



Discovering the connection between natural heritage and cultural influence in Swanton Novers woodland using volunteers



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Bat Conservation Trust



**NATURAL
ENGLAND**

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PROJECT SUMMARY REPORT

Overview

Ancient woodland is one of our richest and most valuable habitats for wildlife. It is historically important, with direct links to the original Wildwood thought to have once covered the UK after the last ice age. Some sites have a cultural heritage that highlights past land use and it is the value of these woodlands to people in the past that has ensured their long-term survival. Management over the years has created the wooded sites we have now, with many supporting a range of habitat features that are beneficial to wildlife. With only 10% (around 1.3 million hectares) of England's land area covered by woodlands and only 2.6 % of the country supporting ancient woodland (Independent Panel on Forestry, 2012), it is essential that these habitats are protected and managed sympathetically with conservation in mind. However, to understand the effects of management on bats and other woodland biodiversity we need to have a better understanding of the link between historical and current management and the wildlife it supports. All UK bats are reliant in some way on woodland habitats, either for roosting, for foraging or for much needed cover as they move through the landscape. Some bat species will use woodlands all year round for roosting (rearing young and hibernating) and for foraging. Despite this importance for bats, little detail is known about how bats use woodlands or how woodland management affects them. In particular, little is known about the use of interior components of the woodland away from easy to walk rides and tracks, due to the difficulties with surveying for bats in a woodland environment.

Funding from the Heritage Lottery Fund has enabled the Bat Conservation Trust (BCT) and Natural England (NE) to run a project from 2016 to 2018. This project had two main aims:

- to engage and involve the local community with work taking place at Swanton Novers NNR;
- to learn more about bats and other biodiversity on the site and the effect of forestry practices on these species.

Over two years the project engaged with local communities and volunteers to enable them to discover more about Swanton Novers woodland heritage and biodiversity, as well as to contribute towards a bat monitoring Citizen Science project and other monitoring and conservation activities. The project has utilised the knowledge gained from a long record of historical management of the site and accumulated species records, as well as the newly acquired knowledge of how bats and other biodiversity use Swanton Novers. The project was committed to delivering a series of outcomes (Table 1) that will benefit the community; raise awareness about the reserve's natural and social heritage and recruit a group of volunteers who will contribute to the important task of monitoring and raising the profile of the NNR once the project is completed.

Table 1 – Project outcomes

Outcome	Activities
<u>Community engagement</u> - engage with local communities.	Eight bat walk events at Swanton Novers NNR and offsite.
	Provide an annual community/family day at Swanton Novers NNR.
	Create and maintain a project website
	Attend the 'Wild about Norfolk' environmental fair to promote the project and recruit new volunteers
	Launch a photography competition
	Produce regular newsletters about the project
	Engage with school groups and youth groups
	Engage with a local school
	Engage with a local youth group
	Deliver winters talks to scout/brownie groups
	Provide a woodland management event for landowners/managers.
	Dedicated volunteer workforce of 20 people who will become skilled in bat surveys and sound analysis techniques.
	Run a series of training events to help advertise and recruit additional surveying volunteers
<u>Volunteer outcomes:</u> 778 volunteer days at all levels of skills.	40 volunteers that will undertake additional necessary tasks such as data entry, practical works to maintain equipment and historical research
	10 Swanton Novers Woodland Champions
	Collating all records held by the site into one centralized database and producing at least 9,000 new records.
	Bat survey data collected through the lifetime of the project.
<u>Heritage outcomes</u>	New guidelines disseminated to 61 woodland specific NNRs, with a summary provided to all 224 NNRs in England and other woodland managers
	Local community feel engaged with woodland and bats
	Volunteers feel appreciated and provided with useful skills

The woodland site

Swanton Novers National Nature Reserve (NNR) is a Site of Special Scientific Interest, an ancient woodland with exceptionally rich and diverse wildlife. It is set within a large area of commercial forestry in Norfolk and is currently managed by Natural England. Containing four separate ancient woodland parcels; Great Wood (52.87ha), Barney Wood (19.7ha), Little Wood (7.98ha) and Guybon's Wood (5.09ha), the NNR has considerable variation in geomorphology, soil conditions and hydrology, which means it supports a high floristic diversity, a mosaic of different habitats and is species-rich.

Research into the history of the woods shows that they were probably part of the great 'Wildwood' which once covered around 75% of the British landscape. It was first documented in the Domesday book when it was known as 'Swineton Woods' due to the numbers of pigs kept in the woodland for foraging on acorns. With its rich diversity of flora and fauna, its long history of active management and its ancient past, the reserve is classified as some of the most important ancient woodland in the country. Another indicator of its past is the presence of ancient woodland indicator species such as midland hawthorn, herb paris, lily of the valley, yellow archangel and small-leaved lime.

Woodland management

There is documented evidence that Great Wood has been managed by the local people of Swanton Novers as far back as the 1400's with coppicing carried out on a nine-year rotation, leaving very few trees over 1' in diameter. Some of the products, branches and twigs known as faggots were used as fuel, firing up brick and pottery kilns located on the southern outskirts of the village. After the First World War, coppicing within the reserve was gradually phased and is now less intensive. This has resulted in a woodland that supports a range of woodland types of different ages, a mosaic of habitats all under different management (Figure 1) from active coppice to abandoned coppice, minimum intervention and high forest, providing a very valuable habitat for a variety of flora and fauna which includes seven species of bats.

Figure 1 Current management at Great Wood with each colour representing a different form of management.



Methodology

Swanton Novers NNR supports seven species of bats including woodland specialist species such as *Barbastella barbastellus* (barbastelle) and *Plecotus auritus* (brown long-eared bat). Other bat species present are common pipistrelle, soprano pipistrelle, Natterer's bat, noctule and serotine.

To collect the bat data required for this project, monitoring locations (points) were selected, with each chosen point being a mature oak tree, greater than 10 metre high with a large canopy branch that was suitable for the attachment of a microphone bracket.

Selection of the 40 monitoring points in the reserve was carried out using a random stratified sample design, to ensure a similar number of recording points was located in each recognisably different block of habitat type. The reason for randomly allocating monitoring points within different woodland habitat types was to remove the bias of personal preference, e.g. only picking trees and surrounding habitat that were thought looked suitable for bats. It was important to ensure that the data are representative of the woodland as a whole and to allow comparison between the habitat types. During the monitoring period, one monitoring point tree was blown down and an alternative tree was not selected.

All the monitoring points were located 20 metres from the compartment edges (to avoid sampling transitional habitats) and at least 100 metres away from other monitoring points to maximise independence between each location. In positioning the monitoring points across the woodland, factors like different habitat management were considered, to ensure coverage of both dry and wetland areas of the reserve. 5 monitoring points situated near wide rides were positioned to look at how bat activity differed between the different forest stand types and these were monitored from April 2016 to November 2017.

10 static SM2 Bat + detectors with SMX –US microphones were deployed in Great Wood every three weeks in five different locations from April 2016 to November 2017. The location of the five monitoring points were randomly selected. Each detector was set to record for two consecutive nights from 1 hour before sunset to one hour after sunrise.

To investigate the difference in bat activity recorded on a bat detector within the canopy and within the understory, a paired design was used. One static detector microphone was hoisted into the canopy bracket that was selected to be:

- As high as could be safely attached to the tree, and at least 10 metres from the ground.
- Three-quarters of the distance from the trunk to the far edge of the canopy, and at least 5 metres from the trunk.
- As level as possible, and at an angle of no more than 15 degrees.

The second static detector microphone was fixed to a pole directly below the canopy microphone, 2.5 metres off the ground. A cage was created that fitted to the trunk of the selected tree to hold the two detectors securely.

Key findings and associated recommendations

1. How bats use Swanton Novers National Nature Reserve

1.1 Key findings

Swanton Novers National Nature Reserve (NNR) is an ancient woodland in rural Norfolk managed by Natural England. It is 84ha of ancient woodland, which has a long history of active management dating back to the Domesday Book. It was, therefore, the ideal site to run an innovative monitoring project that would provide us with an insight into the use of the woodland by bats.

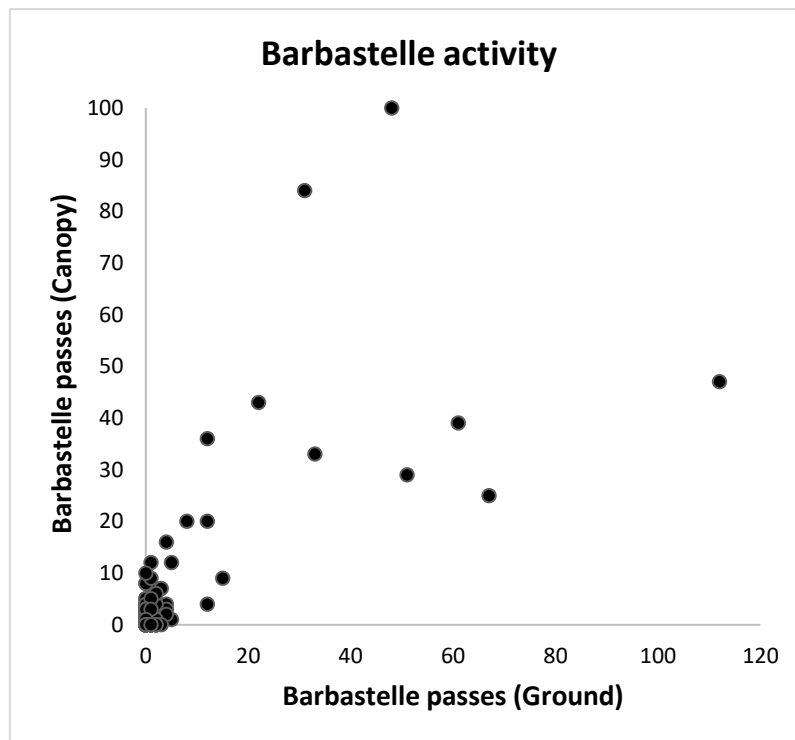
Analysis of the bat monitoring data collected by the project was carried out using GenStat, which is a statistical analysis software, capable of carrying out data analysis. The analysis was carried out to show the results from all data (January to December over the duration of the project) where the covariates were relied on to adjust for day length and other seasonal effects and the results from the months of May to September. A stand-alone technical document with supporting statistics for each key finding, details about the statistical tests used and how they were applied is available and can be requested directly from BCT.

The results from the analysis show that our detection of bat activity does differ between the understorey and the canopy, with significantly more bat activity recorded in the canopy across all bat species (though this was dominated by common pipistrelle), highlighting the importance of the woodland canopy to bats and most importantly shows us that the position of the detector can have a significant impact on the activity recorded. There was also significantly more activity in the canopy, compared to the lower level, for the following individual species: barbastelle (Figure 2), common and soprano pipistrelle bats, with common pipistrelle being the most recorded species. The placement of acoustic monitoring equipment when recording bat activity, should therefore be considered when monitoring in a woodland environment, especially for some species such as the barbastelle. However it is worth noting that although more activity was recorded in the canopy, the results show that the detectors are still picking bat activity from detectors placed on poles 2.5m high. Therefore, static detectors left to record at ground level will record bat activity for all species, although on a lesser scale.

To find out if the canopy is of significance importance to bats there would need to be no overlap in detection between the ground based and canopy based detectors, where a cut off in bat activity between the ground and canopy areas is established. But this is difficult to establish as woodland clutter will vary, affecting the range of the detectors between the detector points. In addition considering variation between bat species calls detectability and amounts of clutter it is not always possible, so it would be difficult to determine the significance of the canopy to bats based on just acoustic surveys.

What we know is that the greater level of bat activity recorded on the canopy detectors does indicate that the canopy may be of importance to bats, probably providing an edge feature for bats to follow as they move across the woodland. It is also likely that the woodland as a three-dimensional structure with a horizontal edge can provide suitable foraging opportunities for bats, especially if the canopy surface has a varied structure (Muller et al. 2013 & Jung et al. 2012). In addition, barbastelles have quieter echolocation calls and would need to be flying close to the detector to be recorded clearly. With significantly more barbastelle activity recorded on the canopy detectors this does indicate that they are utilising the canopy habitat. However, further research to understand how bats like the barbastelle are using the canopy, whether for commuting or foraging, and to assess the level of significance will be necessary.

Figure 2: scatterplot showing number of barbastelle passes per night in the canopy against number of barbastelle passes at ground level. All data used. Each circle represents a single night.



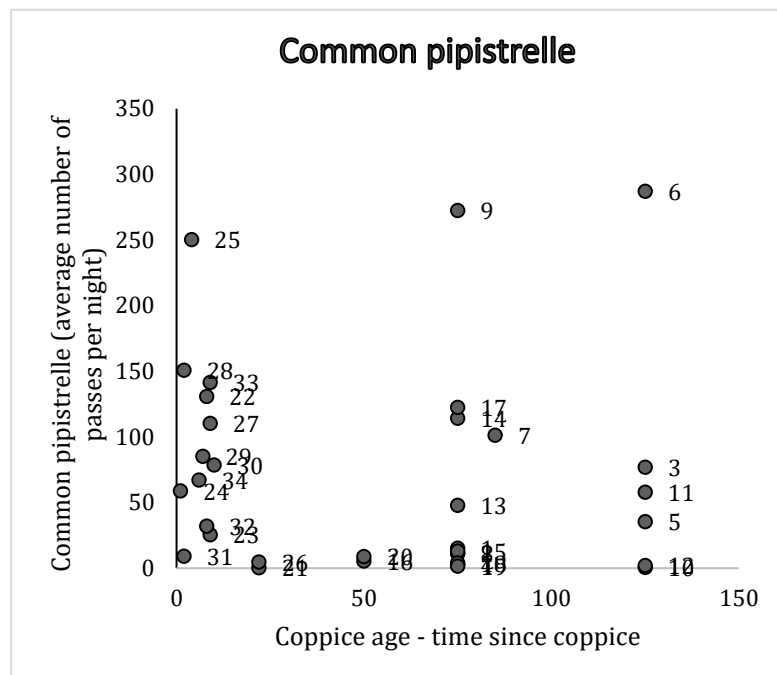
Through the project we wanted to learn more about how bats use the interior of the woodland compartments, as monitoring is normally carried out in accessible areas of a woodland, along rides and woodland edges. The interior of each woodland compartment in Swanton Novers NNR varied due to the different management practices carried out on the site, ranging from active coppicing, to minimum intervention, high forest and abandoned coppice. The key findings of this work were:

Active short coppice rotation woodlands containing a mixed species deciduous understorey had reduced barbastelle activity when compared to high forest. Barbastelle are regarded as a woodland specialist that will roost in woodlands with closed canopy and a cluttered understorey and when foraging has a preference for feeding along edge habitats (Table 3). Active coppice woodland is managed to ensure that the mature trees are sparsely distributed so that they do not create too much shade to prevent the growth of coppice plants underneath. However, this would need further research to better understand how the different stages of the coppice cycle (as rotation lengths can vary depending on the product and the species growing) are utilised by barbastelles.

A high number of common pipistrelle bat passes were associated with a low dense ground vegetation structure throughout the year. For May to September common and soprano pipistrelle both showed a significantly more positive association with the denser lower shrub layer. This kind of low vegetation structure was most prevalent in areas of active coppice with deciduous mixed species (small leaved lime, hazel, field maple and alder) and many of these active coppice compartments were fenced off, so the regrowth was protected from deer browsing. There is therefore the possibility that because the vegetation is more pronounced during the summer months, this kind of habitat could provide an important food resource for non – gleaning bats. Further research will be necessary to understand the importance of these habitats to non-gleaning bats.

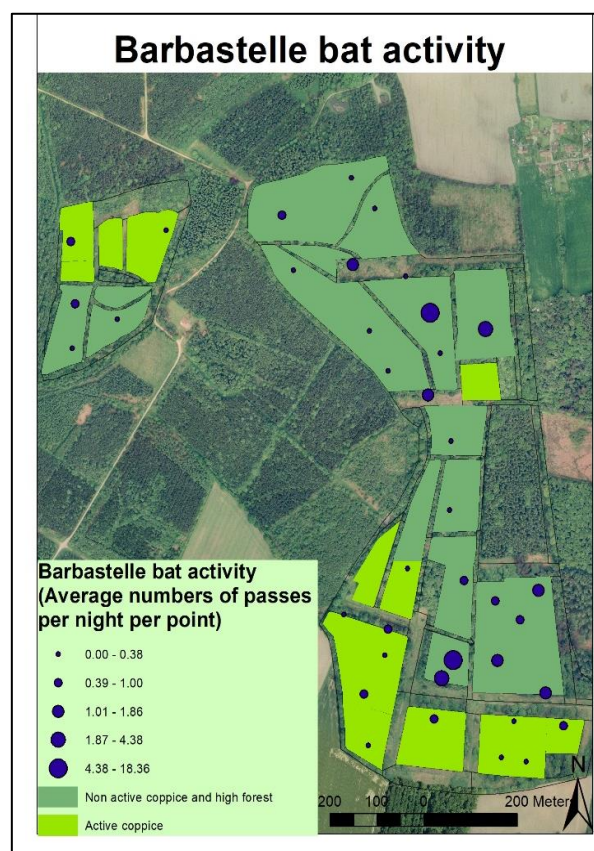
In contrast, compartments that hadn't been recently coppiced, showed variable common pipistrelle bat activity, while active coppiced sites (up to 10 years regrowth) had fairly high activity (Figure 3). Coppicing periodically opens up the habitat, allowing sunlight in and a wide range insects and plants to establish during the first few years. In the later stages of the coppice cycle, taller, denser growth will shade out many typical coppice species, becoming suitable for more shade tolerant species.

Figure 3: average numbers of common pipistrelle passes per night against coppice age. Numeric labels refer to sample point numbers.



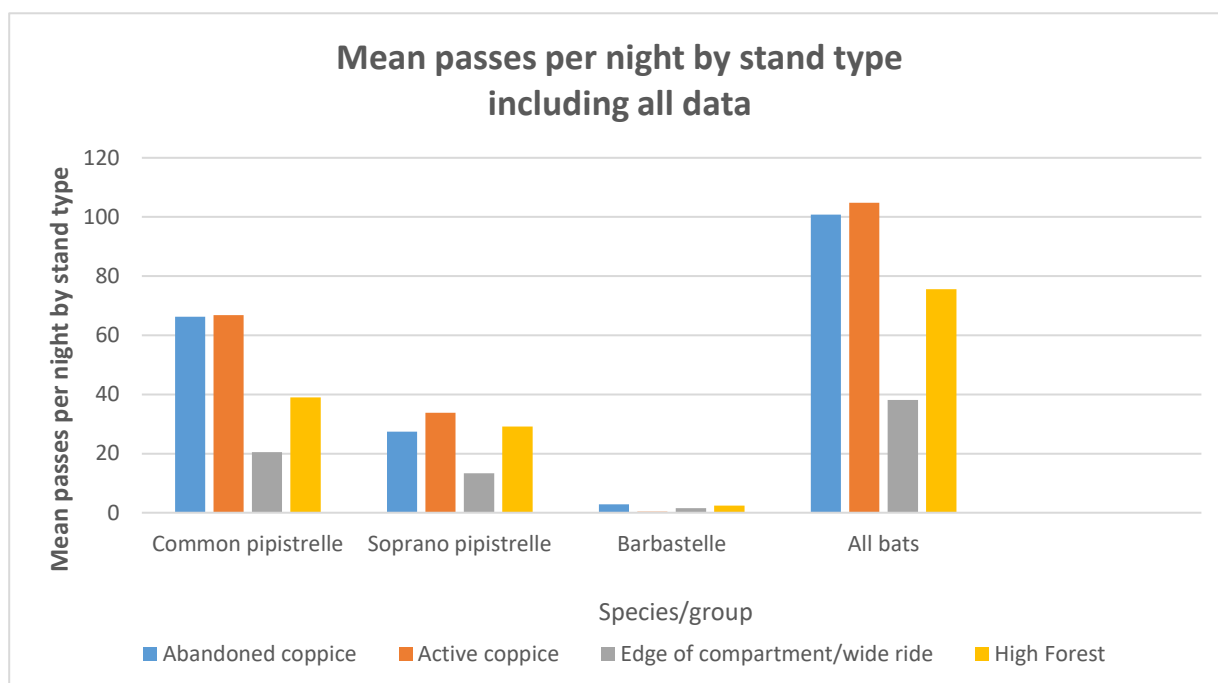
For other individual species like the barbastelle (edge species), no positive significantly significant relationship with active coppice was seen, though the distribution maps do show reduced activity in the active coppice compartments for this species (Figure 4 and Figure 5).

Figure 4 Barbastelle activity



Though not significantly significant it is worth noting the following observations, which will all require further research to improve our understanding:

Figure 5: Mean passes per night by stand type - including all data



The interior of the woods was found to be of importance to all bat species recorded. There was notable bat activity at the monitoring points that were located in the woodland compartment interiors (Figure 5). This includes woodland interior and edge species (Table 3), thus highlighting the importance of the woodland compartment interior as a key habitat for bats. Further research would be necessary to better understand the importance of the woodland interior to bats.

Table 3 – When using woodlands, bats species can be loosely divided into interior and edge/open species

Species	Edge/open or interior species
Common pipistrelle <i>Pipistrellus pipistrellus</i>	Edge species – will use open areas, glades and woodland rides for foraging. Will also feed in a range of different habitats.
Soprano pipistrelle <i>Pipistrellus pygmaeus</i>	Edge species
Barbastelle <i>Barbastella barbastellus</i>	Woodland specialist – An edge species which will use hedgerows, woodland rides and edges for foraging and commuting, but also makes use of a well-developed understorey for foraging, as less light infiltrates through at dusk giving an early feeding opportunity. They roost in mature trees in woodlands or occasionally younger trees depending on crevice features being present, in particular loose bark. Roosts found in woodland with closed canopy and a cluttered understorey, which supports the sheltered, humid conditions that this species needs.

Brown long –eared bat <i>Plecotus auritus</i>	Woodland interior species – will roost and forage within the woodland interior, preferring cluttered woodland areas. Broad wings allow for a slower more controlled flight.
Natterer’s bat <i>Myotis nattereri</i>	Woodland interior species
Noctule <i>Nyctalus noctula</i>	Open species – will use open habitat, glades and woodland rides for foraging. Has narrow wings to allow faster flight
Serotine <i>Eptesicus serotinus</i>	Open species

Barbastelle activity increased in areas of woodland where time has elapsed since last coppiced. This supports a recent study by Carr, A. *et al.* (2018) that shows that barbastelles are affected by management and activity of this species increased on sites where management has lapsed.

Though not significant the mean number of passes per night per deployment, indicates that barbastelles are active in compartments containing a holly dominated or a mixed holly understorey (Table 4). Holly does not support a diverse insect population (Southwood, T 1961 & Brandel, M., *et al.*, 2002), and the age of the holly and its density may determine the invertebrate population it will support. Holly however can provide a structure that invertebrates will shelter in and from which gleaning bats could take their prey from and may therefore support a high abundance of insects, though this will need further research to improve our understanding. Foraging opportunities in holly dominated compartments are therefore likely to be limited for barbastelle. However, at Swanton Novers NNR, some of the woodland compartments with a holly understorey also contained a range of suitable mature oak trees that have roost potential. These were where higher levels of barbastelle activity were recorded, particularly during June and August when bats are rearing their young, so it is likely that the activity recorded is indicative of a tree roost being near the monitoring points. It does however suggest that holly may have some importance to barbastelle, by providing the right environmental conditions (dark and humid) for the roost trees that barbastelles prefer. However, it is important to note that holly has only dominated the freer-draining soils at Swanton Novers in recent years and therefore further work is needed to understand whether these holly dominated areas would continue to support barbastelles in the longer term.

Table 4: mean passes per night by species and understorey type - including all data

Species/group	deciduous	holly	mixed holly
Common pipistrelle	59.3	40.2	46.7
Soprano pipistrelle	28.2	20.9	46.4
Barbastelle	0.37	2.76	5.01
Myotis sp.	0.46	1.39	0.93
All bats	91.8	67.0	106.5

Mixed holly includes ‘heath and holly’, ‘heath and sparse holly’ and ‘holly/deciduous’.

1.2 Management recommendations - These recommendations are written up for Swanton Novers National Nature Reserve. However the principles behind each recommendation can be used when considering and planning any woodland management at other woodland sites.

- **Retain a high percentage of canopy cover with a mosaic of different age classes and native broadleaf species.**

The woodland canopy surface provides a structurally complex interface, although little work has been conducted in the UK to compare the biodiversity of the woodland canopy to the woodland understorey. The results of this study have demonstrated that the woodland canopy area is used by bats with the higher placed detectors recording more activity. This provides much needed evidence to support current management advice for bats, which suggests that **canopy cover** is beneficial for bats, especially for woodland bat specialists like the barbastelle and brown long-eared bat (Boye, P 2005, & Entwistle, A.C., et al., 2001).

- **For the woodland interior, management should also encourage structural diversity and species richness.**

The understorey layer should have a range of locally appropriate native shrubs (as well as tree saplings) that will support a diverse and abundant insect population. Where possible, the understorey should be retained and encouraged over a significant proportion of the site. This is likely to require deer management to prevent excessive browsing reducing understorey and regrowth. This will create a cluttered understorey that will benefit a range woodland specialist bats whilst rides, glades and woodland edges and areas of coppice will be utilized by generalist (edge) bats such as pipistrelle species.

- **Old growth woodland, mature trees and standing dead wood should be retained so that there is a continuity of suitable tree roosts.**

High levels of barbastelle activity was recorded in woodland compartments containing mature trees and standing dead wood. Naturally functioning forest systems provide such structural variation, but given the long and often continuous history of woodland management in English woods, such conditions are often the result of direct intervention. In the short term, a cessation in management tends to result in increased structural complexity, as the plants, which would otherwise be suppressed by management attempt to achieve a competitive advantage over each other. Over a period of several decades this can result in an increase in habitat niches for bats and their insect prey. However, over time, the trees that achieve dominance result in the death of their subdominant neighbours, leading to a reduction in tree density, a phenomenon termed 'self-thinning'. At this point, the woodland can resemble a plantation; consisting of evenly spaced, straight trunked trees of uniform age. If the management objective is to ensure **structural and species diversity** then, in order for the woodland manager to achieve this, it is important to understand the history of the woodland and follow a well thought out management plan. Currently it is recommended that long term roughly 20 m³ of deadwood per hectare should be retained though not uniformly distributed (Humphrey, J et al 2012).

- **High forest that is found to support woodland bat species should be managed to maintain structural diversity and a range of different age classes.**

High forest is the result of outgrown, neglected coppice, direct planting or natural regeneration and can develop a range of habitats such as closed canopy and dense native understorey that will support a range of bat species. The project does show that there was reduced barbastelle activity within active coppice sites when compared to high forest. Suitable management of high forest should therefore be considered in the management plan, to protect any existing or potential roosts and retain suitable foraging grounds for barbastelle and other woodland specialist (interior) species..

- **Small, temporary clearings to encourage young native deciduous trees to grow through natural regeneration can be carried out to increase the range of age-classes and, thus, structural diversity and ensure canopy continuity.**

This type of management can be beneficial for woodland specialists as it will ensure a continued supply of suitable tree roosts in the long term as tree roosts are transient. This level of **management should be sensitively carried out and large areas should not be felled during one felling year.** Managing grazing by deer in some cases, will be essential to maintain a complex understorey as well as replacing trees through planting or natural regeneration.

- **Manage areas of your woodland under minimum intervention.**

The central core of Swanton Novers Great Wood is managed on a 'minimum intervention' basis, which includes areas of high forest and abandoned coppice and this is something that should be considered at other sites on a site to site basis. Setting aside areas and following a policy of minimum intervention would leave sections of a woodland relatively undisturbed, allowing it to create a range of different habitats and reach maturity naturally, provided grazing/browsing was kept to a low level. Trees in these compartments will develop suitable roost features over time and provide cover and a rich feeding ground for woodland specialist bats. However, this technique is dependent on the overall objectives for the woodland. Often, ancient woodlands are situated on clayey soils and are susceptible to seasonal flooding. As a result these woods can be hard to access to extract timber and replant. **Concentrating any silvicultural management to more productive, accessible areas and focusing minimum intervention on the wetter, heavier soils can benefit a range of wildlife, not just bats, without impacting on the profitability of the woodland.**

- **If the woodland already contains coppice stands, then it is often best to continue coppicing on a suitable rotation.**

Common pipistrelle association with low dense ground vegetation is prevalent in active coppice. Add to this high levels of common pipistrelle activity was recorded in coppice compartments with regrowth up to 10 years old. This confirms that common pipistrelles will utilise managed woodlands. Management could consider providing a range of coppice age classes throughout a woodland and restock if needed by layering existing coppice stools to maximize the structural complexity of the wood. Mixed deciduous coppice is generally cut-over on an 8-10 year rotation, although the actual interval between cutting often varies in reality to take account of the prevailing demand for particular products i.e. small whips for hurdle making require a shorter rotation than stakes for river revetment works. The length of coppice cycle should also be determined by the local conditions and species composition of the woodland – local knowledge is the best guide here. For example, in some Cambridgeshire clay woodlands shorter coppice cycles have been correlated to an increase in coarse grass species with species like False Brome *Brachypodium sylvaticum* and Wood Small Reed *Calamagrostis cespitosa*. In such cases, longer rotations may be required to create a longer period of shade, in order to prevent dominance by single species after cutting.

- **When coppicing avoid isolating some bat species and reduce disturbance.**

Coppicing should be done on a sequential pattern, with each newly cut coupe positioned adjacent to the previously cut-over coupe. The area of coppice should also be viewed as one component of the habitat provided by the woodland and a balance of this with other management and minimum intervention areas should be maintained, taking into account the management recently and currently in place and the bat species that are known to use or in the area that could be using the woodland.

- **Before felling standard trees within a coppice coupe an assessment of bat potential should be carried out** (refer to [https://www.forestry.gov.uk/pdf/england-protectedspecies-bats.pdf/\\$FILE/england-protectedspecies-bats.pdf](https://www.forestry.gov.uk/pdf/england-protectedspecies-bats.pdf/$FILE/england-protectedspecies-bats.pdf)). This recommendation covers any suitable trees old and young that has bat potential. **Any confirmed or potential tree roost should be retained and all records, including final decisions should be kept.**
- **Deer grazing management such as fencing should continue to be carried out, especially around recently coppiced compartments.**
Targeted deer control will also reduce the impact of deer browsing on the understorey cover in other areas of a woodland, especially if they support suitable mature trees or confirmed bat tree roosts.

2. Monitoring at Swanton Novers NNR

2.1 Surveying for bats

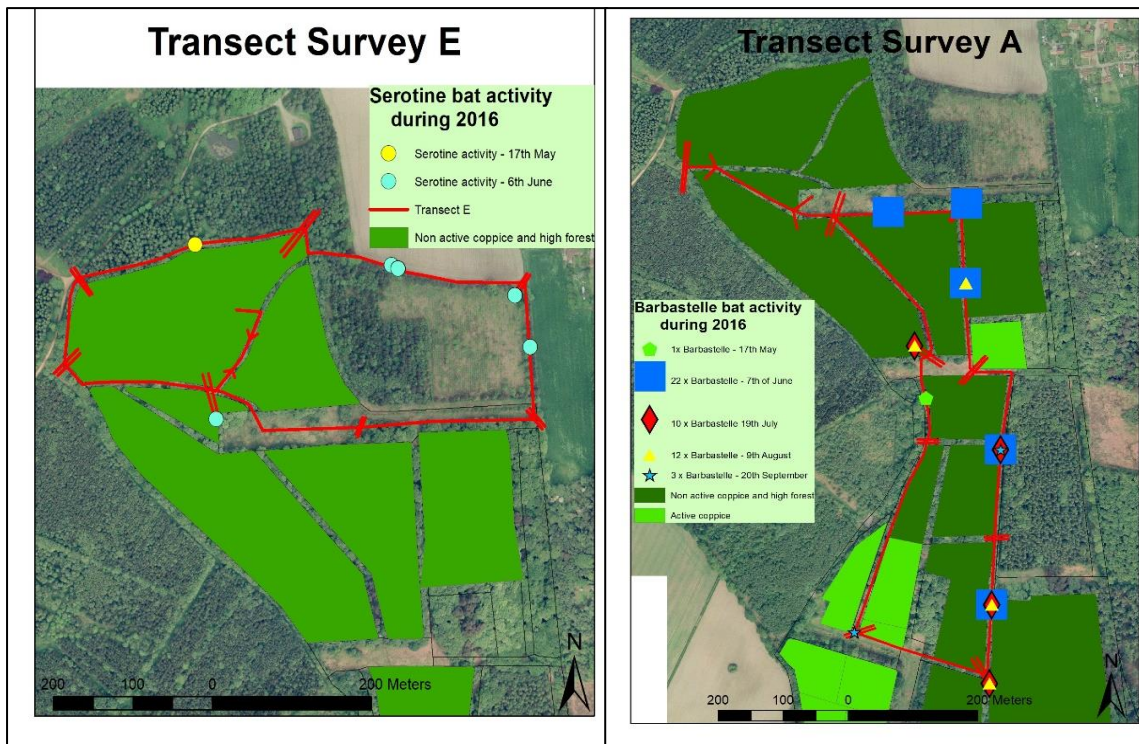
Throughout the project, volunteers and the project team collected a dataset of bat recordings using a variety of different survey techniques. As bat species have different requirements and preferences, the level of bat monitoring carried out by the project has given us a better understanding of the effects forestry management can have on bats.

Static surveys – Deploying 10 static detectors at 5 randomly selected monitoring points (with one detector in the canopy and one at ground level), every three weeks from April 2016 to November 2017 allowed the project to collect 578 nights of data. This dataset, combined with our understanding of historic and current management, has allowed us to learn about how bats used Swanton Novers woodland.

Transect surveys - 34 walked transect surveys that covered four predetermined routes through Great Wood were carried out by volunteers. The results from the transect surveys gave the project information about the main areas of bat activity along the rides and covered areas where there were no nearby monitoring points. For example, significant numbers of noctule and serotine bats were found using the edge of the woodland adjacent to arable fields during May and early June (Figure 6). Also, barbastelle were recorded along the main rides as they commuted under cover to their foraging grounds; while common and soprano pipistrelle activity was recorded along all transect routes.

This highlights the importance of having areas of non-wooded quality habitats, such as pasture, adjacent to woodlands that can support ‘big bat’ species such as the noctule and serotine. This is especially important if the woodland has mature tree with woodpecker holes, which are the preferred roosting feature used by noctule.

Figure 6: Results from the transect surveys carried out during 2016 along one of the predetermined routes, shows serotine and barbastelle activity on the edge of the woodland

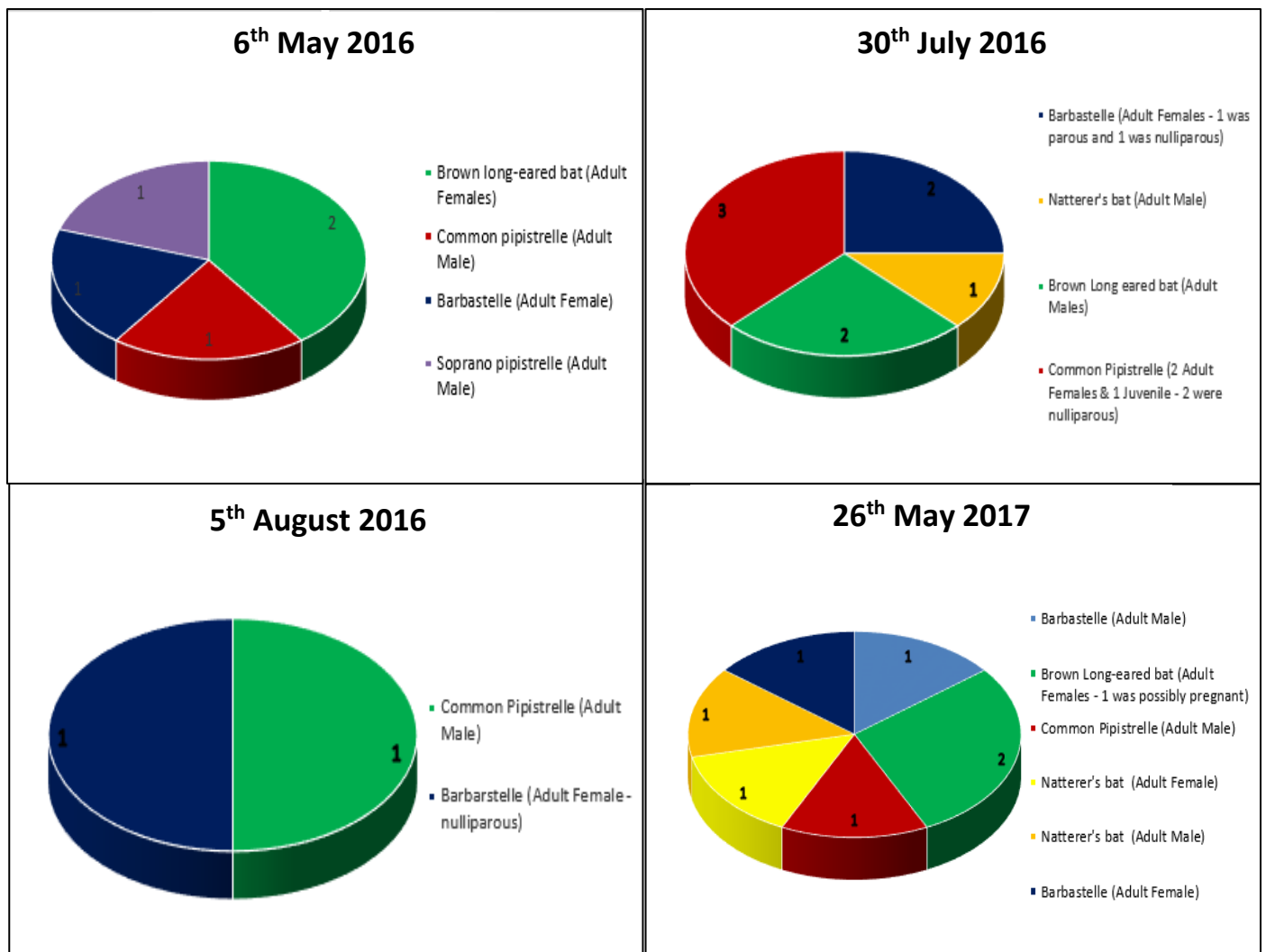


Trapping surveys - Four trapping surveys were carried out during the project (Figure 7), where mist nets were placed along and near rides where the transect surveys results had indicated high levels of activity. Trapping in the top, middle and bottom section of the woodland was scheduled to take place during 2016 and 2017 (see Figure 7 for dates), but unfortunately unsuitable weather conditions meant trapping sessions were cancelled and were not rescheduled. Trapping started at sunset and finished around one am in the morning. A harp trap with an acoustic lure, emitting woodland bat calls was used on the 30th of July. This was placed within a compartment interior, where high levels of bat activity were recorded on the static detectors. This trap caught five out of the eight bats caught during the evening.

Specially trained and licenced bat workers extracted the bats out efficiently and quickly. This advanced survey technique provided the opportunity to catch bats and identify them in the hand. This is a very helpful exercise as some bat species, like myotis bats have calls that are similar and therefore need to be seen close up to identify to species. The trapping survey also gave an opportunity for volunteers to assist in this activity and gain a rare chance to see their local woodland bats in close-up.

The sex ratio of bats caught (not possible to determine by echolocation call analysis) reveals information about the woodland. Bat species caught were brown long-eared bat, barbastelle, Natterer's bat, common pipistrelle and soprano pipistrelle (Figure 6). Female bats being present in a woodland can be a good indicator that a woodland contains good quality habitat and therefore has potential to be suitable for a nursery roost supported by good foraging. This is because females have higher foraging quality demands than males, particularly before and during the breeding season from mid-May to mid-August. The trapping results shown below reveal a good mix of the sexes, with females showing evidence of having given birth or being pregnant, indicating the suitability of Swanton Novers NNR for supporting breeding populations of bats.

Figure 7: Trapping survey results from 2016 and 2017



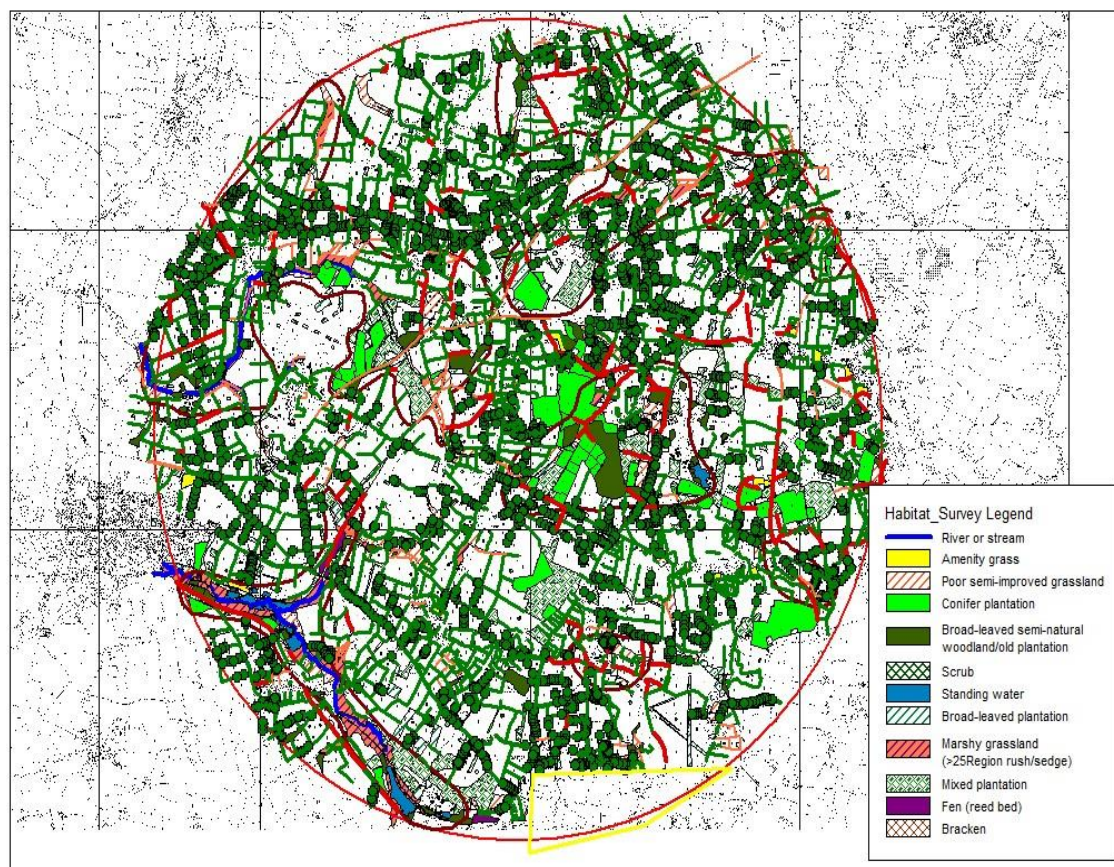
2.2 Wider species surveys/monitoring data

Throughout the project, an attempt to address the data deficiencies that exist at the site was carried out. As well as carrying out a wide range of surveys on biological and physical attributes at each of the bat monitoring points (with a particular focus on ten of these), we have also completed surveys on the woodland as a whole and, in the case of one survey, out to a distance of 5km radius.

Volunteer surveyors carried out surveillance work on butterflies (National Butterfly Survey transects), vegetation (coppice surveys, National Vegetation Surveys of the entire wood and of the wide rides), bryophyte surveys, lichen surveys, beetle surveys, fungi surveys, bee and wasp surveys, soil fauna surveys. In total, these surveys created many tens of thousands of data points for the wood (i.e. individual records relating to specific locations within the wood).

In order to better understand how the woodland fits within the context of the wider landscape, volunteers assisted paid specialists to carry out a broad habitat (Phase 1) survey out to 5km from the wood. This survey paid special attention to features suitable for foraging and roosting bats and provides a vivid picture of the habitat linkages and gaps that exist in the surrounding countryside (Figure 8).

Figure 8 Extended Phase 1 survey out to 5kmNNR



Vegetation surveys were carried out at all of the bat monitoring points to measure a wide-set of attributes that help us to understand why bats use the woods in the way they do. Surveyors created a 25m² grid with the bat monitoring tree at the centre, before breaking the grid down into 1m² sub-sections. In each of these, the surveyors mapped out every standard tree and coppice stool, as well as the ground layer. The pH and soil moisture was measured at the southwest corner of the overall grid. Surveyors then measured: the number of coppice stems on each coppice stool, the height and diameter at breast height (DBH) of each standard, as well as noting whether each tree was stag headed or supported bat roost features.

In addition to general vegetation surveys at each of the points, lichen, bryophyte, and bird surveys were also carried out by volunteers. These used a novel methodology that, having been successfully tested over the course of this project, can be rolled out more widely. Some detail is given below.

At ten of the bat monitoring trees, surveys were carried out to build up a more complete picture of invertebrates in the immediate area around the trees. Pit fall traps were arranged in a line running north from the bat tree at each point and flight interceptor traps were run in the canopy to sample canopy invertebrates. Actinic moth traps were also positioned just outside each of these 25m² grids.

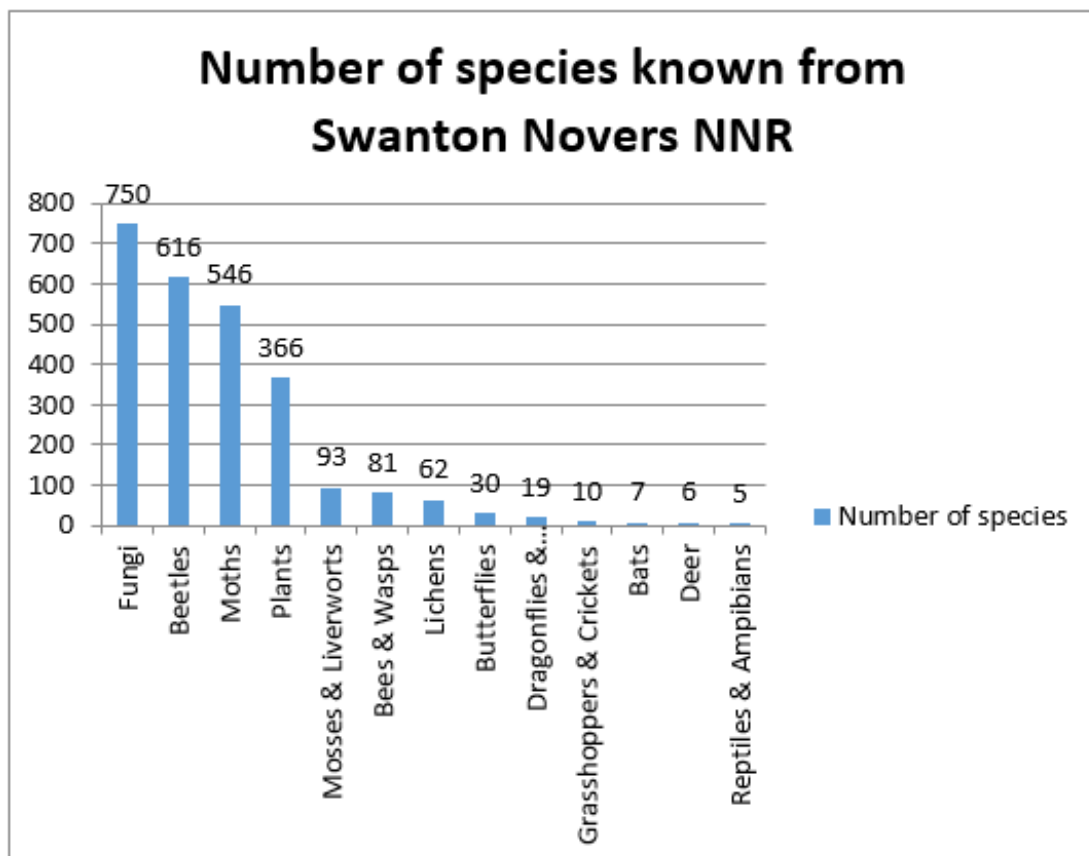
In total, the pitfall traps resulted in an additional 2,784 beetle records for the woods and included one Notable A and four Notable B species of conservation significance. The sample also included a

new species for Norfolk. All of these were from woodland interior areas, a habitat that had been given a little attention before. Molluscs were also identified from the pitfall samples. The flight interceptor traps yielded 132 beetles, all of which were identified to species level. These results are novel in an English Woodland context and will provide valuable baseline data for future woodland studies.

As well as carrying out surveys of the bat monitoring points, the volunteers also carried out or assisted staff in carrying out larger scale surveys across the woods, including: water chemistry surveys, butterfly transects, bee surveys and vegetation community mapping (National Vegetation Classification surveys of the entire woodland area and more detailed surveys of the wide rides). These data have helped to build a greater understanding of the woods and will be invaluable when planning future management of the NNR.

The collated dataset has provided a clearer picture of the incredible importance of the woodland for the variety of biodiversity it supports. The species records include records on fungi (750 species), beetles (616 species), moths (546 species), vascular plants (366 species), non-vascular plants (93 species), bees and wasps (81 species), lichens (62 species), butterflies (30 species), dragonflies and damselflies (19 species), grasshoppers and crickets (10 species), bats (7 species), other mammals (18 species) and reptiles and amphibians (9 species). (Figure 9).

Figure 9 Number of species found in Swanton Novers NNR



2.3 Monitoring recommendations for woodlands in general

- **Any experimental design will need to consider the placement of detectors at height.**
The results from the project shows that the height of the detector has a significant impact on the activity recorded for some species, like barbastelle. If the results collected in a particular area prove good for barbastelle, or if understanding their use of an area is especially important, then consideration could be given to the ground survey being supplemented by monitoring at height.
- **Ideally monitoring should commence in April and continue until September.**
Surveying for bats in a woodland environment is dependent on surveyor availability, effort and equipment availability. **If possible monitoring through the autumn and winter months should also be considered**, as some bat species are active throughout the winter if nights are relatively mild and their prey available. Bats have different habitat requirements in summer and winter. Survey data relating to the winter period can, therefore, be critical to building up an understanding of how important different features of a woodland are.
- **To monitor the activity of open or edge species like noctule and serotine, a transect survey along woodland edges and rides is recommended.**
Though noctules roost in trees, as an open species, they forage over open habitat and fly high above the canopy so are not easily picked up by static detectors.
- **Survey and monitoring schemes for all species groups (not just bats), within woodlands should include coverage of the interior areas, not just the rides and glades.**
For bats, the dataset from the static surveys showed that there is less activity in rides and for all species recorded there was more activity in the compartment interiors. **It is therefore recommended that future monitoring using static broadband detectors should include woodland compartment interiors** to gain a better understanding of bat activity. This has not been standard practice up until now. For other taxon groups, most notably invertebrates, Notable A and Notable B species of conservation significance were found in woodland interiors at Swanton Novers NNR.

It is worth noting that although more activity is recorded in the canopy, the results show us that the detectors are still picking up bat activity at ground level. So static detectors left at ground level can record bat activity for all species, albeit on a lesser scale. As we are now providing or updating guidance to woodland managers on how to monitor for bats, we will ensure this flags the need to be aware that for some species, like the barbastelle, there is likely to be more activity in the canopy. For barbastelle, the ground data should be treated with caution when trying to interpret the results and understand barbastelle activity in a woodland environment.

Further details on how to monitor woodlands for bats are available in the following documents- ***Recommendations for surveying bats in managed woodlands*** and ***Finding out more about how bats use your woodland***.

3.1 Species Association

It is important to note that multi-layered taxonomic studies such as this have not been attempted before in UK woodland interiors and the resulting data is unique and offers a valuable resource for students studying the effects of changes to our woodlands e.g. from atmospheric nitrogen deposition or climate change.

The project has tested the feasibility of using indicator species to indirectly assess a woodland's potential for bats. By developing a standardised means of collecting data on a wide range of taxonomic groups, it was hoped that we may be able to identify proxy indicators that could be used to model for the presence of bat species that would otherwise be hard to detect using conventional methods. Social classification systems are generally based on individual species groups. For example, the National Vegetation Classification system is a sociological classification system based on plant associations/groupings that consistently occur across the UK. By surveying for the easier, to detect, more showy species in an association, it may be possible to predict the likely presence of more cryptic components within that grouping.

3.2 What we have learnt

The data collected at the bat monitoring points to date has shown that, at present, it is unlikely that the use of proxy indicators will provide a more cost effective, less technically demanding and reliable means of modelling bat presence at a fine-spatial scale. Widely occurring, abundant species form the bulk of records at each of the bat monitoring points. Since these species tend to be able to tolerate a wide range of environmental conditions (the reason for them being widespread and common) they are generally poor indicators of scarcer species with more constrained habitat requirements. Whilst scarcer species would potentially be better proxy indicators, they tend to occur in smaller numbers. This means that any survey designed to detect them would require a high sampling rate or rely upon more targeted methods. Such species are also more likely to require specialist skills to identify them, adding a further complication to the process. However, it is worth noting that novel approaches in the future may resolve this issue e.g. DNA bar coding. It should be remembered that the data collected in this project relates to a single woodland. It is therefore recommended that, in the future, broad taxonomic surveys should be extended to other woodlands in order to determine whether, at a broader spatial scale, it might be possible to identify suites of species that might act as proxy indicators for bats.

Through testing this approach, we have developed a set of quick, repeatable methods for carrying out broad taxonomic surveys. More information can be requested from the local Natural England Office at Wolferton, Norfolk. In addition to exploring the possibility of using proxy indicator species to model for bats as part of this project, these methods will enable woodland managers to gather more comprehensive data on their woodlands, leading to a more holistic approach to management; rather than the tendency to target management to the most obvious species.

In considering the species data in conjunction with the historic management data that was digitised, we have been able to develop a better understanding of how different management techniques affect the species, which live in the woods. This has been explored most intensively for bats.

The combined data have done much to improve our understanding of how the physical conditions, management and species present in the wood are intrinsically linked. For example, through examining bat data collected during the project in conjunction with management carried out, we have demonstrated there is significantly more common pipistrelle activity in active coppice with a dense understory, than compartments managed as high forest with a sparser understory. As well as demonstrating the importance of active coppice for this species of bat, this also has implications for deer management within the woods.

4. Storage and use of data

4.1 Storage and use of data

Over the course of the project, 4,314 miscellaneous species records were entered onto a Mapmate database and has been made openly available, via the county records center. In addition, a vast quantity of more complex historical data was analysed and mapped using GIS applications (MapInfo or ArcGIS). These included: a lily of the valley survey (1993-4), common bird census surveys (1988-2010), coppice vegetation surveys, National Vegetation Surveys and water hydrochemistry data. Some data was neither suitable for transferring to maps, nor for entry into the species database e.g. historic site management records. Instead, these were entered onto a bespoke spreadsheet. All of these data have been made available free of charge and wherever possible, the records have been provided to local and/or national data network managers. The data in its more accessible format will inform the next Natural England management plan for Swanton Novers NNR and when needed has been shared with woodland managers to advise them on landscape scale monitoring and onsite woodland management. In its accessible format the data is also ready for a Masters or PhD project, to further study species associations and the history of management on the reserve. A full set of records will be maintained at the Natural England site office.

Once all of the species records had been checked and digitized, a quick search revealed that there was a huge spatial data bias, with almost all records for the woodland pertaining to the network of wide rides; the easiest parts of the woods to access and record in. In addition, it became clear that almost all of the records related to the zone from ground level up to head height. Once again, the zone easiest to survey. When considered in a three dimensional context, this meant that almost all of the species data relating to the woods relates to approximately 0.05% of the site as a whole – the non-wooded part. This discovery demonstrates the massive importance of the work carried out during this project to survey the interior areas of the woodland in a standardized, repeatable manner. In seeking to address this data gap, the project has identified and tested a variety of survey methods, which will be used to build a better understanding of the NNR. (See ***wider species surveys/monitoring data*** section for more information).

The collation and data entry of all recent taxa data (moth, beetle, other invertebrates, plants and bird data) have continued to be uploaded onto the Mapmate database. Data entry to this database will continue for the foreseeable future and will be undertaken by volunteers who have been trained on how to use the database.

Approximately 80,000 bat records, including data from four trapping surveys and from thirty-four transect surveys, have been collected by this project. Due to the enormous amount of data gathered, the most efficient way to store the data has been on an external hard drive in a format, in this case, of an Access database, which is accessible for any research questions that are identified as a result of this project.

All recent data collected during the project in its more accessible format will be shared with the Norfolk Biodiversity Information Service (NBIS), the Local Environmental Records Centre for Norfolk at the end of the project. This will then feed into the National Biodiversity Network Atlas which acts as a data warehouse allowing all records to be displayed on a map in a format that will allow a better understanding of various species distributions.

4.2 Recommendations for storage and use of data

- **A scoping exercise of any existing data should be carried out.**
Once completed, a suitable record storage database should be sourced and designed to ensure that the data is in an accessible format. Volunteers and staff should be trained up to carry out data entry to ensure any recent data is uploaded to the database regularly.
- **Monitoring of a woodland by different wildlife surveyors is best implemented by selecting long term monitoring points throughout a woodland.**
These monitoring points should cover a range of different habitat types, and include the woodland interiors, which are not usually surveyed. A range of woodland taxa including vegetation cover can then be surveyed at all the long term monitoring points. Though dependent on surveyor availability, monitoring of these long-term points should be repeated over time in order to build up a more complete picture of distribution and monitor changes within the woodland. This could be highly valuable in climate change studies, as well as measuring how woodland changes affect bat activity and other biodiversity over time.
- **Develop a reasoned, evidence based protocol for assessing future surveillance needs within woodlands which can then direct survey and monitoring work by visiting specialist groups and researchers.**
The data from the wider species monitoring supports the need for more targeted survey and monitoring work on less studied species and for better spatial targeting of surveillance work within the woods.

5. Working with volunteers

5.1 Project volunteers

To collect the vast amount of data necessary to give us a better understanding of how bats and other wildlife use a woodland, required assistance from volunteers. During the lifetime of the project, 95 volunteers were involved with different aspects of the project. The volunteers were recruited through events like bat walks (offsite and onsite), at community events (Wild about Swanton and Wild about Norfolk), via word of mouth through NE volunteers and the project's volunteers and from other wildlife organisations like the Norfolk Wildlife Trust.

- 27 bat volunteers were recruited from the local community, the surrounding parishes and from further afield. This total included five experienced licenced bat workers who provided their expertise to the project and gave their support when trapping and tracking. The volunteers core focus was to help the project team monitor the woodland using a suite of bat survey techniques (transect, static, trapping and radio tracking), while some assisted with the big task of analysing the call data after it was collected. This core group of volunteers also supported bat walks, and other engagement activities like writing articles for the newsletter and the Swanton News blog page and carried out the understorey vegetation survey, to collect data about the understorey structure around each monitoring points.
- 13 additional volunteers gave vital support towards the project's public engagement element; providing specialist information about other wildlife using the woodland at events like the project's Community Day event.

- An additional 55 volunteers were involved in a variety of different tasks that benefited the project. This involved practical management tasks, like holly removal, erection of electric fencing to control deer browsing, strimming, equipment maintenance and ride maintenance. While other tasks included monitoring of Swanton Novers flora and fauna to collect data that would allow us to look more closely at species association, data entry onto an accessible database such as MapMate and the digitisation of historical management records and wildlife survey data, both past and present.

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In total, the volunteers contributed 928 volunteer days towards the project.



Swanton Novers volunteers © Sonia Reveley

Volunteers were encouraged to develop their skills and assist with public engagement activities like bats walks, while other volunteers who came to the project with some experience were encouraged to lead on some events and workshops. Other volunteers contributed to the newsletter, blogs and website providing an insight into the work in which they were involved. Getting volunteers to become further involved with the project and expand their engagement skill set was successful, as it allowed volunteers to gain ownership of aspects of the project, thus giving the feeling of being part of something that would raise awareness and benefit their local woodland.

5.2 Woodland and Wildlife Champions

During the project, ten woodland champions were selected. It was important to handpick a selection of volunteers to become champions because:

- I. it was important to acknowledge their valuable contribution to the project and the show our appreciation for their efforts and;
- II. to have a selection of champions with an extensive range of skills that will contribute to the legacy of the project and continue to raise awareness about the importance of the nature reserve.



5 of the project's Woodland Champions © Jamie McDonald

5.3 Recommendations for working with volunteers

- **If a local group of volunteers already exists, then contacting them is recommended.** Utilising existing skills is an excellent way to get any monitoring project off to a good start. Some of these volunteers will be able to provide support to new volunteers.
- **If the project is funded, try contacting those who have provided letters of support for the project.** This potentially could provide another pool of volunteers for the project.
- **Work closely with specialist wildlife groups and establish a good relationship with them.** Many members of these groups are happy to volunteer their time and help with any public engagement events, especially if it allows them to promote their work and share their knowledge.
- **Establish a good relationship with a local wildlife group contact** who may be happy to promote and recruit on your behalf at the beginning of a project. This was established in the second year of this project through one of the woodland champions.
- **Providing a short training recap session before each survey** is useful as many volunteers needed refresher training.
- **Provide continuous support to the volunteers and make them feel valued for the work that they have carried out.** Acknowledge their hard work through emails, newsletters, blogs, and articles.
- **When selecting woodland champions, it is recommended that volunteers have a range of skill sets that will be able to support the legacy of the project in a variety of ways,** not just through monitoring. Volunteers should be approached and asked if they would be happy to take on the important role of being an ambassador of the woodland beforehand.

6.1 Engaging the community

Community engagement was one of the project's main core objectives. Four onsite bat walks were delivered to engage with a wide range of people and raise awareness about the Swanton Novers heritage and the wildlife it supports (in particular bats). These four walks provided opportunities to recruit new volunteers and show attendees how to use a portable bat detector and how to identify a bat by its call. An additional four bat walks were delivered off-site to reach an audience further afield. These walks covered a range of different habitats, from a nearby ancient woodland managed by the local wildlife trust to the Norfolk Broads. This allowed the project to achieve its aim of raising awareness about bats.



Bat walks at Swanton Novers National Nature Reserve @Sonia Reveley

Three community events were held at Swanton Novers with the emphasis on engaging with the local community, especially young families. The first event was held in August 2016 in the woodland to take advantage of the woodland natural resources available at that time of the year.

The second event took place at the local village hall in May 2017 to coincide with the flowering of the bluebells and other woodland flowers. The event was called the Wild about Swanton Community and Wildlife Day and was packed with activities and display stands, including live bats and harvest mice. Conservation and wildlife groups like the Fellbeck Trust and the Norfolk fungus group took part, as the event was a perfect platform to highlight the work of the project, while giving wildlife enthusiasts the opportunity to showcase their work and engage with the local community. Two walks (a woodland and bird walk) on the day were led by Natural England and the North East Norfolk Bird Club. These walks gave participants the opportunity to improve their knowledge and for some even the chance to use an endoscope to look into a tree hole.

The poster is for 'Wild about Swanton Community & Wildlife Day'. It features a blue background with illustrations of bats, a robin, mushrooms, and a tree. The text provides details about the event on Saturday 6th of May 2017, from 10.30am to 3pm, at Swanton Novers Village Hall. It is free of charge and encourages people to come along to learn about fungi, moths, bats, and birds. Contact information for Sonia Reveley is provided, along with a note about fundraising for the Village Hall and the Swanton Novers National Nature Reserve Woodland Bat Project. At the bottom, there is a list of exhibitors and displays, including the Swanton Novers Woodland Bat Project, Bat Conservation Trust, and Norfolk Barbastelle Study Group, among others. Logos for the Norfolk Wildlife Trust and The National Lottery are also present.



Wild about Swanton © Sonia Reveley & Jan Collins



Wild about Swanton Woodland Walk © Jan Collins

The third event took place at the local village hall during spring 2018. Volunteers and local communities were invited to this event and were given an overview of the project's findings. The event also allowed the project to show its appreciation to all the volunteers who came along and thank them for all their help. Volunteers were able to socialise and share their experiences. In addition, attendees were given the opportunity to see some live bats close up and attend a woodland walk in the afternoon. This walk was led by Natural England and covered Swanton Novers cultural heritage and woodland management practices.



**SWANTON NOVERS NATIONAL
NATURE RESERVE**
WOODLAND BAT MONITORING PROJECT

SATURDAY 7TH APRIL 2018
09.30 AM – 16.30 PM
SWANTON NOVERS VILLAGE HALL
57 GILES ROAD, SWANTON NOVERS, NORFOLK, NR24 2RB
FREE

Bat Conservation Trust (BCT) and Natural England (NE) will be running an event on Saturday 7th of April 2018 at the Swanton Novers Village Hall to share our findings from the Heritage Lottery Funded woodland bat monitoring project and talk about the work Natural England have carried out on the reserve. There will be bats to look at, followed by lunch and a woodland walk in the afternoon (see programme on the 2nd page).

http://www.bats.org.uk/pages/swanton_novers_woodland_bat_project.html

We would like to invite all our volunteers, previous participants and members of the local community to this event.

Places are limited so please email Sonia Reveley at SReveley@bats.org.uk or ring her on 07788 226528 to book yourself a place at this event.

RSVP BY TUESDAY 13TH OF MARCH 2018






EVENT PROGRAMME

THE SWANTON NOVERS BAT PROJECT
SONIA REVELEY, BCT VOLUNTEER COORDINATOR

SWANTON NOVERS NATIONAL NATURE RESERVE
JEREMY SPILLING, NE WARDEN

THE PROJECT RESULTS
SONIA REVELEY, BCT VOLUNTEER COORDINATOR

COFFEE BREAK

OPPORTUNITY TO TALK TO JANE HARRIS ABOUT HER BAT CARE WORK

WILDLIFE MONITORING ON A NATIONAL NATURE RESERVE – 10 YEARS OF SERVICE
ROBERT BAKER, PREVIOUS SWANTON NOVERS NNR SEASONAL WARDEN

VOLUNTEERING ON A NATIONAL NATURE RESERVE
KEITH FOX, NE AND SWANTON NOVERS WOODLAND BAT PROJECT VOLUNTEER

FUTURE MANAGEMENT PLANS
JEREMY SPILLING, NE WARDEN

BUFFET LUNCH

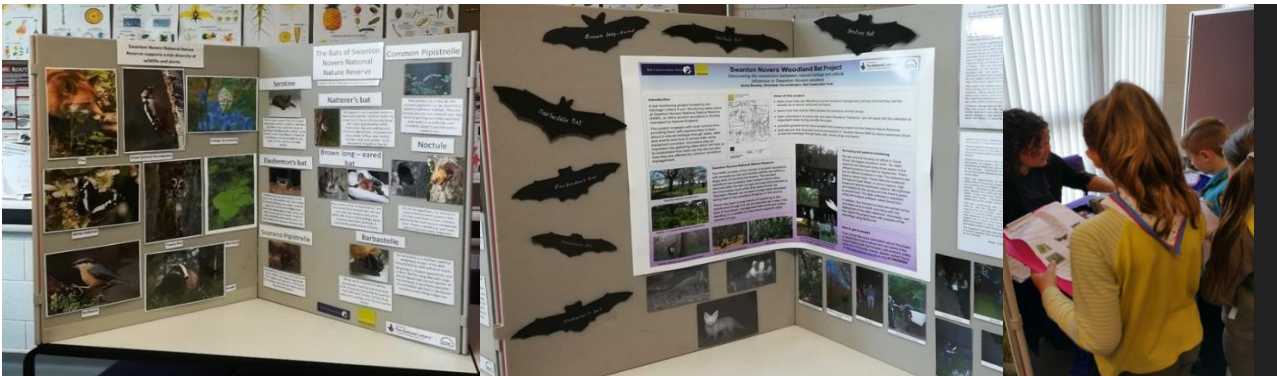
WOODLAND WALK WITH NATURAL ENGLAND & JOHN DEW
A GUIDED WOODLAND WALK IN SWANTON NOVERS NATIONAL RESERVE. THIS IS A GREAT OPPORTUNITY TO GAIN ACCESS TO A SPECIAL WOODLAND. PLEASE WEAR SUITABLE CLOTHING AND WELLIES AS WE MAY WALK ON UNEVEN AND WET TERRAIN.





The project team also attended a well established conservation and wildlife fair called Wild about Norfolk (<https://www.eastonotley.ac.uk/wild-about-norfolk/>) during 2016 and 2017. This allowed further engagement with a broader range of people and a chance to raise awareness about the reserve and the project. The event attracts over 40 exhibitors and between 1,000 to 2,000 visitors. It offers families the opportunity to learn about the impressive work carried out by local groups and national organisations, who protect, enhance and restore Norfolk's wildlife and landscapes.

Approximately two hundred and ninety young people (brownie, girl guides and scout groups), families and adults directly engaged with the project's display stand, which contained bat activities, videos showing bats emerging from trees roosts and quizzes. This proved very popular with the brownies, scouts, and families.



Wild about Norfolk © Sonia Reveley

Furthermore, a monthly blog called the Swanton News sits within the web pages and contains a table that highlights the progress made by the project. The table includes links to information about the project's activities, photographs from the reserve, drone footage of the woodland canopy, camera traps photographs, information about the project's ten Woodland and Wildlife Champions and the images taken by photography competition winners. Newsletters and blogs were all shared with Norfolk schools, scout groups, and the project volunteers. In total 861 visitors have visited the Swanton Novers website during the project, viewing the pages 1257 times. All social media posts on Twitter and Facebook received 500 + likes.

A photography competition called 1, 2, 3 Snap your Woodland was also launched during the second year of the project, with the aim of engaging with the local community and encouraging them to reconnect with their local woodland.



Age group 6 - 18 winner - Woodland plants and fungi

The project was also dedicated to engaging with the next generation and worked closely with a youth group called the Dersingham Bog Hoppers. This group was involved in the project from the beginning, and members were given the opportunity to learn about plants, bats, small mammals, and mammal tracking during specially developed field study activities. Seven sessions were delivered to the Dersingham Bog Hoppers youth group over the duration of the project, and eighty-eight young people and thirty-eight parents were engaged. As a result of these sessions, one young member became interested in small mammals and started rearing harvest mice. At the Wild about Swanton Community and Wildlife Day in May 2017, he brought his harvest mice display, providing one of the centrepiece displays for the event.



Dersingham Bog Hopper © Vicky Etheridge

The project also engaged with a local school and delivered a suitable class session to a group of twenty-nine Year One students. To fit in with the class curriculum requirements, the teacher was keen to ensure that habitats and life cycles of bats were included. Subsequently a suitable session was developed and was presented to the class. This included a reading session, (where the book of choice was Bobby the brown long-eared bat, which included the habitat requirements and life cycle of a brown long-eared bat) and an appropriate bat activity.

The project also worked closely with five additional schools who had heard about the project through the Newsletters, the website and the volunteers. Five sessions were delivered to five schools in Norfolk covering the habitat requirements of our UK bat species and their life cycle. In total 227 pupils and teachers were engaged through these sessions, which included activities that the pupils could participate in. A further 102 students were engaged at a local school careers day.



School visit © Sonia Reveley

During the winter months, sixty-five brownies and beaver youth group members and their leaders were introduced to the project. The talks contained a summary of the work carried out by the project's volunteers and gave an introduction to UK bats, with a particular focus on the habitat requirement of these bats.



Brownie and Beaver winter talks © Sonia Reveley

Local landowners and woodland managers visiting Swanton Novers reserve during 2016 and 2017 were kept informed about the project. In many cases, best practice and lessons learnt from the project were shared and used to advise future management and monitoring practices. Towards the end of the project, a Natural England's Senior Reserves Manager provided an update on the project to share best practice and lessons learnt at the inaugural National Nature Reserves Science Conference to fifty-five National Nature Reserve managers.



Woodland management events © Ash Murray and Natural England

6.2 Recommendations for engaging communities

- **To engage with the local community use a village hall as the hub.**
Events starting in the woodland were not as popular as the ones that began in the village hall. It is a more effective way of connecting with local communities. Coffee mornings at the village hall were found to be an excellent way to drum up some support and promote an event.
- **Newsletters were useful for engaging with a wider audience particularly school groups.**
They can also be used for promoting engagement events.

- **When possible, articles in the local parish magazine is an excellent way to promote local event.** Also, establishing contact with adjacent parish councils improves the chances of sharing the aims and objectives of the project to the communities nearby.
- **Work with other wildlife and conservation organisations.**
Sharing expertise and knowledge will mean a range of different activities can be offered to families and local communities when delivering any engagement events. Events will also be promoted on their website, increasing the chances of reaching a new audience.
- **Ask volunteers to develop display stands, activities, and training workshops.**
Like above this will ensure different activities are offered to participants while allowing volunteers to feel involved and valued.
- **Bring live animals like bats and small mammals to community events.**
However ensure that the appropriately experienced and if necessary licenced individuals who understand the correct protocols are used for engaging the public with live animals. Giving young people and adults the opportunity to see wildlife close up will provide them with a better connection with something they wouldn't usually see.

7. Conclusion

Working with volunteers is vital for a woodland like Swanton Novers National Nature Reserve. To gain a better understanding of how our woodlands are being used by a range of species and how they are changing requires a citizen science approach to monitoring. Volunteers will feel involved and therefore better connected to the environment. The skills volunteers will learn along the way will contribute to the legacy of the site but will also improve their life chances such as employment opportunities, their confidence and wellbeing. These volunteers are the safe pairs of hand for the future of our most treasured habitats and for helping that all important sense of place and culture.

From the Swanton Novers project, the dataset collected has contributed to improving our understanding of how bats and other biodiversity use a woodland. However, it is a site-specific project and the first time a bat monitoring project of this scale has been carried out and also the first time that multi-taxa monitoring protocols for woodland interior have been designed and applied. This has revealed the large gap in our understanding and appreciation of the importance of the woodland interior for the woodland wildlife it supports; some of which will be restricted to this habitat. The knock-on effect of this is to consider the interior with a greater awareness when looking to future management. It also highlights the need to have a strategic view of how those who wish to monitor a range of taxa in woodland should be directed to collect such data from across the habitat niches available.

The data from this project has provided a lot of information about bat use, in particular raising the importance of the canopy as well as woodland interiors. However, research into how bats are using specific elements of the woodland would be very useful in gaining a better understanding of their behaviour, such as the feeding buzzes recorded being analysed to allow a greater definition of where the activity observed was related to feeding.

It is hoped that this project will provide a foundation upon which greater awareness and understanding can be developed which will result in the vitally important remaining UK woodland being assured of maintaining the best possible future for the wildlife it supports.

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