Cavity Trees in Urban Areas

Guideline





Development of a guideline
for preserving a valuable habitat
in parks and urban forests,
taking into account road safety

UMWELTAMT

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General principles for the attention to species protection in the course of tree care and road safety

- Old trees are particularly worthy of preservation. They shape our environment, have a positive effect on people and are an essential habitat for many animal species.
- In towns and villages, old trees need thorough care in order to preserve them as habitats and to nevertheless ensure road safety.
- Many species of animals living in old trees are endangered. Regulations pertaining to species protection law serve the special and strict protection of these species and their habitats.
- Statutory species protection is obligatory for tree maintenance and road safety. Violations are an offence and can, in accordance with § 69 and 71 of the Federal Nature Conservation Act (BnatSchG), be punished with substantial fines or, in the worst case, with imprisonment.
- With regard to special species protection, it is particularly true that there need be no intention to commit an offence. Excuses ("I didn't see it, didn't know about it...") do not hold good.
- For factual and legal reasons, it is necessary that tree inspectors and surgeons themselves keep up-to-date with regard to species protection. Experts must be consulted for specific types of issues relating to species protection law.
- Each case of conflict requires its own factual assessment and a decision has to be made between road safety and species protection. The formal way (an assessment that takes species protection law into account, the evaluation of exemption in accordance with § 45) must be respected even in cases of "imminent danger".
- According to the Federal Nature Conservation Act, the principle of avoiding anything that impinges on species-protection laws applies over any possible minimisation. Before a tree is felled, the alternatives must be considered.
- Diligent tree inspections take into account the protection of species in the inspection certificate.
- When carrying out unavoidable tree felling or tree maintenance work, tree inspections shall be performed according to current state-of-the-art methods to avoid any direct risk to specially protected species.
- For landowners, the principle of precautionary measures relating to species protection applies. These include the following: expanding one's knowledge of specially and strictly protected species; the marking and registration of trees affected by species protection laws; taking old stocks of trees into consideration when planning paths and construction projects and much more.

1. Introduction

With increasing age, trees become not only larger and more impressive, but habitats colonised by a variety of animal species develop. Without bark splits, cavities and deadwood, many wild mammals, birds and insects would not be present in our landscape. Due to their rarity and endangerment, these species enjoy special or strict protection in accordance with European and German laws. The same thus apply *mutatis mutandis* to the old tree that offers such breeding and resting places of legally protected species.

In urban areas, old trees are found in parks, cemeteries, public places or on avenues. The owner of the area on which an old tree stands, along with tree inspectors and surgeons, have a duty to road safety in order to prevent damage to property and above all personal injury. Conflicts can arise from the legal requirements of species protection as well as from the obligation to maintain road safety that need to be resolved objectively, taking into account all circumstances.

The purpose of this guideline is to provide practical information to people who, on the grounds of their profession or voluntary activities, are looking for solutions to the conflict area of species protection and road safety. After a description of the legal situation, technical information about the origin and structure of tree hollows and species that dwell in tree cavities is presented. Distinguishing features of the tree hollows and their inhabitants are intended to raise awareness of this habitat. Finally, possible solutions in general as well as case studies are presented. In the further references, you can find a collection of materials on the topic of species protection in old trees.

On the use of this guideline: it does not claim to be complete. Given the large number of species in and on trees, it can only heighten one's awareness and draw attention to the issue. Furthermore, there is an obligation to continue to inform oneself or to obtain appropriate advice from experts. Further references relating to this are given in the appendix.

Overall, the guideline is intended to refer to old trees as a habitat and to thus promote their careful handling. Placing strong emphasis of the legal protection of species is an important requirement, however, and should not be the sole motivation for sustainable arboriculture.

2. Legal framework

The legal framework of the legal duty to maintain road safety ensues – in contrast to the protection of species – not directly from a law, but rather from direct current case law. A current example is the judgment of the Federal Supreme Court (Bundesgerichtshof – BGH) of 02.10.2012 - VI ZR 311/1. It states, among other things:

"Note, however, that not every abstract risk can be addressed proactively. A general ban on not endangering others would be utopian. Road safety measures which exclude any damage cannot be achieved in everyday life."

The judgment deals with typical forest hazards and, with regard to road safety measures, the degree of precaution exercised by the forest owner. Among other things, it states "*that the forest owner is, in principle, not obliged to protect the traffic on forest roads from dangers that are typically found in forests*". The Federal Supreme Court even believes that the forest visitors should take responsibility for themselves: "*Since visitors to forests use forest at their own risk, any liability of the forest owner is excluded for dangers that are typically found in forests*."

The aforesaid judgment does not govern the future handling of road safety measures in principle, but is, at least for forests, already a major advance in solving the problem.

Requirements of species protection law are implemented in the Federal Nature Conservation Act (BNatSchG). It is divided into "General Regulations" (Articles 37 and 38), the "General Species Protection" (especially **Article 39**) and the "Special Species Protection" in Articles 44 and 45. With "Special Species Protection", the legislator has implemented international obligations arising from the European Birds Directive 2009/147/EC, the Flora-Fauna-Habitat (FFH) Directive and the Environmental Liability Directive 2004/35/EC.

Requirements of "**General Species Protection**" are explicit and usually easy to implement. According to these, pursuing, injuring, killing wildlife or destroying their habitats wilfully or without reasonable cause (Article 39 (1), nos. 1 and 3) is prohibited. Similarly, according to Article 39 (5), no. 2 it is prohibited

" to cut or graft trees located outside of forests, short-rotation forestry operations or horticulturally used soil areas, and hedges, living fences, shrubs and other woody plants, in the period from 1 March to 30 September; gentle pruning for form and care, for removal of additional growth or for maintenance of tree health, is permitted. "

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

The statutory requirements of the "**Special Species Protection**" are formulated in **Article 44 and 45 BNatSchG** and are much more relevant in the possible field of conflict of species protection and road safety measures. Quotation:

(1) It is prohibited,

1. to pursue, capture, injure or kill wild animals of specially protected species, or to take from the wild, damage or destroy their developmental stages,

2. to significantly disturb wild animals of strictly protected species and of European bird species during their breeding, rearing, moulting, hibernation and migration periods; a disturbance shall be deemed significant if it causes the conservation status of the local population of a species to worsen,

3. to take from the wild, damage or destroy breeding or resting sites of wild animals,

4. to take from the wild plants of specially protected species, or their developmental stages, or to damage or destroy them or their sites (prohibitions on taking).

(…)"

All prohibitions applying to specially protected species also apply to strictly protected species, as this is a matter of a hierarchised classification (see below).

Which species are specially and strictly protected?

This is basically defined in more detail in **Article 7 Federal Nature Conservation Act**. The Federal Agency for Nature Conservation has published a document relating to the specially and strictly protected species on the internet: *www.wisia.de*. Depending on the project, the Federal Nature Conservation Act distinguishes between species that are protected under national and under European law. With regard to tree care in the broadest sense, the prohibitions according to Article 44 para. 1 BNatSchG apply to the species protected by both **national** as well as **European law**. The table below shows a selection of species that are regularly found in or on trees:

Tab. 1: Selection of legally protected species that dwell in tree hollows. All “strictly protected species” also enjoy “special protection” (cf. www.wisia.de)

	Specially protected species	Specially and strictly protected species
Insects	Stag beetle (*Lucanus cervus*)	Hermit beetle (*Osmoderma eremita*)
	Violet click beetle (*Limoniscus violaceus*)	Great capricorn beetle (*Cerambyx cerdo*)
	Many species of scarab beetles, longhorn beetles, jewel beetles and other insects groups	Scarlet beetle (*Cucujus cinnaberinus*)
Birds	All European bird species	Grey-headed woodpecker (*Picus canus*)
		European green woodpecker (*Picus viridis*)
		Collared flycatcher (*Ficedula albicollis*)
		Middle spotted woodpecker (*Dendrocopos medius*)
		Black woodpecker (*Dryocopus martius*)
		Eurasian wryneck (*Jynx torquilla*)
Bats		All European species of bats
Other mammals		Hazel dormouse (*Muscardinus avellanarius*)

A key difference between the "special species protection" as opposed to the "general species protection" is that the prohibitions relating to special species protection are independent of the motivation of the actor and thus take effect with even a "reasonable" reason, insofar as no exceptions referred to in paragraphs 4 and 5 are given. (Kratsch 2011).

Apart from the prohibition on disturbance (Article 44 (1), no. 2 BNatSchG), all prohibitions apply to individuals, that is to say that the prohibitions relate to each individual animal of the protected species, and it does not matter whether the killing or destruction of the breeding site or resting place has an impact on the conservation status of the population of the species or not.

In contrast, the prohibition under Article 44 (1), no. 2 Federal Nature Conservation Act does not apply as soon as an individual animal is disturbed but at the point at which the conservation status of the "local population" deteriorates. This dimension may be reached very quickly with bats, for example, with the detection of or the threat to a nursery colony (Runge *et al.* 2010).

With regard to the protection of cavity trees, the protection of breeding and resting sites is of importance. Various judgments confirm that the "breeding site" is not only the currently occupied hatchery, but also the regularly used hatchery (Federal Administrative Court, 21.06.2006, 9 A 28.05), regardless of whether the hatchery is always visited by the same breeding pair or by other breeding pairs of protected species (OVG Berlin-Brandenburg, 05.03.2007, 11 S 19.07). In addition, "resting sites" (including habitations) need not be used all year round; regular use for a considerable part of the year is sufficient. This also applies to the breeding ground of migratory birds during their winter absence, provided they return to their nest (OVG Hamburg, 21.11.2005, 2 Bs 19/05; LG Hechingen, 29.12.1994, 3 p. 29/94). This also applies to the nursery colonies of bats in trees when they are hibernating or to hibernation trees when the bats are in their summer habitats.

Paragraph 5 of **Article 44 of the Federal Nature Conservation Act** stipulates that the prohibitions of sentences 1 and 3 do not apply with regard to interventions in nature and landscape permissible pursuant to Article 15 if

"(...) the ecological function of the breeding or resting sites affected by the intervention or project continues to be fulfilled within a spatial context. Where necessary, advance compensation measures may be stipulated."

The Federal Administrative Court has now (judgement of 14.07.2011, 9 A 12/10), however, clarified that the legal exception of Article 44 (5) sentence 2 of the Federal Nature Conservation Act applies only to the case of the destruction of breeding sites or resting places (if such are still present in a spatial context, so that the animals concerned may use this easily, in place of the previously used habitats that are disappearing). The legal exemption, however, does not apply insofar as the realisation of the killing is to be feared. The requirements of Art. 12 of the Habitats Directive and Art. 5 of the Birds Directive that must be observed as a matter of priority allow an exception only insofar as other exception conditions exist (Article 45 (7), Art. 16 of the Habitats Directive, Art. 9 of the Birds Directive).

As a case study, it can be assumed that in a cavity tree complex of 40 or more tree hollows, which a bat colony uses in rotation during the summer months, not every loss of a cavity will lead to the complete loss of breeding sites and resting places, as all 40 tree hollows in their entirety can be regarded as a breeding site and resting place. The difficulty for the tree owner or tree surgeon, however, lies in demonstrating that there is a sufficient number of suitable alternative cavities for the colony.

This proof must be furnished by a professional review under special species conservation law. In case of doubt, early compensatory measures (so-called CEF – continuous ecological functionality – measures) must be carried out. An exception to the species conservation regulations offences is likewise possible, but the risk to "life and limb" at the very least would then have to be demonstrated.

Article 45 (7) states:

(7) The competent authorities for nature conservation and landscape management, pursuant to the legislation of the Länder, and, in the case of introduction from other countries, the Federal Agency for Nature Conservation (BfN), may grant further exceptions from the prohibitions of Article 44, in individual cases,

(…)

5. for other imperative reasons of overriding public interest, including those of a social or economic nature.

An exception may be granted only if no reasonable alternatives exist and the conservation status of a species' population is not worsened, except where Article 16 (1) of Directive 92/43/EEC contains more extensive provisions. Article 16 (3) of Directive 92/43/EEC [FFH Directive] and Article 9 (2) of Directive 79/409/EEC shall be observed. The Länder governments may also grant exceptions on a general basis, via statutory ordinance. Via statutory ordinance, they may transfer the authorisation pursuant to Sentence 4 to other Land authorities.

Clarification of the exception conditions must be ensured via the aforementioned review relating to species conservation law or some other legal way, one that has been decided on in coordination with the conservation authority.

If the prerequisites for the granting of an exception within the meaning Article 45 (7) of the Federal Nature Conservation Act do not apply, the granting of an exemption pursuant to Article 67 (2) of the Federal Nature Conservation Act may be considered.

Article 67 (2) of the Federal Nature Conservation Act states:

An exemption from the prohibitions of (…) Article 44 (…) may be granted, upon application, if execution of the provisions, in an individual case, would lead to an unreasonable burden.

A burden can, however, be recognized as "unacceptable" only in special individual cases. In the commentary literature, it is said (in this case from Schumacher/Fischer Hüftle, Federal Nature Conservation Act (2nd ed.), Article 67, marginal note 14): When reviewing reasonableness, the authority must take into consideration the assessment of the legislator. Such consequences of the prohibitions that are foreseeable for all or most of those affected are, therefore, considered reasonable. The exemption thus comes into effect only as a possible corrective for land-related features. Subjective (personal) circumstances – e.g. personal, financial and family-related ones – cannot, however, in principle, constitute a case of hardship and therefore do not justify any exemption. Anything else only applies in exceptional cases when, in an individual case, there is any impairment of the person or property owner that goes far beyond the "normally" expected impact of

the standard. If an unreasonable burden arises, one that is beyond the "normal" burden, the degree of unacceptability may be achieved. In this case, an exemption may be granted.

Compulsory tolerance of breaches of species protection

Breaches of species conservation should be considered as an **administrative offence** pursuant to **Article 69 of the BNatSchG**. Severe fines may be imposed, and, in the case of repeated and habitual violations of species protection, even terms of imprisonment are conceivable (**Article 71 BNatSchG**).

As regards cases of conflict arising less from the duty to maintain safety than from the capriciousness of the tree owner (e.g. tree felling because of leaves), it should be noted that there is, on the part of the owner of the piece of land/tree owner, an **obligation to tolerate** in accordance with **Article 65 BNatSchG**. This applies when the conservation measure is of particular value (preservation of trees covered by species protection law) and the toleration does not lead to an unreasonable restriction on the use of the land.

Consequences for tree maintenance and road safety

Species conservation takes a high priority legally and there is no general principle and no legal basis that gives road safety obligations precedence over the requirements of statutory species protection. When weighing up issues, the courts attach very high priority to species conservation in general.

- Breaches of species conservation are an offence and can, according to Article 69 of the Federal Nature Conservation Act, be punishable by substantial fines, at worst, in the case of repeated violations, even with imprisonment (Art. 71 Federal Nature Conservation Act).
- What holds particularly true for the special species protection is that there need be no intention to commit an offence. This means in inverse conclusion that one cannot extricate oneself with excuses ("I didn't see, didn't know about ...").
- Conflicts between species protection and road safety require their own substantive considerations and decisions. The formal way (a review in accordance with species protection law, the requesting an exception (Art. 45 (7)) or an exemption (Art. 67 (2)) must be complied with.
- For factual and legal reasons, tree inspectors or surgeons must continue to keep themselves up-to-date as regards species protection. An appropriate expert should otherwise be consulted when answers to species protection issues are sought.

3. Information on tree hollows as a form of habitat

Natural tree cavities come in all shapes and sizes; they have various origins and the way they develop further depends on a number of factors. The spectrum ranges from short-lived small cavities in standing deadwood to cavities several cubic metres wide that have grown over the decades in old living trees. Below, we will briefly discuss the main cavity types, their shape and properties and the resulting suitability for different types and forms of use.

3.1 Development of tree hollows

The emergence of tree cavities is usually caused by damage to the bark or roots (felling, pruning, storm, lightning and frost damage or active construction, above all by woodpeckers). If these injuries are only superficial, the wood continues to develop after the formation of new surface tissue; if the growth zone or the cambium is damaged, the tree will try to close the wound by forming callus tissue. If the tree cannot manage to do that, wood-decaying fungi can invade and enlarge the cavity by decomposing the wood. Certain species of wood fungi are specialised in colonising living trees with intact transpiration and assimilation streams and are parasitic on their host trees, driving the development of the cavity forward. In the case of woodpecker holes, it is often observed that the tree's callus tissue is pecked off again by the woodpecker, so that it is impossible for the tree to close the wound. While the decomposition inside the trunk continues, the outer layers of wood usually remain unaffected, so the tree can still remain alive for many years or even decades, and during that time the tree hollow is available as a habitat.

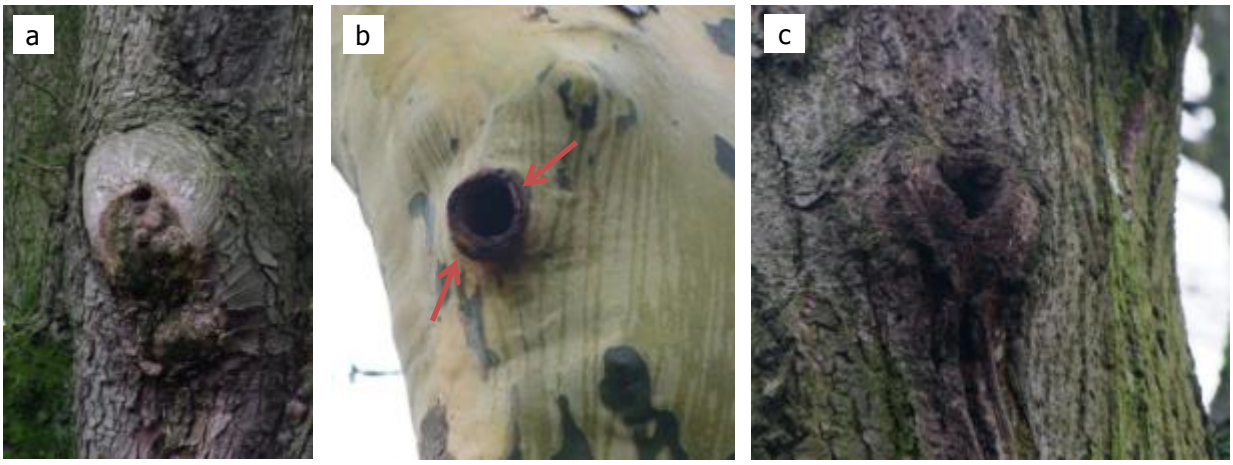


Fig. 1: Callused over and almost overgrown site of a broken-off branch (a), a cavity kept open by a woodpecker with signs of recent pecking (arrows) on a plane tree (b) and partly successfully callused over woodpecker hole on an oak tree (c).

The cavities, which can be of different shapes depending on their origin, can be divided into woodpecker holes, those formed by broken branches, cracks in wood bodies, and the loosening of the bark of usually dying trees. The latter is not one of the classic type of tree hollows in the wood body, but is a commonly used hiding place of, for example, bird and bat species and thus of equal ecological relevance under nature protection law.

3.2 Woodpecker holes

Woodpeckers are active cavity builders who also benefit from organisms that cause wood to decay. When looking to build a cavity, woodpeckers specifically seek out places on trees that already show signs of damage (Blume 1961, 1990). They create several initial cavities only a few cm long, which are then colonised by rotting pathogens and can then be processed further under simplified conditions after some time. Depending on the species of woodpecker, the cavity dimensions vary. All woodpecker holes have a clearly defined border and are round or oval depending on the species. Recent signs of pecking and processing can be seen at the cavity entrance of woodpecker holes (cf. Fig. 1b, Fig. 2a, Fig. 5,). Depending on the density of the woodpeckers, the most commonly found cavities are those of spotted woodpeckers, the most noticeable the large oval cavities of the black woodpecker. The wryneck also belongs to the family of woodpeckers. However, it does not build its cavities itself, but uses existing cavities and hollows made by other woodpecker species. It is predominantly found in orchard meadows and open, park-like landscapes. Since woodpeckers often make their own cavities in pre-damaged wood, they can often be found in the holes caused by broken-off branches, cracks, or in places where the bark has been noticeably damaged.

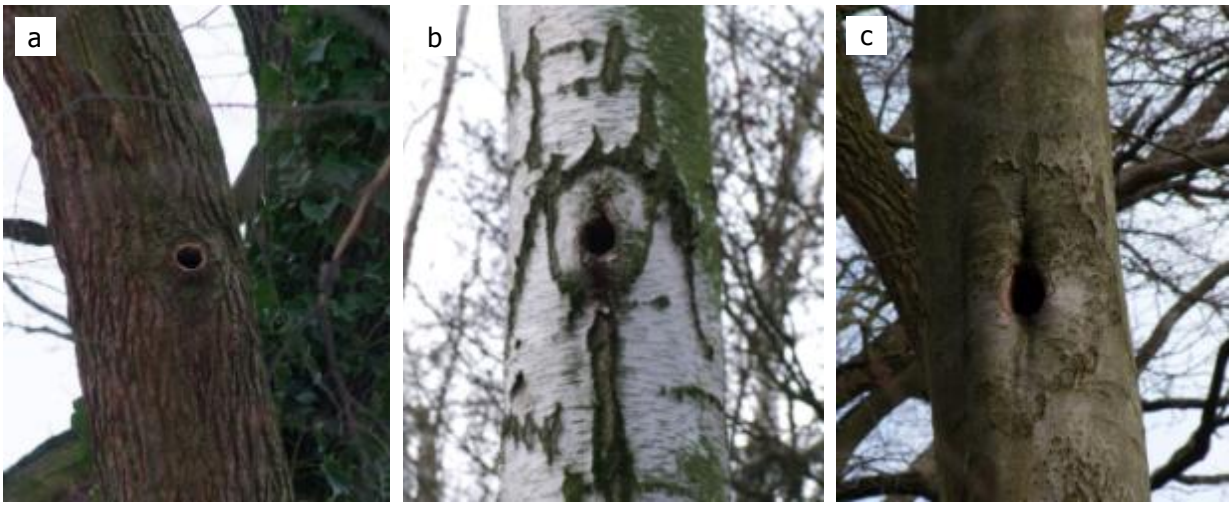


Fig. 2: Woodpecker holes in the hollows caused by branch breakage (a) (b) and in a crack (c). Recent signs of the pecking of a woodpecker (light-coloured ring in a) and a bare spot to the right of the cavity entrance, which may have originated through a cavity-dweller slipping in and out (c).

Woodpeckers always make their cavities in such a way that the brood chamber is below the entrance hole; the brood chamber may be 10 to 65 cm deep, depending on the species. In its further development and in association with the natural growth in the girth of the trees and incipient putrefaction processes, the size of the interior increases and changes its shape and properties. This process takes years or decades; Günther & Hellmann (1995) state that the interior diameter of regularly measured spotted woodpecker cavities grew on average by 0.14 cm a year. It takes, therefore, more than a decade before the inner volume of a woodpecker cavity with an average inner diameter of 12 cm becomes big enough to be attractive for secondary users (with the common swift, for example, 20 cm internal diameter, ≙ a growing season of 60 years).

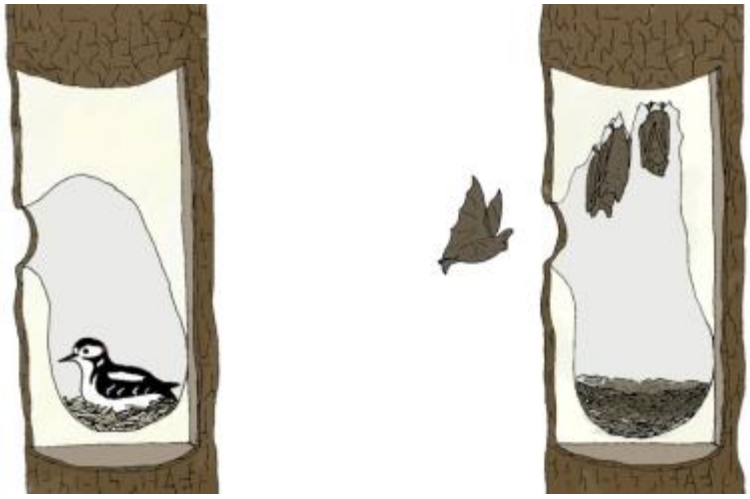


Fig. 2: Woodpeckers install their brood chamber below the entrance hole. In the course of years, the cavity extends upwards and becomes attractive for bats.

The creation of new woodpecker holes takes – depending on the woodpecker – an average of nine days (lesser spotted woodpecker) to four weeks (black woodpecker). Although many woodpeckers use the same nest cavity for years (black woodpeckers use a cavity for more than ten years if possible) and also continue to visit old cavities and repair them, all species regularly create new cavities. The lesser spotted woodpecker makes, for example, up to five cavities a year and does not necessarily use old breeding cavities to sleep in but specially hewn cavities.

In the following, the widespread woodpecker species, their habitat requirements and their preferred trees and conditions when making their cavities are briefly presented and the appearance of their cavities characterised.

Black woodpecker

Habitat: Can breed in almost all types of forest, prefers older beech forests interspersed with conifers. Due to the size of its territory of ≥ 400 ha, it needs correspondingly large and unfragmented forest areas.

Location of cavity: Almost exclusively in beeches with a DBH > 40 cm, much less frequently in other tree species, on the trunk below the first branch, a free approach must be guaranteed, often in places that are conspicuous from a forest pathology viewpoint (cf. Fig. 4b).

Cavity: The largest woodpecker hole found in our country, oval, often arched at the top and almost horizontal at the bottom. Characteristic shape with drip edge (upper cavity entrance) and water leg (lower cavity entrance) for keeping out the water that flows down the smooth trunk. Glutz Blotzheim & Bauer (2001) state that inhabited breeding and sleeping cavities display typical signs of usage (cf. Fig. 4a).

Fig 4. A cavity currently used by a black woodpecker with a spot below the entrance hole been rubbed smooth by the tail and semi-circular scratches on the hole (a), a black woodpecker cavity created in a damaged area and currently not used by a black woodpecker and whose edges are slowly becoming overgrown (b).

Spotted woodpecker

Habitat: Nearly all types of forest, also in small groups of trees, gardens, parks, etc.

Location of cavity: In trunks or thick side branches, mostly in damaged wood or growth-disturbed sites, not in rotten wood, with softwood trees even in healthy wood.

Cavity: Round, nests; in contrast to sleep cavities, often display a more or less clearly pulled down lower edge.

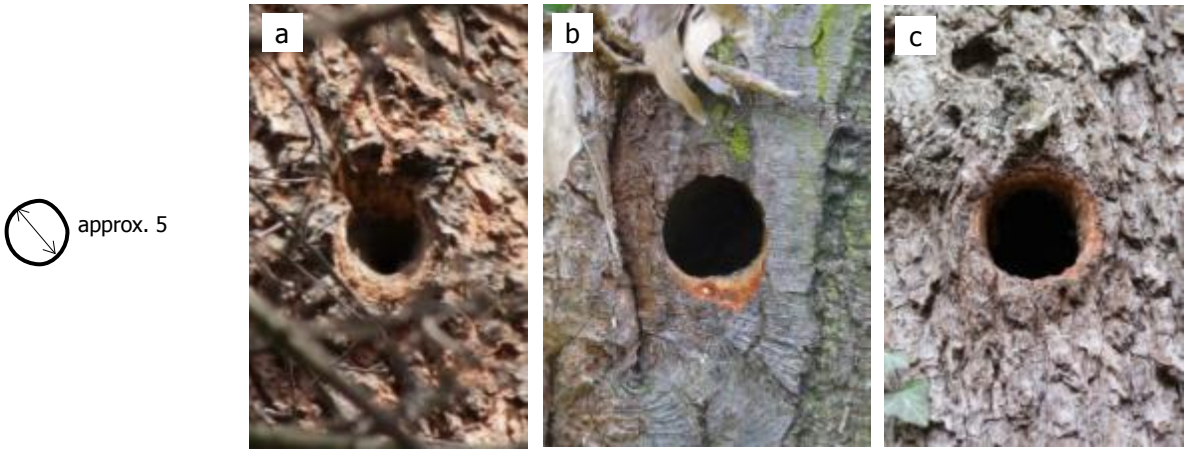


Fig. 3: Cavities currently used by great spotted woodpeckers: initial cavity (a) and newly created cavities (b) with "pulled down" lower edge, older cavity (incipient callusing over evident) reworked at the edge of the cavity (c).

Middle spotted woodpecker

Habitat: Near to nature forests with old, tall trees, preferably oak.

Location of cavity: In trunks or large branches of hardwoods, only exceptionally in softwoods. Builds frequent cavities in strong side branches. Cavities are always created in damaged, more or less rotted, wood.

Cavity: Slightly higher than wide.  approx. 4 cm

Lesser spotted woodpecker

Habitat: Park-like or clear deciduous and mixed forest, coniferous forests with hardwood admixture (also likes parks, orchards, cemeteries, front gardens).

Location of cavity: In trunks or branches (in that case, the cavity entrance is located on the underside of the branch) of softwoods and trees with fissured bark. Usually in dead or decaying wood.

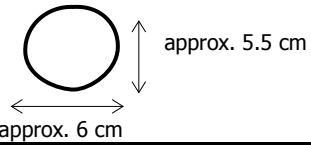
Cavity: Round or slightly oval (taller than wide).  approx. 3 cm

Grey-headed woodpecker

Habitat: Typical of broken up old mixed forest, riparian forests, as well as in parks, orchards and cemeteries.

Location of cavity: On the trunks of beeches, oaks, trees in alluvial forests or fruit trees. Rarely on the smooth trunk, more at the higher end of calluses, under broken-off branches or in knotholes. Can also be on the underside of leaning trees.

Cavity: Elliptical (a bit wider than high).

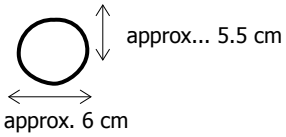


Green woodpecker

Habitat: Cavities often in woods, daily activity above all in adjacent parklands, gardens and semi-open landscapes such as orchard meadows and agricultural areas with copses.

Location of cavity: On rotting areas of beeches, oaks, and other deciduous trees, also likes fruit trees. Overall, new cavities are rarely bored out and the cavities of other woodpeckers are also often also taken over.

Cavity: Round or slightly oval (slightly higher than wide).



3.3 Broken-off branches

When branches break off, fungi can penetrate the area of branch breakage and encourage the formation of a cavity. In the case of smaller cavities, trees are able to callus over the area where the break took place. Cavities caused by branch breakages vary greatly in shape and size, but a ridge is often left standing around the site where the branch broke off. Most of the time, the sites of broken-off branches first rot towards the bottom and form water bodies (phytotelma) with their own faunal communities that are far from having been fully investigated.

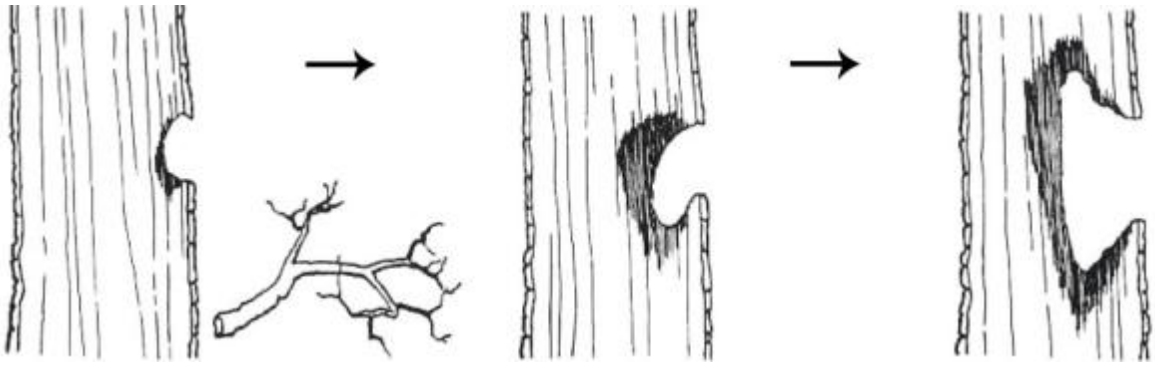


Fig. 6: Cavity formation at the site of a broken-off branch. Drawing by A. Dettwiler (pro natura & Birdlife Switzerland 1998)

If the sites of the broken-off branch are nearly circular, it is sometimes hard to distinguish them from partially callused over woodpecker holes. In most cases, it can be seen from the structure of the bark surrounding the site whether it is a matter of a broken-off branch or a woodpecker hole (cf. Fig. 7, Fig. 8).

Fig. 7: Sites of broken-off branches of various shapes and sizes. Clearly visible is the altered structure of the bark around the site. Particularly strong indications that the cavity was caused by branch breakage are the "Chinese beards" (angular scars) of the beeches (d).

Fig. 8: Comparison of these sites of branch breakages (or imminent branch breakages) and of the woodpecker holes located in close proximity shows the differences in the damaged caused to the surrounding bark (a) (b). The callused over woodpecker hole could at first sight be confused with the site of a broken-off branch, but lacks the "Chinese beard" so typical of branch breakages (c).

3.4 Cracks

Cracks or crevices are formed through vertical damage, particularly broken-off forks, damage caused by felling and frost or lightning strikes as well as shear and torsional forces in high winds. As a rule, the cracks are at least 30 cm long, but they can reach several metres in length. Despite narrow openings, they sometimes have surprisingly large interior spaces if the damage goes very deep. As a rule, crevices initially rot upwards. They occur in all species of trees, especially often in the smooth barks of the hornbeam and beech

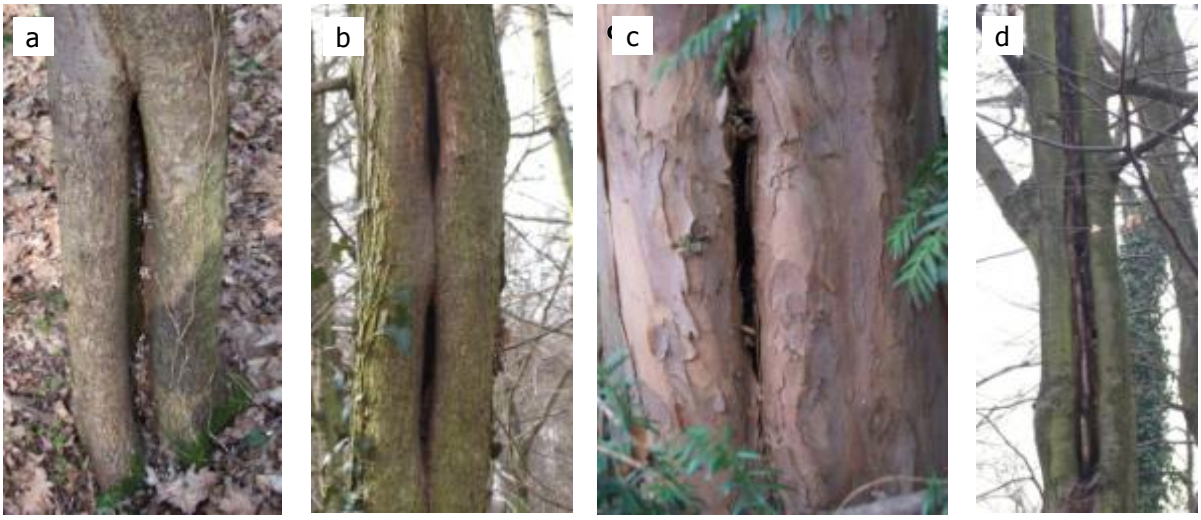


Fig. 9: Various crevices: crevice at base of trunk with tree fungi(a), crevice with scratch marks on the upper cavity entrance, indicating that an animal is living there (b), woodpecker holes in a crevice that is open right through to the heartwood (d).

3.5 Bark habitats

With older trees with fissured bark, typically with tree species whose bark is rough with deep grooves such as the oak, ash or elm, large areas of the bark often stick from the trunk of the tree. Narrow crevices and cavities form under the protruding bark, which are used as hiding places by some bird and bat species. Compared to cavities in the body of wood, these hiding places have a shorter lifespan and are particularly sensitive to mechanical impact.

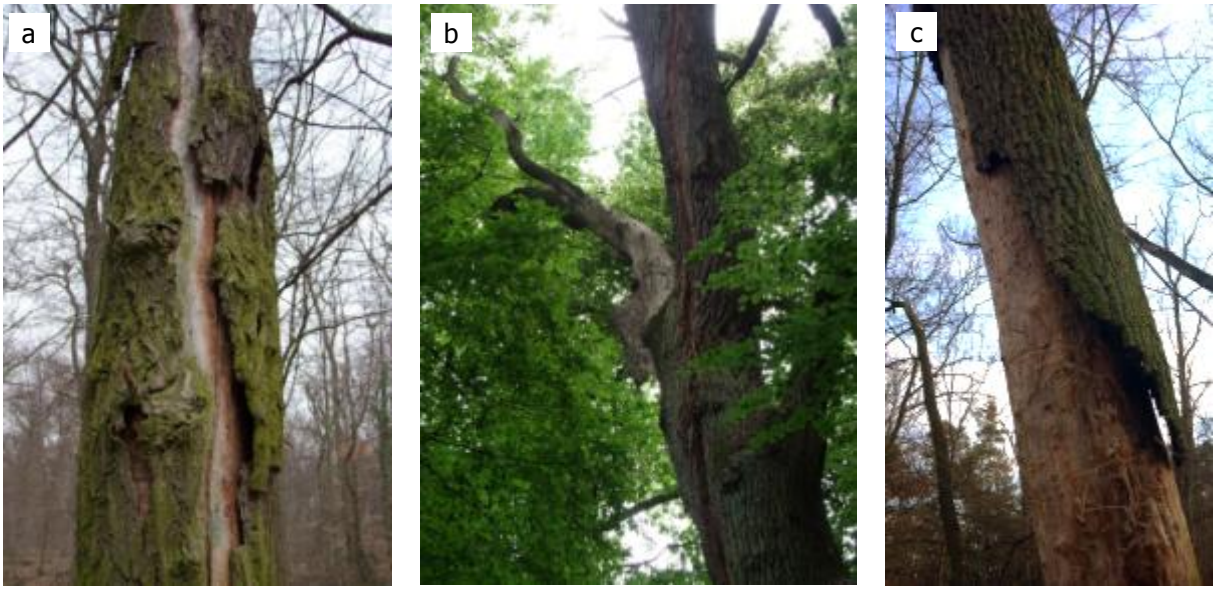


Fig. 10: Typical bark habitats: Very often, species such as the treecreeper, whiskered bat and the barbastelle bat often live behind the bark projecting from the trunk (a). Some nymph bats were hanging behind the relatively small piece of bark on the side branch in the middle picture (b), numerous whiskered bats behind the bark split of the trunk of a dying oak (c).

3.6 Location of the cavities on the tree

Basically, one has to expect populated cavities in all sections of trees, whereby the most favourable time for inspecting the trees is at the foliage-free time of the year. Woodpecker holes on branchless trunks are often easy to find. It is more difficult to find cavities on side branches and in the crown and even harder to do so in leafy trunks. Even when tree cavity mapping, which must invariably take place during the leafless period, not all cavities in the crown are discovered. Bats fitted with a transmitter repeatedly show that suitable quarters can be found there.

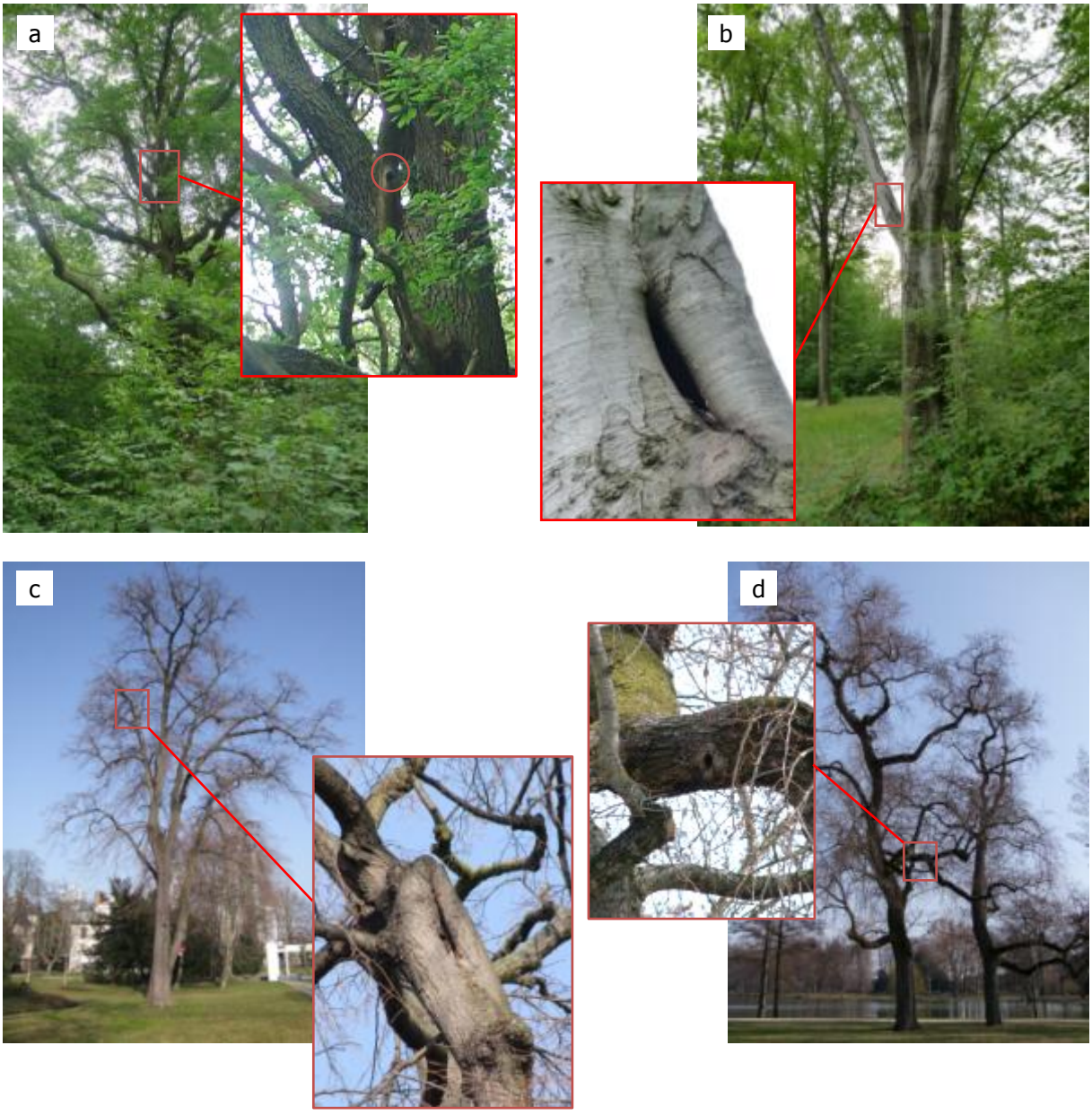


Fig. 11: Location of tree cavities that cannot be detected at first glance. When searching for cavities, trees must, therefore, be viewed from all angles and from different distances, ideally in favourable conditions and when the trees are free of leaves.

4. Ecology and habitat requirements of cavity-dwelling animal species

The spectrum of cavity-dwelling animal species is just as broad as the range of different types of cavity. Besides vertebrates and insects, which will be discussed in more detail below, wood-decaying fungi, mosses and lichens are found in cavities and their rotten wood, among them several endangered and rare species. Wood fungi play a key role in wood decay in that it is they that make further colonisation by insects possible in the first place. Since insects cannot form most of the enzymes they need to digest wood, they are dependent on other organisms. Fungi, yeasts or bacteria decompose the lignin and cellulose components of the biomass and also provide insect larvae with certain trace elements, amino acids, vitamins, etc. (e.g. Möller 2005).

Due to the large variety of users and ways of using cavities, a tree cavity can be occupied at any time of the year. Depending on the type of use, the cavities are regularly, irregularly or even over a longer period of several years (e.g. beetle larvae) not left unoccupied at all. When the animals also live in hiding (e.g. insects in the duff of a hollow) or are nocturnal (bats, dormice), it is hard to judge from the outside whether a cavity is currently being used or not.

	Spring	**Summer**	**Autumn**	**Winter**
Bats	Roost	hanging spot	nursery roost	courtships site roost
Other mammals	Sleeping quarter (nest site)	breeding site		sleeping quarter
Birds	Roost	(nest site)	breeding site	sleeping quarter
Insects	Use all year through, sometimes uninterrupted over several years			

Fig. 12: Over the course of the year, many different kinds of tree hollows are used for different purposes. There is no time of the year in which one could generally assume that a cavity was empty.

Tree hollows are used by a permanently changing array of different cavity-dwellers. Often this change is essential for the ongoing usability of the cavity. Frank (1994) describes, for example, a cavity of Daubenton's bats, which was so full of their faeces and urine that they trickled out of the cavity and the cavity could no longer be used by the bats. After the Daubenton's bats moved out, numerous Dipteran larvae moved into the mass of faeces so that, within four weeks, several centimetres of faeces had been removed and the cavity could once again be used by the bats. Tree fungi perform a similar function as insects; they play an important role in the decomposition of organic matter and the enlargement of the hollows. Likewise, the stubborn processing of the cavity by woodpeckers and the clearing out of nesting material and the like (by woodpeckers, nuthatches, or other species) is crucial for the further usability of the hollow. These examples demonstrate the use dynamics of the habitat of

the tree hollow and how the different tree cavity dwellers are dependent on each other and thus enable the cycle of usage.

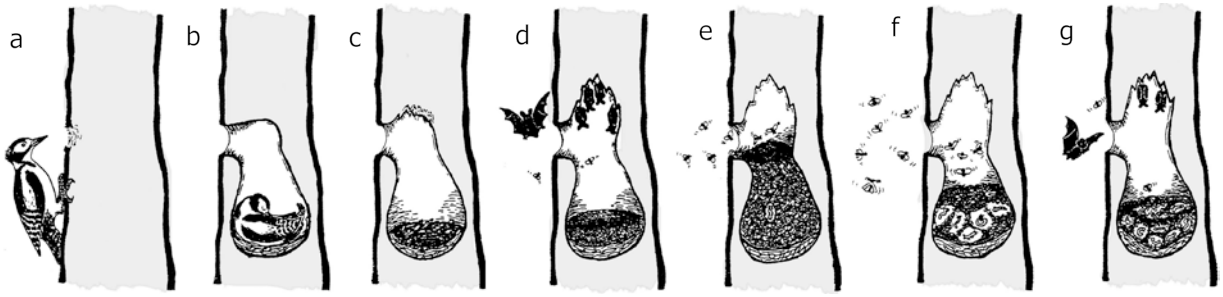


Fig. 13: The use of a woodpecker hole over time (according to Frank 1994): a: woodpecker boring out the hole, b: woodpecker brooding, c: woodpecker has left the cavity, digestion in an upward direction starts, d: bats use the upwardly digested cavity e: bats have left the cavity, cavity is filled to the edge of the entrance hole with faeces, which is inhabited by insects and insect larvae, f: progressive faeces decomposition by insects and insect larvae, g. faeces is largely depleted, bats inhabit the cave again

The most important cavity-using species are presented in the following sections. The cavity and the requirements of the cavity-user form the centre of attention in each case.

4.1 Insects

Since old trees and tree hollows are used by a huge number of insects, only a few species can be presented as examples here, the focus being on strictly protected species.

For the groups of species of beetles in particular, old and dead wood is of outstanding importance and offers a habitat in many ways: as a space where they can develop, forage, hibernate, sun themselves and mate. Among the species of old and dead wood, it is, above all, the families of click, jewel, longhorn, scarab and stag beetles with numerous endangered species that are represented.

When they monitored the success of deadwood protection measures, Weiss & Köhler (2005) ascertained 16 to 62 deadwood beetle species and 35 to 733 individuals per deadwood tree. Almost 50% of these species are considered rare or only locally occurring; more than 20% are regarded as endangered.

In the following, the strictly protected species of the great capricorn beetle *Cerambyx cerdo* is presented, along with the hermit beetle *Osmoderma eremita*. They represent examples of a variety of beetles with similar life habits found in old trees in areas of settlement.

The **great capricorn beetle** is a strikingly large longhorn beetle, found only in a few warmer regions of Germany. It is monophagous, eating only oaks, and is usually found on the pedunculate (or English) oak *Quercus robur*, occasionally on the sessile oak *Quercus petraea*. It lays its eggs in bark cracks, whereupon the larvae eat through the bark and phloem and enter the sapwood. The larva overwinters at least twice; the generation time is 3 to 5 years. During this time, the beetle larva is bound to the tree, immobile. The adult beetle also does not fly far and, when it wants to lay its eggs, will have to find the nearest appropriate tree within just a few metres. The beetles live on already damaged old oaks which get some sun in parks, on avenues, in the remains of riparian forests and in old oak forests.

The **hermit beetle**, like the great capricorn beetle, is a beetle of old forests and forest sites that have survived mainly in mature trees in urban areas. It belongs to the family of *Scarabaeidae*. The beetle lives, just like the larvae, in the cavity duff of deciduous trees (especially oak, beech, linden, and in pollard willows and fruit trees) that has built up over several years. Plane trees, chestnuts and black locust are likewise populated. The bugs are extremely loyal to their breeding tree and demonstrate only a slight tendency to spread. Suitable trees must, therefore, ideally be in close proximity to a populated tree. Development from egg to beetle is temperature-dependent and takes 3-4 years.

Fig. 14: Striking beetles such as the hermit (left) or great capricorn beetle are representative of the fauna of the old wood and trees rich in cavity duff (photos: Claus Wurst, Katharina Schieber).

Fig. 15: Oak and pollard willow with duff cavities and presence of the hermit beetle *Osmoderma eremita* (photos: Claus Wurst).

Besides beetles, social insects are oft-encountered residents of tree hollows. Famous above all are wasps, with the hornet as a particularly striking species, as well the honey bees. A significant difference in ecology is that the bees form perennial colonies and nests, whereas with hornets, the queen hibernates and establishes a new nest and a new population in a new site the following year. Hornets are predators and prey on a variety of insect species that live in trees. The honey bee lives on the nectar of flowering plants.

Fig. 16: Social insect species form colonies in hollow trees. These are built new each year, as with the hornet (pictured) or occupied and extended throughout the year as with the honey bee.

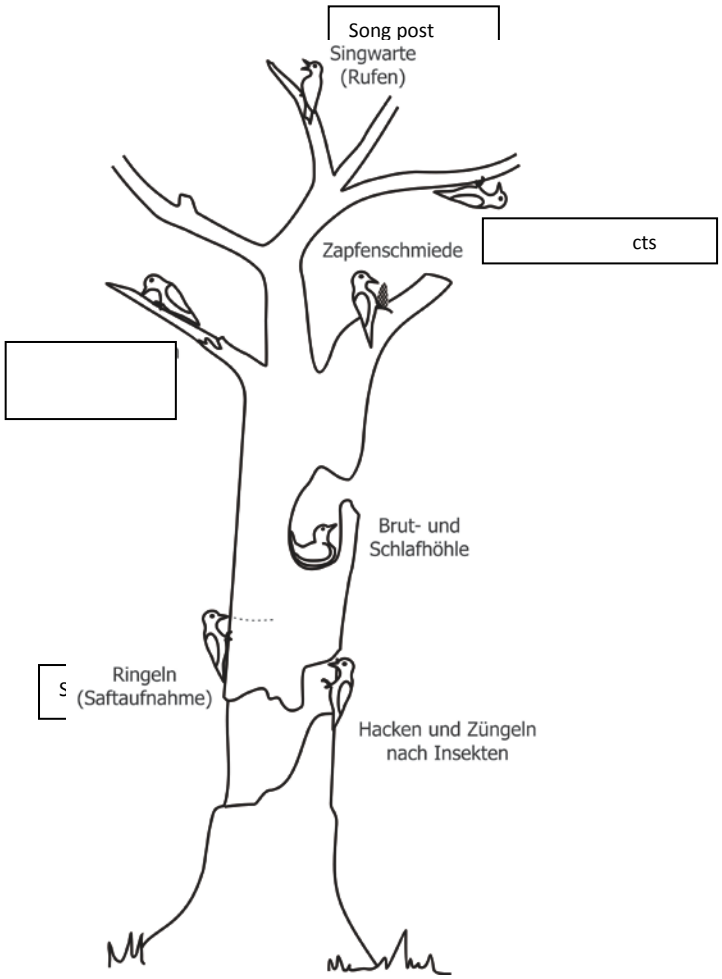
4.2 Birds

Since all European bird species are specially protected under Articles 7 and 44 f. of the Federal Nature Conservation Act, the groups of bird species require special attention when carrying out all tree-related measures. In Europe, over 50 species of birds that have a functional dependency of tree hollows are known. The tree hollow is of particular importance as a breeding ground; it also serves as a safe place to sleep in and as a food source. Requirements as regards the appearance and size of the cavity differ according to the species. Many cavity nesters remain loyal to their cavity and often use the same one over several years or for several broods. In general, a distinction should be made between primary and secondary cavity users. Primary cavity users are species that are able to build their cavities themselves. In Germany, they primarily include the true woodpeckers, a sub-family of woodpeckers, as well as some species of tits that are also able to create cavities in decaying wood or enlarge existing ones. Secondary cavity users include all the species that make use of existing hollows. This includes the wryneck (a sub-family of woodpeckers).

Fig. 17: Tree cavities used by birds: woodpecker cavity in the site of a broken-off branch with starling (a), a stock dove looking out from a woodpecker hole (b), lesser spotted woodpecker in his nest cavity (c), site of a broken-off branch reworked by the great spotted woodpecker with blue tit (d) crack with young great tits (e) (Photos: b and c Thomas Stephan)

4.2.1 Primary cavity users

Primary cavity users are able to create their cavities themselves. Woodpeckers are the only species to make relatively large-volume cavities and are thus of great importance to many secondary users. Seven species of true woodpeckers are found in Germany: black woodpecker, grey and green woodpecker, great spotted woodpecker, middle spotted woodpecker, lesser spotted woodpecker and three-toed woodpecker. The most common woodpecker is the great spotted woodpecker, which therefore provides the bulk of the woodpecker holes. Black and green woodpeckers also occur regularly in Germany. However, in Germany, the three-toed woodpecker is limited to breeding occurrences in the Alps, in the Bavarian Forest and, for some years now, in the Black Forest and the Fichtel Mountains. It prefers pine forests rich in deadwood and is found predominantly at an altitude of above 1000 m. While the great spotted woodpecker is a generalist and its habitat selection is less sophisticated, black and middle spotted woodpeckers are specialists who are, in terms of their food spectrum and in their choice of nesting trees, much more demanding. All woodpecker species depend on wood in the form of young growth, old and dead wood, which they need not only to make their breeding and sleeping cavities, but also for foraging (pecking and poking for insects, drilling holes to suck the sap), tool use ("woodpecker anvil": cones are inserted into cracks and the seeds picked out) as well as for courtship and communication (song post, drumming) (Fig. 18).



The close relationship between the woodpeckers in the life in and on tree is evident in a number of external characteristics and adaptations: the particular arrangement of the claws and the particularly stable quills in the supporting tail allow the woodpecker to cling onto vertical trunks and to climb them fast. With its pointed and strong beak, the woodpecker taps and pecks under the bark and decaying wood looking for food (it can pick the insects out of the wood with its long, sticky tongue which is covered with hooks). It also uses its beak to peck holes in trees to lick up the sap that oozes out as well as to carve out its breeding cavity. A special cartilage mass in the head of the woodpecker prevents its brain from being damaged by the hard taps.

The woodpeckers and their demands as regards habitat and the cavity tree are described in Section 3.2. In line with the other species sections, only a summary table (Table 8) showing the most important aspects, especially in terms of the function of the tree hollow and the characteristics of the cavity tree/the cavity, is given here.

Tab. 2: Function and form of the tree cavities with primary cavity users

Species	Habitat	Cavity function(s)	Demands on the breeding tree/characteristics of the cavity
Great spotted woodpecker	Forests, gardens, copses, parks, cemeteries	Hatchery	Cavities in the trunk or strong side branches Entrance hole about 5 cm in diameter, interior depth of 20-50 cm, internal diameter 8-17 cm
		Roost	Often a former breeding cavity whose design is no longer optimum or less thoroughly made own sleeping cavities
Crested tit	Forests rich in softwood, parks, gardens	Roost and hatchery	All tree species, prefers coniferous Own cavities in rotten trunks (often a few metres above ground in stumps broken by a storm with the cavity entrance from above), extended sites of broken-off branches or initial woodpecker cavities Cavities with a concealed entrance hole are preferred Entrance hole of irregular shape about 3 x 5.5 cm, interior depth about 11-18 cm
Lesser spotted woodpecker	Sparse forests with old rough-barked deciduous trees, orchard meadows	Hatchery	Cavities in the trunk or side branches Entrance hole about 3 cm in diameter, interior depth 10-22 cm, internal diameter about 11 cm
		Roost	As with breeding cavity, but further away from the forest, located lower on the tree and slightly larger entrance hole
Middle spotted woodpecker	Forests with lots of old and dead wood, floodplain forests	Hatchery	Cavities in the trunk or strong side branches Entrance hole 3-4 cm diameter, interior depth 21-34 cm, internal diameter about 12 cm In part also former woodpecker cavities or extended lesser spotted woodpecker holes
		Roost	As with hatchery/nothing else known
Grey-headed woodpecker	Old, sparse forests, rich textured open country	Breeding place	Entrance hole approximately 6 x 5.5 cm, interior depth <56 cm, internal diameter <18 cm
		Roost	As with hatchery/nothing else known
Green woodpecker	Edge of the forest, orchard meadows, copses, richly structured open land	Hatchery	Old cavities (also from other woodpecker species) are preferred Newly built in sites of putrefaction, entrance hole about 6 inches in diameter, interior depth 25-59 cm, inner diameter of 15-20 cm
		Roost	Old cavities (also from other woodpecker species) are preferred

Species	Habitat	Cavity function(s)	Demands on the breeding tree/characteristics of the cavity
Black woodpecker	Large forests with thick beech trees	Hatchery	Beeches, DBH> 40 cm Cavities on the trunk, free approach Entrance hole about 9 x 12 cm, interior depth 35-65 cm, internal diameter at the height of the depression > 25 cm
		Roost	Frequently former breeding cavity not of optimum design (putrefaction, callus, etc.)
Marsh tit	Edge of forest, copses, orchard meadows, parks	Roost and hatchery	Small cavities (branch breakage sites, initial woodpecker cavities) in rotten wood, which can be expanded through hacking, but also finished cavities. Rotting cavities if no rotten wood available Cavity shape and size vary greatly
Willow tit	Forests, swamps, marsh, wet areas with rotten trees	Roost and hatchery	Prefers birch, willow (alder, elder) Cavities they have made themselves in rotten logs, only rarely are existing cavities extended (initial woodpecker cavities) Cavities usually located <1 m high on the trunk Entrance hole about 3 cm in diameter (usually slightly higher than wide), interior depth of about 15 cm

4.2.2 Secondary cavity users

The spectrum of secondary cavity users among birds is large and includes the families of ducks and pigeons, owls, sailors, rollers and passerines. The demands on the cavity vary depending on the family and species (Table 3). Owls, for example, use the cavities in many ways: as a hatchery and roost, but also as a place for storing prey. Different cavities are used in line with their different purposes. Due to the limited number of cavities available, there is great competition for existing cavities, so that the choice of the nest cavity is always dependent on cavity supply and competition. The collared flycatcher, for example, returns from its wintering area beyond the Sahara only at the end of April or the beginning of May and then has to make do with the cavities which its competitors have left it. Broods have been observed in cavities which were not large enough to accommodate all chicks or which were permanently exposed to rain (Glutz Blotzheim & Bauer 2001). In experiments with sufficient cavities available, the collared flycatcher shows its preferences, going for, among other things, larger cavities and those located higher up. Depending on the cavities on offer, for example, the breeding behaviour of starlings also differs between those who breed individually, in loose associations or in colonies. The latter is, however, only possible in areas with high densities of

(greater spotted) woodpeckers holes. Stock dove populations depend on the presence of the black woodpecker, as they almost exclusively use black woodpecker cavities for nesting.

Besides the birds that typically nest in cavities, there are many types of semi-cavity nesters, which also often nest in tree hollows. The semi-cavity nesters include, for example, the wagtail, the spotted flycatcher, the common and the black redstart, the short-toed treecreeper and the Eurasian treecreeper. Table 3 lists only the cavity nesters.

Tab. 3: Function and form of the tree cavities with secondary cavity users

Species	Habitat	Cavity function(s)	Preferred cavity type/characteristics of the cavity
Blue tit	Nearly everywhere where old trees can be found	Hatchery and roost	With sufficient cavities available no preference can be seen, otherwise mostly small entrance holes (≤ 3 cm diameter = lesser and middle spotted woodpecker holes) Prefers larger cavities than great tits
Jackdaw	Open and semi-open landscapes, forests, parks	Hatchery and roost	Brood mainly in buildings, but also in tree cavities (oaks, poplars) Entrance hole ≥ 5.5 cm (at least spotted woodpecker cavity size)
Eurasian tree sparrow	Open landscapes, copses, edge of forest, the urban fringe	Hatchery and roost	Tree hollows of all kinds, but shaded cavities avoided
Collared flycatcher	Deciduous forests, parks, gardens, orchard meadows	Hatchery and roost	Seemingly unassuming as regards cavity choice (the collared flycatcher returns very late from its wintering ground, so most cavities are already occupied) Prefers high locations (3-23 m above the ground)
Stock dove	Forests and parks with old trees and incidences of the black woodpecker	Hatchery and roost	Black woodpecker holes Entrance hole 10-20 cm Spruces are avoided There must be enough space close to the cavity for the display flight
Nuthatch	Mixed deciduous forests, parks, cemeteries, copses with mature trees	Hatchery and roost	Oaks are chosen more often and beeches less often than average Woodpecker holes, sites of broken-off branches Prefers cavities on upper half of trunk As the entrance hole can narrowed with clay, nearly all sizes of entrance hole are accepted Nest hollow 10-24 cm diameter
Great tit	Almost everywhere where there are trees (preferably in deciduous and mixed forests)	Hatchery and roost	Cavities variable, usually in the lower trunk area (3-6 m), Due to competition from larger cavity nesters Mostly small flight holes (≤ 3 cm diameter = Lesser and middle spotted woodpecker holes) Prefers smaller holes as with blue tits
Common swift	Originally cliff breeders, brood today in all kinds of stone buildings, rarely	Hatchery and roost	In sparse crowns of pines or oaks, green, black and spotted woodpecker holes

Species	Habitat	Cavity function(s)	Preferred cavity type/characteristics of the cavity
	in old trees (in Germany 1%)		
Tengmalm's owl	Large, old, contiguous forests (pine, spruce, beech) with free hunting areas (clearings, reforestation areas)	Hatchery and roost, food store	Black woodpecker holes with free approach, Cavities with multiple entrances are preferred Entrance hole 5-18 cm diameter (at least of spotted woodpecker hole size) Interior depth of 10-100 cm
Goldeneye	Standing water, adjacent forest or old trees	Hatchery and roost	Knotholes, black woodpecker holes Entrance hole 10-25 cm in diameter, interior depth> 45 cm
Pygmy owl	Near-natural coniferous forest and mixed forest dominated by coniferous forest with lots of old and dead wood, alternation of dense woodland resources and open spaces, likes to be near water	Hatchery (rarely roost)	Nesting tree preferably spruce, often sickly or dead, often several holes on the trunk, then the lower one is always the nesting cavity Spotted and green woodpecker holes, Entrance hole 4.3 to 5.5 cm in diameter, interior depth 21-36 cm Nest hollow 10- 19 cm diameter
		Food store	Also smaller holes as described above, occasionally, in cavities under roofs
Starling	Forests (not in the centre of large closed forests), parks, cemeteries, copses with mature trees	Hatchery and roost	(Spotted) woodpecker holes Entrance hole ≤ 5.5 cm in diameter, Nesting cavity 14-17 cm in diameter Prefers cavities located higher up
Little owl	Open richly structured terrain: pastures and mowing meadows, ruderal areas, pollard willows, orchard meadows	Hatchery and roost, food store	Often pollard willows, avenue and fruit trees with free approach Entrance hole 6-19 cm in diameter (at least of black woodpecker hole size), interior depth 13-130 cm Nest hollow 8-12 cm in diameter, usually protected from rain and light
Coal tit	Coniferous forest, mixed forest, also gardens	Hatchery and roost	Due to the great pressure from competition often makes breeding burrows in the ground Narrow entrance (<2.5 cm)
Tawny owl	Deciduous and mixed forests, parks, cemeteries, avenues, gardens with mature trees	Hatchery and roost, food store	Prefers spacious cavities (larger than black woodpecker holes) at any height Interior depth of 1.5-3 m
Wryneck	Parks, cemeteries, orchard meadows, copses	Hatchery and roost	Woodpecker holes, above all in softwoods, even small cracks in fruit trees Entrance holes 3.5-5 cm in diameter (middle-spotted and greater-spotted woodpecker cavities)

4.3 Mammals

4.3.1 Bats

All European bat species seek out tree holes. Depending on the species, its bond with the tree cavities varies in intensity as does the functional significance of the tree hollow. Noctule bats, for example, use tree hollows as nursery roosts, wintering grounds, mating roosts and male roost sites. The Bechstein's bat is probably the species most closely linked to the forest and to tree hollows, but hibernates in underground caves, tunnels, etc., and not, as far as is known so far, in tree holes. Some species (noctule bat, Brandt's bat, brown long-eared bat, etc.) are regularly shown to use tree cavities, but also use buildings to roost in. Likewise, species that have their roosts in buildings only seek out tree hollows at certain stages of their life. The greater mouse-eared bat, for example, seeks out only buildings (attics) for its nursery roosts, while many males frequent tree hollows throughout the entire activity phase and also mate with females there in the autumn. Some species such as the greater and lesser horseshoe bat, serotine bad, pond bat, grey long-eared, Northern, parti-coloured, Geoffroy's bat and Kuhl's pipistrelle, which are also found in Germany, rarely use tree hollows, so they not included in the list below (Table 4).

On the whole, a species-specific relationship of bats with certain types of tree cavity is evident (Fig. 20). Depending on the function, a tree hollow can be occupied by single individuals (males, mating roosts) or over 1,000 bats (hibernation colonies).

Fig. 19: Tree holes used by bats: crack in a fruit tree with a Bechstein's bat nursery (a), crevice in a beech with hibernating great noctules (b), great spotted woodpecker cavity with brown long-eared bat (c) and Daubenton's bat (d) (Photos: Thomas Stephan (b, c), Marko King a, d)

Fig. 20: Other tree holes used by bats: branch breakage site with bat roost (brown long-eared) (a), woodpecker hole in an oak populated by a nursery of local noctule bats (b), crack worked on by woodpecker with a nursery of brown long-eared bats (c), bark roost of Brandt's bats (d) and nymph bats (e), crack with a nursery of Brandt's bats (f) and Brandt's bat co-housed with Nathusius' pipistrelle (g).

Tab. 4:

Tab. 4: Function and form of the tree cavities of bat species regularly found in tree hollows (*apart from black woodpecker holes)

Species	Habitat[1]	Cavity function	Preferred cavity type/characteristics of the cavity
Bechstein's bat	Deciduous forests, structurally rich open land (orchard meadows, gardens, etc.)	Nursery roosts, male roost sites and mating quarters	Woodpecker holes*, more rarely crevices
Brown long-eared bat	Forests, parks, gardens, orchard meadows	Nursery roosts, male roost sites and mating quarters	Cracks, branch breakage sites, woodpecker holes*
Natterer's bat	Forests, parks, structurally rich open land (orchard meadows, pastures, streams, etc.)	Nursery roosts, male roost sites and mating quarters	Cracks, branch breakage sites, woodpecker holes*
Brandt's bat	Forests, park-like landscapes (copses, hedgerows), bodies of water	Nursery roosts, male roost sites and mating quarters	Bark quarters, cracks
Common noctule bat	Deciduous forests, open areas, parks, water bodies, settlement areas	Nursery roosts, winter, male and mating quarters	Woodpecker holes, cracks, branch breakage sites
Greater mouse-eared bat	Forests, orchard meadows, settlements	Male roost sites and mating quarters	Cracks, branch breakage sites, woodpecker holes*
Whiskered bat	Settlements, forests	Nursery roosts, male roost sites and mating quarters	Bark quarters, cracks
Lesser noctule bat	Deciduous forests, open land, farms, orchard meadows, settlement areas	Nursery roosts, winter, male and mating quarters	Woodpecker holes*, cracks
Barbastelle bat	Structurally rich forests of different ages, hedge areas, forest-like gardens	Nursery roosts, male roost sites and mating quarters	Bark quarters, cracks
Soprano pipistrelle	Riparian forests, plains, waters	Nursery roosts, male roost sites and mating quarters	Bark quarters, cracks
Alcathoe's bat	Natural forests, waters	Nursery roosts, male roost sites and mating	Bark quarters, cracks

[1] The habitats of rock cavities (for hibernation) and buildings (as nursery roosts) are not listed here.

Species	Habitat[1]	Cavity function	Preferred cavity type/characteristics of the cavity
		quarters	
Nathusius's pipistrelle	Forests, parks, close to waters, settlements	nursery roosts, winter, male and mating quarters	Bark quarters, cracks
Daubenton's bat	Forests, waterways, parks, orchard meadows, settlements	Nursery roosts, male roost sites and mating quarters	Woodpecker holes*, cracks
Common pipistrelle	Almost all habitats	Male roost sites and mating quarters	Bark quarters, cracks

4.3.2 Other mammals

Besides bats, other mammals also make use of tree hollows. The spectrum ranges from small and medium-sized rodents, such as mice, dormice and squirrels, to larger species such as the pine marten and raccoon, the latter of which is becoming increasingly common in urban areas. The dormouse (garden dormouse, edible dormouse, hazel dormouse) spends a good six months of the year in hibernation, during which it reduces its metabolism to a minimum. Even in summer, animals can fall into such a state of lethargy to save energy in bad weather or when food is scarce. They like to spend these periods of rests in tree hollows, where they sleep undisturbed and completely invisible from the outside. Evidence of hibernating dormice in tree hollows is still rare; they often withdraw into more temperature-constant ground burrows for this long period. Systematic monitoring of tree hollows in the winter, however, shows that, to date, the proportion of dormice hibernating in tree holes has been underestimated (cf. Fig. 32). Raccoons and pine martens seek out tree holes for raising their young and, throughout the year, as a place to sleep. In line with their size, they depend on large-volume cavities, such as those found, above all, in old trees.

Fig. 21: Cavity-dwelling mammals: hazel dormouse (a), old black woodpecker cavity with pine marten (b) and a large cavity with multiple entrances through the sites of broken-off branches and woodpecker cavities with squirrel nursery (c) (Photos: Marko König, Katharina Schieber).

Tab. 5: Function and form of the tree cavities used by mammals (excluding bats)

Species	Habitat	Cavity function(s)	Preferred cavity type/characteristics of the cavity
Pine marten	Forests (preferably coniferous forests), thick hedge structures, scrubland	Roost, raising young	All types of tree holes of suitable size
Squirrel	Forests, parks, gardens	Roost, raising young, hibernation	Larger-volume cavities where the drey is built
Garden dormouse	Coniferous and mixed forests with rock and geological formations	Raising young, hibernation, sleeping	Woodpecker holes, cavities under bark
Hazel dormouse	Forests (preferably clear, sunny deciduous forests with pronounced fruit-bearing shrub vegetation), parks, orchard meadows	Raising young, hibernation, sleeping	Prob. woodpecker holes
Edible dormouse	Deciduous and mixed forests, parks, orchard meadows with a sufficient number of tree hollows	Raising young, hibernation, sleeping	Woodpecker holes, which are not far from the first branches (so they do not have to climb along the trunk unprotected) in trees with textured bark (rarely beech)
Long-tailed field mouse, bank vole, yellow-necked mouse	Forests	Nursery, roost, food store	Cavities of all kinds
Racoon	Floodplain and mixed forests with a large	Nursery, roost	Prefers older oaks

	proportion of old-growth forest with lots of cavities and bodies of flowing water, as well as gardens, parks in residential areas		

5. Distinguishing features of populated cavity trees

In the following chapter, examples are given as to how one can determine from the outside or while looking into the cavity whether and by what species the cavity is currently being used.

In doing so, a distinction is made between

- direct indications that arise from the observation of the animals and
- indirect evidence 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 hollow (saproxylic beetles, insect larvae, etc.). Even though it is more difficult to interpret, indirect evidence is, therefore, given much higher priority and one should keep a keen lookout for such evidence in particular.

Even if there are obvious indications that the cavities are occupied, it is, with the majority of them, not always immediately evident that they are occupied when one looks at them from the outside and from the ground and at different times of the season and day. If a cavity will, therefore, be affected by measures, one must – apart from in a few obvious exceptions (e.g. when young animals can be heard in the cavity or adult birds are feeding) – to look into the cavity by means of an endoscope camera (cf. Ch. 7). The following pages will help you to identify the animals and their signs in the cavity.

Fig. 22: Rarely does the nesting material of a bird poke out so noticeably from a cavity (a), but if one looks closely, one can see, for example, signs of abrasion at the cavity entrance (b) (c). They show that the cavities are in use; deductions regarding the users can only be partly drawn on the evidence of such marks (cf. also Fig. 4).

5.1 Insects

As with other species, when trying to establish colonisation by insects, the insects or their larvae should be observed. In addition, there are various signs of indirect evidence, but these are usually recognized only by trained observers. These include, in the simplest case, the nests of state-forming insects (hornets, honey bees) or feeding traces, faeces, vermiform burrows or flour-like wood powder made by beetles. Standing in for a huge diversity of insects, great capricorn beetle, the hermit and the hornet will be presented below.

Great capricorn beetle

Direct indications

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

Indirect indications

The most noticeable signs are the large holes bored by hatched beetles. They are oval (upright) and have a transverse diameter of just over a centimetre with a height of about two centimetres. With holes in the lower portion of the trunk, debris is often found at the foot of it.

Fig. 23: Oak trunk with holes from the great capricorn beetle (top) and detail and borehole cuttings at the base of the trunk (right).

Hermit beetle

Direct indications

The beetle is only very rarely observed directly, since it lives almost exclusively in duff cavities and very rarely actively flies or moves along the trunk. The larvae that live in the duff are also hard to

find, unless the duff is removed and examined, which can be done only in exceptional cases because this disturbs the habitat.

Indirect indications

The most certain indirect evidence of a settlement comes from faecal pellets that, together with the duff of the tree hollow, trickle out of the cavity and lie at the base of the trunk. The faeces may, however, be confused with the faeces of other species of rose chafers.

Fig. 24: Faecal pellets and remains of the hermit beetle from a duff cavity (left). Duff with faecal pellets and sealed cell with pupa of the great rose chafer, which, like the hermit beetle, belongs to the family of scarab beetles (Photos: Claus Wurst).

Social insects

Direct indications

During the flying time from April/May to October, the flight activity at the cavity entrance by both bees and hornets can be well observed. In the winter, bees remain in the combs while hornets die and the queen overwinters alone (usually in the ground).

Indirect indications

It is easy to distinguish between the nests: hornet nests are papery and composed of tiny wood chips (Fig. 25), while the bees' honeycomb is made of wax.

Fig. 25: Open "paper" nest of a hornet population people with vertically oriented honeycomb cells in a fruit tree hollow.

5.2 Birds

Direct indications

Birds use tree hollows primarily for the breeding and rearing of their young and as a sleeping area. In the period of selecting a breeding cavity or building the cavity (spring) and rearing young (summer), it is possible, with a little patience and a keen eye, to observe birds in and at the cavities relatively well. When breeding and sleeping, it is hard to tell from the outside whether or not a bird is living in a tree hollow. With many species of birds, selection of the nesting place is part of courtship: usually, the male shows the female several cavities by waiting at the cavity entrance, slipping into it, coming back out and repeating the process again and again. When the female selects a nest cavity, it remains longer in the hollow and "measures" it from the inside and soon starts nest building. In some species (e.g. jackdaw), after the nest has been selected, bird remains at the cavity entrance to defend it from competitors. Such behaviour can be well observed in the spring and shows, for one thing, that these hollows are obviously coveted breeding places and will in all likelihood be occupied the following spring.

Fig. 26: The striking showing and viewing of cavities of the blue tits with courtship flights of the male can be observed at the beginning of breeding season (March).

During the breeding season, foraging adult birds can be observed and, if one listens very carefully, one can hear the young inside the cavity begging for food (especially with the larger species with sufficiently loud calls).

Fig. 27: Spotted flycatcher (a) and black woodpecker (b) feeding their young (Photos: Thomas Stephan).

Indirect indications

Indirect evidence that cavities are occupied varies depending on the species. Some typical examples are documented in photographs below.

Indirect evidence for occupation by birds varies, depending on the species. Such evidence is rarely as conspicuous as the droppings of starling at the cavity entrance or the conspicuous narrowing of the entrance hole of the nuthatch. When viewing a cavity with an endoscope camera, however, plenty of other indirect evidence of birds can be found. It is their nests, above all, that can provide information

about which species has moved into the cavity during the breeding season. Some textbooks show the different nests and eggs of different species (cf. Ch. 7) and aid with identification.

Fig. 28: Distinct traces of faeces at the entrance hole indicate it is occupied by starlings. (a, b and c) As can be seen in the first photo, droppings are also often found on branches (where they land when the birds approach the nest). Right, a cavity narrowed by a nuthatch. To make access to the hollow impossible for larger competitors, nuthatches often narrow the entrance holes until only they can fit through them. The nuthatch can see off smaller competitors (especially tits). Besides the narrowing of the entrance hole, the nuthatch also "plasters" the interior of the cavity: cracks, gaps and irregularities are glued, which makes the inside of the cavity look as though it has been plastered. Materials used include earth, especially clay, and, when dry, the dung of wild game and cattle. In addition, pieces of wood may be inserted into larger cracks. The material is, if possible, found in close proximity, and is stuck to the hollow with brief pressure on the substratum and is immediately attached by tapping with the tip of the beak.

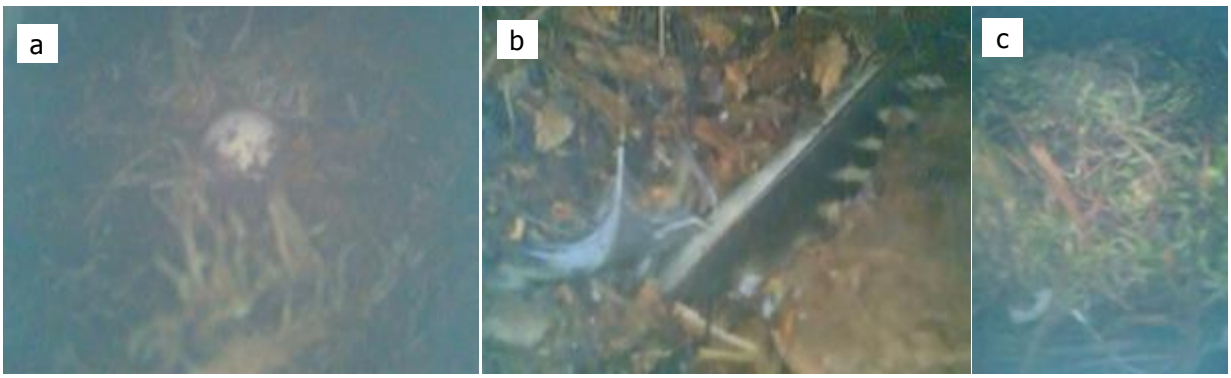


Fig. 29: Nests in the cavity (taken with an endoscope camera): tit nest with egg (a), great spotted woodpecker nest with a feather; woodpecker nests are typically composed only of wood chips (b) and a mossy nest with a base made of dry grass stalks (c).

5.3 Mammals

5.3.1 Bats

Direct indications

Bat activity is very difficult to record due to their nocturnal habits. In the summer months, they display conspicuous swarm behaviour around the tree hollow towards the end of the night. This behaviour can be used to find occupied tree cavities, although this requires some experience. In large study areas, particularly in forests, the method is extremely complicated and thus serves little purpose.

In the summer, some bat species and, in this case, the two species of noctule bat in particular make noticeable social sounds that can be perceived from the ground with the naked ear. The concomitant use of a bat detector is helpful, since, above all, colonies of smaller species (e.g. Daubenton's bat) will thus become more obvious. Acoustic conspicuousness is especially true for nursery roosts and courtship and mating roosts. In winter, during sudden rises in temperature, hibernating colonies of the common noctule bat awake and are then also audibly active. When on a targeted search of bat roosts, this method requires a lot of experience.

The most efficient method of detecting the tree roosts of bats in forests would be telemetry, which should, however, be carried out only by experienced users and when particular issues are raised as it can cause great stress in animals if done incorrectly.

As species conservation must be into consideration when ensuring road safety, efficient indications of the presence of bats result from the use of an endoscope camera. Many animals hang in narrow crevices or cracks so that the entire interior cavity must be thoroughly investigated. Occupied cavities are not always obvious at first glance; interpreting the images taken by the camera so that there is no doubt needs to be practised. In large and highly rugged cavities, it is also not possible to enjoy an unrestricted view of the entire area of the cavity, so sometimes a stocking by bats cannot be excluded, despite the visual inspection.

Determining the different bat species on the basis of recordings with an endoscope camera requires experience. Important indications are given by the size and shape of the ears (cf. Ch. 7). Besides visual indications, cavities nearly always display indirect evidence that clearly reveal settlement by bats.

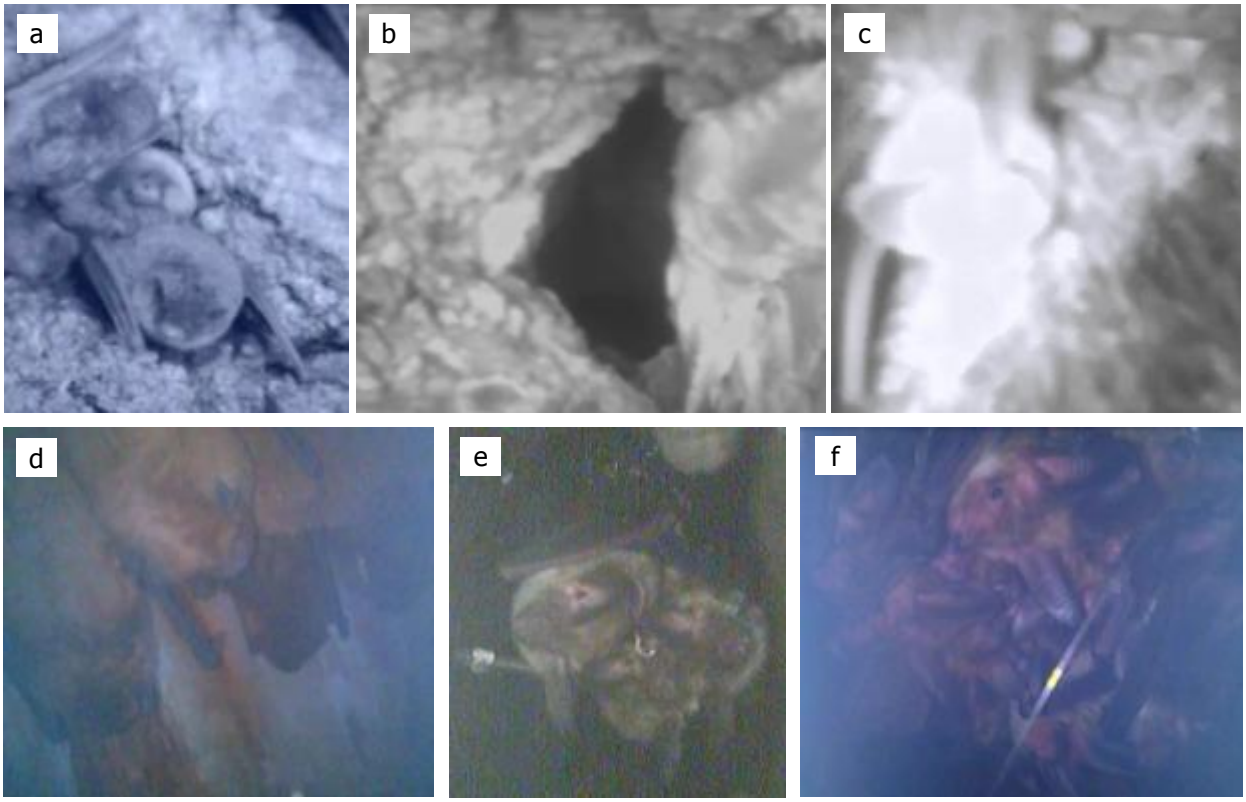


Fig. 4: Tree cavity recordings of bats; some of them can be recognised very easily, some only with a practised eye: noctule bats (a) (b), Bechstein's bats (c), (e), (f) and noctule bats with smaller undefined bats (d).

Indirect indications

The clearest evidence of bats in tree cavities comes from bat droppings. They vary from one species to another, but are basically easy to crush between one's fingers, whereby the glittering remnants of digested insect exoskeletons can be seen. The somewhat equally sized droppings of real mice consist of plant debris, are hard and cannot be crushed between one's fingers.

The bat droppings also usually contain individual hairs of the bats, which can be determined with the help of their fine structure as seen under the microscope.

Dark fat deposits from the wings of bats flying in and out of the entrance hole of cavities regularly used by bats can often be seen. Crystallized urine, streaks of droppings as well as a typical smell can also point to bats. The absence of such evidence is by no means a criterion to exclude the use of the cavity by bats.

Fig. 5. Bat droppings (left) are black or brown, often sparkle a little and crumble when ground between one's fingers. With the aid of a magnifying glass, one can see insect remains (legs, feelers, butterfly scales). Depending on the species, they are 1-2 mm thick and usually 1 cm long. Some are spiral-shaped, others less so. A streak of guano might develop under bat cavities used for many years; in most cases, however, it is not present (right).

5.3.2 Other mammals

Direct indications

Except for squirrels, mammals dwelling 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 the detection of any animals in the hollow. During hibernation, dormice roll together or completely hide themselves in their nests, so they are hard to see or detect. Fig. 32d, for example, shows a dormouse that has curled up in her spherical nest so that only her tail is visible. Due to the size and structure of the nest (spherical, made of blades of grass) and the bushy tail (real mice have bald tails), it is clear that this animal is a dormouse.

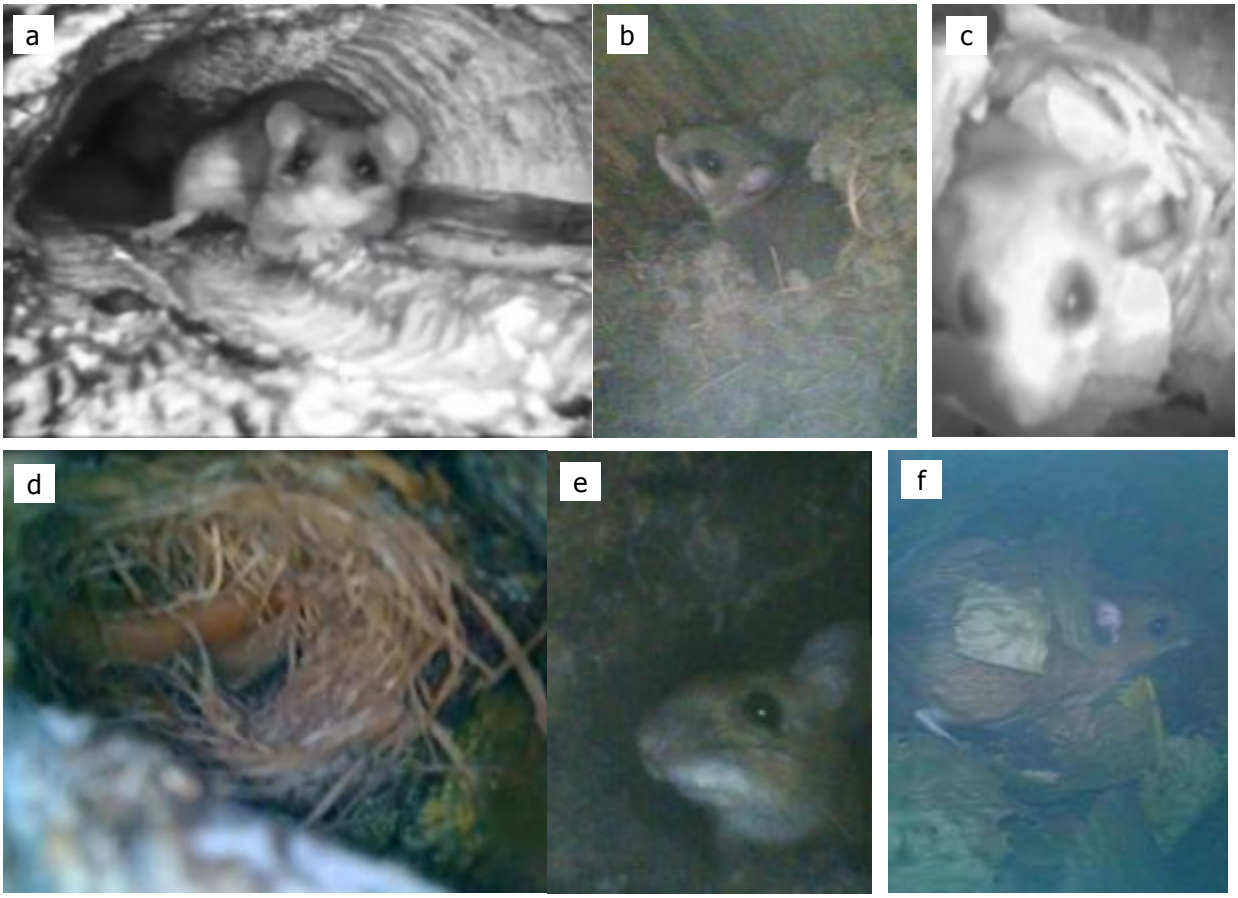


Fig. 6: Photos of the tree cavities of edible dormice (a), (b, (c), hazel dormouse (d) and long-tailed field mice (*Apodemus spec.*) (e), (f).

Indirect indications

With mammals, nests, feeding marks and droppings often provide information about what species is using the cavity. Sometimes, claw marks are also clearly visible at the cavity entrance. As with the indirect evidence of other animals, experience and the correct identification literature (cf. Ch. 7) are also required to interpret such traces.

Fig. 7: Raccoon droppings (a), spherical dormouse nest made of blades of grass in a tree hollow (b) and feeding marks of squirrels on a tree base and in the cavity (c), (d), (e).

6. Species protection in the practice of tree maintenance and road safety

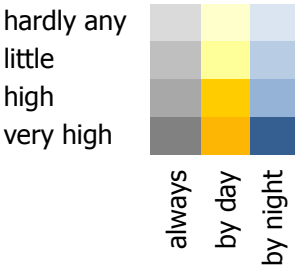
The previous chapters addressed the various methods and observation hints used to prove the presence of protected species. The suitability of the different methods varies depending on the species groups and the season. Tab. 6 provides an overview of which method is suitable with regard to season and species. One should note that one can only decide that no animals are using the cavity if, with the aid of an endoscopic camera, it was possible to inspect and check the cavity interior fully. Measures that make allowances for cavity tree protection as a precaution and thus help to protect and maintain this valuable habitat are presented in the following chapter.

Tab. 6: Detectability of the cavity-users by various methods

Method and effort		Insects				Birds				Bats				Other mammals[2]			
		Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W	Sp	Su	A	W
!	Indirect evidence, e.g. traces of droppings and urine, nesting material, and the like																
!!	Observance of ingress and egress, swarming behaviour																
!!	Courtship/social calls, begging calls of young animals																
!!!!	Cavity inspection																

Sp = spring, Su = Summer, A = Autumn, W = Winter

Detectability of occupation



Amount of effort required

hardly any	!
little	!!
high	!!!
very high	!!!!

6.1 Forward-looking planning

Conflicts between wildlife conservation and road safety can be avoided through a great deal of forward-looking planning. Conflict avoidance takes top priority over any other measure, which must be observed especially in the legal assessment of an incident in accordance with the Federal Nature Conservation Act.

Conflicts can be avoided or solved by, for example, altering pathways. In doing so, the legal requirements of species protection must be weighed up against the needs of visitors to an area. Species conservation law conflicts can most obviously be avoided if species conservation is considered when planning and designing the areas. For example, no points of attraction, such as benches or

[2] The details refer to nocturnal mammals, since these are the predominant species that dwell in tree hollows (cf. 0)

playground equipment, should be installed under endangered old trees or trees that are particularly relevant with regard to species protection.

6.2 The field mapping and marking of tree hollows

To improve the conservation efforts with regard to future tree maintenance and use, it is useful to map and mark the tree hollows and to record the species that potentially make use of tree hollows. By marking trees and including them in the tree register, cavity trees can be more quickly identified as such and given appropriate protection. Additional marking has the advantage that one does not need to first access the data files relating to a tree, but that it is evident, at first glance, that the tree in question is a cavity tree, which, with appropriate measures, may give rise to conflicts under species protection law.

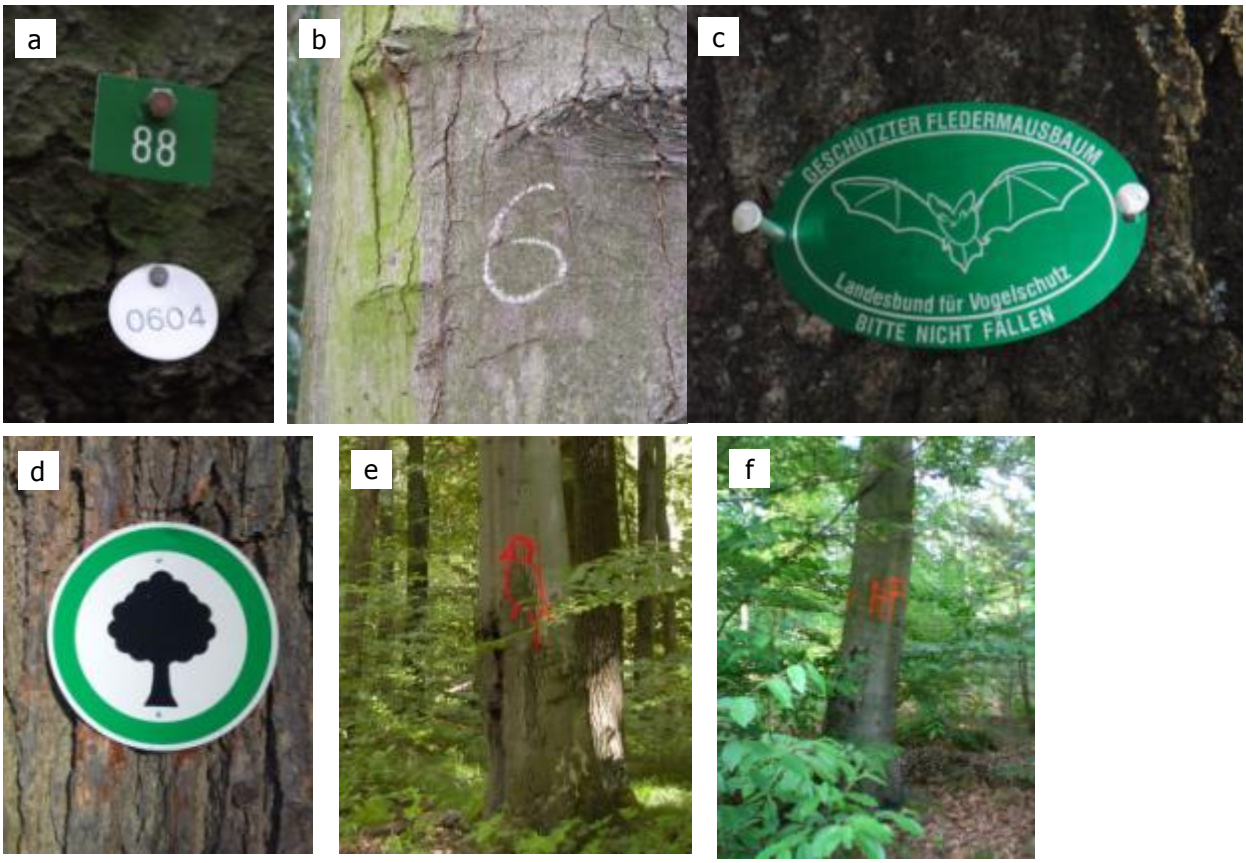


Fig. 8: Marking cavity trees: additional sticker (silver) to the tree registry badge (green) in the city of Frankfurt (a), with forestry and industrial marker pen (Edding 950) (b), with bat plaques in Nymphenburg Palace Park in Munich (c), Habitat Tree plaque (d). The marks in the forest vary depending on jurisdiction and foresters; sometimes hollow trees are marked with a woodpecker (e), sometimes with an "H" for Habitat Tree (*Habitatbaum*), sometimes with "HF" for habitat and bat tree (*Habitat- und Fledermausbaum*) (f), sometimes with "FM" for bat tree (*Fledermausbaum*).

The mapping of the existing species spectrum has the advantage that, when carrying out interventions and with regard to the resulting conflicts with certain species, statements can be made on their population size, the alternatives, etc. The effects of certain measures can thus be far better estimated.

Please keep in mind at all times that old data (more than 5 years old) do not permit reliable conclusions to be made. Both tree cavity mapping and species registration must, therefore, be repeated and updated at regular intervals. Investigations in a park in Frankfurt (am Main) show the tremendous momentum in tree hollow development: within 6 years, nearly 15% of the mapped cavities were no longer available, but, in return, nearly four times as many had been created and had to be re-marked and measured (ITN 2012).

6.3 Amending the inspection logs

In the current guidelines for arborists (and related occupations), there is no or very inadequate reference to species protection law and the way of life of any rare species that inhabit cavities. Species protection likewise plays no role in standard inspection logs. To meet the requirements of species protection, a review of the issues concerning species protection law must form an integral part of the tree inspection. A separate point entitled "affected by species conservation" should be added to the inspection logs. This can, for example, look as shown in Fig. 35. This example was based on the exemplary control sheet drawn up for a single tree of the FLL (FLL 2010).

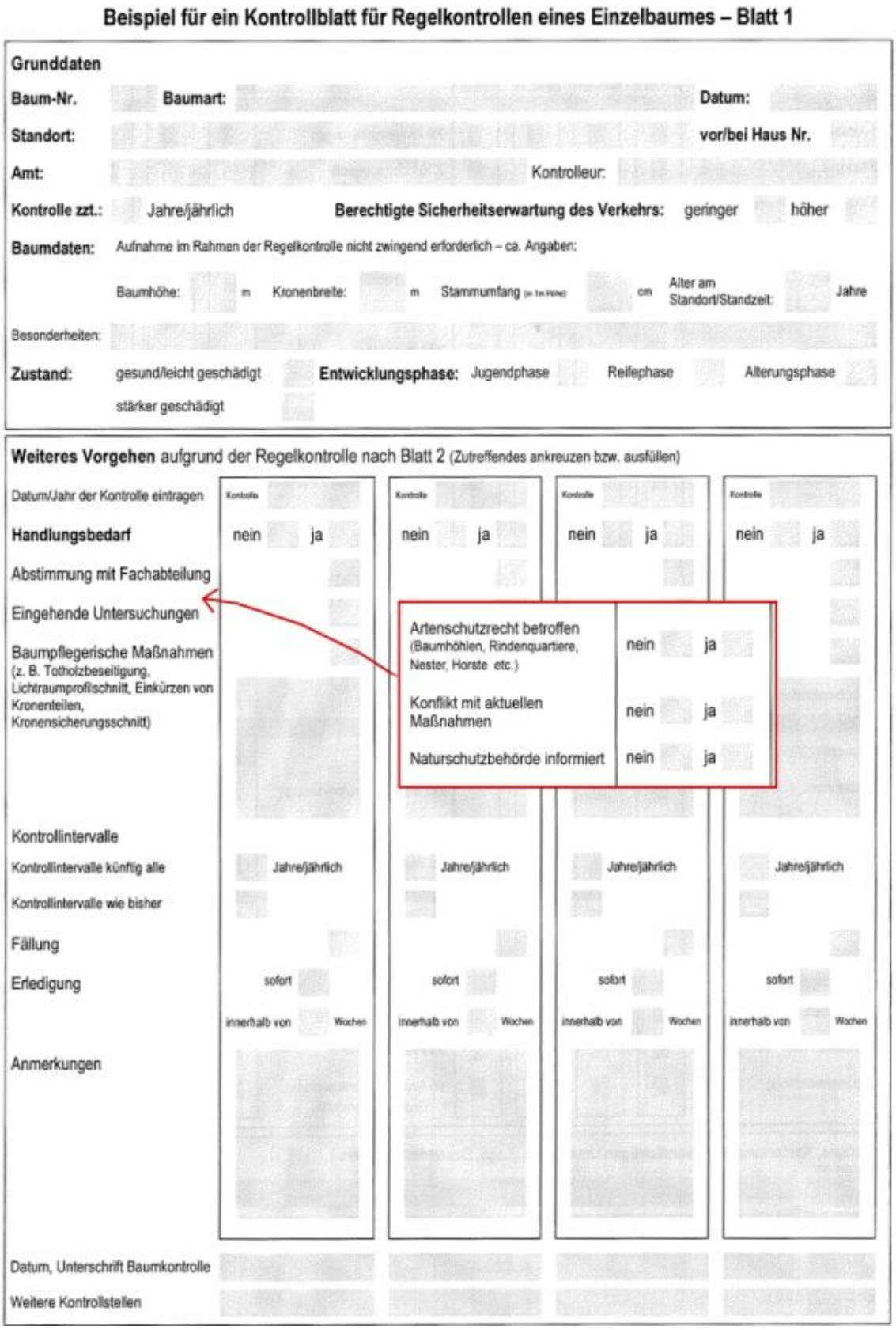
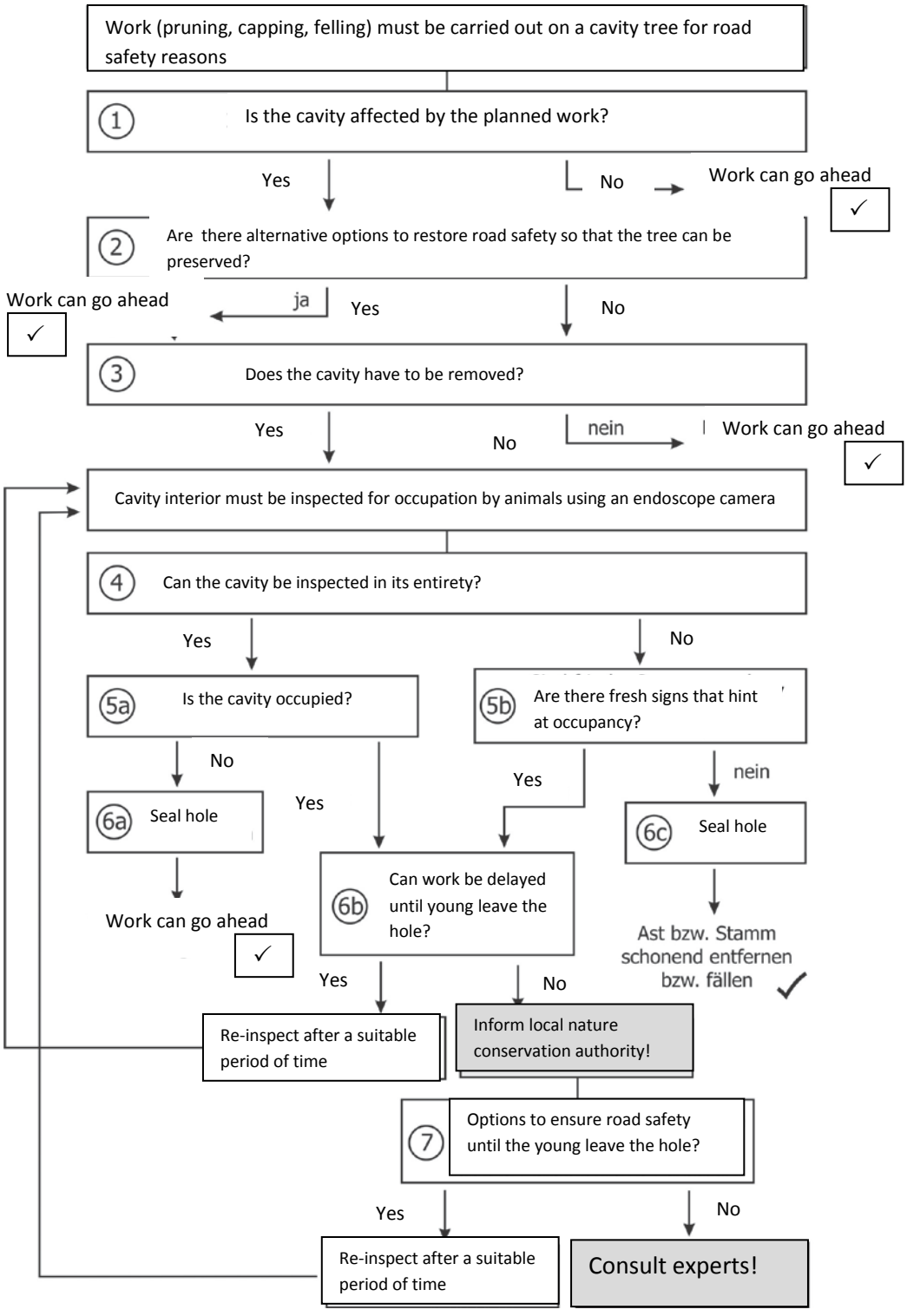


Fig. 9: Amended inspection log for the single tree inspection according to the FLL, 2010

6.4 Exemplary procedure

If, in the course of tree maintenance and/or road safety work, measures have to be carried out on a cavity tree, one can proceed as follows:



Comments on the individual points:

② If, for example, a tree is destined to be felled because of impaired stability, alternative methods can be tried out that restore the tree's stability by relieving the strain on the tree and thus preserve the cavity. Such alternatives may include:

- Cutting off the branch
- Crown reduction
- Capping

Particularly in parks and other urban green spaces, care should also be taken to ensure that the overall image of the park is not spoiled by the sight of lots of tree ruins.

ge of a park in Frankfurt am in.

④ An inspection of cavities can never be done from the ground or from the outside; looking into the cavity is indispensable. To this end, the endoscope cameras often used by doctors are suitable (product note in Ch. 7.). These cameras have a flexible "gooseneck", so one can easily examine the entire cavity interior with them. They can also record both images and videos. When inspecting the cavity, care must be taken to ensure that all areas of the cavity interior can be illuminated.

⑤a The issue of whether the cavity is occupied or not always refers to specially or strictly protected species (cf. Tab. 1, in Ch. 2). As a precautionary measure, species on the Red List of the federal and state governments should also be noted. If the cavity is occupied by other species (e.g. long-tailed field mouse or yellow-necked mouse), the cavity must remain open, but the tree may felled or the branch cut off, as long as this is done carefully (for example, by a harvester).

⑤b With large or irregularly shaped cavities, it is not always possible, despite extensive inspection, to survey the entire cavity interior. If this is the case and fresh tracks (droppings, nests, eggs, intense smell, etc.) point to occupation by animals, the cavity must be subsequently treated as an occupied cavity.

⑥a The cavities are sealed, so that no animals settle in the cavity before the measures are carried out. They are best sealed with scrunched-up newspapers, which adapt perfectly to the shape and size of the cavity entrance. To protect against rain and humidity, the newspapers should be packed in plastic bags.

⑥b At this point, it is important to consider whether the measure cannot be delayed once again. The time when the animals no longer use the cavity depends on the species using it and for what function. Many species use tree cavities as a place to sleep and regularly change them. If it is the sleeping place of a single animal, the cavity is often unoccupied the very next day. It should be noted that bats and dormice are nocturnal and occasionally form sleeping communities.

Tab. 7: Cavity function and useful life of the different cavity tree dwellers

	Spring	Summer	Autumn	Winter
Insects	All-year-round use to multi-year use → one cannot assume the abandonment of the cavity			
Birds	Courtship, nest building → before nest building and breeding, the cavity is regularly left empty and can then be inspected	Brooding → cavity can only be inspected again when brooding has ended (varies depending on the species, at the latest by mid/late August)	Roost → cavity is regularly left (by day) and can then be inspected	
Bats	Sleeping place → regularly changes cavity so that the cavity can be inspected a few (1-3) days later	Sleeping place, nursery → regularly changes cavity so that the cavity can be inspected a few (5-10) days later	Sleeping place, courtship → regularly changes cavity so that the cavity can be inspected a few (1-3) days later	Hibernation → cavity is only left at the end of hibernation (about March), and can then be re-inspected
Other mammals (in this case the hazel dormouse)	Sleeping place → regularly changes cavity so that the cavity can be inspected again after a few days	Rearing young → cavity is only abandoned in July/August and can then be inspected again	Hibernation → cavity is left only towards May and can then be inspected	

If delaying the measures is not possible, a prohibition under Article 44 of the BNatSchG cannot be ruled out. In any event, the local conservation authority must be informed.

(6c) If it cannot be excluded that animals are living in the cavity or if there are animals in the cavity not protected by Article 7 of the Federal Nature Conservation Act, the tree must be felled with care. This can, for example, be done by using a harvester. When branches have to be removed, they should be cut off and then placed carefully on the floor.

(7) If the time when the animals will leave the cavity is foreseeable, options as to how the tree or the affected limb can be maintained until then might be practicable. Such options may include:

- Relief cuts,
- Crown reduction,
- Capping,
- Fastening the tree to the neighbouring tree,
- Cordoning off the area and putting up signs stating that road safety cannot be ensured either temporarily or permanently,
- Blocking the path or re-routing it.

Fig. 11: A beech infested by brittle cinder in a park a Frankfurt (am Main). When the beech was to be felled because it posed a risk, there was a brood of starlings in a woodpecker hole. The load on the beech was lightened through severe crown reduction and, as a precaution, the tree was also fastened to the adjacent tree. After about two months, the follow-up inspection was shown to be empty, so the tree could be felled.

If none of the above alternatives is possible and the cavity has to be removed despite it being occupied by strictly or specially protected species under Article 7 of the Federal Nature Conservation Act, qualified personnel (animal ecologists, conservationists, etc.) must be consulted.

6.5 Case studies

The following case studies reflect possibilities that arise when carrying out tree maintenance and with regard to the obligation to traffic safety. The technical background of the solutions are formed by the basic principles of animal ecology and the consideration of species protection provisions under Articles 39, 44, 45, and 65, 67 and 69 BNatSchG. Likewise, it is assumed that an advanced and forward-looking careful examination of the facts has been made and that close professional and formal legal consultation with the relevant nature conservation authority will take place (e.g. review of the legal requirements relating to species protection, exemption under species conservation legislation among others.).

Advice on how to proceed

- Check that the tree has any habitat structures that fall under species protection law (tree hollows, crevices, strong dead wood, nests).
- Check to see if the tree is currently being used or shows evidence of use by animal species (e.g. birds flying to and fro, droppings, nests, borehole cuttings).
- If there is a recognisable indication of a specially or strictly protected species, inform the conservation authority of this; in the event of conflict or uncertainty, seek external advice.
- If the tree is inhabited, the measure must be postponed. In the event of "imminent danger", seek external advice, get the nature conservation authority involved and find a solution together.
- If the tree is currently vacant, but displays signs of being a protected breeding and resting site, please check whether the measure is absolutely necessary (avoidance!) or whether the preservation of the habitat structures is possible (e.g. relief cut instead of felling).
- Get the conservation authority involved and clarify the legal action (if necessary, condition for exemption under species conservation law, exemption application, etc.).

Case study 1: occupied bat tree in winter

If you find hibernating bats in a tree hollow when performing a tree inspection before carrying out maintenance or felling measures, extreme caution is required. In winter, bats fall into a deep lethargy and become unreactive. They use the deep sleep to survive the foodless winter period. Any disturbance 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 matter of a normal maintenance measure (e.g. the removal of dry branches), delay the work on the tree until the animals voluntarily abandon the tree. Any direct disturbance is prohibited. The first flight is weather-dependent and usually occurs sometime in the spring. Many animals use the tree throughout the winter from November to April. As winter roost trees are extremely important trees, one must consider whether any tree maintenance work is required. Please inform the competent local nature conservation authority and consult bat watchers.

b. If the tree is in "imminent danger" due to its condition, the hazard area should ideally be cordoned off until the animals abandon the tree voluntarily. You cannot actively rescue hibernating bats from the tree. Failing this, the tree must be secured to prevent it from falling or breaking. In particularly difficult cases, e.g. when the hazard area cannot be cordoned off and one cannot wait until the birds take flight, there are individual solutions, which are not, however, without stress and threats to animals. In this case, one should draw on the advice of bat experts. What is possible in an emergency, for example, are controlled cutting measures using a harvester, the generous excision of the piece of the trunk harbouring the bats and immediate placing the piece of the trunk next to adjacent trees.

Case study 2: bat tree occupied by bats in the summer

Ideally, no maintenance work should be carried out on trees in the summer, unless essential for the maintenance of the tree or road safety. If bats are discovered in a cavity of the tree, the following options apply:

a. Refrain from carrying out the maintenance measure, wait until late autumn or, in acute and urgent cases, wait at least until the animals abandon the tree. In the summer, bats change their daytime roosts every few days. Observe the tree and the cavity and make sure that no animals are present. Please inform the competent local nature conservation authority and consult bat watchers.

b. In the case of "imminent danger", the hazard area should, ideally, be cordoned off until the animals leave the tree voluntarily. In the summer, this should be quite possible in almost all

cases, since the animals change the tree after a few days. Failing this, the tree must be secured to prevent it from falling or breaking. Please inform the competent lower nature conservation authority and consult bat watchers.

Case study 3: currently vacant bat tree

Prior to carrying out the maintenance or felling work, bat droppings are found in the tree hollow, but the tree is not currently occupied. Since bats traditionally use their tree hollows recurrently and over many years, the currently unoccupied tree is a strictly protected breeding site and resting place and definitely worthy of preservation. You must first check whether the tree or the tree cavity can be preserved, even if the animals face an acute risk of injury or death. Only in very exceptional and duly justified cases and taking all technical alternatives into account may the tree be subsequently removed.

Case study 4: tree currently occupied by breeding birds

a. If the tree is known to be a currently occupied nesting tree, general maintenance work must be postponed within the meaning of Article 39 BNatSchG. If the breeding birds are discovered during maintenance activities, the work must be delayed until the young birds have flown voluntarily. Any disturbance of breeding birds (i.e. all European bird species!) – whether intentional or not – are to be avoided.

b. If there is "imminent danger", the hazard area should, ideally, be cordoned off until the animals leave the tree voluntarily. Failing this, the tree must be secured to prevent it from falling or breaking. In very justified emergency situations, there may be special solutions, such as moving by a few metres a tree hollow with young animals that still need to be fed. Such special solutions are possible only with experienced support. Please inform the competent local nature conservation authority and consult birders for advice.

Case study 5: unoccupied bird nesting tree

If a maintenance or felling measure has to be performed on a tree that has a recognizable bird hatchery, but the nest tree or cavity is vacant, the following facts must be considered:

a. If the nest is identified as being the nest of a bird species that builds a new nest for each brood, the measure can be carried out, so long as it is ensured that no birds or clutches are affected. The vast majority of bird species found in parks and gardens build a new nest every year.

b. If the hatchery is used repeatedly by a bird, for example, after hibernation, the hatchery is a protected breeding site and resting place and must not be destroyed. As with an unoccupied bat tree (see below), one must first examine whether the hatchery, the tree or the tree cavity can be preserved, even if it poses an acute threat of injury or death to the animals. Only in very exceptional and duly justified cases and taking all technical alternatives into account may the tree be subsequently removed. Repeatedly used hatcheries are usually nests or tree hollows that take some effort to build.

Case study 6: tree with specially or strictly protected species of insects

If maintenance or felling work has to be carried out on a tree inhabited by specially or strictly protected species of insects, one must, in the case of general maintenance measures, check within the meaning of Article 39 BNatSchG whether the measure can be avoided so that the – often very specialized – habitat of the insects is not destroyed. In the event of measures that cannot be avoided or even in cases of "imminent danger", the following facts should be examined:

If it is a matter of social insects that form states, one must ideally postpone the measure. Wasp species – and this includes among others hornets – abandon the nest towards winter. The queen overwinters and establishes a new colony in a new place the following year. Honeybees, however, overwinter in their nest. In this case, the nest site should be preserved. If this is not possible, seek external help with the resettlement.

Beetle species that live in the hollows of trees or dead wood usually have a development time of several years. In this case, one first has to check whether the measure is absolutely necessary or whether the habitat can be preserved by a suitable minimising measure (e.g. a relief cut instead of felling). If, in the case of "imminent danger", the tree cannot be saved, the structures relevant to the beetles must be carefully safeguarded by, for example, generously excising the relevant piece of the trunk and attaching it to a suitable location in the vicinity. In any event, external expertise should be sought.

Case study 7: felled tree with animals found in it

If, despite all the precautionary approaches taken as part of a felling measure, animals, such as hibernating bats, birds or young beetle larvae are found, then advice by trained species experts is

absolutely essential in order to look after the animals properly. Immediately inform the competent nature conservation authority. Please ensure that the animals cannot suffer any more harm until they receive further care (e.g. letting the work rest, no further work carried out on the trunk, preserving the animals in a safe container, among other things). If the animals are not hurt, efforts should be made so that they can be reintroduced to the local site immediately or as promptly as possible.

7. Additional Information

Projects

DBU project "Nature Conservation and the Preservation of Monuments and Historic Buildings of Historic Parks", TU Berlin

Quotation from the website: *"Historical parks are important parts of our cultural heritage and are of prime importance to monument conservation. Because of their long history of use, they are often also treasuries of biological diversity and, therefore, of great importance to nature conservation. This internet handbook, which results from a research project, addresses all those who deal with historical parks. The information provided is intended to promote an understanding of nature conservation objectives in historical parks and to help to integrate these objectives into a style of park management that takes into account monument preservation."*

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

DBU project "Historical avenues in Schleswig-Holstein – protected biotopes and green cultural monuments. Final publication of the DBU-funded pilot project 2005-2009.

Editor: Landesamt für Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig Holstein (LLUR), Landesamt für Denkmalpflege (LfD) und Institut für Baumpflege Hamburg (IfB)

Collection of texts relating to conservation 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.

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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 on the hermit, great capricorn and violet click beetles

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

http://www.totholz.ch/artenportraits/hirschkaefer_DE

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Wurst, C. (2012): Praxishilfe Geschützte Arten und Wert gebende Strukturen. Praxisfächer. Editor: Nürnberger Schule, ISBN: 978–3–00–039393-8

Wurst, C. (2013): Habitatstrukturen an Bäumen - ein Leitfaden für den Baumpfleger. In: Dujesiefken, D. (Ed.): Jahrbuch der Baumpflege 2013: 40-52.

Road safety

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

Endoscope camera

An endoscope camera with an endoscope that is as long and flexible as possible is crucial for inspecting a tree cavity. The camera should be waterproof and have, if possible, a wide-angle and a telephoto camera, since the telephoto camera has a smaller diameter and can thus also be introduced into narrower cracks.

Example: dnt Findoo Profiline Plus endoscope camera available from many retailers, original price €160.

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10. Appendix: Examples of PR work on the topic of tree hollows

Fledermausexkursion im Riederwald

13. August 2010, 20.30-22.30 Uhr

Veranstalter: Umweltamt Stadt Frankfurt am Main (www.umweltamt.stadt-frankfurt.de), Institut für Tierökologie und Naturbildung (www.tieroekologie.com)
Führung: Dr. Markus Dietz, Katharina Schieber
Anmeldung: Beim Umweltamt der Stadt Frankfurt am Main, Herr Gelen: 069 – 21239154
Treffpunkt: Eingang Riederwald an der Philippuskirche (Kirschenallee)
ÖPNV: Je 5 Min. von den U-Bahnhaltestellen Johanna-Tesch-Platz und Schäfflestraße

Die Besucher machen sich unter fachkundiger Anleitung auf die Suche nach Fledermäusen in den alten Eichen des Riederwaldes. Ein besonderer Augenmerk liegt dabei auf Großen und Kleinen Abendseglern, zwei für Frankfurt typische Fledermausarten. Mithilfe eines Fledermausdetektors werden ihre Rufe für das menschliche Ohr hörbar gemacht. So lassen sich die eleganten Jäger bei ihrer abendlichen Nahrungssuche akustisch verfolgen und gut beobachten.

Fledermaus-Nacht im StadtWaldHaus

21. August 2010, ab 15-23 Uhr

Veranstalter: GrünGürtel Lernstation StadtWaldHaus / Grünflächenamt Abt. StadtForst (www.stadtwaldhaus-frankfurt.de), Arbeitsgemeinschaft Fledermausschutz Hessen im NABU, Naturschutzbund Deutschland (NABU), Sielmanns Natur-Range, Staatliche Vogelschutzwarte für Hessen, Rheinland-Pfalz und Saarland (VSW), Schutzgemeinschaft Deutscher Wald, Kreisverband Frankfurt.
ÖPNV: 15 Min. von der Haltestelle Oberschweinstiege der Straßenbahnlinie 14, Richtung Neu-Isenburg

Zum zehnten Mal findet in der GrünGürtel Lernstation StadtWaldHaus die Fledermaus-Nacht statt. Nicht nur in der Nacht, auch den ganzen Tag über wartet auf die Besucher ein buntes Programm aus Vorträgen, Spielen und Exkursionen rund um die Fledermäuse Frankfurts.

Herausgeber:
Stadt Frankfurt am Main, Umweltamt / Untere Naturschutzbehörde, Galvanistraße 28, 60486 Frankfurt am Main

Frankfurter Nachtleben

Fledermäuse in unserer Stadt

Bechsteinfledermaus

(*Myotis bechsteinii*)

Die Bechsteinfledermaus ist eine mittelgroße Fledermaus. In einer großen Männerfaust würde sie glatt verschwinden. Sie gehört zur Gattung der Mausohren und hat, wie dieser Name schon sagt, auffällig lange Ohren. Ihr Rückenfell ist braun bis rötlich braun gefärbt, ihre Unterseite deutlich heller beige oder grau. Ihr Name leitet sich von ihrem Benenner, Johann Matthäus Bechstein, ab.

Obwohl die Bechsteinfledermaus in Mitteleuropa relativ weit verbreitet ist, ist sie nirgendwo häufig. Ihr idealer Lebensraum ist ein reich strukturierter, naturnah bewirtschafteter Laubmischwald. Vor allem im Spätsommer nutzt sie aber auch strukturiertes Offenland, insbesondere Streuobstwiesen, als Jagdgebiet. Die Bechsteinfledermaus ist eine typische Art im Rhein-Main-Gebiet. Besonders ist, dass sie unweit vom Innenstadtbereich einer Großstadt vorkommt, was vor allem den alten Eichenbeständen, z.B. im Fechenheimer Wald und dem Riederwald, zu verdanken ist. Auch der Frankfurter GrünGürtel stellt für diese Art einen wichtigen Lebensraum dar.

STADT FRANKFURT AM MAIN
UMWELTAMT

Die Bechsteinfledermaus ist ein wendiger Flugkünstler und kann selbst zwischen den Blättern der Büsche und Bäume noch manövrieren. Dabei erjagt sie nicht nur Fluginsekten, sondern ist darauf spezialisiert, Beutetiere auch von Blättern oder dem Boden abzusammeln.

Europaweit ist die Bechsteinfledermaus streng geschützt durch die Fauna-Flora-Habitatrichtlinie. Die europäischen Mitgliedstaaten haben dadurch eine besondere Verantwortung für den Schutz der in der Habitat-Richtlinie genannten Arten.

Viele Frankfurter Institutionen haben für Sie in diesem Jahr ein besonders vielfältiges Programm zusammengestellt. Wir wünschen Ihnen viel Vergnügen dabei, Artenvielfalt der besonderen Art zu erleben.

Verborgenes Leben in Baumhöhlen

17. April 2010, 15-17 Uhr

Veranstalter: Umweltamt Stadt Frankfurt am Main (www.umweltamt.stadt-frankfurt.de), Institut für Tierökologie und Naturbildung (www.tieroekologie.com)
Führung: Dr. Markus Dietz, Katharina Schieber
Anmeldung: Beim Umweltamt der Stadt Frankfurt am Main, Herr Gelen: 069 - 21239154
Treffpunkt: Eingang zum Huthpark hinter der Unfallklinik
ÖPNV: 5 Min. Fußweg von der Bushaltestelle Unfallklinik, B3

Um dem verborgenen Leben in alten Baumhöhlen auf die Spur zu kommen, führt das Umweltamt der Stadt Frankfurt am Main zurzeit ein Projekt durch, bei dem in den Parks und Friedhöfen Frankfurts nach alten Bäumen mit Baumhöhlen gesucht wird. In diesen Baumhöhlen leben gut verborgen zahlreiche Tiere. Häufig werden die Baumhöhlen von Spechten angelegt und vergrößern sich im Laufe der Zeit durch Ausfaulen. So können Baumhöhlen von beachtlicher Größe entstehen, die beispielsweise Fledermäusen, Siebenschläfern, Haselmäusen und zahlreichen Vögeln einen geschützten Raum zum Schlafen, Überwintern, Nisten und Brüten bieten. Im Rahmen der Exkursion werden Höhlen bewohnende Vögel beim Ein- und Ausflug beobachtet und einige Höhlen mithilfe einer speziellen Baumhöhlenkamera inspiziert. Mit etwas Glück lässt sich eine Fledermaus oder ein Siebenschläfer beobachten.

Wasserfledermäuse an der Nidda

28. Mai 2010, 20.30-22.30 Uhr

Veranstalter: Umweltamt Stadt Frankfurt am Main (www.umweltamt.stadt-frankfurt.de), Institut für Tierökologie und Naturbildung (www.tieroekologie.com)
Führung: Dr. Markus Dietz, Katharina Schieber
Anmeldung: Beim Umweltamt der Stadt Frankfurt am Main, Herr Gelen: 069 - 21239154
Treffpunkt: Parkplatz des Hessenkollegs im Biegweg 41
ÖPNV: 10 Min. Fußweg von der Straßenbahnhaltestelle Postsiedlung

Fledermäuse sind Tiere, denen man in Frankfurt nicht alltäglich begegnet, obwohl es im Stadtgebiet eine ganze Reihe unterschiedlicher Arten gibt. Einige dieser selten gewordenen Tiere wollen wir bei unserer Exkursion kennenlernen und ihre Rufe mithilfe eines Detektors hörbar machen. Der Spaziergang beginnt im Biegwald und führt uns dann in Richtung Nidda, die einen wichtigen Lebensraum und Wanderkorridor für die Wasserfledermaus darstellt. Am nächtlichen Fluss lassen sich viele Wasserfledermäuse bei ihrem charakteristischen Flug über der Wasseroberfläche beobachten.

Großes Fledermaus-Kinderfest im MainÄppelHaus Lohrberg

20. Juni 2010, 10-18 Uhr

Veranstalter: MainÄppelHaus Lohrberg (www.mainaeppelhauslohrberg.de) in Kooperation mit der Rapp´s Kelterei
ÖPNV: Je 10 Min. Fußweg von den Bushaltestellen Heiligenstock oder Budge-Altenheim

Beim Großen Kinder- und Familienfest im MainÄppelHaus Lohrberg gibt es jede Menge Spiele und Informationen zu den Fledermäusen in Streuobstwiesen. In den alten Obstbäumen in und um Frankfurt leben eine ganze Menge Fledermausarten, die von dem Insektenreichtum der Obstwiesen profitieren.

Weitere Veranstaltungen des MainÄppelHaus' rund um das Thema Fledermäuse, finden Sie unter www.mainaeppelhauslohrberg.de

Vögel in der Stadt

Flatterhafte Anwohner

VON BORIS SCHLEPPER

Vogelsuche (Bild: Michael Schick)

Zu hören ist er schon lange bevor er zu sehen ist. Es klingt wie ein kurzes Pfeifen, das sich mehrfach wiederholt. Dann plötzlich ist er da, blaugrau und ockerfarben, landet geschickt nur wenige Zentimeter von dem kleinen Loch entfernt und flitzt den Stamm hinunter. Ein kurzer Blick auf die sieben Meter unter ihm liegende Erde, dann ist der Vogel mit einem Stöckchen im Schnabel in der Baumhöhle verschwunden.

Die Sumpfzypresse mit der silbernen Plakette 0082 an der großen Wiese im Ostpark ist bewohnt. Und zwar von einem Kleiber. Landschaftsökologin Katharina Schieber und Biologin Anja Hörig schreiben eifrig in ihre Blöcke. In den fünf Minuten, die sie vor dem Baum stehen, wird der kleine Vogel noch einige Male zu sehen sein. Jeder An- und Abflug wird notiert, auch Gesänge anderer Vögel. Nachwuchs hat der Kleiber noch keinen, weiß Schieber später. "Sonst würde er Insekten bringen." Die Äste und Halme seien Material zum Nisten.

Die beiden Wissenschaftlerinnen des Laubacher Instituts für Tierökologie und Naturbildung begutachten im Auftrag des Umweltamtes die Baumhöhlen in Frankfurt. Insgesamt sollen sie 18 Parks, Grünanlagen und einige Friedhöfe unter die Lupe nehmen. 13 haben Schieber und Hörig abgeklappert, elf bereits im Vorläufer-Projekt Frankfurter Nachtleben im Winter 2005/2006. Die restlichen fünf Parks folgen im Spätherbst. Bislang hat das Institut in Frankfurt etwa 2400 potenzielle Wohnquartiere für Fledermäuse, Vögel und Nagetiere kartiert.

Ziel des Projektes ist es, "eine möglichst solide Datengrundlage zu schaffen", erklärt Schieber. Nur wenn bekannt ist, welche Arten die Baumhöhlen bewohnen und wie hoch die Dichte in den einzelnen Parks und Grünanlagen ist, könne es einen "vernünftigen Kompromiss zwischen Artenschutz und Verkehrssicherheit" geben. Anhand der silbernen Plaketten, die die Wissenschaftlerinnen am Stamm anbringen, können Gärtner sofort erkennen, dass ein Baum vielleicht bevölkert ist.

Muss etwa ein morscher Ast an einem derart markierten Baum geschnitten werden, wird das Laubacher Institut informiert. "Wir schauen dann mit einer Kamera, ob die Höhle bewohnt ist", erklärt Schieber. Befinden sich in einer Höhle beispielsweise Fledermäuse, muss die Motorsäge solange ruhen, bis diese in einen anderen Bau gewechselt sind. Die Kartierung soll laut Katharina Schieber Modellcharakter haben. Deutschlandweit könnte das System künftig auch in anderen Städten angewendet werden.

Eine Exkursion zu den Baumhöhlen im Huthpark veranstaltet das Umweltamt am Samstag, 17. April. Von 15 bis 17 Uhr können Teilnehmer etwa mit einer Infrarotkamera einen Blick in die Höhlen von Vögeln, Siebenschläfern und Fledermäusen werfen. Treffpunkt ist am Eingang zum Park hinter der Unfallklinik. Um telefonische Anmeldungen unter 21239154 wird gebeten.

Zusätzlich werden dieses Jahr über die gesamte Saison insgesamt 59 ausgewählte Höhlen im Huth- und im Ostpark beobachtet und kontrolliert. Im Frühjahr, solange die Bäume kaum Blätter tragen, ist das Team nur mit dem Fernglas unterwegs. Erst im Sommer, wenn die Vögel ihre Jungen großgezogen haben, rücken sie auch mit Infrarotkameras an.

Im Bürgergarten des Ostparks reicht einfaches Hinhören. Verhaltenes Hämmern tönt aus einem frischen Loch, das in drei Metern Höhe in einer Erle zu sehen ist. Der Boden drumherum ist übersät mit Spänen. "Das ist ein Specht", erkennt Biologin Hörig am Pochen aus dem Inneren, "der baut gerade seine Höhle aus." Da der Unterschlupf ganz neu ist, wird er mittels eines GPS-Geräts kartiert. Anschließend wird die Plakette 1673 angeschlagen. Der Specht stört sich daran kaum. Nur kurz unterbricht er seine Arbeit - und wirft Holzspäne aus dem Loch.

Frankfurter Rundschau, 26.03.2010

Frankfurter Neue Presse, August 2010

Auf den Spuren der Nachtjäger

Bei einer Exkursion des Umweltamtes durch den Riederwald kamen die Teilnehmer den Fledermäusen ganz nahe

Schwer was los ist in der Fledermaus-Welt, denn es ist Paarungszeit. Rund 40 Teilnehmer einer kostenlosen Exkursion des Umweltamtes bekamen Einblick ins nächtliche Treiben.

Riederwald. Es dämmert gerade, als die bunt gemischte Schar von Hobby-Tierforschern um 20.30 Uhr vom Treffpunkt an der evangelischen Philippusgemeinde Richtung Riederwald aufbricht. Allen voran läuft Dr. Markus Dietz vom Institut für Tierökologie und Naturbildung, das im Auftrag des Frankfurter Umweltamts die heimische Fledermauspopulation überwacht.

Am Trainingsgelände der SG Riederwald biegt die Gruppe in einen dunklen Seitenpfad, auf dem es nach Moos und Feuchtigkeit riecht. Noch ist es so hell, dass Taschenlampen nicht nötig sind. Nach gut zehn Minuten erreicht die Gruppe ihr Ziel – einen Waldspielplatz, dessen Lichtung ideal für Fledermäuse zur Insektenjagd geeignet ist.

Es gibt 1100 Arten

„Nur wenn man weiß, wo sich die Tiere aufhalten, kann man sie auch schützen", sagt Markus Dietz und erzählt, dass Hessen 20 von weltweit 1100 Fledermausarten beheimatet. Sie existieren bereits seit über 50 Millionen Jahren und haben sich im Laufe der Zeit kaum verändert, wie Funde aus der Grube Messel belegen. Während der Biologe davon berichtet, schweift der neugierige Blick immer wieder in den Himmel, der sich zusehends verdunkelt. Doch um kurz vor 21 Uhr scheint die Luft noch rein zu sein. Als Markus Dietz jedoch mehrere Fledermausdetektoren aus seinem Rucksack holt und sie an die jüngeren Exkursionsteilnehmer verteilt, verändert sich die Wahrnehmung schlagartig. Als hätten sie nur darauf gewartet, fliegen Großer und Kleiner Abendsegler, die neben der Zwergfledermaus hierzulande am weitesten verbreiteten Arten, über den Spielplatz hinweg. Ihre Ultraschallrufe werden erst durch den Detektor fürs menschliche Ohr hörbar und klingen wie die Beats moderner Housemusik. „Das Gerät ist bei Kindern sehr beliebt, weil es ein bisschen Technoartig ist", meint Markus Dietz.

Erst jagen, dann paaren

In kurzen Abständen erklingen nun die Geräusche, die sich wie ein tropfender Wasserhahn in einem stark hallenden Badezimmer anhören. Tatsächlich ist die Luft erfüllt von den Abendseglern, die zwei Stunden lang Fliegen, Nachtfaltern oder Maikäfern jagen. Erst wenn die Tiere satt sind, geht es mit der Paarung weiter. Doch auch die gerade flügge gewordenen Jungtiere, die in zwei Jahren geschlechtsreif werden, mischen ordentlich mit.

Die Fledermaus sei noch immer eine recht geheimnisumwitterte Spezies, weiß Markus Dietz. Weder habe man bisher ihre Sprache noch ihre exakten Flugrouten in Richtung Winterquartier entschlüsseln können. „Bis zu 55 Stundenkilometer schnell sind die Tiere und fliegen zum Jagen auch mal von hier in den Vordertaunus", sagt Dietz.

Frankfurt beherbergt 14 Arten. Die 50 Gramm schweren Abendsegler wohnen meist in Baumhöhlen. Auch die seltene Bechsteinfledermaus lebt im Riederwald und angrenzenden Fechenheimer Forst.

Derzeit wird geprüft, wie sich der geplante Riederwald-Tunnel auf sie auswirken könnte. Weitere Informationen gibt es bei der Fledermaus-Nacht am 21. August von 15 bis 23 Uhr im Stadtwaldhaus. *mov*

Erst gab es die Fledermäuse nur auf Bildern zu sehen, doch dann erschienen die Tiere auch live. Foto: Rüffer

Flattermänner fliegen auf Baumhöhlen

Weil die Öffnungen im Holz vielen Tieren als Lebensraum dienen, sollen sie geschützt werden

In 20 Parks und Friedhöfen waren Naturforscher unterwegs, um Bäume, die Höhlen aufweisen, mit Plaketten zu versehen. Jetzt informierten die Forscher auf einer Führung im Huthpark über das Projekt.

Seckbach. Fledermäuse zu entdecken – darauf hofft nicht nur der elfjährige Niklas. Auch Philipp schaut sich während der Exkursion im Huthpark neugierig die Baumhöhlen an. „Ich will unbedingt Fledermäuse sehen", betont der Fünfjährige. Allerdings geht es um die nachtaktiven Tiere bei der Führung nur am Rande. Im Mittelpunkt stehen die Baumhöhlen, die durch Spechte, Blitze und beim Abbrechen von Ästen entstehen – und die Tieren als Lebensraum dienen.

Wichtig für Tiere

Bei Sonnenschein und blauem Himmel führten Markus Dietz und Katharina Schieber am Samstag im Rahmen des Projekts „Baumhöhlen in Frankfurt" durch den Park. „Vielen ist nicht bewusst, welche Bedeutung die Baumhöhlen für etliche Tiere haben", sagte der Geschäftsführer des Instituts für Tierökologie und Naturbildung zu Beginn der Exkursion. Denn während Fledermäuse die Baumhöhlen als Schlafmöglichkeit nutzten, benötigten Vögel diese als Brutplatz. Auch Insekten seien auf diesen Lebensraum angewiesen, erläuterte der Biologe den rund 30 Teilnehmern des Rundgangs.

Zusammen mit dem Frankfurter Umwelt- und Grünflächenamt will sich das Institut für die Erhaltung von Höhlenbäumen einsetzen. In 20 Parks und Friedhöfen waren die Naturforscher unterwegs, um Bäume mit Plaketten zu versehen. „Damit erkennen die jeweiligen Gärtner, welche Bäume besondere Pflege benötigen", sagte Dietz.

Über die Finanzierung seitens der Stadt Frankfurt sowie der Deutschen Bundesstiftung Umwelt freut sich der 43-jährige Naturwissenschaftler sehr. Denn ohne diese wären die Projekte überhaupt nicht durchführbar. 2004 begann das Institut mit Forschungen zum Thema „Frankfurter Nachtleben". In diesem Zusammenhang wurden die Fledermausbestände in der Stadt erfasst, um sie besser schützen und erhalten zu können. „Da die Baumhöhlen einen wichtigen Lebensraum für Fledermäuse darstellen, haben wir uns vor drei Jahren schließlich dazu entschlossen, diese ebenso zu erforschen", berichtete eine Mitarbeiterin des Naturschutzprojekts, Katharina Schieber.

Die Höhlenbäume werden nicht nur mit Plaketten versehen. Die Fachleute des Instituts für Tierökologie und Naturbildung erschließen deren Inneres außerdem mit einer speziellen Höhlenkamera, die genaue Einblicke gewährt.

Die jungen Teilnehmer der Führung machten große Augen, als Frau Schieber das Gerät im Huthpark aus ihrem Rucksack holte. „Das ist eine Endoskop-Kamera, die bevorzugt in der Medizin verwendet wird", erläuterte die studierte Landschaftsökologin.

Spezialkamera im Einsatz

Das Besondere ist, dass sie einen langen biegsamen Hals hat und über Leuchtdioden verfügt, so dass man die Baumhöhle von innen beleuchten kann.

Für Brendan sah die Kamera zwar mehr wie ein Navigationsgerät aus, aber von dem Ergebnis war der Elfjährige hellauf begeistert: „Ich bin echt verblüfft, wie gut man die Blätter und das Moos erkennen kann."

Aber nicht nur die kleinen Exkursionsteilnehmer waren voll bei der Sache. Auch Sandra Gööck sah sich die Baumhöhlen genau an. „Heutzutage, wo viele Kinder gar nicht mehr wissen, wie eine Zucchini aussieht, finde ich es wichtig, dass sie sich mit dem Thema Natur und Umwelt auseinandersetzen", sagte die 31-Jährige.

Markus Dietz war froh über die relativ hohe Teilnehmerzahl: „Es ist schön zu wissen, dass die heimische Umwelt so viele Menschen interessiert." Doch nicht nur den Frankfurtern möchte er seine Forschungsergebnisse mitteilen. So ist geplant, die Höhlenbaum-Erkenntnisse in eine Anleitung für Parkpflege zu integrieren, die bundesweit veröffentlicht werden soll. „Damit soll dieser kleine und unscheinbare Lebensraum die nötige Aufmerksamkeit bekommen."

Philipps Aufmerksamkeit haben die Baumhöhlen schon mal sicher. Auch wenn er keine Fledermäuse gesehen hat, war der Fünfjährige von dem beeindruckt, was die Natur alles zu bieten hatte. *adt*

Frankfurter Allgemeine Zeitung, January 2012

Schutz für Fledermäuse, Informationen für Spaziergänger

Im Riederwald leben viele Fledermäuse. Weil die Säugetiere geschützt sind, sollen die Menschen nun im Forst Rücksicht auf sie nehmen.

Von Bernd Günther

Zu viele Wege: *Im Riederwald sollen Trampelpfade gesperrt werden, um den Lebensraum von Tieren zu schützen.* Foto Felix Schmitt

RIEDERWALD. Im Riederwald leben und brüten seltene Fledermausarten und Vögel. Zugleich wollen dort aber auch die Bewohner des angrenzenden Stadtteils Riederwald spazieren gehen, joggen, spielen und sich erholen. Eine konsequente Pflege des Waldstücks sei daher notwendig, sagte Jürgen Burkert vom städtischen Grünflächenamt in der jüngsten Sitzung des Ortsbeirats 11 (Fechenheim, Riederwald, Seckbach). Aus Gründen der Verkehrssicherheit müssten etwa nicht mehr standsichere Bäume gefällt werden. Dadurch werde jedoch vor allem vielen Fledermäusen der Lebensraum genommen. Um dieses Problem zu lösen, hat das Grünflächenamt nun ein Nutzungskonzept für den Forst erarbeitet, das dem Ortsbeirat vorgestellt wurde.

Das Vorhaben knüpfe unmittelbar an das 2005 begonnene Projekt „Frankfurter Nachtleben – Fledermäuse in Frankfurt" an, sagte Christa Mehl-Rouschal vom Umweltamt. Damals sei untersucht worden, welche Arten von Fledermäusen in der Stadt lebten und welche Orte sie bevorzugten. Dabei habe sich gezeigt, dass vor allem der Riederwald ein wichtiger Lebensraum für Fledermäuse sei. Der Forst, der im Frankfurter Osten vom gleichnamigen Stadtteil, von Gewerbegebieten, Bahnlinien und der Autobahn begrenzt ist, biete viele Baumhöhlen, die bevorzugt von Fledermäusen, aber auch von Vögeln und Insekten bewohnt würden.

Der Forst biete optimale Bedingungen, weil er über einen mehr als 100 Jahre alten Baumbestand verfüge; vornehmlich Eichen, die Spechte als klassischer Höhlenbauer nutzten, sagte Markus Dietz vom Institut für Tierökologie und Naturbildung aus dem Vogelsberg. Es hat im Auftrag der Stadt das 50 Hektar große Waldstück untersucht und kartiert. An 282 Bäumen seien insgesamt 409 Baumhöhlen gefunden worden. Die Hohlbauten seien alle markiert und erkundet worden.

Die Höhlen dienten Marder und Eichhörnchen als Unterschlupf. Viele der 40 Vogelarten, die im Riederwald brüteten, täten dies in Baumhöhlen. Vor allem aber dienten die ausgehöhlten Baumstämme Fledermäusen als Aufenthaltsort. Neun von insgesamt 15 in Frankfurt lebenden Fledermausarten seien im Riederwald gesichtet worden; darunter etwa Exemplare der Bechstein-Fledermaus und des Großen Abendseglers. Viele der Fledermäuse überwinterten im Riederwald sogar, sagte Dietz. Außerdem fand er heraus, dass der Forst „wandernden Fledermäusen" aus Norddeutschland und osteuropäischen Regionen als Ziel dient.

Eine durchaus bemerkenswerte und schützenswerte Population, findet Dietz. Fest stehe allerdings auch, dass der Riederwald bei Joggern und Hundebesitzern überaus beliebt sei. Ein überdurchschnittlich dichtes Wegenetz mit rund 240 Metern Strecke pro Hektar zeuge davon. Abseits der regulären Wege seien jedoch in den vergangenen Jahren viele gern genutzte „Trampelpfade' entstanden. Eigentlich müssten entlang aller Wege und Pfade nicht mehr standsichere Bäume gefällt werden, um eine Gefährdung von Spaziergängern auszuschließen. Die Folgen wären jedoch „dramatisch": Wegen der Dichte des Wegenetzes blieben für die Fledermäuse kaum noch Bäume stehen.

Um eine Lösung für den Konflikt von Artenschutz und Verkehrssicherungspflicht zu finden, hat Dietz ein „Besucherlenkungskonzept" für den Forst erarbeitet. Danach sollen verschiedene Wege geschlossen werden. Dadurch könnten größere zusammenhängende Waldinseln entstehen. Die bedrohten Tierarten wären dort ungestört; entlang der verbleibenden Wege könnten hingegen die nicht mehr stabilen Bäume gefällt werden, sagte Dietz. „Wir wollen niemand vom Riederwald aussperren", sagte Burkert vom Grünflächenamt. Zugleich müsse aber auch der Naturschutz beachtet werden.

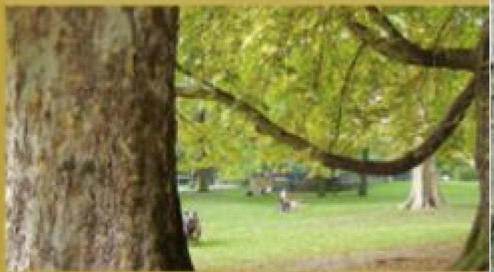
Die Zugänge zu den Pfaden, die aufgegeben werden sollen, könnten nach Darstellung von Dietz mit sogenannten hölzernen Wildnistoren gesperrt werden. Naturerlebnisstationen könnten Besuchern dort zugleich Informationen über die Tierarten im Wald geben. Vorstellbar wäre auch die Aufstellung eines Fledermaus-Detektors, mittels dem die Rufe der Fledermäuse gehört werden könnten.

Dass der Riederwald zusätzlich weiter aufgeforstet werden müsse, sagte eine Vertreterin der Schutzgemeinschaft Deutscher Wald. Burkert versicherte, dass an geeigneten Stellen Nachpflanzungen von Eichen vorgesehen seien. Die Kosten für das gesamte Vorhaben sind nach seinen Angaben noch nicht ermittelt. Unklar sei noch, ob die Pfade nur gesperrt oder auch aufgebrochen, also nicht mehr gangbar gemacht würden.

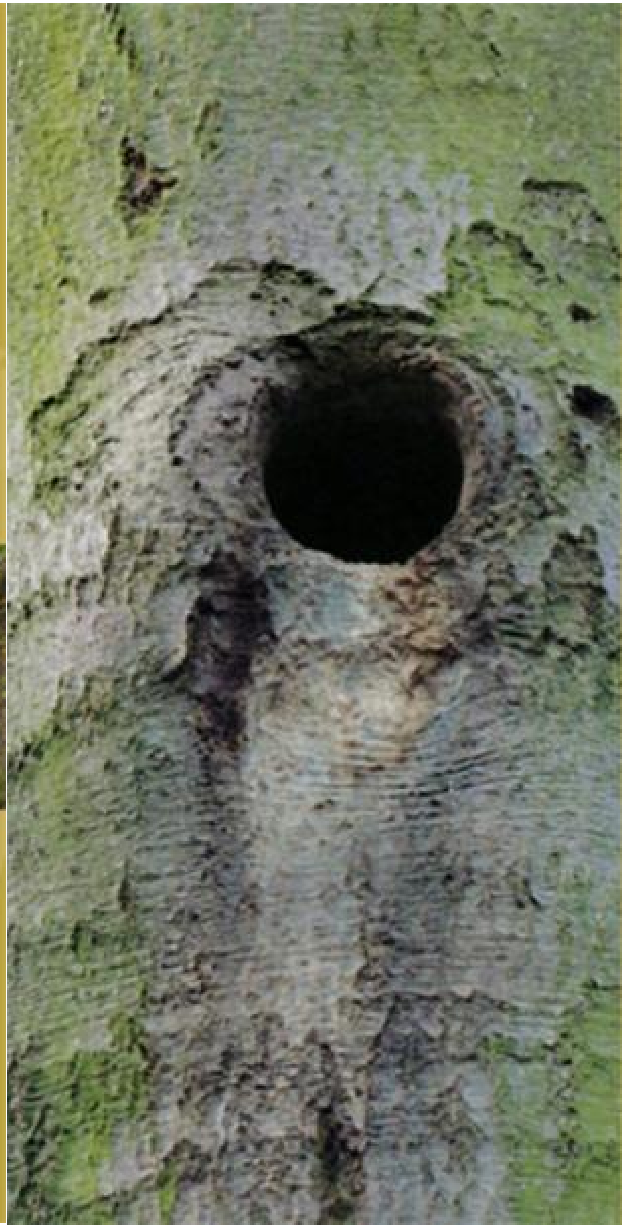
Stadtteilpolitiker bezweifelten, dass allein die Tore ein Betreten der beruhigten Waldstücke verhinderten. Burkert wollte dies nicht verneinen, wies allerdings darauf hin, dass dann jedenfalls nicht mehr eine Verkehrssicherungspflicht für die Stadt bestünde. Bis zum Sommer soll im Detail geklärt werden, welche Spazierwege und Pfade gesperrt werden könnten. Die Ortsvertreter stimmten dem zu.

Baumhöhlen

Wertvolle Lebensräume im Verborgenen



STADT FRANKFURT AM MAIN
U M W E L T A M T



Was ist eine Baumhöhle?

In der Stadt Frankfurt am Main gibt es zahlreiche Grünanlagen, Parks und Stadtwälder, in denen ein den meisten Menschen unbekannter Lebensraum zu finden ist: Die Baumhöhle. Baumhöhlen entstehen durch Frost und Blitzeinschlag, durch die zersetzende Wirkung von Mikroben und Pilzen oder durch gezielte „Baumaßnahmen" von Tieren, vor allem Spechten. Meist tragen mehrere Faktoren dazu bei, dass Höhlen entstehen und sich weiterentwickeln. Spechte bauen ihre Höhlen beispielsweise so, dass diese einen Brutraum unterhalb des Einflugloches bieten. Im Laufe der Zeit erweitert sich die Höhle nach oben, sodass dort Fledermäuse einen Hangplatz finden.

Langohrfledermaus

Wer lebt in Baumhöhlen?

Baumhöhlen bieten zahlreichen Tierarten Schutz vor der Witterung und vor Fraßfeinden. Sie sind also ein optimaler Ort zum ungestörten Schlafen, Überwintern und zur Aufzucht der Jungen.
In Baumhöhlen findet man soziale Insekten (Hornissen, Bienen) und besondere Käferarten, sehr unterschiedliche Vogelarten und Säugetiere wie Baummarder, Eichhörnchen, Siebenschläfer sowie die gesamte Gruppe der Fledermäuse.

Unter den Säugetieren sind die Fledermäuse die bekanntesten und gefährdetsten Baumhöhlennutzer. Viele Fledermausarten gründen ihre Wochenstuben in Baumhöhlen. Das heißt, die Weibchen einer Kolonie ziehen dort gemeinsam ihre Jungen groß. Solche Kolonien können manchmal mehrere hundert Fledermäuse umfassen. Fledermäuse nutzen eine Baumhöhle solange der Baum steht, teilweise über Jahrzehnte.

Star beim Ausflug aus einer Esche im Ostpark

Eichenheldbock

Baumhöhlen werden von zahlreichen und unterschiedlichen Vogelarten aus den Familien der Enten- und Taubenvögel, der Eulen, Segler, Racken und Sperlingsvögel genutzt. Spechte bauen mit ihren langen kräftigen Schnäbeln Baumhöhlen, in denen sie ihre Jungen großziehen. Die anderen Vogelarten nutzen die Spechthöhlen, nachdem die Spechte diese verlassen haben.

Auch verschiedenste Insektenarten nutzen Baumhöhlen. Bienen und Hornissen bauen beispielsweise gerne ihre Waben in Baumhöhlen. Die Larven von Rosenkäfern und Eremit ernähren sich vom Mulm in den Baumhöhlen. Der Eichenheldbock wiederum bohrt selber Baumhöhlen, die danach von solitären Bienen genutzt werden.

	Frühjahr	Sommer	Herbst	Winter
Fledermäuse	Schlafplatz Hangplatz	Wochenstubenquartier	Balzquartier	Schlafplatz
Andere Säugetiere	Schlafplatz	Fortpflanzungsstätte	Schlafplatz	
Vögel	Schlafplatz	Fortpflanzungsstätte	Schlafplatz	
Insekten		ganzjährige Nutzung, teilweise auch ununterbrochen über mehrere Jahre		

Diese Plakette zeigt den Baumpflegern: Achtung Höhlenbaum! Hier ist Vorsicht geboten

Gesetzlicher Schutz

Sowohl die Tiere als auch die Baumhöhle unterliegen einem strengen gesetzlichen Schutz (§ 44, Abs. 1, Nr. 1 - 3 Bundesnaturschutzgesetz). Der betroffene Baum als Lebensstätte streng geschützter Arten ist auch dann geschützt, wenn er nicht dauerhaft besiedelt ist, aber von regelmäßig wiederkehrenden Tieren genutzt wird. So nutzen beispielsweise Fledermäuse regelmäßig dieselben Bäume und kehren immer wieder in ihnen bekannte Baumhöhlen zurück. Die Besetzung einer Baumhöhle durch eine Winterschlafkolonie von Fledermäusen wiederholt sich jedes Jahr. Mehrere hundert bis über 1000 Fledermäuse können über mehrere Monate eine solche Baumhöhle im Winter besetzen, ohne dass es von außen erkennbar ist. Die Fällung eines Baumes mit einer Winterschlafkolonie hat gravierende Auswirkungen auf die Populationen.

Das Umweltamt der Stadt Frankfurt am Main lässt zum Schutz der Baumhöhlen und ihrer Bewohner in ausgewählten öffentlichen Flächen des Frankfurter Stadtgebietes zurzeit Baumhöhlen kartieren und untersuchen. Das Projekt wird gefördert durch die Deutsche Bundesstiftung Umwelt (DBU). Jeder erkannte Höhlenbaum wird mit einer Plakette gekennzeichnet, sodass bei Rückschnitt- oder Fällmaßnahmen sofort ersichtlich ist, dass bei diesem Baum besondere Vorsicht geboten ist. Manchmal lassen sich die Maßnahmen aus Sicherheitsgründen nicht vermeiden, dann wird vorher die Höhle mit der stadteigenen Höhlenkamera auf einen Besatz durch Tiere kontrolliert.

Mitmachen erwünscht!

Die Bewohner von Baumhöhlen sind Teil der Frankfurter Artenvielfalt. Ihr Schutz kann nur gelingen, wenn auch ihre Lebensstätten erhalten bleiben. Helfen Sie mit, die Artenvielfalt in Frankfurt am Main auch für die kommenden Generationen zu bewahren. Sollten Sie Tiere an Baumhöhlen beobachten, z.B. Fledermäuse, Bilche, brütende Vögel, freuen wir uns über die Meldung, vielleicht auch ein Foto, Ihrer Beobachtung. Auf diese Weise können Sie dazu beitragen, das Bild über diesen Lebensraum und seine Bewohner in Frankfurt am Main zu vervollständigen.

Gern stehen wir auch für Beratungen zur Verfügung wenn es erforderlich werden sollte einen Höhlenbaum zu beschneiden oder zu fällen. Kontaktadressen finden Sie auf der letzten Seite dieser Broschüre.

Kontrolle einer Spechthöhle mit der Teleskopkamera

Bechsteinfledermauskolonie in einer Baumhöhle

Aufnahme mit der Baumhöhlenkamera: Siebenschläfer in Höhle

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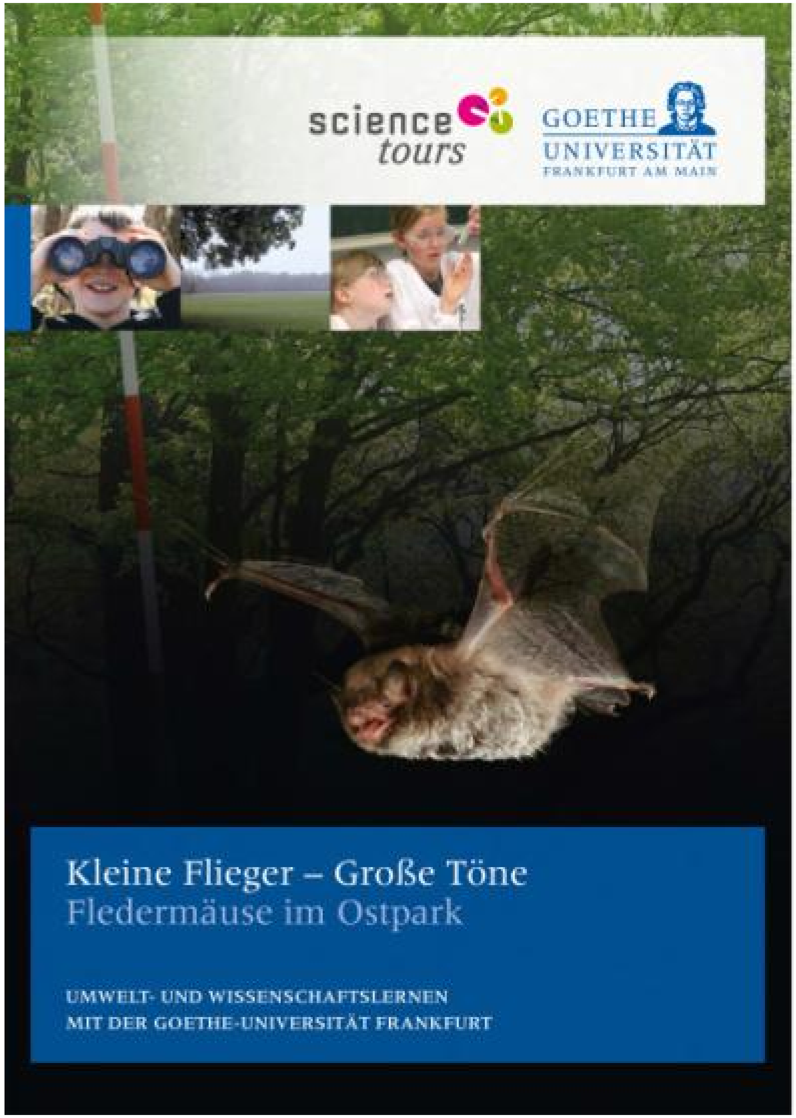

Title photos from the accompanying booklet for teachers and the research booklet for schoolchildren. Full documents can be found here