DEAD WOOD MANAGEMENT

in arboricultural practice

European
Arboricultural
Standards

FACT SHEETS

European
Arboricultural
Standards

DEAD WOOD MANAGEMENT IN ARBORICULTURAL PRACTICE

FACT SHEETS

EDITORIAL:

Author: Beata Pachnowska, Kamil Witkoś-Gnach
Graphic design: Paulina Sanecka
Photos and pictures: as indicated in subtitels

TeST (acronym for 'Technical Standards in Tree Work') is an EU funded project aiming to develop European technical standards on tree pruning, tree planting and tree cabling and bracing. These standards will reflect the good practice in tree work across Europe and will provide technical definitions and guidelines for tree work.
The project is run by a partnership representing 11 European countries and runs from September 2019 to August 2022.

Co-funded by the
Erasmus+ Programme
of the European Union

Table of Contents:

PURPOSE OF THIS FACTSHEET **5**
1. What is dead wood? 5
2. Where does the dead wood come from? 5
3. Types of dead wood 5
4. Values of dead wood 8
5. Wood decaying process 9
6. Associated species and colonisation of dead wood 9
7. How to manage dead wood in urban area 12
8. Dead wood assessment areas 13
9. Parameters for inspection of trees in relation to dead wood 14
   Surveying whole dead trees 14
   Surveying dead wood on individual trees 14
10. Work that the dead wood may require 17

Basic rules for pruning dead wood according to ETPS, 2021 18
What concepts are worth knowing 22
RESOURCES **23**

Dead wood management

THIS DOCUMENT COVERS THE ELEMENTARY KNOWLEDGE AND GUIDELINES FOR THE MANAGEMENT OF DEAD WOOD AND DEAD TREES IN SITES NORMALLY DEALT WITH BY ARBORISTS - URBANISED OR OTHERWISE - VISITED BY PEOPLE.

PURPOSE OF THIS FACTSHEET

The publication aims to bring together the key information on what dead wood is, what value it represents and how to deal with it, taking into account the different values associated with it and its safety for the environment.

1. What is deadwood?

Most wood is dead - in physiological processes - even in a living tree. Usually, however, by "dead wood", we mean wood created after the loss of vital functions of the entire tree or part of it, i.e. after dying or after cutting/felling. The term "dead wood" refers to an entire individual with interrupted vital functions - usually through a natural process - ageing, physiological processes (e.g. drought) or due to pathogens (not after felling). (There is a recommendation to use rather non-living wood instead of dead wood but to keep consistency with existing terminology and documents both terms could be used as well).

Usually, recommendations for dead wood refer to the more significant parts of the tree - trunks, limbs, and branches over 10 cm in diameter (see Humphrey, Bailey, 2012). In a broader approach, smaller branches important for different animal species, e.g. for nesting, are also considered.

2. Where does the dead wood come from?

Dead wood and dead trees occur mainly as a result of:

- **natural** dying processes of trees or parts of them (ageing, competition)
- **activities of other organisms (**fungi, pathogens, beavers/other herbivores)
- **intentional human activities (**pruning, felling trees)
- **weather phenomena** (especially extreme ones)
- **climate change** (drought, high air temperature)
- **other processes and events** - both anthropogenic and non-human (e.g. fire, wind, snowfall, fall of another object, e.g. a neighboring tree, building disasters or accidents)

Nowadays, the number of dying trees is likely to increase due to, among other things, climate change and the resulting considerable weakening of trees and reduced resistance to harmful agents.
Tree managers and workers copy with more and more situations where they have to and can decide on the further fate of dead trees or other types of dead wood.

3. Types of dead wood

Several categories of dead wood can be distinguished. The division into lying wood, standing wood, and stumps is also used in forests. It helps to assess the value of dead wood for biodiversity and to evaluate possible threats to the environment. A particular category worth distinguishing is veteran and ancient trees - a reservoir of dead wood usually in significant decay both in the crown and in their stumps. However, due to their values, they require a different management approach than other categories of standing dead wood.

Dead wood management

Types of dead wood	Examples
Standing	• dead or dying standing trees - before or after reduction (up to the so-called witness or high stump) • dead wood on living trees (branches, boughs, stubs, necrotic parts of the trunk, hanging branches)
Lying (on the ground)	• lying dead trees (scrap wood, tipping) • felled tree logs • branches felled or broken off cut or broken branches
At and in the ground	• removed tree stumps (usually up to 0.5 m high) or scrap wood (height varies) • root systems of dead or removed trees
Veteran and ancient trees	• old live trees, but with a high proportion of dead wood and a high biocenotic value

„Present day arboriculture has undergone a character reassessment driven by the study of ancient trees. This focuses on the life cycle and natural history of the tree, which encompasses a much wider set of circumstances than those provided by the previous conventional arboricultural paradigm. In this new context account is taken of natural processes over extended periods of time, and of the plant, wildlife and other communities that surround the tree.

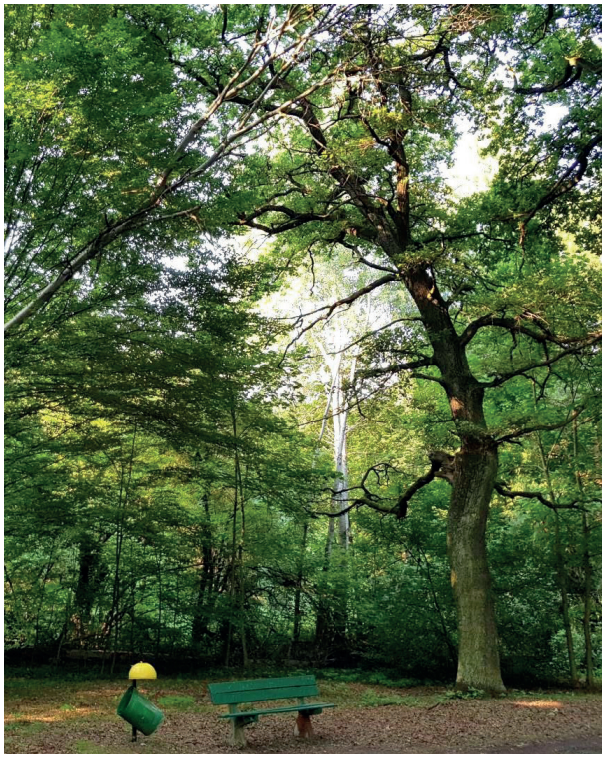
Until recently conventional arboriculture adopted the view that dead wood was harmful to the parent tree indicating decline, weakness and the presence of hazards. This was reflected in industry practice through to the 1990s. A sanitised approach required 'crown cleaning' with emphasis on dead wood removal, and cavity and decay treatment. Practices outlined in the original 1966 British Standard included the use of wound sealants, concrete cavity filling and the drilling and drainage of cavities and water pockets. The prejudice against dead wood remained and the subsequent British Standard (1989) persisted in recommending removal of dead, dying and diseased wood.

Wood decay has long been studied by naturalists, including entomologists and mycologists and under the influence of the Ancient Tree Forum, the study of ancient trees called into question previously accepted practices. This in turn led to a comprehensive reappraisal of the sanitisation approach to tree management, such that the current British Standard represents a paradigm shift. Practical guidance today recognises the fundamental importance of dead and decaying wood and the irreplaceable value of ancient trees (BSI 2010; BSI, 2012; ATF, 2014) and the importance of eveloping innovative practices under the auspices of conservation arboriculture."

Neville Fay, Nigel de Berker, Trees – a lifespan approach

PICTURE 1: Dead standing tree
(photo: Beata Pachnowska)

PICTURE 2: Standing and lying dead wood in a park
(photo: Beata Pachnowska)



PICTURE 3: Broken trunk of a dead tree in a park
(photo: Beata Pachnowska)

PICTURE 4: Stumps at different levels of decay
(photo: Beata Pachnowska)

PICTURE 5: Stumps at different levels of decay (photo: Beata Pachnowska)

PICTURE 6: A veteran tree managed in urban area (photo: Beata Pachnowska)

4. Values of deadwood

In modern arboriculture, dead wood is valued for its diverse values. The priority is to preserve it in the environment for other organisms and, if this is not possible for safety reasons, to use it according to its current state or its potential to create value in the future. The dead wood handled by the arborist usually has no economic value, although it may be sold as fuel. However, it is worth mentioning other functions of dead wood - nowadays more appreciated:

- **Biodiversity**, e.g. as a habitat or refuge for various organisms (created either by natural processes or by additional treatments that favour their creation), by contributing to biodiversity, or by enriching the soil as a result of slow decomposition;
- **Ecosystem services** - including sequestration of CO_2 (both in the wood itself and - as a result of decomposition processes - ultimately in the soil), or contributing to water retention;
- **Historical & cultural**, e.g. standing dead natural monuments or other historically or socially important trees;
- **Architectural and decorative** - dead wood can be used as an element of a plant composition or small architecture, e.g. lying logs can be used as seats, after minor processing as bicycle racks, after major processing as garden sculptures, etc;
- **Recreational** - use in playgrounds or recreation areas as an enhancement to play equipment or a rest area;
- **Educational** - especially in combination with the biodiversity function - dead wood can be used to build environmental awareness and pro-environmental attitudes in society;

One of the most important tasks of the tree manager is to assess the function that a particular piece of dead wood - either on site or in another location - can perform, and to ensure that this function is carried out in an optimal way with regard to public safety.
The biodiversity function, which is a priority in forests

or natural areas, may not be as important or feasible in many urban areas, e.g. on a street. Therefore, the management of dead wood in an urban area requires flexibility and the cooperation of many stakeholders.

5. Wood decaying process

The key attribute assessed in dead wood is its value for biodiversity, which depends primarily on the level of decay of the wood. Each type of dead wood may have a different value or increase risk in the environment depending on the decay and stability of the wood/dead tree. Some species of animals, fungi or lichens depend on the presence of wood in a highly decayed state or the type of decayed wood. Many can also be found in cities because of the long list of species closely associated with dead wood.
For example, the relict and charismatic beetle species protected at European level (see Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora) *Osmoderma eremita*, requires brown rot and specific habitat conditions - large decayed deciduous tree trunks, although it is not picky about their species and inhabits both limes, oaks and - alien to Europe - robinias.
Wood decay is usually faster in lying wood than in standing wood. It depends on the colonisation by wood-decaying fungi (parasitic and saprotrophs) and the conditions that favour their growth. Wood decomposition processes may be natural but can be accelerated by deliberate action (mycelial colonisation or pruning to favour microhabitats).

6. Associated species and colonisation of dead wood

When working on dead trees and with dead wood, you may encounter a wide variety of species including protected species, and you may need to be supervised or consulted by a specialist - so it is useful to know who is dealing with a particular group of organisms.

Main groups of organisms associated with dead wood	Specialist
invertebrates (especially insects, e.g. beetles, bumblebees, ants, runners) - both increasing the amount of dead wood (e.g. by affecting the dying of trees) and saproxylic (feeding on it)	entomologist
birds - hollows are particularly important for them, as well as dead branches or limbs as breeding, shelter/resting or foraging sites (e.g. woodpeckers, creepers)	ornithologist
mammals (e.g. bats, which inhabit hollows, cracks and bark splits, but also, like the Pipistrellus, in the post-beetle corridors)	chiropterologist (bats), zoologist (animals in general)
fungi - both protected species and parasitic fungi that may be important for other trees in the area	mycologist (fungi)
slime molds	
bryophytes, lichens - especially as protected species **algae**	lichenologist (lichens) briologist (bryophytes) phycologist (algae)

Dead wood management

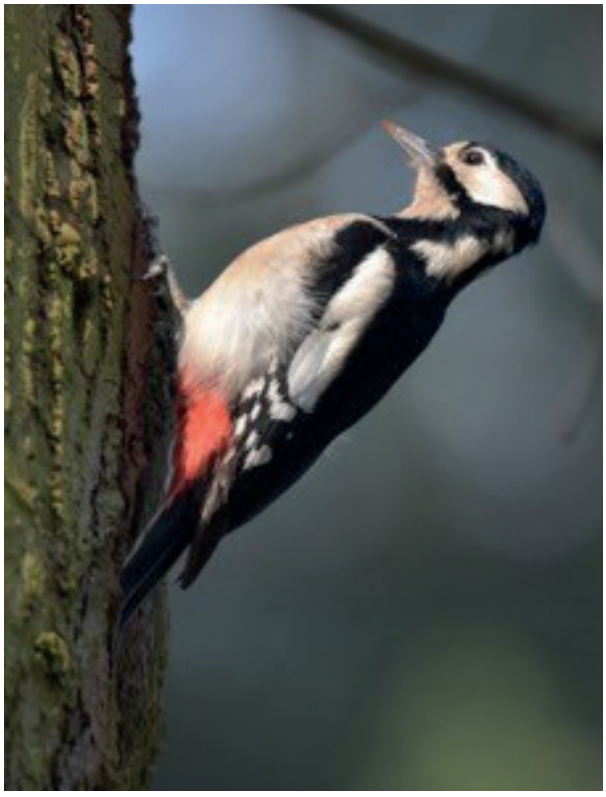
Many valuable species strictly depend on dead wood in the environment - both as foraging (e.g. woodpeckers), resting (e.g. many birds of prey), breeding (e.g. hollow bills).

PICTURE 7: *Protaetia speciosissia*
(photo: Jakub Józefczuk)

PICTURE 8: *Osmoderma eremita*
(photo: Jakub Józefczuk)

PICTURE 9: *Cerambyx cerdo*
(photo: Jakub Józefczuk)

PICTURE 10: *Rough woodlouses*
(Photo: EKO-TREK archiv)



PICTURE 11: *Woodpecker*
(Photo: Jakub Józefczuk)

PICTURE 12, 13: *Fungal fruiting bodies (photo: Beata Pachnowska)*

PICTURE 14: *Fungal fruiting bodies (photo: Beata Pachnowska)*

PICTURE 15: *Lichens (photo: Beata Pachnowska)*

7. How to manage dead wood in urban area

3 general principles of dead wood management:

a. Leave as much dead wood as possible to decay naturally
b. Protect and keep veteran and ancient trees standing as long as possible
c. Provide safety for the surrounding area at an acceptable level according to the specifics of the site

This can be broken down into 3 stages:

Step 1: Determining the possibility of leaving dead wood including requirements (prohibitions, orders) for the site and characteristics of use:

- Identification of site specifics - purpose, use, visitor access, conservation requirements.
- Determine whether it is possible to leave dead wood and dead trees on the site
  - if yes - what and where
  - if not - what can be done (e.g. move).
- This should result in guidelines for the management of dead wood on the site including options for leaving it or storing or receiving it from other sites.
- Including other regulations and standards (e.g. certification, protection such as area protection).

Step 2: Assessing existing dead wood on the site taking into account site specifics and determining next steps.
Review of existing dead wood on-site with inventory of significant sites:

- Assessment of the feasibility and appropriateness of leaving the dead wood in its current location without carrying out other activities, including assessment of:
  - risks to the surroundings in the context of land-use intensity
  - habitat / nature conservation value / forms of protection
  - biosecurity risks
  - current and potential functions of the site.
- Identify and carry out follow-up work with sites that require it:
  - risk remedial work
  - work to increase the value of dead wood in selected functions
  - agreements and consultations where restrictions exist (e.g. species protection or monument protection).
- Documenting the results of the work with recommendations for further action, including inspections.

Step 3: Monitoring of sites already inventoried and managed and assessment of new dead wood on the site with the determination of actions for it.

8. Dead wood assessment areas

Standing dead wood	**Safety assessment - as for other standing trees** • Site assessment • Inspection/individual assessment of trees • Advanced diagnostics - on valuable trees
All types of DW	**Biosecurity evaluation** • Alien invasive species • High-risk diseases (e.g. graphiosis, *Hymenoscyphus fraxineus* (*Chalara fraxinea*) disease) • Taking into account the specific characteristics of the area and the remaining stand of trees
All types of DW	**Assessment of colonization, biodiversity value, forms of protection** • Level of decay, are there any hollows, surroundings (possibility of migration of valuable species from other trees) • "The worse, the better". • Special attention to protected species (not only vertebrates and insects) and those supporting microhabitats (wood decaying fungi, black woodpecker) • *Biodiversity* - standing trees that are inhabited, have a high level of wood decay, are veteran and aged or **can meet the conditions through appropriate treatments to increase biocenotic value,** • *Architectural* - wood from felled trees, scrap wood or windrows with good wood structure but little natural value, which can be used as landscaping or animal shelter, as well as smaller parts of the tree, e.g. branches or boughs, which can be used to enclose the site, • *Recreational* - parts of the tree used as elements of playgrounds, meeting places, exercise areas, • *Cultural and educational* - dead natural monuments or other socially or historically important trees, including tipping and scrap.

9. Parameters for inspection of trees in relation to dead wood

Surveying habitat trees requires additional parameters compared to basic tree inspection. Below is a a selection of parameters that can that have been used in various methods. One of the most popular and widely used is the Specialist Survey Method (SSM) developed by the Woodland Trust in the UK (Fay N., De Berker N., 2017). The value of veteran trees increases with the presence of habitats for valuable and protected species, as well as with the presence of potential habitats, mainly related to dead, decaying wood, the presence of hollows, dead wood, etc. Detailed method for assessment and inventory of micro-habitats associated with dead wood are presented in the recently published *Guide to Tree-related Microhabitats. Descriptions and size limits for their inventory* by Bütler, R and colleagues.

Surveying whole dead trees

In forestry dead wood survey is a typical procedure. Details might vary between different countries however the principles are the same. It is worth using similar parameters as these will allow comparisons to woodlands and forests. Usually only deadwood with a minimum length of 50 cm is surveyed. In forests, selected sample plots are used but in urban environment whole area can be surveyed. General guidelines for surveying whole trees:

- there are 3 main categories of dead trees that can be recorded: standing dead tree, standing broken dead tree and lying trees;
- dead wood shall be recorded if the diameter of the stump is greater than or equal to 70 mm. Recording lying trees takes place if its thickness at the thicker end is greater than 100 mm
- recording data includes:
    - tree species,
    - type of dead wood: dead standing, dead standing broken, dead lying
    - for dead standing trees DBH in mm and the height in meters, parts with diameter less than 70 mm thick are not included;
    - for lying trees the DBH of the tree in mm measured at the mid-length and the length of the tree in meters parts with diameter less than 70 mm thick are not included

Surveying dead wood on individual trees

a. Standing/lying (parameter based on the SSM method)

This parameter indicates the position in which the tree (main trunk) is located. The following characteristics have been used: standing, fully lying, much leaning, scrap - broken trunk.

- standing - the trunk is more or less upright
- fully lying (collapsed) - main trunk is lying on the ground partially attached or entirely detached from ground
- much leaning - the trunk is leaning at strong angle for the ground with the rootplate fully or partially attached to ground
- scrap - broken trunk - the trunk is fractured attached to parent tree or separated

b. Crown loss (parameter based on the SSM method)

This parameter indicates how much of the original crown of the tree has been lost. Crown loss is a comparison between the current size and shape of the crown and the probable size of the full crown the tree had when it was at its peak. Parameter estimated and determined with one of four.

- Full or almost full crown outline - the current framework is reduced by less than 25% of likely peak crown framework (the tree has shed less than 25% of its likely peak crown framework)
- Reduced crown outline - current framework of canopy is reduced by 25-50% of estimated peak

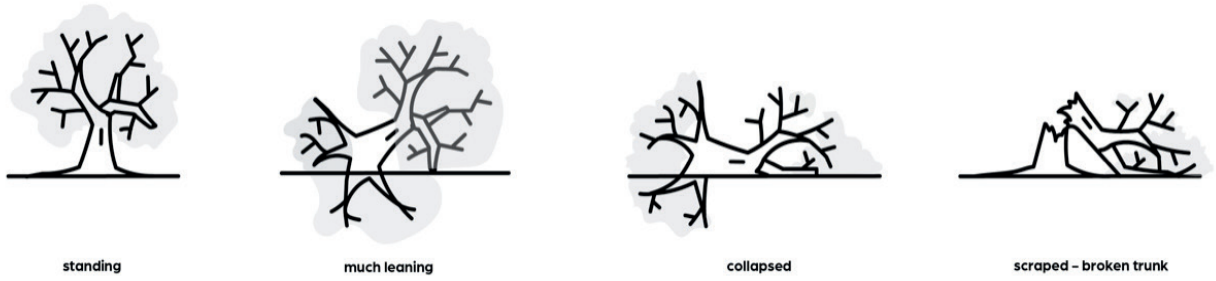
crown framework (the tree has shed 25-50% of its likely peak framework)
- Partial (fragmentary) full crown outline - the actual crown size is reduced by 50-75% compared to estimated peak crown framework (the tree has shed 50-75% of its likely peak crown framework)
- Remnant crown outline - the tree has shed over 75% of likely peak crown framework.

c. Live crown (parameter based on the SSM method)

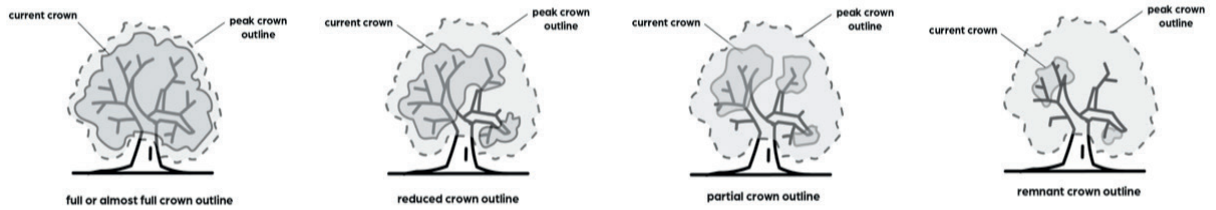
This parameter indicates how much of the current crown is alive. Parameter estimated and determined with one of the five possibilities below:
- Live canopy - mostly full canopy is covered with live growth
- Live partial canopy - 25-50% of actual crown outline is living
- Live residual canopy - less than 25% of crown has live growth
- Crown is dead but the trunk has some live growth
- No live growth. The whole tree is dead.

d. Hollows (parameter based on the SSM method)

Open hollows in the trunk base, trunk and main branches are assessed. The process of hollowing could be continuous or partial. The assessment is carried out according to the following guidelines:
- Apparently solid - the circumference is full, but there are small cavities
- Hollow trunk - the circumference is full, but small holes may be present
- Partially solid - the circumference is incomplete, with major cavities and large openings
- Remnant trunk - incomplete shell up to 30% of outer circumference is missing
- Remnant trunk - more than 30% of outer circumference is missing



PICTURE 16: Standing/lying, source: Kamil Witkoś-Gnach, 2022, Comparison of the approaches to the maintenance of veteran trees and habitat trees (author: Zosia Gagoś)



PICTURE 17: Crown loss, source: Kamil Witkoś-Gnach, 2022, Comparison of the approaches to the maintenance of veteran trees and habitat trees (author: Zosia Gagoś)

PICTURE 18: Live crown, source: Kamil Witkoś-Gnach, 2022, Comparison of the approaches to the maintenance of veteran trees and habitat trees (author: Zosia Gagoś)

e. Dead wood in the crown (parameter based on the SSM method)

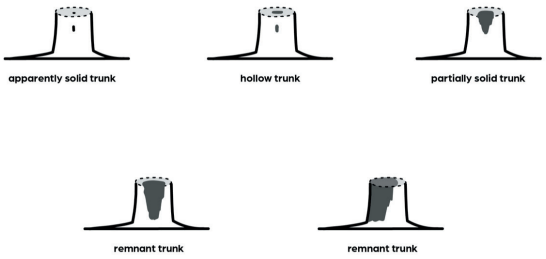
- The parameter defines the number of units of dead limbs present in the crown of the tree. One unit includes a piece with a length of 1 m and a diameter of 15 cm. The sum of the units is indicated in the table

f. Number of associated species

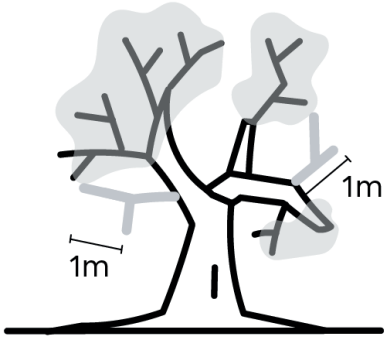
The presence of associated species should be taken into account in the tree assessment and species names should be provided where possible. When noting the observed presence of associated organisms the following is specified

- the species name of the organism (or if this is not possible, the generic name),
- the location of the detected organism (base of stem, trunk, branches, crown)

frequency of occurrence (O - occasional, F - frequent, A - abundant, D - dominant),



PICTURE 19: Trunk hollows, Kamil Witkoś-Gnach, 2022, Comparison of the approaches to the maintenance of veteran trees and habitat trees (author: Zosia Gagoś)



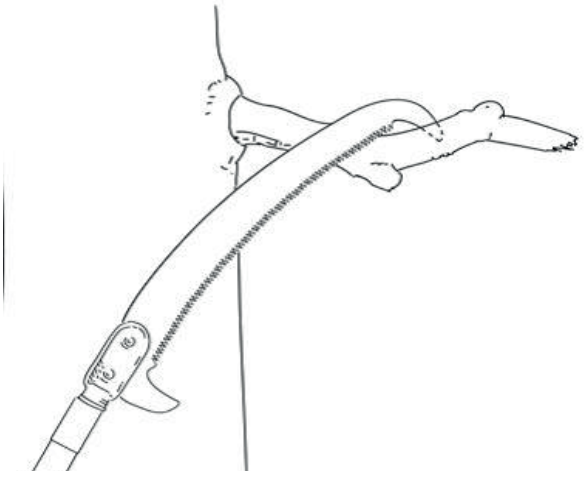
PICTURE 20: Dead wood in the crown, Kamil Witkoś-Gnach, 2022, Comparison of the approaches to the maintenance of veteran trees and habitat trees (author: Zosia Gagoś)

10. Work that the dead wood may require

Work which reduces the risk to the surroundings or to the tree	**Standing dead trees:** • Complete removal - only if necessary • If possible reduce to "snag" (min 4-6 m height) • If not - stump as high as possible • In tourist and protected areas and veteran trees - mimic natural processes (tree breakage, cuts that mimic natural breakage) • After removal, leave next to the stump, if not possible move to a suitable location **Dead wood on standing trees:** • assess stability - e.g. by hand-pull test with a pole or rope see fig. 1 • remove unstable parts completely according to the pruning standard (keep the live collar when present), partially (with stubs), or break off – see rules for pruning dead wood according to ETPS, 2021. • stabilize to maintain and control **Dead wood on the ground:** • if it does not interfere with traffic or other functions of the site leave it in place, if it does interfere move it to a designated location - appropriate to the intended function **Stumps:** • low stupms treat as lying dead wood on the ground - remove when it interferes with traffic or takes up space that can be used for new planting • high stumps and snags control like standing trees
Increasing biodiversity value	• Dead wood is particularly valuable when it is left to fully decompose at its destination and until fully decomposed it promotes habitat creation. • Techniques that increase the biodiversity value include cuts that create artificial cavities, bores that create openings, breakouts • They are intended to accelerate decomposition processes (colonization by fungi) and/or create refuge/breeding sites for various organisms • Implement on standing trees in parks, urban forests or reserves according to the function of the site and the strategy for it • It will require regular inspection to control risk.
Use of wood for other natural purposes	creation of shelters for larger and smaller animals (e.g. hedgehogs)
Use of wood for architectural purposes	e.g. as benches, area dividers, resting places standing trunks - after reduction and carpentry work, they can be mini local libraries or used as advertisement poles

BASIC RULES FOR PRUNING DEAD WOOD ACCORDING TO ETPS, 2021

1. Dead branches are a natural part of a tree crown and should not be removed unless necessary. They are important for biodiversity support. In some species, dead branches may have a role in damping the movements decayed and can easily break and fall (note that some dead branches do not fall off readily, e.g. dead limbs without shoulder in Quercus and Castanea, and dead limbs in some Pinus species).
2. Dead wood and stubs hinder complete closure of the wound by woundwood (callus). This can increase fungi colonisation and decay development in the area of branch attachment and in the stem.
3. If dead branches must be removed, leaving the base of the dead branches (stubs) can give a more natural appearance to the tree (especially if they are removed by breaking the branch) and support biodiversity. The pros and cons of this approach must be considered for each individual tree.
4. Dead wood management during structural pruning significantly differs depending on the tree's status and the type of pruning



PICTURE 21: Check of dead wood stability on standing tree with a pole. Source: Standard for tree pruning and care, 2021 Borowski, Witkoś-Gnach (eds.)

GENERAL RULES OF APPROACH TO PRUNING DEAD WOOD

Formative pruning
Dead and dying branches in the temporary crown should be removed regularly and completely. If permanent crown is present, stable dead stubs can be left in justified cases.

Crown maintenance
Dead and dying branches in the permanent crown should be retained (completely or reduced) for biodiversity reasons as long as this does not compromise an acceptable level of risk.
If dead wood is to be removed, this should only apply to branches likely to cause damage or injury, e.g. with a diameter exceeding 5 cm and a length over 1 m.
Dead branches can also be reduced to stubs or broken off. Stable dead stubs can be left.

Veteran trees (ancient, senescent, over-mature)
Dead wood should be preserved as much as possible in order to protect the associated habitat and the decay processes under natural conditions (in the crown and on the ground), while keeping risk at an acceptable level.

Source: EAS -European Tree Pruning Standard. TeST Group. 01: 2021, page 10

Inspection of dead wood - dried wood - on standing trees for stability can be carried out as a hand pull test. These can be carried out using, among other things, a rope, dart line or pole (see Fig. on the left).

EXAMPLE 1: CREATION OF MICRO-HABITATS USING STANDING DEAD WOOD

PICTURE 22: Creation of micro-habitats using standing dead wood (photo: EKO-TREK archive)

EXAMPLE 2: CREATION OF MICRO--HABITATS USING LYING DEAD WOOD

PICTURE 23: Small animal shelter under construction in the park area (photo: Beata Pachnowska)

EXAMPLE 3: LEAVING SNAGS AND VETERAN TREES WITH DEAD WOOD

PICTURE 24: A tall stump of biocenotic value left in a park (photo: Beata Pachnowska)

PICTURE 25: Veteran oak - bat habitat with removed branches left near the trunk (photo: Beata Pachnowska)

PICTURE 26: This small specimen, despite its considerable dryness, is not threatening and can even be left in a heavily used area (photo: Beata Pachnowska)

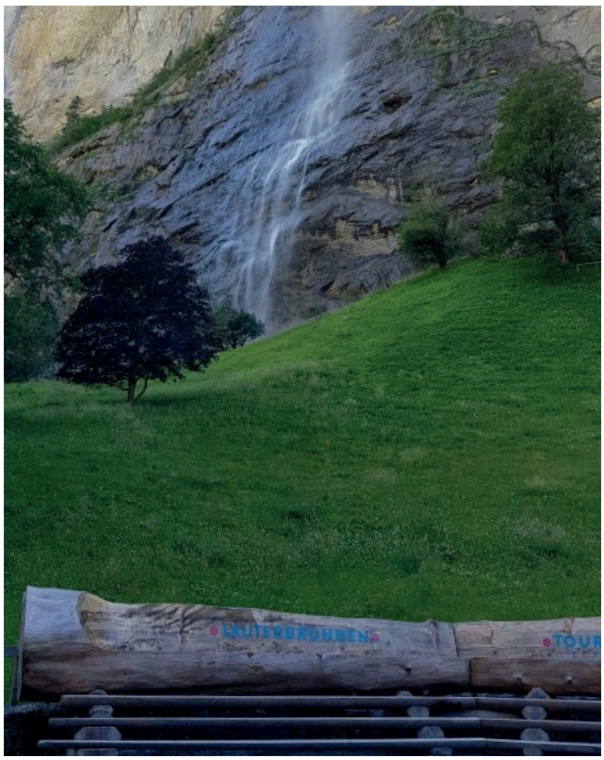
EXAMPLE 4: USE OF DEAD WOOD FOR RECREATION AND LANDSCAPING

PICTURE 27: A felled lying trunk as a resting place (photo: Beata Pachnowska)

PICTURE 28: A trunk left laying on the ground - debarked and a few fallen branches - a natural playground for children and dogs (photo: Jakub Józefczuk)

PICTURE 29: A small sculpture was created from a branch of a removed tree, Poland (sculpture by Jerzy Stolarczyk, photo: Beata Pachnowska).

PICTURE 30: Cut trunks or branches can be used to create paths (photo: Beata Pachnowska)



PICTURE 31: Use of felled logs as resting places (photo: Beata Pachnowska)

PICTURE 32: Using fragments of cut branches as a decorative element outside the green area (photo: Beata Pachnowska)

WHAT CONCEPTS ARE WORTH KNOWING

- **Biocenotic tree** - an individual with features that are important for biodiversity (e.g. with micro-habitats)
- **Veteran tree** - a tree of high conservation value, at an old or late maturity stage, usually of considerable size for the species, high level of wood decay in the trunk and/or branches, hollow, with a significant proportion of naturally precipitated bark dries, symptoms typical of the old age stage such as the formation of cambial columns, crown retraction, numerous reiterations, possible fungal or hollow fungal infestation. High historical cultural or social value is also common.
- **Environmental engineer** - an organism that alters its environment in a way that favours other organisms (e.g. the goatsucker, black woodpecker, beaver)
- **Microhabitat** - microstructure that allows organisms with specific requirements to survive (e.g. hollows, cracks, decay, necrotic areas)
- **Biodiversity** - the multiplicity of life forms in a given area

RESOURCES

1. Borowski, J., Witkoś-Gnach, K. (eds.) Standard of tree cutting and care, EcoDevelopment Foundation: Wrocław, 2021
2. Bütler, R.; Lachat, T.; Krumm, F.; Kraus, D.; Larrieu, L., 2020: Field Guide to Tree-related Microhabitats. Descriptions and size limits for their inventory. Birmensdorf, Swiss Federal Institute for Forest, Snow and Landscape Research WSL. 59 p.
3. Gutowski J.M., Bobiec A., Ciach M., Kujawa A., Zub K., Pawlaczyk P. The second life of a tree. 2nd edition. WWF Foundation, Poland. 2022
4. Dujesiefken D., Fay N., de Berker N., de Groot J-W., Trees in the life-span, EcoDevelopment Foundation, 2016
5. Fay, N., De Berker, N. Veteran Trees Initiative: Specialist Survey Method. Peterborough: English Nature, 1997
6. Witkoś-Gnach, K. Tree Inspection. Tree Institute, Wrocław, 2021.
7. Witkoś-Gnach, K. Comparison of the approaches to the maintenance of veteran trees and habitat trees. Fundacja EkoRozwoju, Wrocław, 2022.
8. European Tree Pruning Standard (2021). EAS 01:2021. European Arboricultural Standards (EAS), Working group “Technical Standards in Tree Work (TeST)”
9. Lonsdale, D. (ed,) Veteran tree management. Ancient and other veteran trees: further guidance on management. Ancient Tree Forum, 2013.
10. Humphrey, J., Bailey, S. Managing deadwood in forests and woodlands. Forestry Commission Practice Guide. Forestry Commission, Edinburgh. 2012.
11. The Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

	ČSOP Arboristická akademie	Sokolská 1095, 280 02 Kolín 2 Czech Republic	www.arboristickaakademie.cz
	Natuurinvest	Havenlaan 88 bus 75 1000 Brussels, Belgium	www.inverde.be
	Instytut Drzewa Sp. z o.o.	ul. Obozna 145, 52-244 Wroclaw Poland	www.instytut-drzewa.pl
	European Arboricultural Council e. V. (EAC)	Haus der Landschaft Alexander-von-Humboldt -Str. 4 D-53604 Bad Honnef, Germany	www.eac-arboriculture.com
	Silvatica s.a.s.	Via Solferino, 7 I - 31020 Villorba, Italy	www.silvatica.com
	Boomtotaalzorg B V	Lange Uitweg 27 3998 WD Schalkwijk Netherlands	www.boomtotaalzorg.nl
	Doctorarbol	Carrer Solsones 4 Igualada, Spain	www.doctorarbol.com
	SIA LABIE KOKI eksperti	„Annas koku skola“, Klīves, Babītes pag., Babītes nov., LV-2107 Latvia	www.labiekoki.lv
	Lithuanian Arboricultural Center	M.K. Čiurlionio g. 110, LT-03100 Vilnius, Lithuania	www.arboristai.lt
	ISA Slovensko	Brezová 2 921 77 Piešťany, Slovak Republic	www.isa-arbor.sk
	Institut für Baumpflege	Brookkehre 60, D-21029 Hamburg, Germany	www.institut-fuer-baumpflege.de
	Urbani šumari d.o.o.	Prudi 25a 10 000 Zagreb, Croatia	www.urbani-sumari.hr