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Cavity trees in urban areas

Part 2 Guide





Development of guidelines for obtaining a valuable habitat in parks and urban forests, taking into account the public safety

Municipality of the City of Frankfurt am Main, Environmental Office
Institute of Animal Ecology and Nature Education

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General principles for the consideration of species protection in the course of tree maintenance and traffic safety

- Old trees in particular are worth preserving. They shape our environment, have a positive effect on people and are an essential habitat for many animal species.
- Old trees in towns and villages need compassionate care in order to preserve them as a living space whilst still ensuring traffic safety.
- Many of those species living in old trees are endangered. Species protection law regulations serves special and strict protection of these species and their habitat.
- The statutory species protection is mandatory in the case of tree care and traffic safety. Violations are a misdemeanour and can (according to § 69 and 71 Federal Nature Conservation Act) result in substantial fines, and even imprisonment.
- In the case of legally protected species the intention must be to avoid committing an offence. Excuses ("I have not seen / do not know ...") are not acceptable.
- For both professional and legal reasons, it is necessary that tree inspectors and Arborists receive training regarding the protection of species. For special types of protection issues experts must be consulted.
- Where there is the potential for conflict, this will require an assessment in order to balance the need for public safety and the needs of the protected species. In the case of "imminent danger" a formal assessment (protection of species and verification of the exception under § 45) must be conducted.
- In accordance with the Federal Nature Conservation Act, where there is the potential for a legally protected species to occur, the mitigation hierarchy must be applied; i.e. before a tree is felled, the alternatives must be considered.
- Careful tree controls should be applied in order to take into account the protection of species already identified as potentially present by the test protocol.
- When unavoidable tree work or tree felling inspections are carried out they must be done so in accordance with current best practice guidance and methods, in order to avoid the direct risk of harm to specially protected species.
- For land owners, the principle of species protection provision applies. These include: knowledge and evidence to safeguard especially and strictly protected species, marking and registration and protection of legally relevant trees, considering the presence of trees when planning routes and construction projects etc.

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1. Introduction

With increasing age, trees are not only powerful and impressive, but create habitats that are colonised by a variety of animal species. Without gaps in and behind bark, hollows and dead wood many wild mammals, birds and insects would not present in our landscape. Due to their rarity and endangerment these species are protected under European law as well as German legislation. The same also applies to trees which hold breeding sites and resting place of legally protected species.

Old trees may be found in many urban areas in parks, cemeteries, public squares or in alleys. The owner of the surface on which an old tree stands, and potentially tree inspectors and arborists, have a duty to public safety in order to prevent personal injury and damage to property. From these legal commitments both in respect of the to maintain safety and the requirement for species protection, conflicts can arise that need to be resolved objectively and considering all the facts.

The purpose of this guide is to provide practice-oriented information to inform people who are professionally (or in an amateur capacity) involved with surveying and defining solutions for the resolution of conflict involving species protection and public safety. After a description of the legal situation, technical notes on the formation and structure of tree hollows and cavities occupied by tree-dwelling species are presented. A summary of the features that are used by particular species is then provided in order to raise awareness of this habitat. Finally, possible solutions to frequently encountered problems are generally presented as well as case studies. In the further references you will find a collection of materials on the subject of field conservation in old trees.

Overall, the guide is intended to identify old trees as a habitat and promote careful handling. The particular weighting of the statutory species protection is an important requirement; however, this should not be the sole motivation for careful tree care.

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2. Legal framework

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The legal framework with the obligation of result as opposed to the protection of species not directly from a law, but from the direct current case law. A current example is the judgment of the Bundesgerichtshof (BGH) of 2 10 2012 - VI ZR 311/1. It states, inter alia: "*Note, however, that not every abstract risk can be addressed proactively. A general prohibition, to not endanger others, would be utopian. A public backup that excludes any damage, cannot be reached in practical life.* "

The judgment deals with the typical forest hazards and in terms of public safety, the degree of preparedness by the forest owner. Among other things, it says "that the forest owner basically is not obliged to secure the public on forest roads to forest typical hazards." The Bundesgerichtshof takes the forest visitor himself in responsibility: "As the forest visitor uses the forest at their own risk, any liability of the forest owner is excluded for typical forest hazards."

The aforesaid judgment controls the future dealing with the public safety not always, but at least for forests already a major step forward in the solution of the problem.

Species protection law requirements are executed in the Federal Nature Conservation Act (Federal Nature Conservation Act). It is divided into "General provisions" (§ § 37 and 38), the "General conservation" (especially § 39) as well as the "Special Protection of Species" of § § 44 and 45 With the "Special Protection of Species", the legislature has international obligations arising from the European Birds Directive 2009/147/EC, the Fauna-Flora-Habitat (FFH) Directive and the Environmental Damage Directive 2004/35/EC, implemented.

Requirements of the "general species protection" are unique and usually easy to implement. After that, it is prohibited wildlife willfully or without reasonable cause to begin to hurt, kill or destroy their habitats (§ 39 paragraph 1, points 1 and 3). It is also prohibited in accordance with § 39 para 5, No. 2.

"Trees that are outside the forest of short rotation plantations or horticulturally used base areas, hedges, living fences, shrubs and other woody plants in the period from 01 March to 30 September or cut to sit on the floor; are allowed gentle form and nursing cuts to eliminate the growth of the plants or for maintaining the health of trees. "

For more information on pruning, see: http://www.bfn.de/0320_gehoelzschnitt.html.

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The statutory requirements of the "special species protection" are formulated in § 44 and 45 Federal Nature Conservation Act and much more relevant in the possible area of conflict species protection and public safety. Quote: (1) It is prohibited;

1. *to catch them, injure or kill wild animals of protected species or to take their development forms from nature, to damage or destroy*
2. *significantly disturb wild animals of strictly protected species and of European bird species during the breeding, rearing, moulting, hibernation and migration; significant disturbance is when worsened by the failure of the conservation status of the local population of a species,*
3. *To remove breeding sites or resting places of wild animals of protected species from the wild, damaging or destroying,*
4. *to remove wild plants of specially protected species or their developmental forms from nature, damaging them or their sites or destroy (access restrictions).*

(...) "

All bans for specially protected species also apply to the strictly protected species, as this is a graded assignment (see below).

What types are special and strictly protected?

This is basically defined in more detail in § 7 Federal Nature Conservation Act. The Federal Agency for Nature Conservation has published a documentation of the particularly and strictly protected species on the Internet: www.wisia.de. A selection of species regularly to frequently occurring in trees is shown in the following table:

Table 1: Selection of legally relevant tree holes inhabiting species. All "strictly protected species" are also "special protection".

	Specially protected species	**Especially and strictly protected species**
Insects	Stag beetle *Lucanus cervus*	Hermit beetle *Osmoderma eremita*
	Violet click-beetle *Limoniscus violaceus*	Great Capricorn beetle *Cerambyx cerdo*
		Flat bark beetle *Cucujus cinnaberinus*
Birds	all European bird species	Grey-headed Woodpecker (*Picus canus*)
		Green woodpecker (*Picus viridis*)
		Collared catchfly (*Ficedula albicollis*)
		Middle spotted woodpecker (*Dendrocopus medius*)
		Greater spotted woodpecker (*Dendrocopus martius*)
		Eurasian wryneck (*Jynx torquilla*)
Bats		all European bat species
Other		Dormouse (*Muscardinus avellanarius*)

	Specially protected species	Especially and strictly protected species
mammals		

The important difference of "special species protection" to the "general species protection" is that the obligation relating to the special protection of species are independent of the motivation the agent and thus engage "reasonable" even with a reason, if no exceptions referred to in paragraphs 4 and 5 are given. (Kratsch, 2011).

Apart from the disturbance prohibition (§ 44 Section 1 No. 2 Federal Nature Conservation Act) any prohibition offenses are individual-based, ie the prohibitions apply to every animal on the protected species and it does not matter whether the killing or destruction of breeding sites or resting place has impact on the conservation status of the population of the species.

On the other hand the prohibited activity in accordance to § 44 Section 1 No. 2 Federal Nature Conservation Act does not apply, even at the fault of a single animal, but then when the conservation status of the "local population" deteriorated. This dimension is reached very quickly in bats under certain circumstances, eg the detection or the threat of a nursery colony (Runge et al. 2010).

For the cavity tree protection is the protection of breeding sites and resting places of importance . Confirmed by various judgments , the " breeding site " not only the currently occupied , but also regularly re -used Hatchery (Federal Administrative Court , 21.06.2006 , 9 A 28.05) , is irrelevant here whether the breeding place of always the same breeding pair or from other breeding pairs of protected species is sought (OVG Berlin- Brandenburg, 05.03.2007 , 19:07 11 S). In addition, " resting places " (including dwellings) need not be used all year round , is a sufficiently regular use for a considerable part of the year. This also applies to the breeding site for migratory birds during which winter absence , provided they return to their nest (OVG Hamburg, 21.11.2005 , 2 B 19/ 05; LG Hechingen, 29.12.1994 , 3 S 29 /94). This also applies to nursery trees of bats when they are hibernating for winter or roosting trees when the bats are in the summer habitats.

In paragraph 5 of the Federal Nature Conservation Act § 44 regulates that do not apply the prohibition offenses of points 1 and 3 for allowable under § 15 interventions in the natural surroundings, when "(...) the ecological function of the affected from the engagement or project breeding sites or resting places will continue to be met in a spatial context. Where necessary, even early compensatory measures may be imposed. "

The Federal Administrative Court has, however, now (judgment dated 14.07.2011, 9 A 12/10) clarified that the legal exception of § 44 para 5 p 2 Federal Nature Conservation Act applies only to the case of the destruction of breeding sites or resting places (where such in a spatial context are still present, so that the animals concerned may use this readily instead of perishing previously used habitats). However, the legal exemption does not apply to the extent that realization of the killing of facts is no more to be feared. The priority to be observed requirements of Article 12 of the Habitats Directive and from Article 5 of the Birds Directive are an exception so far only in the presence of other exceptional circumstances (§ 45 paragraph 7, Article 16 of the Habitats Directive, Article 9 VS -RL).

As a case in point it can be assumed that, in a tree cavity complex of 40 or more tree holes, which a bat colony uses during the summer months every loss of a cavity does not result in the complete loss of breeding and resting place, as in the exchange all 40 recurring in their entirety as such be considered. The difficulty for the tree owner or rather the arborist is, however, to demonstrate that there is a sufficient number of suitable alternative cavities for the colony.

This proof must be provided by a professionally stored specific species conservation law exam. In case of doubt make early compensatory measures (so-called CEF - actions - continuous ecological function). An exception to the species conservation regulations offenses is also possible, but at least the risk of "life and limb" must then be demonstrated.

In § 45, paragraph 7 states: *(7) under state law for nature protection and landscape conservation authorities and in the case of introduction from abroad, the Federal Agency for Nature Conservation 44 may grant other exceptions from the prohibitions of § in the individual case 5 for other imperative reasons of overriding public interest including those of a social or economic nature. An exception may only be approved if reasonable alternatives are not given and the conservation status of populations of a species not degraded, unless Article 16, paragraph 1 of Directive 92/43/EEC contains further requirements. Article 16 paragraph 3 of Directive 92/43/EEC [the Habitats Directive] and Article 9, paragraph 2 of Directive 79/409/EEC are complied with. The state governments can also generally permit by ordinance exceptions. You can delegate this authority pursuant to sentence 4 by ordinance to other state agencies*.

The clarification of the exception conditions are sure about the above-mentioned species conservation law exam or another, legally sound and in accordance with the nature conservation authority route.

Lying within the meaning of the conditions for granting an exception § 45 paragraph 7 Federal Nature Conservation Act do not apply, may interfere with the grant of an exemption pursuant to § 67 para 2 Federal Nature Conservation Act come into consideration.

In § 67 paragraph 2 Federal Nature Conservation Act states: The prohibitions of the (...) § 44 (...) may be granted exemption if the implementation of the rules in a particular case at the request would result in an undue burden.

A burden can, however, be recognized only in special individual cases as "unreasonable". In the commentaries it is said (here from Schumacher / Fischer Hüftle, Federal Nature Conservation Act (2nd ed), § 67, para 14.): The Authority shall be reviewed by the legislature when considering the reasonableness note. Such consequences of prohibition offenses which are predictable in all or most of those affected are, therefore, classified as reasonable. The exemption thus engages only as a possible corrective for land-related features. Subjective (personal) circumstances - such as personal, financial, family conditions - can, however, generally do not constitute hardness and therefore do not justify exemption. Different only in exceptional cases when there will be no distortion of the person / property owner in a specific case, which go far beyond the "normally" expected impact of the standard.

If it comes as the "normal case" exposure to a non-severe strain, the degree of unreasonableness can be achieved. Then, an exemption can be granted.

Obligation to tolerate violations of the protection of species

Violations of the protection of species are to be regarded as a misdemeanour pursuant to § 69 Federal Nature Conservation Act. Heavy fines can be pronounced, in the case of repeated and habitual violations of the protection of species and even imprisonment is possible (§ 71 Federal Nature Conservation Act).

For cases of conflict, the less the duty to maintain safety but rather the arbitrariness of the tree owner arise (eg tree felling due to foliage attack), it should be noted that there is an obligation to tolerate pursuant to § 65 Federal Nature Conservation Act by the surface owner / tree owner. This applies if the conservation measure is of particular value (conservation of species protection legislation relevant trees) and the toleration does not lead to an unreasonable restriction on the use of the land.

Consequences for tree service and public safety

Wildlife conservation has legally a high priority and there is no general principle, and no legal basis, which gives the duty to maintain safety take precedence over the requirements of the statutory species protection. Formal legal protection of species takes precedence over the established case-law, with the ensuring public safety is regulated. The courts measure the protection of species usually at a very high value in the assessment.

- Violations of the protection of species are an offense and can according to § 69 Federal Nature Conservation Act be punishable by substantial fines, and at worst, in the case of repeated offenses, even with imprisonment (§ 71 Federal Nature Conservation Act).
- Particularly for special protection of species there must be no intention to commit an offense. This means the inverse conclusion that you cannot with excuses ("I have not seen know ...") can make excuses.

- Conflicts between species protection and public safety require their own separate factual consideration and decision. The formal route (species conservation law exam, applying for an exception (§ 45 paragraph 7) or an exemption (§ 67 paragraph 2) must be complied with.
- From the factual and legal reasons, it is necessary that the tree controller / arborist continues forms in terms of species protection. An appropriate expert should otherwise be consulted to answer species protection issues.

3. Information on the tree hollow habitat

Natural tree hollows are available in numerous variants, which differ depending on the origin and already a number of factors continue to develop depend in different ways. The spectrum ranges from short-lived small cavities in standing deadwood to several cubic meters of extensive cavities, which have grown over the decades in living old trees. Below are outlined the main cavity types, their shape and properties and the resulting suitability for different types and forms of use are presented.

3.1 Formation of tree hollows

The formation of tree hollows usually results from historic bark or root injury caused by pruning, storm damage, lightning, frost or active construction (mainly by woodpeckers). If these injuries are only superficial, wood development continues, forming new tissue without interference. If, however, the growth zone or the cambium is damaged, the tree by overgrowth tries to close the wound. If this is not successful, wood-decaying fungi can invade and continue the wood decomposition of the cavity. Certain wood species of fungi are specialised in the colonisation of living trees with intact transpiration. Many of these fungi are parasitic and drive cavity development. In woodpecker-holes it can be observed again and again that the overgrowth of the tree is repeatedly cut off by the woodpecker, so it is not possible for the tree to close the wound. While the decomposition in the root interior continues, the outer layers of wood usually remain unaffected, so that the tree can still remain alive for many years (even decades) and continue to offer the tree hollow habitat.

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Figure 1: Callused and almost overgrown knot-hole (left), Woodpecker-hole with fresh hack marks on either side on a Plane (centre) and partially successful callus growth on a woodpecker-hole in an oak tree (right).

The differently shaped cavities can, according to formation, be distinguished as woodpecker-holes, knot-holes, longitudinal splits and lifting bark. The latter is not one of the classic tree holes in the wood body, but is a commonly used example of a nesting/roost feature occupied by bird and bat species and thus of the same ecological and nature conservation law relevance.

3.2 Woodpecker holes

Woodpeckers are active cavity builders who benefit from wood-rotting organisms. Woodpeckers preferentially select pre-damaged trees as excavation sites (Blume 1961, 1990). Initially, woodpeckers make small diameter cavities which, if they are then colonised by decay pathogens, can be further enlarged under simplified conditions (i.e. softer rotten wood) after some time. Depending on the woodpecker species, the cavities are dimensioned differently. All woodpecker-holes have a clearly defined boundary and are species specific round or oval. Often (See Figure 1b, Figure 2a, Figure 5) fresh hack marks can be seen at the cavity entrance. The most striking are the large oval black woodpecker holes which, depending on the density of woodpeckers, may be the most commonly encountered woodpecker cavities. Wryneck also belong to the woodpecker family, and are mainly found in orchards and open park-like landscapes, but uses pre-existing cavities and dens of other species of woodpeckers. Since woodpeckers often make their nest holes in pre-damaged wood, they are regularly encountered in knot-holes, longitudinal splits and bark injuries.

Figure 2: Woodpecker holes in knot-holes (left & centre) and in a tear-out (right). Fresh traces of pecking are evident by the bright ring on the left photograph, and a bare spot on the right of the cavity entrance in the centre photo. Bare wood on the left of the hole shown in the photo on the right may have originated from a cavity user going in and out.

Woodpeckers excavate their cavities so that the brood chamber, which is deep 10 to 65 cm depending on the type, is always below the entrance hole. In its further development (which is connected to the natural thick growth of trees and incipient decay processes), the interior dimensions of the cavity increases bringing about a change in the internal shape. This process takes years or decades; Günther & Hellmann (1995) describe that the interior diameter of regularly measured woodpecker cavities grew an average of 0.14 cm per year. A woodpecker cavity with an average of 12 cm inner diameter therefore needs more than a decade until the chamber volume reached an attractive size for secondary users (Common Swift, for example, 20 cm inner diameter, ≙ 60 years growing season).

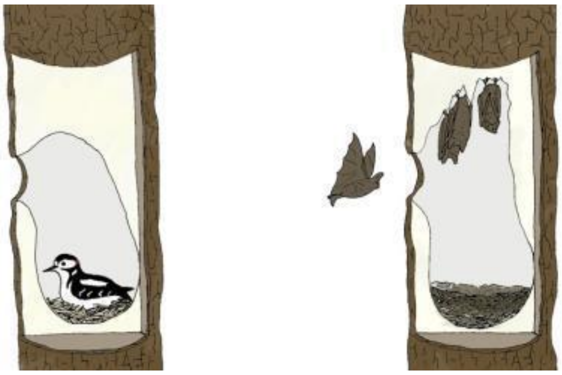

Figure 3: Woodpeckers make their brood chamber below the entrance hole. Over time, the cavity extends upward and is attractive to bats.

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Creating new woodpecker-holes takes according to species an average of nine days (lesser spotted woodpecker) to four weeks (black woodpecker). Although many woodpeckers use the same nesting hole for years (black woodpeckers may use favoured cavities for more than ten years) and continue to visit old cavities, all species will regularly create new cavities. For example, the lesser spotted woodpecker creates up to five cavities per year and uses specially hewn cavities (i.e. not necessarily old nest holes) as a sleeping place.

In the following text the widespread woodpecker species, their habitat requirements and their preferred cavity trees and conditions are briefly introduced and characterized the appearance of their cavities.

Black Woodpecker

Habitat: Preferably older beech forests with scattered conifers but can breed in almost all forest types. However, needs correspondingly large and un-fragmented forest areas.

Cavity location: Almost exclusively in beech with DBH> 40 cm, much less frequently in other tree species on the trunk below the first branch, free approach must be ensured, often at forest pathological conspicuous locations (See Figure 4b).

Cavity: Largest occurring woodpecker hole, oval, often round-arched up and down almost horizontally. Characteristic shape with drip edge (upper cavity entrance) and water leg (lower cavity entrance) for directing the water that flows down the smooth trunk. Glutz of Blotzheim & Bauer (2001) describe typical usage traces that inhabited breeding and sleeping cavities exhibit (See Figure 4a).

Figure 4: Cavity currently used by the Black Woodpecker with bare scrubbed from the tail spot below the entrance hole and semi-circular scratch marks on the hole (a), applied to the damaged area black woodpecker hole that is currently not used by the black woodpecker and the edges grow slowly (b).

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Great Spotted Woodpecker

Habitat: Almost all forest types, even in smaller groups of trees, gardens, parks etc.

Cavity location: In stems or strong side branches, mostly in damaged wood or growth-disturbed sites, not in rotten wood, on softwoods also in normal wood.

Cavity: Round circle, nests, in contrast to sleep cavities often on a more or less clearly pulled down lower margin.

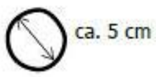


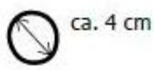
Figure 5: Cavities currently used by the great spotted woodpecker: (to recognise incipient surrounding wall) initial cavity (a) and newly created cavities (b) pulled down lower margin, older cavity at the edge of the cavity has been reworked (c).

Middle Spotted Woodpecker

Habitat: Natural forests with decaying dead wood, preferably oak.

Cavity Location: trunks or thick branches of hardwoods, softwoods only exceptionally. Builds frequent cavities in strong side branches. Cavities are always created in damaged, more or less putrefied, wood.

Cavity: A little higher than wide.

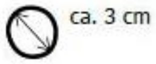


Lesser Spotted Woodpecker

Habitat: Park-like or light deciduous and mixed woodland, and coniferous forests with hardwood admixture (as in parks, orchards, cemeteries, gardens).

Cavity location: trunks or branches (then the cavity entrance is on the underside), typically in dead or decaying wood.

Cavity: Circle round or slightly oval (higher than wide).

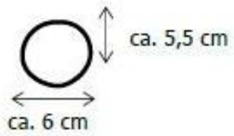


Grey-headed Woodpecker

Habitat: Typical of open old mixed forest, riparian forests, in parks, orchards and cemeteries.

Cavity Location: At the trunk of beech, oak, riparian woods or fruit trees. Rarely on the smooth trunk, more likely at the upper end of Over flushes rotted under tear-outs or in knots. Also happy on the underside of inclined trees.

Cavity: Elliptical (slightly wider than tall).

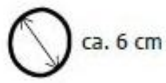


Green Woodpecker

Habitat: Cavities often in the forest, daily activity especially in adjacent parklands, gardens and semi-open landscapes such as orchards and agricultural areas with copses.

Cavity Location: On decaying stands of beeches, oaks, other hardwoods and also fruit trees. Totally new cavities are rarely excavated and often the dens of other species of woodpeckers are taken over.

Cavity: Circle round or slightly oval (slightly higher than wide).



3.3 Knot-holes

Where knot-holes remain open, fungi can penetrate to the termination point and promote cavity formation. Where cavities are smaller incremental growth of wound-wood callus may close the hole by overgrowth. Cavities, caused by knot-holes vary in shape and size, but often have a wall left standing around the base of the lost branch (the branch collar). Most knot-holes first rot down and form water pockets (Phytotelma) with their own faunal communities that are far from completely understood.

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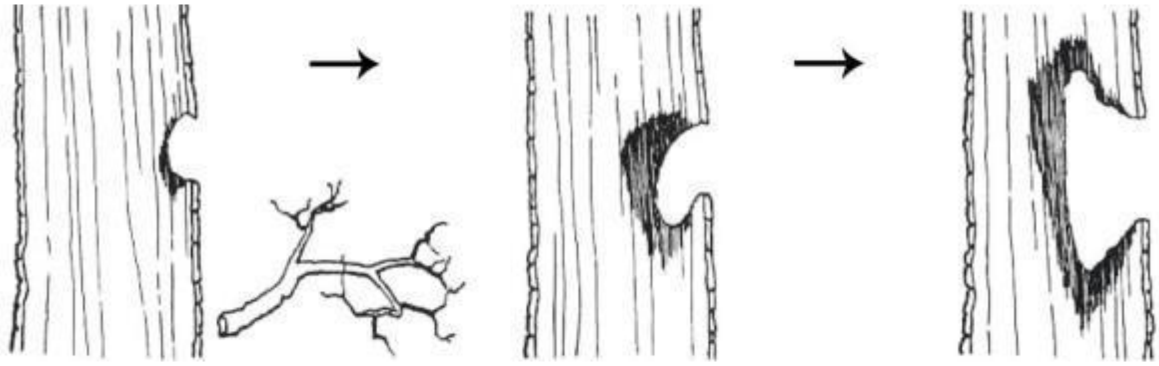


Figure 6: Formation of knot-hole cavities. Drawing by A. Dettwiler (Pro natura & Birdlife Switzerland 1998)

When knot-holes are nearly circular, they are sometimes difficult to distinguish from partially overgrown woodpecker holes. Most of the time bark surrounding the knot-hole (i.e. the branch collar) can be used to identify the structure as a knot-hole, and not a woodpecker-hole (See Figure 7, Figure 8).

Figure 7: Knot-holes of different shape and size. The change in bark structure around the Knot-hole is easy to recognise. The "Chinese moustache" (angular scars) give particularly clear evidence that there is a cavity present behind the entrance opening.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Figure 8: The comparison of these knot-holes (or imminent knot-holes) located in close proximity to woodpecker-holes, shows the differences in the injuries surrounding cortex (left and centre photos). The outgrowth surrounding the woodpecker-hole on the right, could be confused with a knot-hole, but lacks the typical knot-hole "Chinese moustache".

3.4 Splits

Splits are formed by vertical stresses, caused by frost damage, lightning strikes and subsidence as well as by shear and torsional forces in wind.

Figure 9: Various splits: trunk base gap with tree fungi (left), gap with scratch marks on the upper cavity entrance, indicating animal occupancy (centre left), woodpecker holes in an open to the heartwood column (right).

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

In general, columns are at least 30 cm long, but can reach several meters in length. Despite narrow openings, some have surprisingly large interior spaces (particularly if the injury has been very low). Crevice roosts usually rot initially upward. They are found on all tree species, but especially frequently among the smooth bark of hornbeam and beech.

3.5 Bark roosts

On older trees, typically on deciduous tree species such as oak, ash or elm, it is often the case that the bark extending over large areas of the trunk of the tree is fissured. Under the protruding bark arise narrow crevices and cavities that are used by some bird and bat species as a hiding places. Compared to cavities in the timber body, these hiding places offer lesser durability and are particularly sensitive to mechanical impact.

Figure 10: Typical bark roosts: Treecreeper, whiskered bats and Barbastelle very often live behind bark-plates protruding from the stem (left). Behind the relatively small bark clod at side branch in the middle picture hung some Alcathoe bats (centre), numerous whiskered bats behind the cortical column of the trunk of a dying oak (right).

3.6 Location of the cavities on the tree

Basically, you have to anticipate populated cavities in all tree sections, so the best time for the surveying trees is when they are bare of leaves. This is often a good time to discover woodpecker holes on bare stems. It is more difficult is to find cavities on side branches in the crown, and even more so when the tree is in leaf. Even with tree cavity mapping, which must invariably be held at the leafless period, not all cavities are discovered in the crown; bats fitted with radio-transmitters repeatedly show that there are more suitable features that cannot be seen from the ground.

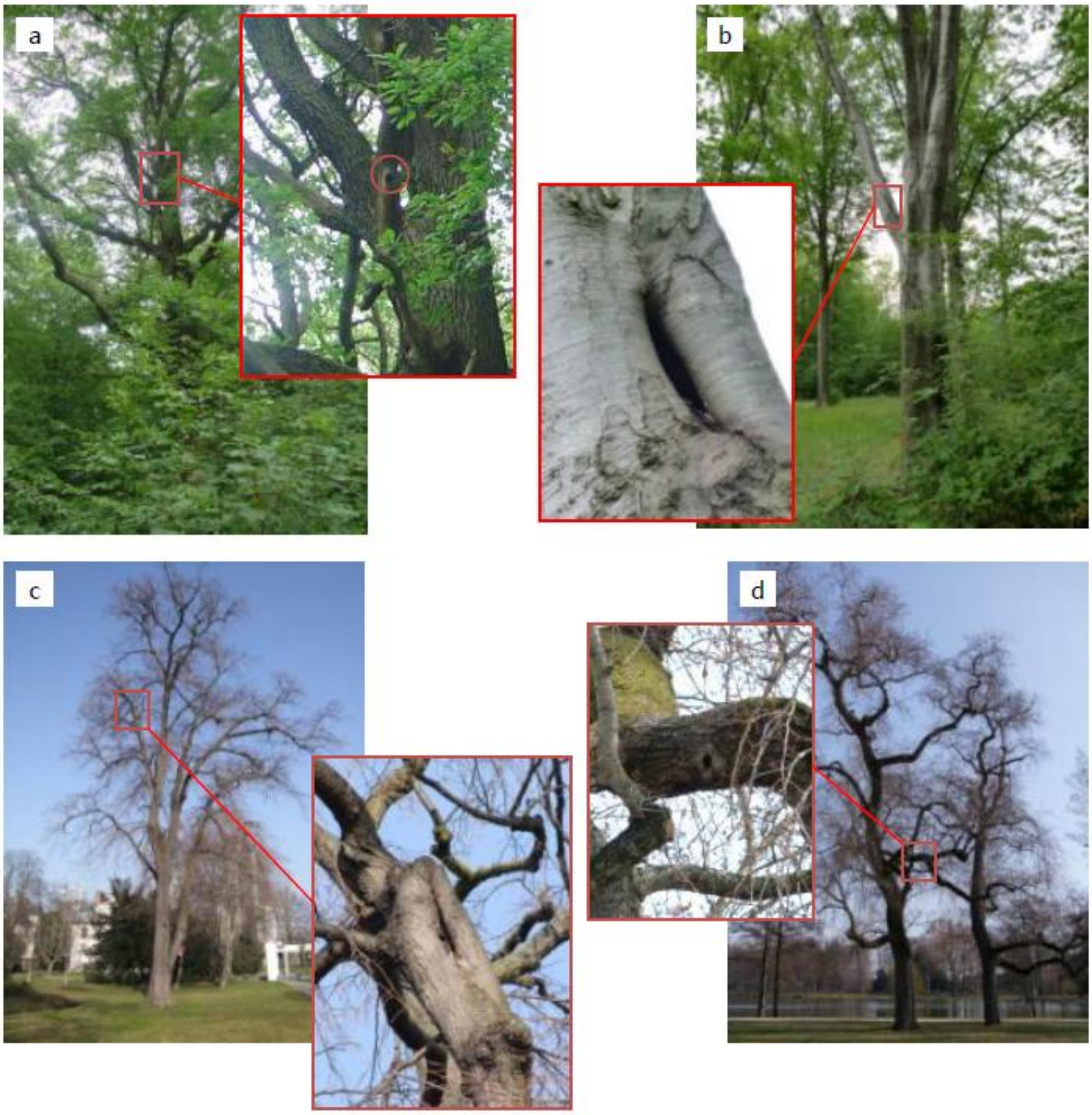


Figure 11: Location of tree cavities which cannot be detected at first glance. When searching for cavities, trees therefore need to be viewed from all sides and from different distances, ideally with good lighting conditions and when trees are bare.

4 Ecology and habitat requirements of tree-inhabiting species

The spectrum of cavity-using species is as wide as the range of different types of cavity. In addition to vertebrates and insects, which will be discussed in more detail below, wood-decaying fungi, mosses and lichens are involved in the cavities and their rotten wood, among them are many endangered and rare species. The fungi plays a key role in wood degradation and further colonization of wood is often only made possible by insects. Since insects lack most of enzymes that are necessary for the digestion of wood, they are dependent on other organisms. Fungi, yeasts or bacteria connect to the lignin and cellulose components of biomass and provide the insect larvae also with certain trace elements, amino acids, vitamins, etc. (eg Möller 2005).

Due to the variety of cavity users and uses, a tree cavity can be occupied at any time of the year. Depending on the form of use, the cavities are left irregularly or are regularly not left over a longer period of several years (eg beetle larvae). When the animals still live in hiding (for example, insects in cavity detritus) or are nocturnal (bats, dormice), it's hard to judge from the outside whether a cavity is currently used or not.

Figure 12: During the year, tree holes of many different types are used for different purposes. There is no time in the year in which it could be assumed in general, a cavity was empty.

	SPRING	SUMMER	AUTUMN	WINTER
BATS	Hibernation Roost	Nursery roost	Lekking roost	Hibernation
OTHER MAMMALS	Hibernation (Breeding) Nesting site			Hibernation
BIRDS	Hibernation (Breeding) Nesting site			Hibernation
INSECTS	Year-round use some grassland and continuously over several years			

Tree hollows are used in a permanent exchange of different cavity dwellers. Often this change is essential for the ongoing usefulness of the cavity. Frank (1994) for example, describes a Daubenton's bat cavity that was filled through the faeces and urine of the animals so that it ran out of the cavity and the cavity was no longer usable for Daubenton's bats. After the departure of the Daubenton's bats numerous dipteran populated the faecal mass so that within four weeks, several centimetres faeces were removed and the cavity was used for the bats again.

A similar function is performed as that of the insect when it comes to tree fungi that play an important role in the decomposition of organic material and the extension of the cavities etc. Similarly, the persistent cavity processing of woodpeckers and the clearing of nesting material (by woodpeckers, nuthatches and other species) is crucial for further usability of the cavity. These examples show the use dynamics of the tree cavity habitat and how the different tree cavity dwellers are dependent on each other and allow the use cycle.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

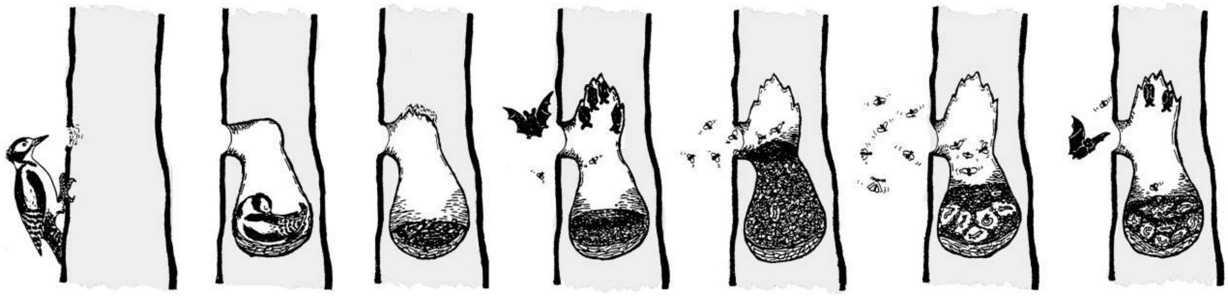


Figure 13: Use development of a woodpecker hole (after Frank 1994): a: Woodpecker while hitting the cavity, b: Woodpecker with the Brood, c: woodpecker has left the cavity, rotting starts up, d: bats use the rotted up cavity e: bats have left the cavity, the cavity is filled to the brim of the test flight hole with mud, which is inhabited by insects and insect larvae, f: Progressive faeces decomposition by insects and insect larvae, g: faeces is largely degraded, bats return to the cavity.

In the following subsections the most important cavity-using species are presented. In the centre of focus are each the cavity and the claims of the cavity to this user.

4.1 Insects

As old trees and tree hollows are used by an enormously large number of insects, only a few species can be introduced as examples here, the focus is on the strictly protected species.

For the groups of species of beetles in particular old and dead wood has a crucial role and provides a lot in habitat: as a development space, foraging, wintering, exposition to sun and mating place. Among the old and dead wood species, the families of high-speed, superb, longhorn, scarab and stag beetles are represented by numerous endangered species.

Weiss & Köhler (2005) showed in performance reviews of deadwood protection measures 16-62 deadwood beetle species and 35-733 individuals per deadwood tree. Nearly 50% of these species are considered rare or only locally occurring, and more than 20% as endangered.

Old trees in the urban area support a variety of beetles with similar life habits, including the strictly protected species great Capricorn beetle *Cerambyx cerdo* and hermit beetle *Osmoderma eremita* are representative presented below.

The great Capricorn beetle is a strikingly large longhorn beetle, which is detected only in a few warm regions of Germany. The species is monophagous, bound by oaks, and is usually found on the pedunculate oak *Quercus robur* and less frequently on the sessile oak *Quercus petraea*. It lays its eggs in bark gaps, whereupon the larvae eat their way through the bark and bast in the sapwood. The larva overwinters at least twice and the generation time is 3-5 years. During this time the beetle larva is immobile tied to the tree. The adult beetle also does not fly far and needs to lay their eggs within in a few meters of the host tree in the nearest suitable tree. The beetles live at pre-damaged, partly sunny old oaks in parks, avenues, riparian forest residues and old oak forests.

The hermit beetle, as the great Capricorn beetle, is a beetle of old forests and forest sites, which has survived mainly in mature trees in urban areas. He belongs to the family of the rose beetle. The beetle and the larvae live for several years in the cavity-detritus of deciduous trees, especially oak, beech, lime, and in pollarded willows and fruit trees. Likewise, sycamores, chestnuts and black locust are populated. The beetles are extremely limited to the breeding tree litter and show little tendency to spread. Suitable trees must therefore ideally be in close proximity to a populated tree. The development from egg to beetle is temperature dependent and takes 3-4 years.

Figure 14: Striking beetles such as a hermit (left) or great capricorn beetle are representative of one of the old fauna, rich in dead wood and trees cavity detritus (Photo: Claus Wurst, Catherine Schieber).

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Figure 15: oak and pollard willow with cavity detritus and occurrence of the hermit *Osmoderma eremita* (Photos: Claus Wurst)

In addition to the beetles, the social insects are an often encountered inhabitant of tree hollows. Hollows are well recognised for their use by wasps, hornets and honey bees. A significant difference in ecology is that the bees form perennial colonies and nests, while in wasps and hornets only the queen hibernates and next year a new nest and a new race is based on a new place. Hornets are predators and prey on a variety of insect species that live on trees. The honey bee thrives on nectar of flowering plants.

Figure 16: Social insect species form colonies in hollow trees. These are annually re-erected, as the Hornet (pictured) or colonized and expanded over the years as the honey bee.

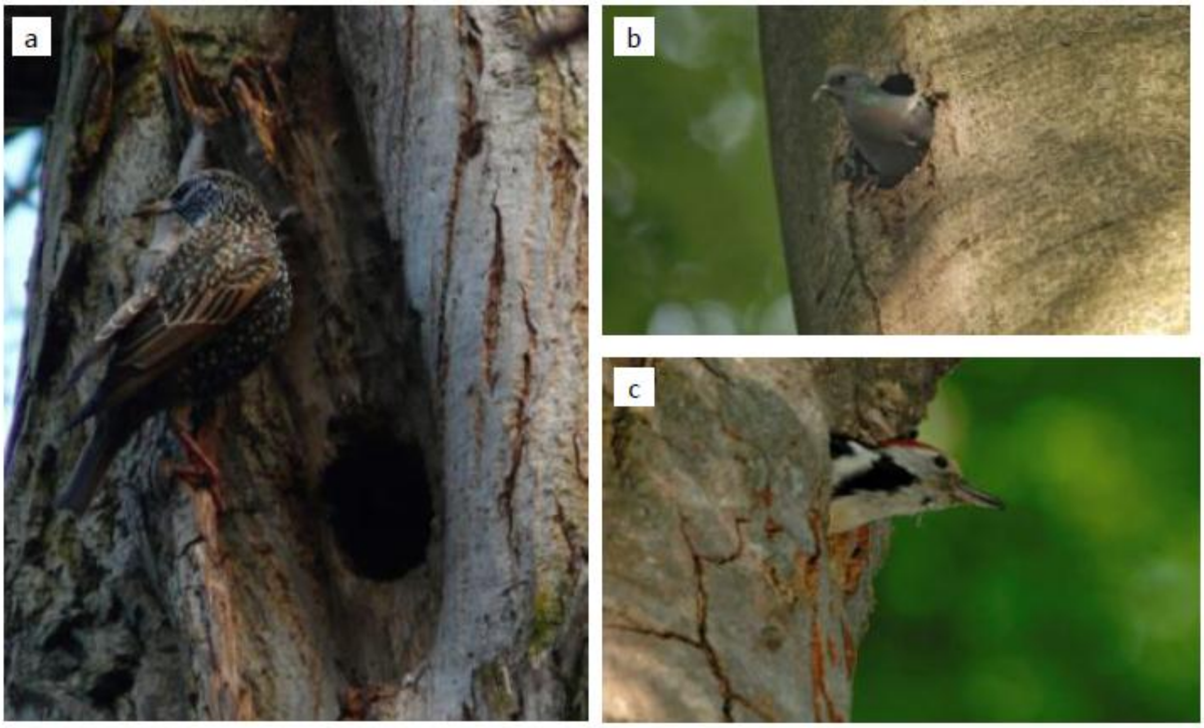
Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

4.2 Birds

Since all European bird species are specially protected by § § 7 and 44 f of the Federal Nature Conservation Act, the groups of species of birds need special attention. In Europe, over 50 species of birds are known to have a functional dependence on tree hollows which serves as a breeding ground, night-roost and even as a source of food. The demands on appearance and size of the cavity differ depending on the species. Many of the cavity nesters are cavity-faithful and favoured sites may be used over several years or for several years broods in the same year.

4.2.1 Primary cavity users

In general, primary and secondary cavity users are to be distinguished. Primary cavity users are species that are able to build their cavities themselves. In Germany these comprise the true woodpeckers, and a subfamily of woodpeckers as well as some tit types, which are also able to create cavities in rotten wood or expand existing ones. Secondary cavity users include all the species that make use of existing cavities. This includes the Wryneck (subfamily of woodpeckers).



Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Figure 17: Tree holes used by birds: woodpecker-hole in knot-hole with starling (a), a dove looking from a woodpecker-hole (b), lesser spotted woodpecker in his breeding cavity (c), a great spotted woodpecker-hole in a tear-out that has been colonised by a blue tit (d) rot-column with young great tits (e) (Photo: Thomas Stephan b and c)

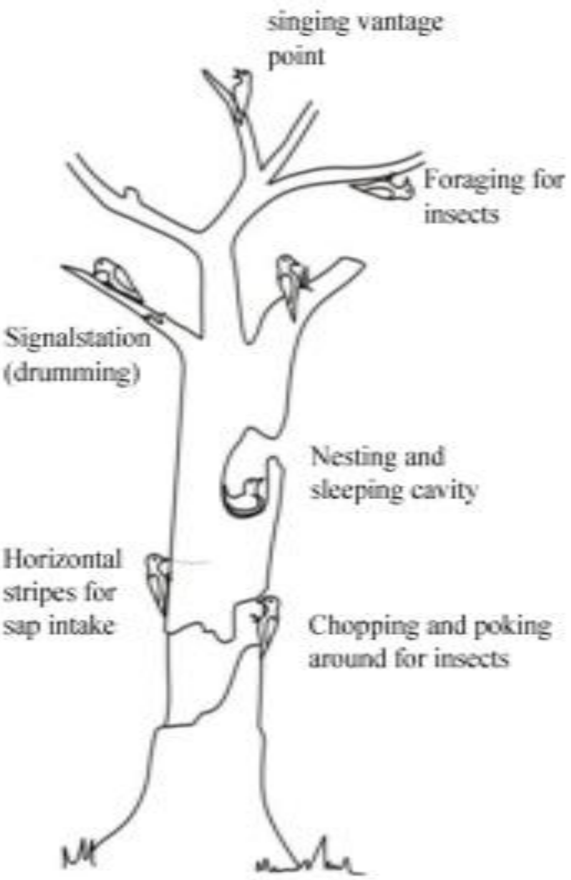


Figure 18: Binding of woodpeckers to life in and around the tree.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

The close relationship between the woodpeckers to life on and in trees is evident in numerous external characteristics and adaptations, such as the particular arrangement of the strong claws and the particularly stable quills in the tail which allow the woodpecker to cling on vertical trunks and climb fast. In addition, the acute and stable beak enables it to tap and hack in search of food under the bark and in rotten wood (which it can pick the insects out of using its long, sticky tongue), or to excavate nesting cavities, and even to hack horizontal stripes in the trees to draw off the sweet sap. A special cartilage mass in the head of the woodpecker prevents the brain being damaged by the hard knocks.

The woodpeckers and their demands on habitat and cavity tree are described in Chapter 3.2. Accordingly only a summary table is included here (Table 8) that shows the most important aspects, especially in regard to the function of the tree hollow and the characteristics of the cavity tree / the cavity.

Table 2. Function and shape of the tree holes in primary cavity users.

SPECIES	HABITAT	FUNCTION OF THE CAVITY(S)	ASSETS OF THE BROOD TREE / CHARACTERISTICS OF THE CAVITY
GREAT SPOTTED WOODPECKER	Forests, gardens, hedgerows, parks, cemeteries	Nesting place	Cavities on the trunk or strong side branches Entrance hole about 5 cm in diameter, the interior depth of 20-50 cm, internal diameter 8-17 cm
		Sleeping place	Often former breeding cavity that is not optimally designed or less thoroughly created their own sleeping cavities
CRESTED TIT	Coniferous rich woods, forests, parks, gardens	Sleeping and nesting place	All tree species, preferably coniferous wood. Own cavities in rotten logs (often a few meters above the ground by the storm broken stumps with the cavity entrance from the top), extended knot-hole or Initial woodpecker cavities cavities with concealed entrance hole are preferred Entrance hole of irregular shape about 3 x 5.5 cm, a depth of about 11-18 cm interior
LESSER SPOTTED WOODPECKER	Sparse forests with old rough barked deciduous trees, orchards	Nesting place	Cavities on the trunk or side branches Entrance hole about 3 cm in diameter, interior depth 10-22 cm, internal diameter about 11 cm
		Sleeping place	As breeding cavity, but further away from the forest, located at the lower tree and air hole slightly larger
MIDDLE SPOTTED WOODPECKER	Forests with a lot of old and dead wood, riparian forests	Nesting place	Cavities on the trunk or strong side branches Entrance hole 3-4 cm diameter, interior depth 21-34 cm, internal diameter about 12 cm Part. also former woodpecker cavities or extended small woodpecker holes
		Sleeping place	As breeding cavity or otherwise known
GREY-HEADED WOODPECKER	Old, small woods, richly structured open land	Nesting place	Entrance hole approx 6 x 5.5 cm, interior depth <56 cm, internal diameter <18 cm
		Sleeping place	As breeding cavity or otherwise known

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

SPECIES	HABITAT	FUNCTION OF THE CAVITY(S)	ASSETS OF THE BROOD TREE / CHARACTERISTICS OF THE CAVITY
GREEN WOODPECKER	Edge of the forest, orchards, copses, richly structured open land	Nesting place	Old cavities (also from other species of woodpecker) are preferred. Designed to rot herds entrance hole about 6 inches in diameter, interior depth 25-59 cm, internal diameter 15-20 cm
		Sleeping place	Old cavities (also from other species of woodpecker) are preferred.
BLACK WOODPECKER	Large forests with thick beech	Nesting place	Beech, BHD> 40 cm Cavities at the base, free approach to entrance hole approx 9 x 12 cm, interior depth 35-65 cm, inner diameter equal to the trough> 25 cm
		Sleeping place	Often former breeding cavity that is not optimally designed (rotting, overgrowth, etc.)
MARSH TIT	Edge of the woods, copses, orchards, parks	Sleeping and nesting place	Small cavities (knot-holes, Initial woodpecker cavities) in rotten wood, can be expanded by hacking, but also finished cavities. Rot cavities if no rotten wood available. Cavity shape and size varies greatly.
WILLOW TIT	Forests, quarries, swamps, humid, rotten trees	Sleeping and nesting place	Preferably, birch, willow (alder, elderberry) Smoothed cavities in rotten trunks, rarely are existing cavities extended (woodpecker Initial cavities) cavities usually <1 m in height located on the trunk Entrance hole about 3 cm in diameter (usually slightly higher than wide), interior depth of approximately 15 cm

4.2.2 Secondary cavity users

The spectrum of the secondary cavity users among the birds is large and includes the families of ducks and pigeons birds, owls, swifts, rollers and passerines. Depending on the family and the type of course, the demands on the cavity differ (Table 3). The group of owls for example, use cavities in various ways: as a breeding and sleeping place, but also as prey larder. According to the different purposes, different cavities are used. Due to the limited supply of cavities there is great competition for the existing ones, so that the choice of the breeding cavity is always dependent on the cavity on offer and the competition. The collared flycatcher for example, returns only at the end of April, beginning of May back from his wintering area beyond the Sahara, and then has to make do with the cavities, which his competitors have left him, so broods have been observed in cavities that had insufficient space or were permanently exposed to rain (Glutz Blotzheim & Bauer 2001). In experiments with sufficient cavities on offer the collared flycatcher has been shown to favour larger and higher-lying cavities. The cavities on offer also affects the breeding behaviour of starlings, which individually either breed in loose association or in colonies. But the latter is only possible only in areas with high woodpecker-hole density. The populations of the dove are dependent on the occurrence of the black woodpecker, as they almost exclusively use black woodpecker holes for nesting.

In addition to the typical cavity-nesting birds, there are also many types of semi-cavity nesters, which also often nest in tree cavities. Among the semi-cavity-nesting birds include, for example wagtail, spotted flycatcher, garden and black redstart, garden and treecreeper. In Table 3, only the hole-nesters are listed.

Table 3: Function and form of the tree holes in the secondary cavity users

SPECIES	HABITAT	FUNCTION OF THE CAVITY(S)	ASSETS OF THE BROOD TREE / CHARACTERISTICS OF THE CAVITY
BLUE TIT	Almost everywhere where old trees can be found	Breeding and sleeping place	With sufficient cavity offer no preference can be seen, otherwise mostly small air holes (≤ 3 cm in diameter = small and medium-sized woodpecker holes) is preferably greater than cavities tit
JACKDAW	Open and semi-open landscapes, forests, parks	Breeding and sleeping place	Breeding mainly in buildings, but also in tree holes (oaks, poplars) with an entrance ≥ 5.5 cm (min. woodpecker cavities-size)
TREE SPARROW	Open landscapes, open fields, forest, settlement edge	Breeding and sleeping place	Tree holes of any kind, shaded cavities but shunned
COLLARED FLYCATCHER	Deciduous forests, parks, gardens, orchards	Breeding and sleeping place	Seemingly unassuming in cavity choice (the collared flycatcher comes very late back from the wintering area, so most cavities are already occupied) prefers high sites (3-23 m above the ground)
DOVE	Forests and parks with mature trees and deposits of the Black Woodpecker	Breeding and sleeping place	Black woodpecker holes, entrance hole 10-20 cm spruce trees in close proximity to the cavity are avoided as enough space for flight must exist
NUTHATCH	Mixed deciduous forests, parks, cemeteries, open fields with mature trees	Breeding and sleeping place	Oaks are chosen above average frequency, and beech exceptionally rarely. Preferably woodpecker holes, cavities and knot-hole at upper half of the stem. Since the cavity entrance can be narrowed with clay, nearly all sizes of hole are adopted. Nest hollow 10-24 cm diameter
GREAT TIT	Almost everywhere where woody plants (preferably in deciduous and mixed forests)	Breeding and sleeping place	Cavities variable, usually in the lower stem region (3-6 m), due to competition with larger cavity nesters. usually small flight holes (≤ 3 cm in diameter = small & medium-sized woodpecker holes) preferred smaller cavities as Blue Tit
SWIFTS	Originally cliff breeders, breeding today in all types of stone, rarely in old trees (in Germany 1%)	Breeding and sleeping place	in sparse crowns of pines or oaks, green, black and great spotted woodpecker holes

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

SPECIES	HABITAT	FUNCTION OF THE CAVITY(S)	ASSETS OF THE BROOD TREE / CHARACTERISTICS OF THE CAVITY
BOREAL OWL	Large, old, contiguous forests (fir, spruce, beech) with free hunting areas (clearings, reforestation areas)	Breeding and sleeping place, food depot	Black woodpecker holes with free approach, cavities with multiple entrances are preferred. Entrance hole 5-18 cm diameter (at least woodpecker cavities size), interior depth 10-100 cm
EURASIAN PYGMY OWL	Near-natural coniferous forest and coniferous-dominated mixed forest with a lot of old and dead wood, exchange of dense woody stands and open areas, like near waters	Hatchery (rarely sleeping place)	Tree breeding preferably spruce, often sickly or dead, often with several cavities on the trunk. The breeding cavity is always the lower. Woodpecker and green woodpecker holes, 4.3 to 5.5 cm diameter entrance hole, interior depth 21-36 cm, 10-19 cm diameter nest hollow
		Food depot	Smaller cavities as described above, and occasionally in cavities under roofs
STARLING	Forests (not in the centre of large closed forests), parks, cemeteries, open fields with mature trees	Breeding and sleeping place	(Great Spotted) woodpecker holes flight entrance $\leq$ 5.5 cm in diameter, 14-17 cm diameter nest hollow preferably higher ground cavities
LITTLE OWL	Open, richly structured terrain: Cattle grazing and mowing, ruderal, pollarded willows stocks, orchards	Breeding and sleeping place, food depot	Often pollarded willows, avenue and fruit trees with free approach to flight entrance 6-19 cm diameter (min. black woodpecker holes-size), interior depth of 13-130 cm, nest hollow 8-12 cm in diameter, usually protected from rain and light
COAL TIT	Coniferous forest, mixed forest, and gardens	Breeding and sleeping place	Due to the high competitive pressure often nests in the ground close input (<2.5 cm)
BROWN OWL	Deciduous and mixed forests, parks, cemeteries, avenues, gardens with mature trees	Breeding and sleeping place, food depot	Preferably spacious cavities (greater than black woodpecker holes) at any height, interior depth 1.5-3 m
WRYNECK	Parks, cemeteries, orchards, open fields	Breeding and sleeping place	Woodpecker-holes, in softwoods, even small gaps in fruit trees 3.5-5 cm diameter entrance hole (middle and great spotted woodpecker cavities)

4.3 Mammals

4.3.1 Bats

Depending on the preference for tree holes, depends upon which bat species might be present. Furthermore, the nature of the cavity will influence the species of bat that might be present, and for what purpose. For example, the noctule uses tree cavities as maternity roosts, male roosts, mating roosts and winter roosts, whereas the Bechstein's bat (which is probably the most closely linked to the forest and tree cavities) spends the winter hibernating in underground cavities, tunnels, etc., and, as far as hitherto known, not in tree hollows.

Some species (noctule, Brandt's bat, brown long-eared, etc.) are regularly found in tree hollows, but also take advantage of roosts in buildings. Also species that have their roosts almost exclusively in buildings, move to tree hollows in certain life stages. For example, the greater mouse-eared bat has nursery roosts exclusively in building (attics), while many males use tree hollows during this time and mating also occurs there in the autumn. Some species such as the greater and lesser horseshoe bat, serotine, pond bat, grey long-eared bat, northern bat, parti-coloured bat, Geoffroy's bat and Kuhl's pipistrelle that are also present in Germany, rarely use tree hollows, so they are not taken into account in the following list (Table 4).

Overall, a species-specific loyalty of bats to certain types of tree cavity is recognizable (Fig. 20). Depending on the function, a tree hollow may hold individuals (males, mating roosts) or may be populated by over 1000 bats (hibernation groups).

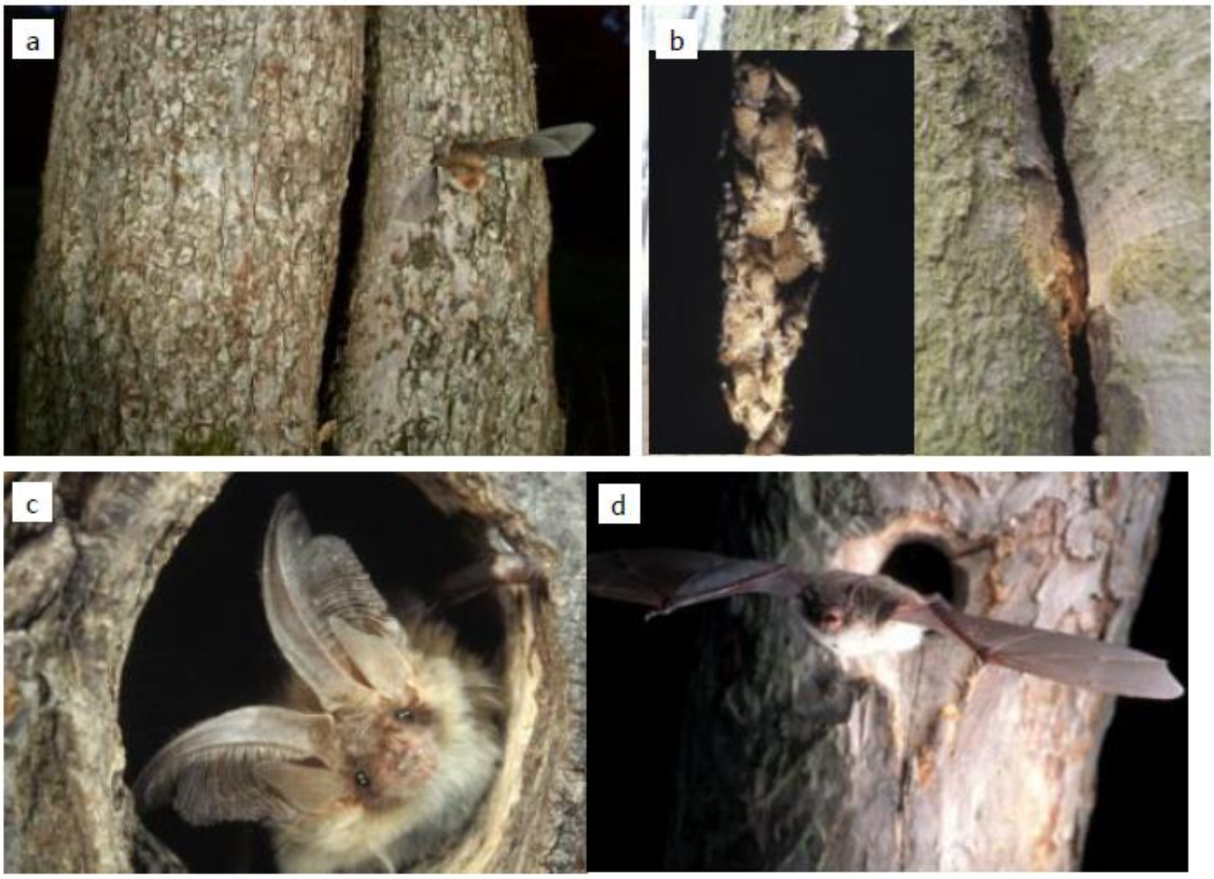


Figure 19: Tree holes used by bats: Column of a fruit tree with Bechstein's bat-nursery (a), column of a beech with hibernating greater noctules (b), great spotted woodpecker cavity with brown long-eared bat (c) and Daubenton's bat (d) (Photos: Thomas Stephan (b , c), Marko König A, D)

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Figure 20: More tree holes used by bats: knot-hole with bat roost (brown long-eared) (a), woodpecker hole in an oak tree inhabited by a maternity roost of the noctule (b), column worked on by woodpecker with a nursery of brown long-eared bats (c), bark roost of Brandt's bats (d) and Alcathoe bat (e) column with a nursery of Brandt's bat (f) and Brandt's bat associated with Nathusius' pipistrelle (g).

Table 4: Function and form of the tree holes at regular intervals in tree hollows to-find species of bats (* except black woodpecker holes).

SPECIES	HABITAT	FUNCTION OF THE CAVITY(S)	PREFERRED CAVITY TYPE/ CHARACTERISTICS OF THE CAVITY
Bechstein's bat	Deciduous forests, structurally rich open land (orchards, gardens etc.)	Nurseries, males and mating roosts	Woodpecker holes*, vertical splits
Brown Long-eared bat	Forests, parks, gardens, orchards	Nurseries, males and mating roosts	Splits, knot-holes, woodpecker holes*
Natterer's bat	Forests, parks, structurally rich open land (orchards, pastures, streams, etc.)	Nurseries, males and mating roosts	Splits, knot-holes, woodpecker holes*

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

SPECIES	HABITAT	FUNCTION OF THE CAVITY(S)	PREFERRED CAVITY TYPE/ CHARACTERISTICS OF THE CAVITY
Brandt's bat	Forests, park-like landscape (hedgerows, hedges), water	Nurseries, males and mating roosts	Bark roosts, splits
Common noctule	Deciduous forests, open land, parks, water bodies, residential areas	Maternity roosts, winter, males and mating roosts	Woodpecker holes, splits, knot-holes
Greater mouse-eared bat	Forests, orchards, settlements	Males and mating Quarter	Splits, knot-holes, woodpecker holes *
Whiskered bat	Settlements, forests	Nurseries, males and mating roosts	Bark roosts, splits
Leisler's bat	Deciduous forests, open land, farms, orchards, residential areas	Maternity roosts, winter, males and mating roosts	Woodpecker holes*, splits
Barbastelle	Structurally rich forests with different ages, hedgerow areas, gardens near forest	Nurseries, males and mating roosts	Bark roosts, splits
Soprano pipistrelle	Riparian forests, plains, water	Natural forests, waters Nurseries, males and mating roosts	Bark roosts, splits
Alcathoe bat	Natural forests, waters	Natural forests, waters Nurseries, males and mating roosts	Bark roosts, splits
Nathusius pipistrelle	Forests, parks, waters nearby settlements	Maternity roosts, winter, males and mating roosts	Bark roosts, splits
Daubenton's bat	Forests, waters, parks, orchards, settlements	Nurseries, males and mating roosts	Woodpecker holes*, splits
Common pipistrelle	Almost all habitats	Males and mating roosts	Bark roosts, splits

4.3.2 Other mammals

In addition to bats, other mammals also use tree hollows. The spectrum ranges from small and medium-sized rodents such as mice, dormice and squirrels to larger species such as pine marten and raccoon, which the former is in particular increasingly common even in urban areas. The dormice (garden dormouse, edible dormouse and common dormouse) spend a good half of the year in hibernation, during which they have reduced their metabolism to a minimum. Even in summer, the animals can fall into such a state of lethargy to save energy in case of bad weather or poor food supply. These periods of rest are spent in tree hollows where they sleep undisturbed and completely invisible from the outside. Encounters with hibernating dormice in tree holes are so far rare, often they withdraw for such a long time into more constant temperature burrows at the back. Systematic controls of tree hollows in the winter show, however, that to date, the proportion of hibernating dormice is underestimated in tree holes (See Figure 32). Raccoon and pine marten use tree holes when rearing their young, and all year round as a sleeping place. According to their size, they have to rely on high-volume cavities as they arise, especially in old trees.

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Figure 21: Tree-cavity dwelling mammals: dormouse (a), pine marten in an old black woodpecker-hole (b) and a large cavity with several entrances via knot-holes and woodpecker-holes holding a red squirrel den (c) (Photos: Marko König, Katharina Schieber).

Table 5: Function and form of tree cavities in mammals (excluding bats)

SPECIES	HABITAT	FUNCTION OF THE CAVITY(S)	PREFERRED CAVITY TYPE/ CHARACTERISTICS OF THE CAVITY
Pine marten	Forests (preferably coniferous forest), dense hedgerow structures, scrubland	Place to sleep, rearing young	All types of tree holes with suitable size
Red squirrel	Forests, parks, gardens	Place to sleep, rearing young, hibernation	Larger volume cavities where the nest is built
Garden dormouse	Coniferous and mixed forests with rock and rock formations	Young rearing, hibernation space, sleeping space	Woodpecker holes, cavities under bark
Common dormouse	Forests (preferably clear, sunny deciduous forests with pronounced fruit-bearing shrub vegetation), parks, orchards	Young rearing, hibernation space, sleeping space	Probably woodpecker holes
Edible dormouse	Deciduous and mixed forests, parks, orchards with sufficient range of tree hollows	Young rearing, hibernation space, sleeping space	Woodpecker holes, which are not far removed from the first branches (so they do not have to climb unprotected along the trunk) on trees with textured bark (rarely beech)
Wood mouse, Bank vole, Yellow-necked mouse	Forests	Young rearing, sleeping, food depot	Cavities of all kinds
Racoon	Floodplains and mixed forests with a high proportion cavity rich old-growth forest, rivers and streams, as well as gardens, parks in the settlement area.	Young rearing, sleeping	Preference of old oak trees

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

5 Distinguishing features of populated tree hollows

In the following chapter examples of field-signs that can be identified from the outside or when looking into the cavity are provided that might indicate whether a cavity is currentlyoccupied, and by what species.

It is important to distinguish between:-

- direct clues that arise from the observation of the animals; and
- indirect indications such as droppings, feathers, nests, etc.

Many species are difficult to observe from the outside, because they are, for example, nocturnal (dormice, bats) or almost never leave the cavity (dead wood beetles, insect larvae, etc.). Even though they are more difficult to interpret, the indirect hints are therefore much more important and just for this should be looked at more carefully.

Although there are obvious references to the occupation of cavities, a large part of the occupied cavity may not be visible from the outside from the ground. Furthermore, the cavity may not be occupied every year, or may be occupied at different times of day. If a cavity therefore is to be affected by any measures a view into the cavity using an endoscope camera (See Chap. 7) must take place for each case, apart from a few obvious exceptions (e.g. when young raised in the cavity can be heard or adult birds seen feeding). The following pages are designed to help recognize the animals and their tracks in the cavity.

Fig 22 It is rare that bird nesting material looks so striking from outside a cavity (a), upon closer inspection, one can, however, see any marks at the cavity entrance (b) (c). These show that the conclusions drawn about the cavity user can be on limited traces (See also Figure 4).

5.1 Insects

Observations of the insects or their larvae will confirm presence immediately. In addition, there is a variety of indirect evidence, but this is usually recognised only by trained observers. These include, in the simplest case the nests of social-insects (hornet, honeybee) or feeding traces, faeces, or the feeding chambers and tunnels of beetle larvae. Representatives the great Capricorn beetle, the hermit beetle and the hornet are discussed below for a huge diversity of insects.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Great Capricorn beetle

Direct evidence

The beetle is rarely observed directly, since it usually only found under appropriate warm, humid (> 18 ° C) conditions at dusk and night flying. It can be found from May to August. The larvae live in the sapwood and are not to be found outside.

Indirect evidence

Most notable evidence are the large holes of hatched beetles. They are upright oval and have a transverse diameter of just over a centimetre at a height of about two inches. With holes in the lower stem portion debris is often found at the foot of the trunk.

Figure 23: Oak trunk with holes from the great Capricorn beetle (top) and detail and debris on the base of the trunk (right).

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Hermit beetle

Direct evidence

The beetle is only very rarely be observed directly, since it lives almost exclusively in the cavity detritus and very rarely actively flies or moves on the trunk. The larvae live in the detritus are also hard to find, unless the detritus is removed and examined, which may be made only in exceptional cases where the habitat is affected.

Indirect evidence

The safest indirect evidence of a settlement arises by faeces that trickle down, along with the detritus from the tree hollow, out of the cavity and lie on the base of the trunk. The faeces may, however, be confused with the faeces of other rose beetle species.

Figure 24: faecal pellets and remains of the hermit beetle from a detritus hollow (left). Detritus with faecal pellets and chrysalis of the Great Gold Beetle, which counts as the hermit to the family of scarab beetles (Photos: Claus Wurst)

Social insects

Direct evidence

During the flight time from April / May to October, the flight activity at the cavity entrance from both bees and hornets is good to watch. Bees remain in the winter in the honeycomb, while hornets die and the queen hibernates alone (usually in the ground).

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Indirect evidence

The nests are unique to each group, the hornets nests are like paper composed of tiny wood chips (Fig. 25), while honeycomb is made of wax.

Figure 25: Open "paper" nest of hornets having vertically oriented honeycomb cells in a fruit tree hollow.

5.2 Birds

Direct evidence

Birds use cavities in trees for breeding and rearing their young and as a sleeping place. In the period of nesting hole choice / cavity construction (spring) and rearing young (summer), one can observe birds in their chosen cavities with some patience and a keen eye. During the breeding and sleep it is hard to tell if a bird is staying in a tree hollow from the outside. In many bird species nesting courtship involves either: Mostly the male displays to the female by staying at the cavity entrance of several cavities, he enters completely into each hole, comes out and the repeats the whole process again and again. Then the female chooses a nesting hole, it remains longer in the cavity and "missing" from the inside and will soon begin to build their nest. In some species (e.g. jackdaw) after the selection of the cavity entrance, the male defends the cavity against competitors. Such behaviour is well observed in the spring and shows, firstly, that these cavities are apparently coveted breeding places and in all likelihood will be filled this spring.

Figure 26. At the start of breeding (March) the striking cavity display is observed and the Blue Tits courtship flights of the male are visible.

During the breeding season foraging entraining adult birds can be observed and when listening very carefully you can often hear the young begging from the cavity interior (especially in the larger species with a sufficient volume of voice).

Figure 27: Spotted Flycatcher (a) and black woodpecker (b) feeding young (Photos: Thomas Stephan).

Indirect evidence

Indirect evidence for usage of the cavities are different depending on the species. The

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following are some typical examples and are documented photographically.

Indirect evidence of the usage by birds are different, depending on the bird and the nature of use. Rarely are they as striking as the droppings of starlings at the cavity entrance or the conspicuous narrowing of the test flight hole of the nuthatch. When looking in the cavity with the endoscope camera you can discover plenty of other indirect references to birds. Above all, their nests can provide information about what kind has been present in the cavity for breeding.

In some textbooks the different nests and eggs of the different species are presented to aid determination (cf. Chap. 7).

Figure 28: Significant traces of faeces at the entrance hole indicate an occupation of the cavity down by starlings. (a, b and c) As can be seen in the first image, starlings are often on branches (waiting approach) in cavity near droppings. The right is a cavity, which was narrowed by nuthatches. In order to make it impossible for larger competitors' access to the cavity, nuthatches often constrict the air holes until only they fit through. In addition to the narrowing of the air hole, the nuthatch "reinforces" the interior of the cavity. Cracks, crevices and bumps are bonded, which when looking at the cavity interior, seems like a plaster wall. Materials used are earth, especially in dry clay and dung of deer and cattle. In larger splits additional pieces of wood can be inserted. The material is, if possible, brought into close proximity and glued to the cavity with a short press on the pad and attached to the tip of the beak by tapping immediately.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

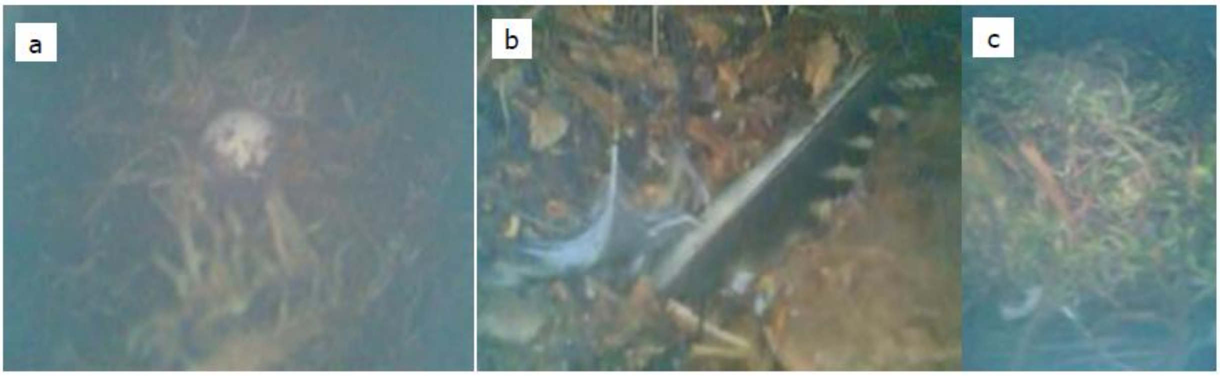


Figure 29: nests in the cavity interior (with an endoscope camera recorded): Great tit nest with egg (a), Great Spotted Woodpecker nest with a spring woodpecker nests are typically made only from wood fritter (b) and a moss nest with a base made of dry grass stalks (c) .

5.3 Mammals

5.3.1 Bats

Direct evidence

Bats are very difficult to measure due to their nocturnal activity. In the summer months they show towards the end of the night conspicuous swarm behaviour to the tree hollow. This behaviour can be used to find the occupied hollow trees, although this requires some experience. In large study areas, particularly in forests, the method is extremely complicated and there is little point.

Some bat species and especially the two noctule species in summer give conspicuous social sounds that can be perceived from the ground with the naked ear. It would be helpful if a bat detector is also used, mainly because colonies of smaller species (e.g. Daubenton’s bat) are more audible. The acoustic conspicuousness is particularly true of nursery roosts, as well as courtship and mating roosts. When awakening during the winter due to sudden temperature rises, hibernating colonies of the Noctule are then also loud and active. For the targeted search of bat roosts, this method requires a lot of experience.

The most efficient method of detection for tree roosts of bats in forests should be telemetry but as they are very loaded with issues to the animals if used incorrectly, they should only be used by experienced processors.

Efficient instructions in respect of bats in the course of consideration of species protection in circumstances of traffic safety may be obtained by the use of an endoscopic camera. Often the animals are hanging in narrow fissures or splits so that the entire interior cavity must be thoroughly investigated. Occupied cavities are not always clear at first glance, and practice is required in order to read the images from the camera clearly. In high-volume and highly rugged cavities, it may not be possible to view the entire cavity space fully, so sometimes presence of bats cannot be excluded despite the visual inspection.

The determination of the different bat species on the basis of recordings with the endoscope camera requires experience. It is important to note the size and shape of the ears (cf. Chap. 7). In addition to the optical references, indirect evidence found in cavities almost always reveals a unique settlement by bats.

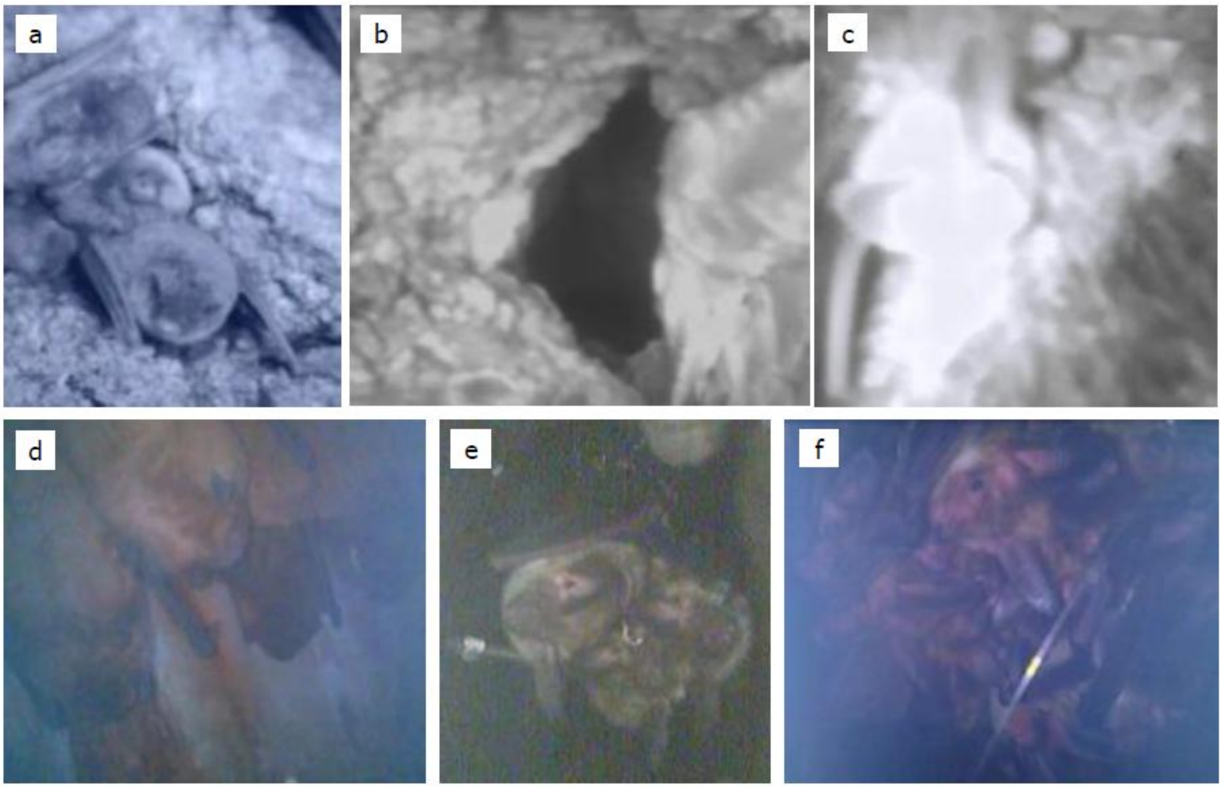


Figure 30. Tree hollow recordings of bats, some animals are very good, some only recognized by a practiced eye such as noctule (a) (b), Bechstein bats (c), (e) & (f) and noctule with smaller undetermined bats (d).

Indirect evidence

The clearest evidence of bats in tree holes results from the bat droppings. This is species-specific specific, but they are in principle easy to crush between the fingers, where the glittering remnants of the exoskeleton of the insects eaten are visible. The comparatively equal sized faeces of mice consists of plant debris, and is hard to crush with your fingers.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

In the bat droppings are also usually single hairs of bats, which can be determined by looking at their fine structure under the microscope.

At regularly used cavities of bats dark fat deposits can be seen from the wings from bats flying in, often at the entrance hole. Also crystallized urine, faeces stripes and a typical smell can indicate bats. The absence of such evidence, however, is not an exclusion criterion for use by bats.

Figure 31. Bat droppings (left) are black or brown, often sparkle a little and crumble when one crushes it with their fingers. With a magnifying glass you can see the remains of insects (legs, feelers, butterfly scales). The thickness is 1-2 mm depending on the type, the length of most are 1 cm. Some are spirally-wound, others less so. Under long-standing bat cavities a guano strip can form (right), but in most cases it is not present.

5.3.2 Other Mammals

Direct evidence

Except for the squirrels, mammals living in tree hollows are crepuscular and nocturnal and therefore difficult to observe during the day. Here again, the use of an endoscope camera lends itself to detection of the animals in the cavity. During hibernation, dormice roll together or are all hidden in the nest, so they are barely visible and hard to seen. Figure 32d shows an example of a dormouse, who has curled up in its spherical nest so that only its tail can be seen. Due to the size and structure of the nest (spherical, made of grass stems) and the bushy tail (real mice have bald tails), it is clear that the animal in this nest is a dormouse.

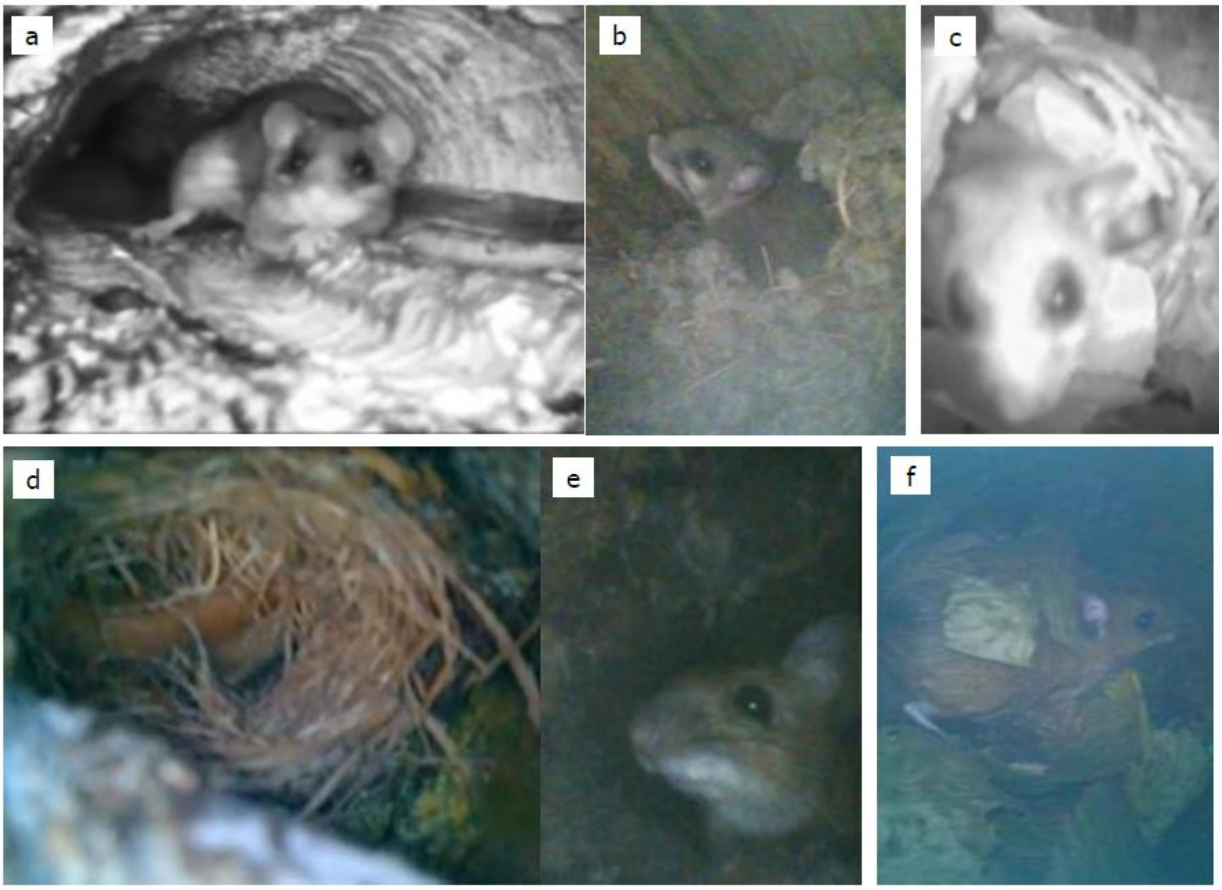


Figure 32. Tree hollow photos of garden dormice (a), (b, (c), common dormouse (d) and wood mice (Apodemus spec) (e), (f).

Indirect evidence

In mammals nests, feeding and droppings often give information about which species uses the cavity. Sometimes claw marks can be seen at the cavity entrance. As with the indirect evidence of the other animals also, it requires experience and proper identification literature (cf. Chap. 7) in order to interpret such traces.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Figure 33: droppings from a raccoon (a), spherical common dormouse nest of grass blades in a tree hollow (b) and traces of feeding of squirrels on the base of the trunk and in the cavity (c), (d), (e).

6. Species protection in the practice of arboriculture & traffic safety

In the previous chapters, different methods and observation notes were discussed to the evidence of protected species. Depending on species, group and season, differing methods are suitable. Table 6 provides an overview of when to use which method with regard to each species group. It should be noted that animals reside in the cavity should only be excluded following inspection using an endoscopic camera, when the inside of the cavity could be completely inspected and checked. Precautionary measures that take account of the cavity tree protection, which help to maintain and protect this valuable habitat, are presented in the following chapter.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Table 6: detectability of the cavity users by various methods

Method and effort	Insects				Birds				Bats				Other mammals			
	Sp	Su	Au	Wi	Sp	Su	Au	Wi	Sp	Su	Au	Wi	Sp	Su	Au	Wi
! Indirect evidence such as droppings and urine marks, nesting material, etc.																
!! Monitoring of ingress and egress, swarming behavior																
!! Surveys of courtship / Social sounds, begging calls of young animals																
!! !! cavity monitoring																

Sp = Spring, Su = Summer, Au = Autumn, Wi= Winter

Detectability of the occupation

	always	by day	night
hardly			
low			
high			
very high			

Effort of the method

hardly	!
low	!!
high	!!!
very high	!!!!

6.1 Planning in advance

In many cases conflicts between species protection and traffic safety can be avoided by forward planning. The avoidance of a conflict is a top priority before any other action, which is to be observed, especially in the legal assessment of an incident under the Federal Nature Conservation Act.

Conflicts can be avoided or solved by, for example, changing marked routes. Here, a consideration of species protection requirements with the needs of visitors of an area is required. The most obvious species conservation law conflicts can be avoided if in the planning and design of the spaces, species conservation is considered.

It should for example, ensure that no points of attraction, such as benches or play equipment, be installed under risk-old trees or trees of particular relevance for the protection of species.

6.2 Tree cavity mapping and marking.

To improve the conservation efforts in future tree care and use, it makes sense to map the tree cavities and mark and detect potentially hollow trees-using species. By marking and the initial treatment in the tree register, cavity trees can be recognized as such and more efficiently protected. An additional marker has the advantage that it is not the first data that must be accessed at a tree, but that is obvious at first glance that the affected tree is a cavity tree, in which case conflicts with the conservation law may occur and appropriate measures may be needed.

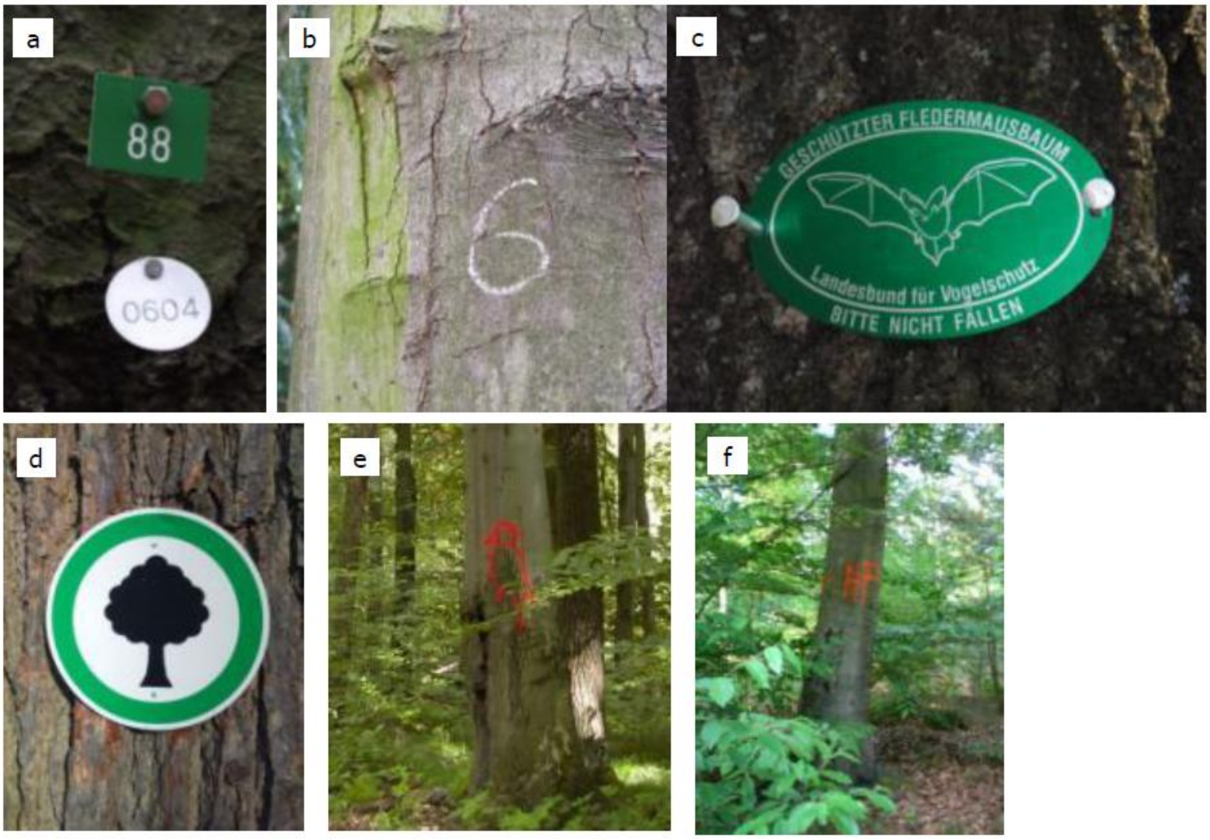


Figure 34: Marking of cavity trees: With the tree register badge (green) additional badge (silver) in the city of Frankfurt (a), with forestry or industrial paint (Edding 950) (b), with bat-plaques in the park of Nymphenburg Palace in Munich (c) Habitat tree plaque (d). The marking in the forest varies depending on the jurisdiction and forester; sometimes hollow trees are marked with a woodpecker (s), sometimes with an "H" for Habitat tree, sometimes with "HF" (Habitat Fledermausbaum) for Habitat and Bat Tree (f), sometimes with "FM" (Fledermausbaum) for bat tree.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

The mapping of the existing species spectrum has the advantage that when intervention/interference that results in a conflict occurs, the potential and/or actual status of sensitive species is known and therefore reasonable alternatives can be considered. Thus, the effects of certain measures can be far better estimated.

Please note that old data (older than 5 years) will not permit reliable conclusions. Both tree cavity mapping and inspection must therefore be repeated and supplemented at regular intervals. Investigations in a Frankfurt (am Main) Park show the tremendous momentum in the tree cavity development: Within 6 years, almost 15% of the mapped cavities were no longer available, but almost four times as many had developed and had to be checked and calibrated/measured (ITN 2012).

6.3 Completing the test protocols

In the current guidelines for arborists (and related occupations) there is no (or inadequate) indication of the species protection law and the way of life of rare tree species inhabiting cavities. In standard test protocols, species protection also does not matter. To meet the demands of the species protection requirements, the test species protection-legal issues must become an integral part of the tree control. The test protocols specifically list "species protection affected". This can for example look like the form shown in Figure 35. This example was based on the exemplary control sheet for a single tree of the FLL created (FLL 2010).

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Figure 35: A fortified test protocol for the single tree control to FLL 2010

Example for a checklist for policy control of a single tree - Part 1

Basic data

Tree No	Tree species		Date
Location			Before/at house No.
Office		Inspector	
Control zzt	Years/Annual	Eligible expectation of sofety of traffic	Low / High

Tree data: Intakes in the monitoring control is not necessary - approximate

Tree height m · Crown width m · Trunk circumference at 1 m high cm · Age at current location / life Year

Extras

State: Healthy/slightly damaged · Heavy damage · Development phase · Juvenile phase · Mature phase · Aging phase

Further action under policy control on Part2 (tick appropriate boxes and fill in)

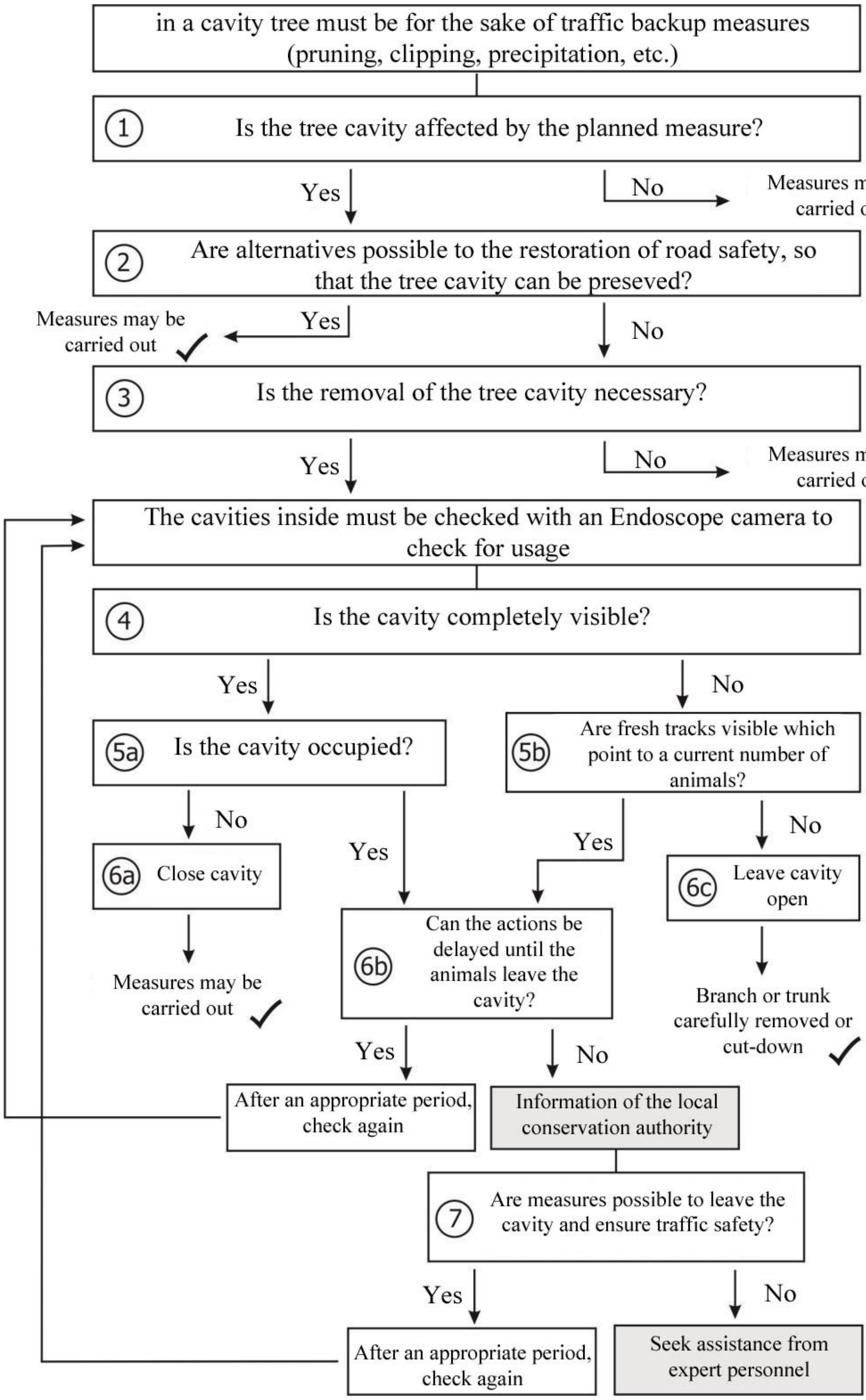
Date/Year of control	Control	Control	Control	Control
Action	No / Yes	No / Yes	No / Yes	No / Yes
Consultation with department				
Detailed investigations				
Tree care measures (e.g. dead wood removal, gauge section, shortening part of the crown, crown interface security				
Control interval				
Control interval options	Years/Annual	Years/Annual	Years/Annual	Years/Annual
Past control intervals				
Precipitation				
Completion	Immediately / Within Weeks	Immediately / Within Weeks	Immediately / Within Weeks	Immediately / Within Weeks
Comments				
Date, signature tree inspection				
Further inspection posts				

Types affected by species protection laws (tree hollows, bark roosts, nests eyries etc)	No / Yes
Conflict with current measures	No / Yes
Conservation authorities informed	No / Yes

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

6.4 Good practice

If it occurs in the course of tree care and / or traffic safety work the case that action must be performed in a cavity tree, proceed as follows:



Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Notes on the individual points:

(2) For example, when the stability of the tree is impaired, alternative methods might be considered in order to restore stability and thereby safeguard the cavity. Such alternatives may include:

- Branch removal
- Crown reduction
- Capping

This is especially important in parks or other urban green areas where only tree ruins characterize the image of the park.

Figure 36: Pollard cavity tree in the edge strip of a park in Frankfurt am Main.

(4) An inspection of cavities can never be done from the ground or from the outside, and the view into the cavity is indispensable. To this end, endoscope cameras are useful, as they are often used in plumbing (Product note in chapter 7.). These cameras have a flexible "gooseneck", so you may examine the entire cavity inside with them. Both images and videos can also be recorded. In the cavity inspection must be performed to ensure that all areas of the cavity interior can be illuminated.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

(5a) If the cavity is in use, always refer to the more or strictly protected species (See Table 1, Chap. 2). Precaution should also be observed for species on the Red List of the federal and state governments. Is the cavity used by other species (e.g. forest or yellow-necked mouse) if occupied the cavity must remain open, however the tree or branch may like be cut off, as long as this is done carefully (for example by a branch excavator).

(5b) For large cavities or where visibility is poor, it is not always possible despite detailed inspection to survey the entire cavity interior. If this is the case and there are fresh tracks (droppings, nests, eggs, an intense aroma, etc.) to indicate a population of animals, the cavity must be treated as an occupied cavity.

(6a) In order to allow the safe implementation of safety measures the cavities are sealed so that animals cannot colonize them. To seal the cavity, crumpled newspaper is taken as it adapts to the shape and size of the cavity entrance. For protection against rain and humidity, the newspaper is packed in plastic bags.

(6b) At this point it is important to consider whether the measures proposed can be delayed again. When the animals no longer use the cavity depends on what species and in which function the cavity is used. Many species use tree hollows as a place to sleep and change them regularly. If it is the sleeping place of a single animal, the cavity is often unoccupied again the very next day. It should be noted that bats are nocturnal and sleeping communities may be present during the day.

Table 7: Cavity function and duration of use for the different tree cavity users.

SPECIES	SPRING	SUMMER	AUTUMN	WINTER
INSECTS	All-year-round usage → it cannot be expected out of the cavity			
BIRDS	Courtship, nest-building → before nesting and breeding begins the cavity is regularly left and can then be monitored	breeding → only after hatching ends can cavity be checked again (depending on the species variable, no later than mid / late August)	Roost → cavity is left regularly (days) and can then be inspected	
BATS	Roost → regular cavity changes, so that the cavity can be controlled by a few (1-3) days again	Roost, nursery → regular cavity changes, so that the cavity can be controlled by a few (5-10) days again	Place to sleep, courtship → regular cavity changes, so that the cavity can be controlled by a few (1-3) days again	Hibernation → cavity is left until the end of hibernation (about March) and can then be checked again

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

SPECIES	SPRING	SUMMER	AUTUMN	WINTER
OTHER MAMMALS	Roost → regular cavity changes, so that the cavity can be controlled after a few days	Breeding season → cavity is left in July / August and can then be checked again	→ hibernation cavity is left only after May and can then be controlled	

If displacement of the measures is not possible, a prohibited activity under § 44 Federal Nature Conservation Act cannot be excluded. In any case, the local conservation authority must be informed.

6c If it cannot be ruled out that there are animals in the cavity, or there are animals in the cavity which are not protected under § 7 Federal Nature Conservation Act, the tree must be treated carefully. When these branches are to be removed they should be cut off and then placed carefully on the floor.

7 If the time until the animals leave the cavity is predictable, options to maintain the tree or the affected limb may be conceivable up to that point. Such options may include:-

- relief cuts;
- crown reduction;
- capping;
- fixation to the neighbouring tree;
- barrier and signage for the area in which road safety temporarily or permanently cannot be guaranteed; and
- blocking existing paths and creating a new diversion.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Figure 37: Scorching in a fungus-infested beech in Frankfurt (am Main) Park. The beech should be taken by default because of the risk, but starlings bred in a wood-pecker hole. The beech was relieved and as a precaution additionally fixed to the next tree and a massive crown reduction was performed. After about two months, the cavity was empty when re-inspected, so the tree could be felled.

If none of the above alternatives are possible and the cavity has to be removed despite the presence by strict or specially protected species in accordance with § 7 Federal Nature Conservation Act, necessarily qualified personnel (animal ecologists, conservationists, etc.) must be consulted.

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6.5 Case Studies

The following examples provide possibilities which have occurred in the tree care practice, as well as the obligation to maintain safety. The technical background of the solutions are the animal ecological basis and consideration of the species protection provisions under § § 39, 44, 45 and 65, 67 and 69 Federal Nature Conservation Act. It is also assumed that a proactive and careful examination of the facts has been made and a close professional and formal and legal agreement with the relevant nature conservation authority takes place (e.g. testing of species protection requirements, protection of species liberation, etc..).

Assistance on how to:-

- Check whether the tree species has legally relevant protected habitat structures (tree hollows, crevices, strong woody debris, nests).
- Check whether the tree is currently used or evidence of use by animal species can be identified (e.g. at and departing birds, droppings, nests, debris).
- inform the conservation authority of recognizable signs of especially or strictly protected animal species, and in case of conflict or uncertainty get external advice to help.
- Is the tree occupied: Measures must be taken. Get in "imminent danger" external advice, involve nature conservation authority and find a solution together.
- If the tree is currently vacant, but has a protected breeding site and resting place: Please check whether the measure is absolutely necessary (avoid option) or whether a preservation of habitat structures is possible (e.g., relief cut instead of felling).
- Integrate the conservation authority and clarify the legal action (if a necessary prerequisite for species conservation law exception, exemption application, etc.).

Case Study 1: Occupied Bat Tree in Winter

If during a tree inspection a tree is found which holds a hibernating roost for bats in a tree hollow, extreme caution should be exercised. Bats in winter are in deep lethargy and are unreactive. They use deep sleep to survive the food shortage during the winter time. Any disruption can result in the animals starving. Cutting or felling can cause the death of the animals.

There are two options:-

a) If it is a usual care measure (e.g. removal of dry branches), they shall delay work on the tree until the animals have left the tree voluntarily. Any direct interference is to be avoided. Dispersal is weather dependent and usually occurs sometime in the spring. Many animals use the tree throughout the winter from early November until April. Since winter roosting trees are extremely important trees, they need to be considered when any tree maintenance action is required. Please inform the competent lower nature conservation authority (UNB) and ask bat watchers to advise.

b) Is the state of the tree in "imminent danger"? If so, the tree should be fenced off until the animals have left the tree voluntarily. You may not actively exclude bats in hibernation from the tree. If necessary, the tree must be additionally secured to prevent it from falling or breaking. In particularly difficult cases, such as if the point is not blocked and you cannot wait for the exodus, there are individual solutions which are not without stress and danger for the animals. Here external bat workers expertise is absolutely vital. In an extreme emergency it is conceivable, for example, by a controlled cutting action with a chain-saw to remove the section holding the bats and immediate re-install it on a neighbouring tree.

Case Study 2: Occupied Bat tree in summer

Ideally, no maintenance measures are carried out on trees in the summer, unless they are essential to the maintenance of the tree or traffic safety. If bats are discovered in a hollow of the tree, there are the following options:-

a) They shall refrain from action until late autumn or (in acute and urgent cases) at least until the animals have left the tree. In the summer, bats change the trees they sleep in every few days. Watch them, the tree and the cavity and make sure that no animals are present. Please inform the competent lower nature conservation authority (UNB) and ask bat surveyors to advise.

b) If the tree is in "imminent danger," the danger point should be shut off until the animals have left the tree voluntarily. In summer, this should be quite possible in nearly all cases, since the animals change the tree after a few days. If necessary, the tree must be additionally secured to prevent it from falling or breaking. Please inform the competent lower nature conservation authority (UNB) and ask bat surveyors to advise.

Case Study 3: Currently unoccupied bat tree

You discover prior to care or felling measures bat droppings in a tree hollow, but the tree is not currently occupied. Because bats return to favoured tree hollows over the years, even the currently unoccupied tree is a strictly protected breeding site and resting place and absolutely worth preserving. You must first check whether the tree or the tree cavity can be retained. Only in very exceptional, justified cases, taking all technical alternatives into consideration may the tree be subsequently removed.

Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

Case Study 4: Currently occupied tree with breeding birds

a) If the tree is known as the currently occupied nesting tree, general care measures as defined in § 39 Federal Nature Conservation Act are to be moved. If breeding birds are discovered during maintenance measures, the work must be interrupted until the young birds have flown independently. Any disturbance of breeding birds (meaning all European bird species!) - whether intentional or not - must be avoided.

b) If there is "imminent danger," the danger point, ideally, should be shut off until the animals have left the tree voluntarily. If necessary, the tree must be additionally secured to prevent it from falling or breaking. In very substantiated emergency situations, special solutions may be required, such as move a tree hollow young with being fed by a few meters. However, such special solutions are possible only with experienced care. Please inform the competent lower nature conservation authority (UNB) and ask birders to advise.

Case Study 5: Unattended bird nesting tree

Do they need to perform maintenance or felling measure to a tree that has a recognizable bird breeding ground, if the nest or the tree cavity is currently vacant, however, the following facts should be checked:

If the nest is one of a bird which builds a new nest for each brood, the measure can be done, if it is ensured that no birds or nests are concerned. The vast majority of bird species that occur in parks and gardens, build a new nest each year.

If the nesting place is used recurrently by a bird, for example, after hibernation, the nesting place is a protected breeding sites and resting place and must not be destroyed. As with an unoccupied bat tree (so) they must first check whether the nesting place, the tree or the tree cavity can be obtained even if acute threat of injury or killing harmful to the animals. Only in very exceptional, justified cases, taking all technical alternatives into consideration may the tree be subsequently removed. Recurring used breeding sites are usually expensive-to-build eyries or tree cavities.

Case Study 6: Tree with particularly or strictly protected species of insects

Do they need to perform maintenance or felling measure on a tree, which is inhabited by more or strictly protected species of insects, is responsible for general care measures as defined in § 39 Federal Nature Conservation Act to consider whether the measure can be avoided so that the

- often very specific - habitat the insects use is not destroyed. In the case that support operations are omitted or even in "imminent danger" following items shall be verified:

Is it social insects that form the communities, one must ideally postpone the measure. Wasp species and these include Hornets among others, leave the nest when winter comes. The queen overwinters and is based in the following year a new community in a new place. Honeybees, however, overwinter in their nest. In this case, the nest site should be obtained. If this is not possible, look for external help please for resettlement.

In the hollows of trees or in dead-wood living beetles usually have a multi-year development period. This applies first to examine whether the measure is absolutely necessary or if the habitat can be obtained by a suitable minimizing measure (eg, relief cut instead of felling). If it is in "imminent danger" and the tree cannot be saved, the beetles relevant structures must be carefully secured, e.g. by large-sized cutting the stem piece and attachment to a suitable location nearby. In any case, external expertise should be consulted for this.

Case Study 7: Felled Tree with animals discovered

If in spite of all precautionary measures as part of a felling measure animals such as hibernating bats, juveniles or beetle larvae are found, it is absolutely necessary and for the animals to be cared for properly by directly trained species experts. Immediately inform the competent nature conservation authority. Please make sure that no further damage comes to the animals (eg resting of the work, no further processing of the trunk, keeping of animals, etc. in a safe container.). If the animals are not injured, it is desirable that they be reintroduced immediately or as soon as possible on the spot again.

7. Further information

Projects

DBU Project "Conservation and the Conservation of Historic Parks", TU Berlin

Quote from the website: *"Historical parks are important parts of our cultural heritage and have an outstanding importance for conservation. Because of their long history of use, they are often treasure troves of biodiversity and therefore also very important for nature conservation. Addressees of this Internet Handbook, which results from a research project, are all that have to do with historical parks. The information provided should promote and help to integrate these objectives in a historically appropriate park maintenance and understanding of nature conservation objectives in historic parks. "*

http://naturschutz-und-denkmalpflege.projekte.tu-berlin.de/

Text collection of nature protection law, international agreements, regulations

http://www.bfn.de/0506_textsammlung.html

http://www.bfn.de/0320_gehoelzschnitt.html.

Lukas, A.; Würsig, T. & Teßmer, D. (2011): Artenschutzrecht. Recht der Natur, Sonderheft 66. HRSG: IDUR e.V., BUND e.V.

Schumacher/Fischer-Hüftle (2011): Bundesnaturschutzgesetz. Kommentar. 2. Auflage, Verlag Kohlhammer.

Information on protected species

http://www.wisia.de/
http://naturschutz-und-denkmalpflege.projekte.tu-berlin.de/pages/recht/naturschutzrecht/artenschutz/besonders-und-streng-geschuetzte-arten.php

Information zum Eremit, Eichenheldbock und Veilchenblauer Wurzelhalsschnellkäfer

http://www.lubw.baden-wuerttemberg.de/servlet/is/30093/osm_ere_end.pdf?command=downloadContent&filename=osm_ere_end.pdf

http://www.lfu.bayern.de/natur/sap/arteninformationen/steckbrief/zeige/122504

http://www.hessen-forst.de/naturschutz-artenschutz-steckbriefe,-gutachten-und-hilfskonzepte-zu-ffh-arten-2294.html
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Traffic safety

Breloer, H. (2003): Verkehrssicherungspflicht bei Bäumen aus rechtlicher und fachlicher Sicht.
FLL Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau e.V. (2010): Baumkontrollrichtlinien. Richtlinien für Regelkontrollen zur Überprüfung der Verkehrssicherheit von Bäumen.

Hilsberg, R. (2011): Rechtsfragen zur Verkehrssicherung in historischen Park- und Gartenanlagen unter Berücksichtigung des Denkmalschutzes und des Naturschutzes. Gutachten erstellt im Rahmen des DBU-Projekts „Naturschutz und Denkmalpflege in historischen Parkanlagen“ an der TU Berlin.

Download über: http://naturschutz-und-denkmalpflege.projekte.tu-berlin.de/media/pdf/Hilsberg_Rechtsgutachten_Endv_Nov2011.pdf#page=47

Endoscope cameras

An endoscope camera with a long and movable endoscope is important for tree cavity inspections. The camera should be waterproof and if possible, should have a wide angle and a telephoto camera, as the telephoto camera has a smaller diameter and thus can be implemented even in narrow splits.

Example: dnt Findoo Profiline Plus endoscope camera to get at multiple vendors, original price 160 €.

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Note: This English translation was primarily interpreted using Google Translate and may therefore not be fully accurate.

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