

# The State of Britain's Dormice 2023

people's  
trust for  
endangered  
species

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- ▶ Hazel dormice have undergone a long decline in Britain and monitoring of populations in established woodlands shows a continuing decrease in abundance. Between 2000 and 2022, the National Dormouse Monitoring Programme (NDMP) shows the population has fallen by 70 per cent.
- ▶ Dormice are locally extinct in 14 English counties within their historical range; in a further six they are known only from reintroduced populations.
- ▶ Under IUCN Red List criteria, dormice are currently assessed as 'Vulnerable' to extinction in Britain, but recent work suggests a higher risk classification of 'Endangered'.
- ▶ The NDMP collects data from hundreds of woodland sites, but monitoring in a greater diversity of habitats where dormice might be present is needed, using new as well as established monitoring techniques, to gain a more complete picture and ensure the future of hazel dormice in Britain.

In two-hundred years, Britain has lost about half its natural wealth. Thirty-eight per cent of species have declined since the 1970s, and a quarter of native mammal species face extinction<sup>1</sup>. One of these is the hazel dormouse, *Muscardinus avellanarius*.

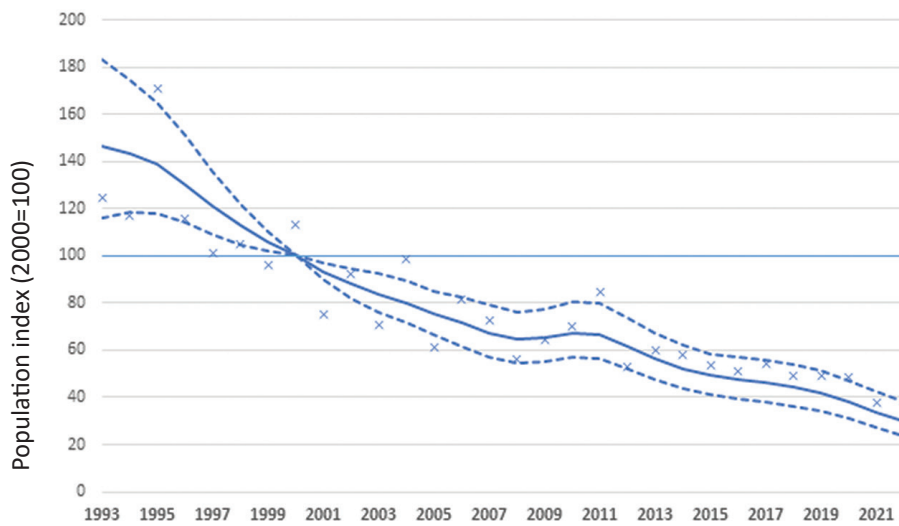
At the start of the last century, native populations of hazel

dormice were present in all but two counties in England and Wales: Norfolk, in the east of England, where records were of reintroduced animals, and Anglesey, in north Wales, where there were no records. In the following hundred years, native populations are thought to have become extinct in 20 English counties<sup>2</sup>, based on the absence of records in the last 20 years;

in six of these, they have been reintroduced. In Wales, dormice retain much of their historic range. Other than a single native population in Cumbria, and reintroduced populations, the species is only found south of a line between Flintshire and Suffolk.

Before 1980, it's estimated that fewer than ten scientific papers





**The population change recorded at NDMP sites between 1993 and 2022.** The underlying trend, smoothing out fluctuations, is shown by the blue solid line and is calculated relative to the index in 2000, given a value of '100'. Statistical confidence limits are shown by the dashed lines (95% CI). Annual estimates (crosses) show the year-to-year variation around the smoothed trend.

on dormice were published in Britain<sup>3</sup>, but beginning in the 1980s (largely through the work of Pat Morris and Paul Bright, who were also instrumental in setting up the NDMP), dormouse ecology and conservation became better understood. Dormice are now recognised as a flagship species for the management and conservation of woodland habitats. They do well in species-rich, structurally

diverse wooded, shrub and scrub habitats that are important for many other woodland species, such as nightingales, chiffchaffs, and many butterfly species.

Dormice are typically active from mid-April to late October, moving between the scrub layer, understorey, and canopy to feed on blossom, insects, fruits and seeds. There are few estimates of population density – the number

in a given area – in different types of habitat, but it's thought that around four-fifths of dormice in Britain are in deciduous woodlands<sup>4</sup> broadly similar to NDMP sites. NDMP trends of nest box counts are the best evidence we have of how dormouse populations are changing. But gaps remain in our knowledge.

Optimal dormouse habitat is widely considered to be early successional woodland, a mix of new growth and established trees, which coppiced or traditionally managed woodland mimics. But dormice are found in other wooded habitats as well and may be less strict habitat specialists than was once thought<sup>5</sup>. They are found in scrub, coniferous plantations, hedgerows, and on roadside and railway verges, and appear more adaptable than was originally recognised. However, little, if any, monitoring is carried out in these habitats and it's unknown how the population is changing outside woodlands.

### Current conservation status and population trend

Hazel dormice are protected in law under the Conservation of Habitats and Species Regulations 2017, and Wildlife and Countryside Act 1981, as amended.

In 2020, they were recognised as 'Vulnerable' in Britain under IUCN Red List criteria<sup>3</sup>, based, in part, on NDMP data from 1993 to 2014. The criterion used was a decline of between 30 and 50 per cent in the most recent ten-year period (i.e., 2005-14). More recently, using data up to 2021, a separate study has suggested this underestimates the risk and that the population should be classified as 'Endangered'<sup>6</sup>, with a decline greater than 50 per cent in ten years. The authors of the new study write, 'contemporary

## What does the population index measure?

The population index is a relative measure of dormouse abundance at sites from year to year. It estimates whether the population is larger or smaller than a baseline value, but doesn't say how big the population is, only how it's changing. It looks at a sample of sites and, as with any study, there are limitations in what it tells us about the population more widely.

The index is estimated using counts of dormice (excluding litters) between May and October at sites with at least 20 nest boxes, surveyed for five or more years. The number of sites each year has varied from fewer than 100, prior to 2001, to between 250 and 350 sites each year since 2011. In total, 503 sites have contributed data.

Estimates for each year (crosses) and a smoothed trend (solid line) are produced using a Generalised Additive Model, taking 2000 as the baseline year (=100); 95% confidence limits are shown by broken lines. Counts of dormice since the mid-1990s show a steady decline. Since 2000, the smoothed trend has fallen by 70 per cent, equivalent to an average annual decrease of 5.3%.

losses are underestimated, as degraded populations are accepted as norms without historical context ... Prioritization based on ... chronic declines might direct more effective action towards species conservation at a point when their recovery is more attainable.'

The NDMP currently measures changes in dormouse abundance at woodland sites nationally. It estimates an 'index', or relative population size, each year from counts of dormice in nest boxes in England and Wales between May and October. The long-term trend in the population index is shown in the graph on page 2.

The population index is a measure of the average (pre- and post-breeding) population in each year. The smoothed trendline evens out annual fluctuations to show the underlying change. In 2022, the measure was 30% of the baseline figure in 2000, i.e., it had declined by 70% in 22 years.

### Long- and short-term trends

Comparing the long-term population trend with the change more recently can give an indication of whether the trend is



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changing or not. Forty individual NDMP sites had sufficient data to estimate a 20-year trend, and 185 to estimate a five-year trend (up to 2021). The chart below shows the proportion of sites for which the population trend increased or decreased (shown in orange/yellow and pale blue/blue respectively). The size of the change was not considered, only its direction, either up or down. Changes labelled 'increase' or 'decrease' are those that are likely to represent true changes in the population (i.e., are 'statistically significant'), while those labelled as either an upward or downward trend fall below this standard

and we can be less confident about them.

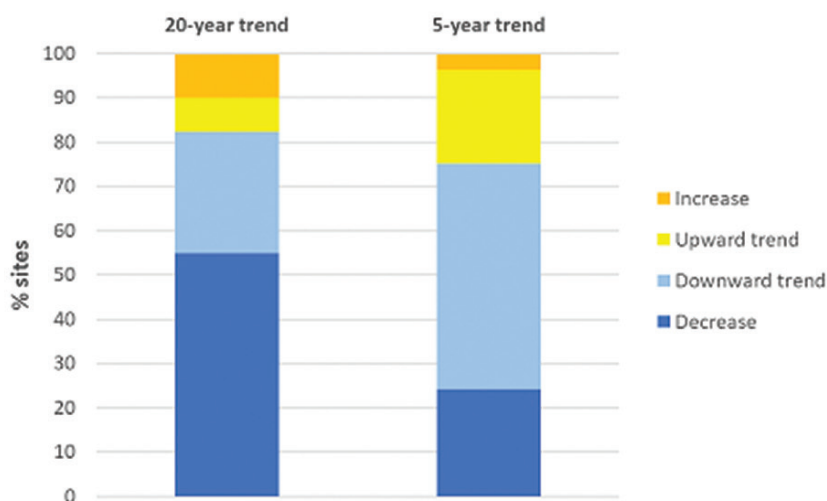
Long- and short-term trends are broadly similar, most sites show declines, but fewer sites, proportionately, show a downward trend or decrease over the recent, five-year trend. Twenty-four per cent compared with 55 per cent show a (statistically significant) decrease over the short- and long-term trends respectively, giving a measure of hope that the decline isn't worsening.

## Current conservation efforts

### Landscape restoration

Over the past two decades, numerous projects have sought to restore dormouse habitat and to connect fragments of habitats that are isolated. This includes work in Warwickshire, as part of the Dunsmore Living Landscapes Scheme, in north Wales, and three projects funded in part by PTES.

The Wensleydale Dormouse Project<sup>7</sup> (2018-21), in Yorkshire, created a 9.5 km stretch of dormouse habitat around a reintroduction site. The condition of more than 12 km of hedgerows was assessed and around 3 km, together with over 4 ha of



**The percentage of sites at which the population index increased or decreased over the long- or short-term linear trend (up to 2021).** Details of the analysis are given in the text.



### **The Dormouse Reintroduction in Derbyshire 2023.**

**Top: Ian White shows a dormouse to the media.**

**Bottom left: a dormouse being put through health checks at ZSL**

**Bottom right: a soft release cage at the reintroduction site**

woodland, brought into better management. Almost 2 km of new hedgerows were planted.

The Test Valley Dormouse Project<sup>8</sup>, in Hampshire, started in 2016. Twenty-seven woodlands and 29.5 km of hedgerows have been surveyed; nest tubes set up at 14 sites; nest boxes, at six; camera traps, at seven; and footprint tunnels, at nine sites. Dormice were identified at two new sites.

One of the key objectives of this project was to plant new hedges and woodland. This was partially successful, with over 2 km of new hedgerow planted and gaps in existing hedges replanted, but to date no new woodlands have been planted.

The Nottinghamshire Dormouse Project<sup>9</sup> encompasses five woodlands (three, reintroduction sites), monitoring dormice and enhancing the habitat. The work is ongoing and involves coppicing, selective felling, tree planting and conifer removal. Almost 300 animals have been microchipped (with PIT tags) and individuals have been recorded moving through woodland and dispersing from reintroduction sites to other woodlands.

### **Surveys**

There are several ways to look for dormice. Earlier survey methods, such as nut hunts or searches for natural nests, require the presence of hazel in the case of the former, and experienced observers, in the latter. Using nest boxes or tubes to locate animals

requires surveyors to be licenced. Recently, footprint tunnels have been shown to be as effective at detecting dormice as nest tubes in hedge and scrub habitats. An advantage of footprint tunnels is that a licence isn't required as dormice are very unlikely to be disturbed.

PTES started the National Dormouse Footprint Tunnel Survey (NDFTS) in 2022 with around 15 surveys, each deploying 20 tunnels for a ten-week period. Tunnels were placed along a section of hedgerow and checked at two-week intervals for footprints on a card sheet between two inkpads at either end of the tunnel.

### **Reintroduction programme**

The first reintroduction of captive-bred dormice into the wild took place in Cambridgeshire in 1993. In the thirty years since, 33 reintroductions have taken place at 25 sites in 13 counties. Nine of these were unsuccessful, where populations failed to become established and haven't been recorded in recent years, but most have persisted, either going on to breed or dispersing beyond the release site.

Further releases have also been undertaken at successful reintroduction sites to improve genetic diversity.

Since 2013, the scope of the reintroduction programme has grown: instead of a single reintroduction area, dormice are released at two or more sites in close proximity, so that populations can bolster each other. A lot of work is done, with partners, volunteers and other stakeholders, to ensure sites are suitable and remain so into the future. Partnership working also helps in the formation of local dormouse groups that facilitate

landscape improvement, aiding dormouse dispersal.

In addition to restoring dormice to their native range, the programme is a poster child for dormouse conservation, attracting media attention and allowing the challenges that dormice face, and how they might be overcome, to be highlighted.

### Dormouse bridges

The aim of dormouse bridges is to enable dormice to move between fragments of habitat separated by roads or other infrastructure. To date, four bridges have been installed, based on a design developed and tested by PTES and Animex International<sup>10</sup>, two traversing the M1 in the south of England, and two in South Wales. Work on another two is in progress, including one across the Furness railway line in Lancashire, and a further seven, awaiting approval.

### The future for dormice

The NDMP is one of the longest-running monitoring programmes of any British mammal. The wealth of data, collected over more than thirty years, gives a unique insight into how dormouse populations are changing, contributing to reports such as *The State of Nature* and the UK Biodiversity Indicators, and driving conservation efforts.

It has shown a fall in counts of 70% in less than 25 years, and the decline is ongoing. If it continues at its current rate, in another thirty years the population will have fallen by 94% since 2000. In their assessment of the status of dormice, Ellie Scopes and others point out that the 'decline of dormice in Great Britain is particularly troubling, given the legal protection ... and conservation attention given to this species'<sup>11</sup>.



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The reasons for the decline are thought to be habitat loss and degradation, compounded by climate change. Habitat fragmentation and poor management can reduce the biodiversity of woodland and lead to overshadowing of the understory. Increasing deer numbers, too, can limit the development of shrubby species. Historically, a decline in coppice management may have led to a reduction in the population range and abundance of dormice.

The possible impact of climate change is apparent, with the

potential for activity patterns, survival rates, and the phenology of food plants to be affected by variable seasonal rainfall and temperatures, and extreme weather patterns.<sup>12</sup> Recent work by Charlotte Armitage, at the University of Exeter, has linked the impact of colder, wetter summers to survival and breeding rates of dormice through increased daily torpor<sup>13</sup>, and climate change has been cited by the advisory body to government on nature as a reason for particular concern over the status of hazel dormice in the UK<sup>14</sup>.

**A commercial dormouse bridge (based on a PTES tested prototype) at a development site near Cardiff. The bridge has been recently installed and vegetation planted at the ends of the bridge has not yet developed.**



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## Recent work published in the scientific press

Cartledge, EL, Baker, M, White, I, Powell, A, Gregory, B, Varley, M, Hurst, JL & Stockley, P (2021) **Applying remotely sensed habitat descriptors to assist reintroduction programs: A case study in the hazel dormouse.** *Conservation Science and Practice*, 3(12): e544

Bullion, S, Burrough, K, Chanin, P, Langton, S, & Looser, A (2021) **Detecting hazel dormice *Muscardinus avellanarius* with nest tubes and tracking tunnels: maximising the probability of success.** *Mammal Communications*, 7: 38-46

Priestley, V, Allen, R, Binstead, M, Arnold, R, & Savolainen, V (2021) **Quick detection of a rare species: Forensic swabs of survey tubes for hazel dormouse *Muscardinus avellanarius* urine.** *Methods in Ecology and Evolution*, 12(5): 818-827

Phillips, BB, Crowley, SL, Bell, O, & McDonald, RA (2022) **Harnessing practitioner knowledge to inform the conservation of a protected species, the hazel dormouse *Muscardinus avellanarius*.** *Ecological Solutions and Evidence*, 3(4), e12198

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Combe, FJ, Juškaitis, R, Trout, RC, Bird, S, Ellis, JS, Norrey, J, Al-Fulaij, N, White, I, & Harris, WE (2023) **Density and climate effects on age-specific survival and population growth: consequences for hibernating mammals.** *Animal Conservation*, 26(3): 317-330

The sensitivity of dormice to annual fluctuations in weather and food availability, and the fact that local populations may respond differently to conservation actions<sup>15</sup> makes it necessary to take a comprehensive approach to their study and conservation. It 'stresses the need for long-term studies of populations at multiple sites and at a large scale', as Cecily Goodwin and researchers at Exeter University have said<sup>16</sup>.

The population trend at woodland sites in the NDMP is part of the picture but may not be the whole one. A recent study<sup>17</sup> found that conservation professionals perceived dormice as more adaptable than traditionally thought, finding populations in hedgerows, scrub, and roadside and railway verges, as well as woodlands. They have been found in high forest with little understorey and will spend a significant amount of time feeding in coniferous habitats, finding occasional hazel shrubs. This type of local knowledge is important but can be subjective and local; it isn't a substitute for broader, systematic monitoring. However, if dormice move between a wider range of habitats than was thought in the past, then a broader monitoring programme, in different habitats and using different techniques, might give a more comprehensive picture of the population as a whole. The first steps towards that are already underway with the NDFTS (see 'Current conservation efforts').

Traditionally, survey techniques for hazel dormice have relied on the detection of field signs (e.g., nests or hazelnut shells) or on the detection of animals (or nests) in artificial nesting sites. However, the selective use of nest tubes and boxes by dormice, alongside natural nesting sites, is likely to

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reflect other factors that may vary over time or between survey locations. Tubes and boxes show a similar seasonal pattern of use, with peaks at the start and end of summer, and both habitat-type and dormouse activity probably influence their use in part. It's been suggested that dormice are less likely to use nest tubes in deciduous woods than in other habitats, such as scrub or hedges, where natural cavities are scarce. If the shrub layer is poorly developed, where it is shaded out, for example, dormice may be reluctant to leave the canopy, making surveys with tubes or boxes – typically no more than two metres above the ground for ease of access – less suitable.

Other factors, too, including competition with nesting birds, wood mice, ambient temperature, and box condition and density in which they're placed in the woodland, may influence box or tube use by dormice, but currently these are poorly understood. One study in 2011 concluded that 'dormouse nest boxes and tubes do not sample populations in the same way, suggesting that the biases may differ between the two methods'<sup>18</sup> and it's likely that different survey methods are better suited to different habitats and populations.

Along with footprint tunnels, other new survey techniques are emerging, including acoustic, environmental DNA (eDNA), and camera trap monitoring. Each has its own practical difficulties and all are more costly than traditional methods but, as the technologies develop, these techniques may have a role in dormouse monitoring.

Camera traps are well-established as a monitoring tool but have rarely been used for small species (such as rodents) or in arboreal

habitats. One study, however, by researchers at the University of Exeter, has successfully detected hazel dormice with camera traps at bait stations in two woodland sites<sup>19</sup>. Similarly, recent studies show that dormice can be identified from vocalisations and from DNA-testing of urine collected from survey tubes<sup>20</sup>.

Currently, dormice are monitored predominantly at woodland sites, with few surveys in other habitat types. Although primarily a woodland species, dormice use other habitats as well, both seasonally and at any one time. Where they're not on the map, it's likely that surveys haven't been carried out rather than because dormice weren't found. More comprehensive monitoring, using multiple techniques where possible, and identifying null records from surveys, is needed.

Hazel dormice continue to face an uncertain future as our climate and countryside change. Conservation challenges remain and, if the gaps in our knowledge are going to be filled, monitoring efforts need to be broadened. ●

## Acknowledgements

The NDMP wouldn't be achievable without the thousands of volunteers who have taken part since the programme began. Their efforts, knowledge and experience are invaluable. Dormice remain in trouble and the ongoing decline is disheartening, but much is being done. Research, monitoring, reintroductions, and landscape projects, together, offer a lifeline. The future of Britain's dormice is not without hope – and more so for everyone involved in efforts to save this extraordinary species.

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