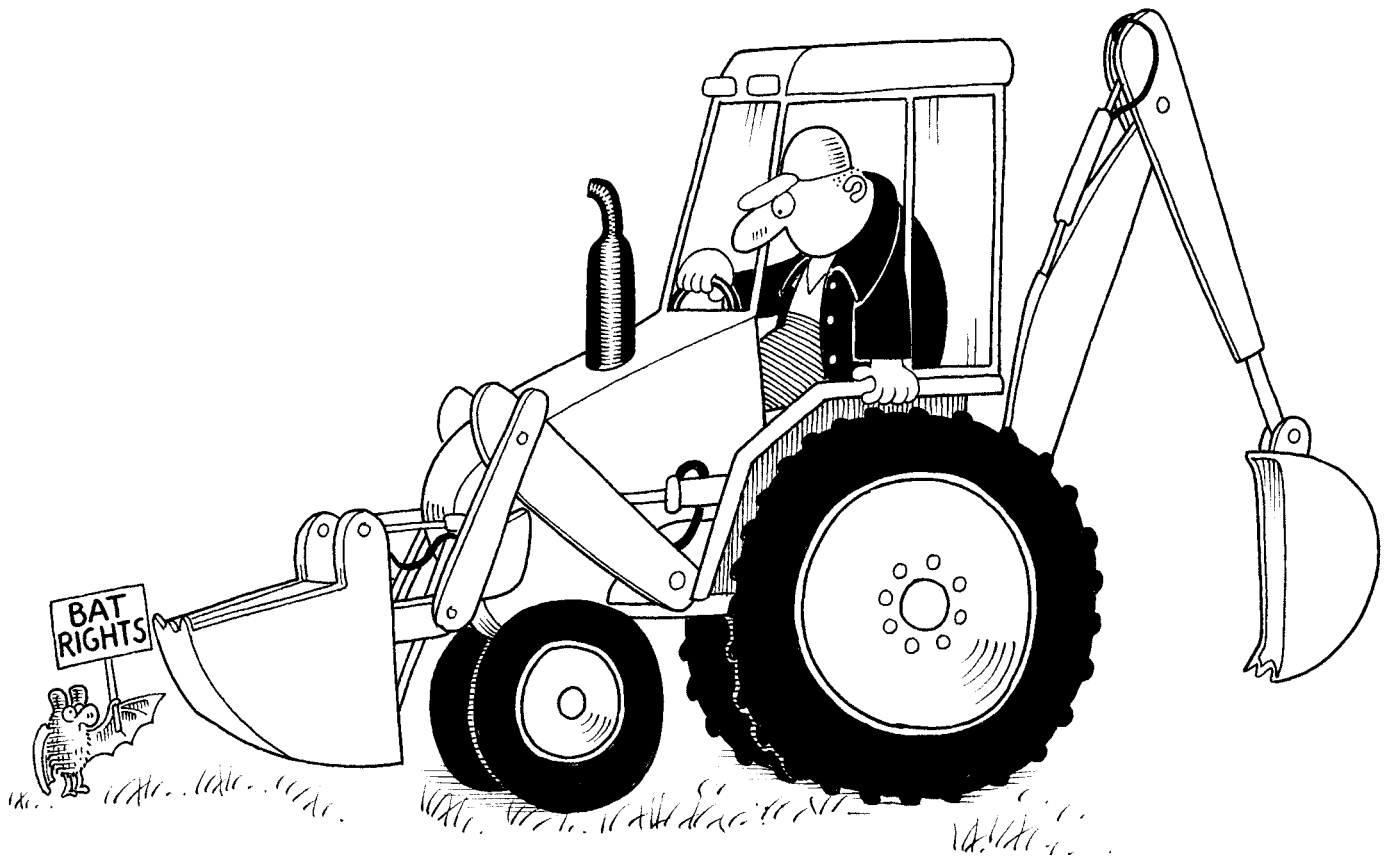
All bats in Great Britain are protected through inclusion on schedule 5 of this legislation. This means that it is illegal to:

- Intentionally kill, injure or take bats
- Intentionally or recklessly damage or destroy bat roosts or disturb bats in their roosts.

Seek advice from the appropriate SNCO before carrying out any work that might affect a bat roost, including those in houses. Intentional or reckless damage to bats or their roosts can result in prosecution and substantial fines.

There is equivalent legislation in Northern Ireland under The Wildlife (Northern Ireland) Order 1985.





The Agreement on the Conservation of Populations of European Bats (Under the Convention on the Conservation of Migratory Species of Wild Animals – The 'Bonn Convention')

Under this Agreement, the Government is obliged to:

- protect all bat species and their roost sites
- endeavour to identify and protect important feeding areas
- protect important bat habitats when deciding general habitat conservation priorities.

The Conservation (Natural Habitats, &c.) Regulations and The Conservation (Natural Habitats & c.) Northern Ireland Regulations 1997

These regulations transpose the requirements of the Habitats Directive into domestic legislation, effectively complementing the Wildlife and Countryside Act 1981 (as amended). All bats are included on Schedule 2 as 'European protected species'. One important addition is the setting up of a licensing system to regulate any essential destruction of breeding or resting places.

The EC Directive on the conservation of natural and semi-natural habitats and of wild fauna and flora (the 'Habitats Directive')

Under this directive:

- protection is given to all bat species (Annex IV)
- four UK breeding species (greater and lesser horseshoe bats, Bechstein's bat and barbastelle) are given special protection under Annex II, making it a requirement to designate roosts and foraging sites as Special Areas for Conservation (SACs).

Annex II: Financial support for habitat management

There are a number of incentive schemes designed to encourage and support farmers in adopting good environmental management on their land. In return for payments, farmers enter into agreements to undertake specific management regimens or changes in land use, many of which benefit wildlife, including bats. The majority of these schemes are in part funded through the European Union. Contact details for relevant organisations are given overleaf.

Grants are available for specific management activities to enhance existing habitats and for the establishment of new habitats. A range of habitat types and features are covered including ponds, streams and rivers, wet grassland, old pasture, orchards, parkland, scrub, heathland and hedges. Schemes also encourage hedge and tree planting, pollarding, pond creation and provide support for farms converting to organic production, all of which could benefit bats. Further information is available from: **the Department for Environment, Food and Rural Affairs (DEFRA) Regional Service Centres, the Scottish Executive Rural Affairs**

Department, Scottish Natural Heritage, English Nature and the Countryside Council for Wales.

There are a number of schemes specifically designed to encourage the planting and management of woodland, including veteran trees and associated habitats. Grants are available for both small and large-scale projects and can be obtained for planting woods on former arable land, natural regeneration in enclosed areas and for conservation management of existing woodland, wood-pasture, parkland and hedgerows. Information can be obtained from: **the Forestry Commission, the Department of Agriculture and Rural Development Northern Ireland, English Nature, the Countryside Council for Wales, Coed Cymru and the Tree Council.**

Assistance is available to support habitat creation and enhancement on set-aside agricultural land, Sites of Special Scientific Interest and for small-scale local projects. Information can be obtained respectively from **DEFRA, English Nature, the Countryside Council for Wales and county councils in England.**

Annex III: Key contacts

The following organisations can help with funding and/or advice to assist in the conservation of bats.

English Nature

Enquiry Service
Northminster House
Peterborough PE1 1UA
Tel: 01733 455101
Email: enquiries@english-nature.org.uk
Website: www.english-nature.org.uk

Scottish Natural Heritage

12 Hope Terrace
Edinburgh EH9 2AS
Tel: 0131 447 4784
Email: enquiries@snh.gov.uk
Website: www.snh.org.uk

Countryside Council for Wales

Plas Penrhos
Penrhos Road
Bangor
Gwynedd LL57 2LQ
Tel: 01248 385732
Website: www.ccw.gov.uk

Joint Nature Conservation Committee (JNCC)

Monkstone House
City Road
Peterborough PE1 1JY
Website: www.jncc.gov.uk

Environment and Heritage Service

Countryside and Wildlife Branch
Commonwealth House
23 Castle Place
Belfast BT1 1FY
Tel: 028 9025 1477
Website: www.ehsni.gov.uk

Forestry Commission

231 Corstorphine Road
Edinburgh EH12 7AT
Tel: 0131 334 0303
Email: enquiries@forestry.gsi.gov.uk
Website: www.forestry.gov.uk

Department for Environment, Food and Rural Affairs (DEFRA)

3-8 Whitehall Place
London SW1A 2HH
Tel: 08459 335577
Email: helpline@defra.gsi.gov.uk
Website: www.defra.gov.uk

Rural Affairs Department Secretariat

The Scottish Executive
Room 440
Pentland House
47 Robbs Loan
Edinburgh EH14 1TY
Tel: 0131 244 6023
Email: ceu@scotland.gov.uk

Department of Agriculture and Rural Development

Countryside Management Division
Dundonald House
Upper Newtownards Road
Belfast BT4 2SB
Tel: 02890 520100
Email: library@nics.gov.uk
Website: www.dardni.gov.uk

Coed Cymru

The Old Sawmill
Tregynon
Newton
Powys SY16 3PL
Tel: 01686 650777
Email: coedcymru@mid-wales.net
Website: www.coedcymru.mid-wales.net

The Bat Conservation Trust

15 Cloisters House
8 Battersea Park Road
London SW8 4BG
Tel: 020 7627 2629
Email: enquiries@bats.org.uk
Website: www.bats.org.uk

The Mammal Society

15 Cloisters House
8 Battersea Park Road
London SW8 4BG
Tel: 020 7498 4358
Email: enquiries@mammals.org.uk
Website: www.abdn.ac.uk/mammal/

Farming and Wildlife Advisory Group (FWAG)

National Agricultural Centre
Stoneleigh
Kenilworth
Warwickshire CV8 2RX
Tel: 024 7669 6699
Email: info@fwag.org.uk
Website: www.fwag.org.uk

The Wildlife Trusts

The Kiln
Mather Road
Newark
Nottinghamshire NG24 1WT
Tel: 01636 677711
Email: info@wildlife-trusts.cix.co.uk
Website: www.wildlifetrusts.org/

British Trust for Conservation Volunteers

36 St Mary's Street
Wallingford
Oxfordshire OX10 0EU
Tel: 01491 839766
Email: information@btcv.org.uk
Website: www.btcv.org

BTCV Scotland

Balallan House
24 Allan Park
Stirling FK8 2QG
Tel: 01786 479697
Email: scotland@btcv.org.uk
Website: www.btcv.org

Conservation Volunteers (Northern Ireland)

159 Ravenhill Road
Belfast BT6 0BP
Tel: 028 9064 5169
Email: cvni@cvni.org
Website: www.btcv.org/cvni



The **Joint Nature Conservation Committee** is the forum through which the three country nature conservation agencies – the Countryside Council for Wales (CCW), English Nature (EN) and Scottish Natural Heritage (SNH) – deliver their statutory responsibilities for Great Britain as a whole and internationally. These responsibilities, known as the special functions, contribute to sustaining and enriching biological diversity, enhancing geological features and sustaining natural systems.

The special functions are principally:

- to advise ministers on the development of policies for, or affecting, nature conservation in Great Britain and internationally;
- to provide advice and knowledge to anyone on nature conservation issues affecting Great Britain and internationally;
- to establish common standards throughout Great Britain for the monitoring of nature conservation and for research into nature conservation and the analysis of the results; and
- to commission or support research which the Committee deems relevant to the special functions.

In the UK, bat numbers have declined rapidly in recent years. *Habitat management for Bats* enables land managers, owners and their advisors to play their part in stemming this trend by providing clear advice on how to manage areas to benefit foraging bats.