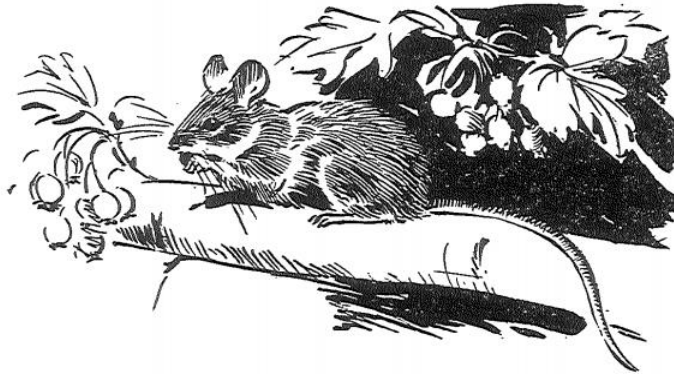




URBAN WOODLAND MANAGEMENT GUIDELINES TO BENEFIT SMALL MAMMALS



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These guidelines were developed as part of London Wildlife Trust's *Vole Patrol* project between 2015-17. They are based on survey results of small mammals in nine woodlands within west and north-west London, subject to varying degrees of use, management intensity, and ecological quality. Seven of the woodlands have an ancient character, one is predominantly an early 20th century plantation, and one is a recent secondary woodland.

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Front cover image: *yellow-necked mouse in Pear Wood, Stanmore* © Huma Pearce

Illustration above: *wood mouse* © Eileen Soper (in *Knight*, 1957)



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INTRODUCTION

In London over the past 20 years the principal drivers for woodland management by most woodland managers have been threefold:

- a) to enhance access within woodlands so that more people can enjoy them safely;
- b) to involve and delegate some responsibilities to local communities (e.g. 'Friends of groups'), compounded by a decline in public resources; and
- c) to increase canopy cover to help strengthen climate change resilience.

Whilst the conservation of biodiversity remains a key objective of most woodland managers in London, a generic approach has largely been adopted, for example the provision of dead wood (primarily for saproxylic invertebrates and fungi). Rarely have specific taxa been taken into account or are a prime focus, although exceptions to this include the conservation of ancient woodland indicator ground flora (e.g. bluebell, wood anemone), and for the needs of bats.¹ The most commonly encountered wild mammal in London's woodland – grey squirrel – is often seen as a problem for woodland managers.

Small woodland mammals are largely ignored in woodland management, none more so than in urban areas. All are difficult to see (they are mostly nocturnal), and none of the common species are subject to legal protection or listed as Species of Conservation Concern.² However, besides their intrinsic appeal, they have an important role within the woodland ecosystem, and the health of their populations will likely influence other aspects of woodland ecology (for example, as prey items for owls, kestrel, stoat and weasel).

This report outlines key habitat management recommendations for land owners/managers to improve their urban woodlands for the benefit of these small mammals.

The recommendations are drawn from the findings of London Wildlife Trust's *Vole Patrol* project.³ This surveyed and monitored small mammal communities at nine urban woodland sites in west and north-west London over three seasons between April 2016 and June 2017, by live trapping capture-mark-recapture surveys. Capture data were analysed against habitat data (condition assessments, localised habitat surveys and wider habitat assessments) to identify features of importance to small woodland mammals. Where species capture data was too infrequent to make valid inferences, observations were reviewed against reference sources. Other surveying methods, including remote cameras and footprint tunnels, were also employed to gain a better understanding of how these species use the woodlands.

The species for which this advice applies are:

- common shrew *Sorex araneus*
- pygmy shrew *S. minutus*
- wood mouse *Apodemus sylvestris*
- yellow-necked mouse *A. flavicollis*
- bank vole *Myodes glareolus*
- field vole *Microtus agrestis*

¹ In other parts of the country attention has been paid to the needs of pine martin, hazel dormouse, some birds (e.g. nightingale, goshawk), and some insects (e.g. pearl-bordered fritillary), most of which are Species of Conservation Concern and/or subject to a level of legal protection.

² Hazel (or common) dormouse, not generally an urban tolerant species and only known from a few woodlands in Greater London, is a UK BAP Priority Species, as is hedgehog (which are not included in this report).

³ Supported by National Lottery players through the Heritage Lottery Fund.

SMALL MAMMALS' ROLE IN AN ECOSYSTEM

Small ground-dwelling mammals – shrews, mice and voles - occur in all biomes, including the urban environment. Like all animals, they seek food, water and safe shelter to nest and breed. They have adapted to use a variety of habitats (e.g. woodlands, grasslands, heathland, roughland, parks and gardens) that offer suitable resources all year round. Their diet includes, nuts, seeds, berries, fruit, roots and shoots, leaves, fungi, and invertebrates. Burrows and nest chambers are typically found at the base of trees, grass tussocks or fallen or standing deadwood, and provide important sites for rearing young and caching food, for when resources are scarcer. Different species will also occupy different spatial (ground dwelling and arboreal) and temporal niches (active by day, night and at dusk and dawn), thus enabling a variety of species to occur within any given habitat.

They provide vital ecosystem services, particularly within woodland habitats, and rely on a diversity of food resources. Their life-histories (short-lived, with rapid turnover of individuals⁴) may be a good indicator of ecosystem function.

ECOSYSTEM SERVICES PROVIDED BY SMALL MAMMALS	
Seed dispersal	Many small mammal species cache seeds and their activity influences plant species communities and species distributions. They have been credited for the control of unfavourable plant species and in some instances are key to maintaining plant species diversity by controlling/ excluding dominant species such as grasses.
Humus content of soils	Small mammals influence the rate of decomposition of organic materials by adding green herbage and excrements to the litter layer and by reducing the particle size of vegetative material. They are more efficient in effecting the mineralization of organic matter than either insects or ungulates.
Soil structure and chemical composition	The burrowing activities of small mammals aids the transfer of minerals (nitrogen, calcium, magnesium) to the upper soil layers and zone of plant root activity; the transportation of organic materials to the lower soil layers; and improved soil water permeability. The addition of faeces and urine to the soil further influences nutrient and mineral cycling rates and pathways.
Insect control	Insects are an important food resource in the diet of small mammals and their function in controlling pests is recognised. For example, shrews and wood mice are important for the management of sawfly and Hymenoptera larvae.
Predators	Small mammals serve as a food supply for a large number of predators and can exert significant influence on predator population cycles e.g. owls.
Other species	Small mammal burrows are frequently used by other species such as arthropods, amphibians, reptiles.

As is true of many common species, particularly those that are not afforded legislative protection, small mammals (with the exception of the hazel (or common) dormouse and water vole) are often overlooked when determining appropriate management of habitats, despite their importance in ecosystem function as well as their own intrinsic appeal.

⁴ These are mostly known as r-strategists, unlike bats and dormouse - which are longer-lived and invest more in rearing fewer young (K-strategists).

HABITAT STRUCTURE AND COMPOSITION

The following section provides a summary of the requirements of small woodland mammals in terms of the structure and species composition of urban woodlands. Habitat features and management practices of benefit to small mammals are described.

Canopy layer

- Support (and maintain) a diversity of tree ages and species to include hard and soft mast species e.g. beech *Fagus sylvatica*, oak *Quercus sp.*, ash *Fraxinus excelsior*, sycamore *Acer pseudoplatanus*.⁵
- Thin out tall spindly trees that inhibit the establishment of rich ground flora due to over-shading, and offer little value to small mammals in terms of food resources.
- Undertake supplementary planting with locally native species of local provenance if either/both the current diversity is assessed as poor or the habitat is showing signs of poor natural regeneration.
- Maintain some linkage between tree canopies to enable the free the movement of arboreal species such as yellow-necked mice (and hazel dormouse) especially across wide rides/footpaths, but also ensure some openings in the canopy to allow the development of rich shrub and ground flora layers.
- Trees with evidence of rot, cavities and fungal growth should be retained (as standing deadwood) to provide nesting opportunities as well as important food resources (invertebrates and fungi) for small mammals.



Tentelow Wood – The canopy is dominated by mature oaks and supports a diverse understorey of elm, hawthorn, elder and bramble. The ground layer includes ancient woodland indicator species (bluebell) as well as ruderal species (e.g. common nettle, cleavers). Dead hedging along paths have become colonised by brambles and there is a good amount of standing and fallen deadwood. Wood mouse, bank vole, common shrew, pygmy shrew and field vole are recorded within the woodland, in addition to hedgehog.

⁵ Whilst a non-native species sycamore is often targeted for removal, this is a common tree that provides benefits for small mammals, and should be retained if present (rather than deliberately introduced).

Tree species

- Preferred species in London appear to be beech, English oak *Quercus robur*, ash, sycamore, alder *Alnus glutinosa*, birch *Betula pendula*, willows *Salix sp*, Scots pine *Pinus sylvestris L.*, wild service-tree *Sorbus torminalis*.

Shrub layer

- Support (and maintain) a diversity of shrub species to include hard and soft mast species that provide food sources throughout the year e.g. hazel *Corylus avellana*, yew *Taxus baccata*, wild roses *Rosa sp*, crab apple, *Malus sylvestris*.
- Management of the shrub layer should seek to avoid dominance by a single species. In particular, those species which can cause shading such as holly, and invasive species such as cherry laurel *Prunus laurocerasus* and rhododendron *Rhododendron ponticum*.
- Low growing trees within the shrub layer: hazel, sycamore and hornbeam *Carpinus betulus*; should be managed by selectively coppicing coupes on 8-12 year rotation to create a diversity of age classes whilst at the same time ensuring food resources are available for small mammals i.e. nuts, catkins.
- Areas of bramble *Rubus fruticosus agg.* thicket should be maintained and managed/controlled within discrete areas such as within fenced-off low intervention areas and/or along pathways as part of dead hedging. This will be of most benefit to bank vole and shrews since bramble offers an important food resource in terms of pollen, fruit and invertebrates, as well as suitable cover. Woodland management often seeks to remove bramble because it can quickly dominate the shrub layer and prevent the establishment of ground flora species such as ancient woodland indicators. However, ongoing management of bramble, dispersed over as much of the woodland as a whole, rather than large scale clearance is recommended.
- Support and maintain a diversity of climbing plants to aid movement by arboreal species (e.g. yellow-necked mouse), and for use as nesting material and a food source (flowers, nectar, seeds, berries). Ivy *Hedera helix* should be left on trees and honeysuckle retained during tree management activities.

Shrub species

- Preferred species in London appear to be bramble, hawthorn *Crataegus monogyna*, yew, holly *Ilex aquifolium*, blackthorn *Prunus spinosa*, dog rose *Rosa canina*, spindle *Euonymus europaeus*, elder *Sambucus nigra*, rowan *Sorbus aucuparia*, elm *Ulmus sp.*

Low growing (fruiting) trees

- Preferred species in London appear to be wild cherry *Prunus avium*, crab apple, hazel, hornbeam, ash, and sycamore.



Gutteridge Wood - Honeysuckle, ivy and brambles can offer connectivity for small mammals within the woodland enabling movement between the ground, shrub and canopy layers. This is particularly important for mice, to allow them to access different food resources (as they become available through the year) and, for movement through the canopy and shrub layers, where they are less vulnerable to predators.

Climbers

- Honeysuckle *Lonicera periclymenum*, ivy, and traveller's-joy *Clematis vitalba* should be encouraged.

Ground layer

- Seek to support a varied mix of alternating dense ground cover and barer clearings.
- Management should not focus solely on ancient woodland indicator species as this can lead to a monoculture effect and a loss in ground flora diversity. Where notable woodland indicator species are present (e.g. wood anemone, *Anemone nemorosa*) the establishment of non-intervention areas can offer an appropriate solution for preserving these species whilst maintaining areas of more common ground flora species. Due to high levels of contamination and nitrification of urban soils, common nettle *Urtica dioica*, cleavers *Gallium aparine*, grasses and/or ivy may dominate, but these offer good cover and food sources for small mammals.
- Clearings offer opportunities for the establishment of a diversity of grasses, ruderal species and ivy, which provide cover, nest sites and food resources (seeds and invertebrates).
- Leaf litter should be retained and the establishment of moss encouraged through the creation of wet areas.

Ground flora (excluding ancient woodland indicators)

- Common bent *Agrostis capillaris*, creeping soft-grass *Holcus mollis*, common nettle *Urtica dioica*, heath bedstraw *Galium saxatile*, wood sedge *Carex sylvatica*, red campion *Silene dioica*, hedge woundwort *Stachys sylvatica*, bracken *Pteridium aquilinum*, wavy hair-grass *Deschampsia cespitosa*, wood spurge *Euphorbia amygdaloides*, heather *Calluna vulgaris*, gorse *Ulex sp.*, bryophytes and *Sphagnum* moss.



Denham Lock Wood - Natural tree falls create clearings and allow a more diverse ground flora to establish: comprising ruderals, grasses and ancient woodland indicator species (e.g. dog's mercury *Mercurialis perennis*). Together with fallen deadwood, these habitats offer suitable nest sites for wood mice, voles and shrew, and food resources: invertebrates and fungi, (particularly for shrews).

Deadwood

- Maintain high levels of deadwood habitat by retaining fallen and standing deadwood to provide suitable nest sites and food resources (invertebrates, fungi) for small mammals.
- Increase the amount of deadwood by creating dead hedges and brash piles.
- Deadwood can be used to maintain discrete pathways, fencing of non-intervention areas and/or to protect newly coppiced/re-growing hazel, sycamore and hornbeam stools.
- Where there are health & safety concerns around standing deadwood, management to retain trees as a monolith, or creating diversions of footpaths away from the perceived zone of risk should successfully avoid any perceived risks/hazards.

Non/low intervention area

- Species that typically encroach or dominate e.g. brambles, bracken, ivy, can be allowed to grow within discrete non- or low-intervention areas (e.g. fenced off areas). These offer undisturbed habitats as well as create edge and transitional habitat within the woodland, of notable value to species such as voles and shrews.



Linear strip of woodland along a ditch bank in habitat adjacent to Tentelow Wood. Low intervention management has allowed the establishment of dense stands of ivy and bramble as well as good quantities of deadwood. Shrew, wood mouse, bank vole and field vole were recorded here.



Derelict brickwork is not atypical in many urban woodlands, and can provide additional refuge for small mammals
© Mathew Frith

Open areas

- Maintain natural or created woodland clearings, wide rides and marginal habitats along woodland edges. Ruderal and grass species should be allowed to establish, together with shrub species such as brambles to create transitional habitat and a gradation in habitat structure.
- Where soil conditions are suitable (acid and free draining), the establishment of heathland species should be encouraged; e.g. heather, gorse, wavy hair-grass and broom *Cytisus scoparius*. These habitats offer suitable nest sites for voles and shrews (and mice) as well as foraging opportunities for these species.



The establishment of wide rides within or between woodland sites gives rise to a diverse transitional habitat comprising woodland edge, scrub and grassland of high value to small mammals, particularly voles, shrews and yellow-necked mouse.

- Open areas can provide opportunities for the establishment of temporary or seasonal wet areas, through the creation of scrapes and earth berms. These habitat features will allow the establishment of a greater diversity of ground flora, as well as opportunities for nest sites and feeding areas for small mammals.



Stanmore Common - Woodland clearings offer opportunities for the establishment of a diversity of ground flora including heathland. Transitional habitat is of higher suitability for certain small mammals such as shrews.

Wet areas

- Woodland topography should be varied and include shallow areas/scrapes and earth berms to create permanent or ephemeral ponds or wet/damp areas. Regular tree and scrub management will be required to prevent desiccation of these features.
- At sites which have high visitor numbers, particularly from dog walkers, these areas may need to be fenced off to avoid over disturbance and soil poaching. Again, the establishment of dead hedges around these habitats can be an effective natural barrier as well as offer enhanced habitat opportunities for small mammals.

Monitoring small mammals

- Installation of mammal (dormouse) nest boxes, in particular in coppice coups and secondary woodlands where they are known or likely to be present, will provide protected nesting opportunities, and enable long-term monitoring of species. Although these are designed for monitoring hazel dormouse, all other small mammal species are found to occupy boxes.
- Refugia can offer a simple and cost effective way of non-intrusive monitoring of small mammals, particularly voles and shrews.
- Live trapping capture-mark-recapture surveys provide more comprehensive monitoring of the abundance, composition and demographics of small mammal communities. However, these surveys are labour intensive and must only be carried out by suitably trained and licenced personnel.



Woodland (ephemeral) ponds and wet depressions can enhance ground flora diversity and increase the availability of insect prey for small mammals (especially shrews). Planting with alder and willow offers additional food sources.



Small mammal nest boxes (dormouse boxes) should be installed onto suitable trees – typically hazel coppice or trees/ shrubs with multiple stems at a height 0.75-1.5m. The boxes should be checked between April and November and cleaned out/maintained during the winter months.

Interpretation

- Interpretation boards should be provided to increase public awareness of the importance of small mammal communities. These should provide information on monitoring activities (e.g. refugia, nest boxes) and the woodland management practices being carried out at a site, (e.g. reasons for fenced-off non-intervention areas, coppicing or tree removal activities) to avoid the removal of monitoring equipment and unnecessary disputes with people using the site, who may be unaware of the wildlife benefits of these woodland management activities.



Reference to wood mouse at Sydenham Hill Wood, 2011 © Mathew Frith



Refugia in the form of corrugated metal sheeting or bitumastic felt can provide a useful and cost effective monitoring tool. Voles and shrews frequently burrow (and nest) underneath these materials.

Wider landscape

- Maintain and enhance habitat connectivity between woodland and other habitats such as grassland, heathland, roughland (mosaic of scrub/bramble and tall tussocky grasses, often with areas of bare soil).
- Plant hedgerows with wide margins (field margins/roadside verges) between habitats to enable the safe movement of small mammals within habitats that offer good cover and suitable food resources.
- Establish/maintain buffers of grassland and roughland around woodlands.
- Consider creating orchards sites within the wider landscape, since these offer high quality habitat for small mammals.



Wood Farm - Habitat connectivity will enhance the diversity of small mammal species occurring within and adjacent to woodlands. Connecting habitats are essential for species to successfully expand their range and ensure viable populations in the long-term (i.e. gene flow between populations).



Ten Acre Wood - Habitat connectivity is managed through maintenance of hedgerows within a grassland complex that provides direct continuity to other woodland nearby, including Gutteridge Wood.

Access

Urban woodlands are criss-crossed with paths which are used by people and dogs. Management and use to maintain them can lead to grassy 'edge habitats' bordering them, and widening to maintain sightlines. With good design and sympathetic management these areas can be beneficial to small mammals. However, very heavy use of paths (especially with dogs) can lead to widening, and poaching and eutrophication of soils by path sides (and woodland entrances) encouraging nettles and other coarse vegetation. This – and the scent of dogs – will dispel small mammals.

Not enough is known about the impact of high public use upon small mammals in urban woodland. Most of the species are largely nocturnal in behaviour when these woods are quietest from a human perspective.

Other species

Small mammals are but one constituent of the woodland ecological community. They form part of the food-chain depending on a variety of invertebrates, seeds, berries and leaves, and occasionally carrion, whilst forming part of the diet of a range of predators. These include birds, such as kestrel, sparrowhawk, and owls, and mammals such as stoat, weasel, badger and fox. In some instances they are significant food items for some predators, for example barn owl is highly dependent on voles, and shows large fluctuations in breeding success that correlate with the dynamics in vole populations. Weasel, too, specialise on voles, whereas stoat and badger will only take them when other food items are less available.

Therefore woodlands and their environs that support a diversity of small mammals may also support a range of predators, especially if their other needs are also catered for.

- Holes and covered cracks in large mature trees (usually with dead wood in the crown) for nesting of barn owl and tawny owl. These need to be of a sufficient size and availability, as tree holes are subject to competition from woodpeckers, jackdaw, ring-necked parakeet, and owls appear to be sensitive to this;
- Dead wood and bramble thickets provide cover for weasel and stoat;
- Connectivity with the wider countryside through hedgerows and roughland will enable foraging by predators;
- Presence of badger setts will determine management due to their legally protected status.

However, as predators require significant numbers of prey to sustain their populations, their territories are much larger and numbers much lower. Small and isolated woodlands may not support them, although these may be home to small mammals.

The presence of domestic cats (and, to a lesser extent, dogs) in woodlands may also exert pressures on small mammals. Cat predation can be significant and will be influenced by the location of a woodland in proximity to residential dwellings. Provision of sufficient cover for small mammals will be one way of minimising the impacts of dogs.

Interventions to benefit voles, mice and shrews are also likely to benefit hedgehog.

SMALL MAMMALS SPECIES-SPECIFIC REQUIREMENTS

Successful interventions to benefit each or any of the six mammal species described will depend as much on the existing status of these populations in any given site. Most urban woodlands, apart from those which are very small (<0.25ha) and isolated from preferential habitat, will support small mammal populations, but this will also depend on the current woodland quality and its management and use. Ascertaining an assessment of what mammals are present first, together with evaluating the continuity of the site with the wider landscape, is essential to help prioritise any proposed management actions.

Undertaking these recommended interventions will not necessarily result in each or any of the six species (and other ground-dwelling mammals such as hedgehog or weasel) colonising a site. However, they should help to sustain and enhance existing populations all other factors being equal.

Shrews; common *Sorex araneus* and pygmy *S. minutus*

Key habitats:

- Good shrub diversity
- Rich, dense ground flora
- Wet and damp habitats
- Open habitats
- Moss
- Deadwood
- Leaf litter
- Refugia.

Notable species: Ruderal species, grassy tussocks.



common shrew



pygmy shrew



trap in position to attract shrews



good shrew habitat, Ten Acre Wood © Tom Hayward

Wood mouse *Apodemus sylvaticus*

Key habitats:

- Healthy canopy composition and structure
- Ground flora and structural diversity
- Distance of the nearest woodland (woodland cover within 500m)
- Logs and dead wood, thickets to provide cover
- Habitat connectivity (e.g. roughland within 500m)

Notable species: ash, birch, holly, hawthorn, honeysuckle, ruderals, grasses, moss.



wood mouse © Phil Winter

Yellow-necked mouse *Apodemus flavicollis*

Key habitats:

- Canopy composition and structure
- Linkage between tree canopies
- Tangled understorey which includes good stands of climbers
- Connectivity to nearby woodlands
- Mast (nut) producing species, notably beech mast
- Older coppice compartments
- Mature/veteran trees with cavity features
- Rich understorey
- Deadwood

Notable species: beech, oak, ash, hawthorn, crab apple, honeysuckle.



yellow-necked mouse © Peter Beadsley

Bank vole *Myodes glareolus*

Key habitats:

- Tree and shrub diversity
- Path access (likely due to the high number of voles caught at sites where there was dead hedging along all access paths)
- Wildlife features (which included ivy cover, standing and fallen deadwood, veteran trees and wet habitats)
- Deadwood
- Long grassland within 500m
- Orchards

Notable species: oak, yew, holly, honeysuckle, brambles, ivy, bracken, moss.



bank vole © Darin Smith



bank vole habitat

Field Vole *Microtus agrestis*

Key habitats:

- Open areas with rich grass cover including tussock (preferably un-grazed)
- Damp margins of marshlands with rich grass cover
- Woodland clearing, young plantations and orchards with open areas dominated by grass and ruderal species
- Orchards with rich grass cover
- Deadwood/brush piles/refugia

Notable species: grass roots and shoots, fruits.



field vole ©



field vole habitat, Oak Hill Wood, East Barnet © Mathew Frith



Long Wood, supports a noteworthy blanket of bluebells in the spring. Although bluebells occur throughout the site, these are partly in discrete areas inter-dispersed with other species to give a rich ground flora throughout the year.

REFERENCES

- Couzens, D. et al. (2017). *Britain's Mammals. A field guide to the mammals of Britain and Ireland*, Princeton University Press.
- Harris, S. & Yalden, D.W., (2008). *Mammals of the British Isles: Handbook*, 4th Edition, The Mammal Society.
- Knight, M. (1957). *How to observe our wild mammals*, Routledge & Kegan Paul, London.
- MacDonald, D. & Barren, P., (1993). *Collin Field Guide: Mammals of Britain & Europe.*, Harper Collins Publishers.
- Merritt, J.F., (2010). *The biology of small mammals*, The Johns Hopkins University Press.
- Mitchell-Jones, A.J. et al. (1999) *The Atlas of European Mammals*, Poyser Natural History. T & A D Poyser Ltd.
- Woods, M., McDonald, R. A., and Harris, S. (2003). *Domestic Cat Predation on Wildlife*, The Mammal Society.