AGENTURA OCHRANY PŘÍRODY A KRAJINY ČESKÉ REPUBLIKY

Lesnická a dřevařská fakulta Mendelova univerzita v Brně

NATURE AND LANDSCAPE MANAGEMENT STANDARDS

ARBORIST STANDARDS	**SPECIAL TREE TREATMENT**	**SPPK A02 009: 2019**
SERIES A		

Speciání zásahy na stromech

Spezielle Baumbehandlung

This standard is intended for definition of procedures used in special treatment particularly of trees growing in non-forest environments.

References:

ČSN 839001 (1999): Orchard and landscape management – Terminology, basic professional terms and definitions

Act no. 20/1987 Coll. on State Heritage Management, as amended
Act no. 89/2012 Coll., the Civil Code, as amended
Act no. 114/1992 Coll. on Nature and Landscape Protection, as amended
Act no. 127/2005 Coll. on Electronic Communications and on amendment of certain acts (Electronic Communications Act), as amended
Act no. 326/2004 Coll. on Phytosanitary Care and on amendment of certain acts, as amended
Act no. 458/2000 Coll. on Requirements for Business and Public Administration in Energy Industries and on amendment of certain acts (Energy Act), as amended

Decree no. 189/2013 Coll. on Tree Protection and Felling Permission, as amended
Decree no. 395/1992 Coll., executing some provisions of Czech National Council Act no. 114/1992 Coll. on Nature and Landscape Protection, as amended

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External examiner:

Authorial collective:
Ing. Jaroslav Kolařík, Ph.D. (head of authorial collective), Ing. Pavel Bulíř, Ph.D., Pavel Haupt, DiS., Ing. Ingrid Hlinomazová, DiS., Ing. Luděk Hojný, Bohdan Chadt, Mgr. Antonín Krása, Ing. Petr Martinek, Ing. Jiří Rozsypálek, Michal Šimek, RNDr. Irena Vágnerová, Ing. Barbora Vojáčková, DiS.

Illustrations:
Bc. David Ladra

Documentation for the standard development is available in the NCA CR library.
Standard approved by:

RNDr. František Pelc
Director of NCA CR

Contents

1. Standard purpose and contents

1.1 Standard purpose

1.1.1 The standard "Special tree treatment" defines procedures used in specific types of treatment particularly of trees growing outside forest.

1.1.2 The treatment comprises exceptional measures suitable for implementation only in especially justified cases.

1.1.3 The standard describes measures implemented on trees in the following, **mutually unrelated areas**:

- nature-based treatment (see chapter 3),
- tree preservation treatment (see chapter 4),
- replanting trees from permanent sites (see chapter 5),
- resolving conflicts of trees with adjacent structures (see chapter 6), and
- phytopathological tree protection (see chapter 7).

1.1.4 Deliberate damaging of trees in order to create biotopes (SPS or SPA protection) is handled by the standard E 02 005 Management of trees as biotopes for rare species.

1.2 Qualifications of persons

1.2.1 Designing special tree treatment is a highly specialised activity, which should advisably be performed by qualified persons, who may be:

- judicial experts under Act no. 36/1967 Coll. with a specialisation including tree assessment or similar, or
- graduates from study programmes and specialisations of faculties of forestry, horticulture, scientific, etc., where tree assessment issues are taught, or
- holders of a national or international proof of expert knowledge in the area.[1]

1.2.2 The recommended qualification for persons performing nature-based treatment is a recognised national or international proof of professional knowledge in the area of arboriculture, qualification for safe movement in the tree crown using climbing equipment or lift platform and safe handling of the chainsaw.[2]

1.2.3 Persons handling pesticides have to meet requirements for professional qualifications for handling of plant protection products pursuant to Section 86 of Act no. 326/2004 Coll.

[1] For example, Czech Certified Arborist – Consultant, European Tree Technician, etc.

[2] For example, European Treeworker, ISA Certified Tree Worker Aerial Lift Specialist, ISA Certified Tree Worker Climber Specialist, ABA International level A2, Czech Certified Arborist – Platform Worker, Czech Certified Arborist – Tree Climber, Arborist Technician, etc.

2. Legal framework

2.1 Woody plants growing outside forest are protected from damage and destruction[3].

2.2 More extensive interventions in trees are permitted in justified cases, namely in three areas (see Section 2 of Decree no. 189/2013 Coll.):

- interventions made in order to maintain or improve a tree function,
- interventions made as part of management of a specially protected plant or animal species,
- interventions made in accordance with a management plan for a specially protected area.

In such cases, interventions up to cutting to the torso can be adequately justified. This standard handles only interventions made in order to maintain or improve a tree function; the two remaining cases are subject to the standard E 02 005 Management of trees as biotopes for rare species.

2.3 In some cases, law specifies a special regime:

- for trees promulgated as memorable trees[3];
- for specially protected tree species[3];
- for trees registered as notable landscape features NLF) or being part of another NLF, whether set by law or registered under law[3];
- for trees that provide a biotope for specially protected species[3];
- for trees growing in protected heritage buildings and zones that are cultural monuments, national cultural monuments or heritage reserves, heritage zones or within the protective zones of immovable cultural monuments, immovable national cultural monuments, heritage reserves, or heritage zones[4];
- for trees growing in protective zones of aboveground utility lines[5,6],
- for trees whose pruning may be interpreted, in the specific case, as an activity that might impair or alter landscape character[3];
- pruning operations have to respect legal requirements for protection of wild birds[3];
- in addition, pruning operations have to respect basic and detailed protection requirements for specially protected areas and their protective zones[3];
- for pruning operations carried out as a prophylactic measure to prevent the spread of regulated pathogenic organisms[7].

2.4 Work procedures specified as the standard may be violated to the necessary extent in the case of *acute danger* of failure of a tree or its part, i.e., cases where there is an *evident and immediate* risk to human health or large-scale property damage and a risk of delay.

2.5 The work contractor is required to act so as to prevent damage to health, property, nature and the environment. The work contractor is liable for the damage that he has caused by violation of his legal obligation unless he proves that he did not cause the

[3] Act no. 114/1992 Coll. on Nature and Landscape Protection, as amended.
[4] Act no. 20/1987 Coll. on State Heritage Management, as amended.
[5] Act no. 127/2005 Coll. on Electronic Communications, as amended.
[6] Act no. 458/2000 Coll. on Requirements for Business and Public Administration in Energy Industries (Energy Act), as amended.
[7] Act no. 326/2004 Coll. on Medical Plant Care, as amended.

damage[8].

[8] Act no. 89/2012 Coll., the Civil Code, as amended.

3. Nature-based treatment of senescent trees

3.1 Purpose of nature-based treatment

3.1.1 Nature-based treatment is carried out on senescent trees (see 3.2) preferably using the techniques and equipment described below. Common methods defined in SPPK A02 002 Pruning of trees are used simultaneously. In accordance with the condition of the tree, the objective of the treatment is primarily:

- assurance of their continued existence (postponement of their disintegration),
- assurance of adequate stability (see 3.1.2),
- retention of maximum possible degree of existing biological value (see 3.1.3),
- assurance of controlled crown reduction (see 3.1.4).

The basic requirement in performing all the above objectives is an effort to imitate or retain natural appearance of senescent trees (see 3.1.5).

3.1.2 **Stability** of senescent trees has to be assured in order to:

- prevent their uncontrolled disintegration,
- ensure adequate site operating safety.

According to SPPK A01 001 Tree assessment, operating safety is always related to the fall target on the site.

3.1.3 Senescent trees are characterised by increased **biological value**. Therefore, treatment aims at the maintenance of existing microhabitats. Interventions aimed at maintenance of the biological value of trees can be made as well, but only to the extent that it does not cause a significant reduction in their life outlook.

3.1.4 **Peripheral crown drying** is one of the natural processes of senescence, where the crown periphery recedes and regeneration occurs in the lower parts of the crown and trunk. The purpose of treatment is to aid the process without major disruptive interventions in the regenerating parts.

3.1.5 **Natural appearance** of senescent trees is one of the important requirements in terms of their treatment. All interventions (particularly cutting of branches over 200 mm in diameter using the random technique) should therefore be made in a way that conceals their anthropogenic (man-made) origin.

3.2 Classification of senescent trees

3.2.1 The term **senescent tree** refers to a tree that has exceptional identified value which can be expressed using the criteria below. The individual should achieve **at least 7 points**:

Trunk dimensions (diameter/circumference)	see 3.2.2	4 points
Significantly impaired condition in one of the main diagnostic aspects (vitality, health condition, stability)	see 3.2.3	5 points
Presence of extensive central cavities or massive damage	see 3.2.6	1 point
Exceptional growth (shape)	see 3.2.7	1 point
Detected presence of accompanying species, particularly of specially protected and Red List species, notably species bound to cavities and cracks (so-called cavity trees[9])	see 3.2.5	1 point
Tree promulgated as memorable under Act no. 114/1992 Coll.	see 3.2.4	1 point

[9] A cavity tree contains cavities formed by rotting of the heartwood or activity of the woodpecker bird family. They can be both trees and tree torsos.

3.2.2 Minimum **trunk dimensions**:

Trunk dimensions		Taxon examples
Circumference	**Diameter**	
189	60	*Abies* (fir), *Acer campestre* (field maple), *Alnus* (alder), *Betula* (birch), *Carpinus* (hornbeam), *Catalpa* (catalpa), *Juniperus* (juniper), *Malus* (apple), *Morus* (mulberry), *Prunus* (widest sense: cherries, sour cherries, plums, almonds, etc.), *Pyrus* (pear), *Sorbus* (rowan), *Picea* (spruce), *Pinus* (pine) – others, *Taxus* (yew), *Thuja* (thuja)
251	80	*Acer* (maple) – others, *Aesculus* (horse chestnut), *Corylus colurna* (Turkish hazel), *Celtis* (hackberry), *Ginkgo biloba* (ginkgo), *Gleditsia* (honey locust), *Gymnocladus dioicus* (Kentucky coffeetree), *Juglans* (walnut), *Larix* (larch), *Liriodendron tulipifera* (tulip tree), *Metasequoia glyptostroboides* (dawn redwood), *Paulownia tomentosa* (foxglove tree), *Pinus strobus* (Weymouth pine), *Pseudotsuga menziesii* (Douglas fir), *Populus tremula* (quaking aspen), *Quercus cerris* (Turkey oak), *Quercus pubescens* (downy oak), *Sophora japonica* (Japanese pagoda tree), *Ulmus* (elm)
345	100	*Fagus* (beech), *Castanea sativa* (sweet chestnut), *Fraxinus* (ash), *Platanus* (plane), *Populus* (poplar) – others, *Quercus* (oak) – others, *Robinia* (locust), *Salix* (willow), *Tilia* (linden), *Taxodium* (bald cypress)

3.2.3 **Significantly impaired condition** of a tree with a value or 4 or 5 in one of the following diagnostic aspects pursuant to SPPK A01 001 Tree assessment:

- vitality (physiological vitality, viability)[10],
- health condition (defects and damage)[11],
- stability[12].

3.2.4 Trees registered as **memorable trees** under Act no. 114/1992 Coll. are promulgated by a nature protection authority decision. They are typically marked in the field with a sign bearing the lesser national coat of arms. A database of memorable trees for the whole Czech Republic is available on the NCA CR Nature Conservation Central Registr website at http://drusop.nature.cz/portal/.

3.2.5 Presence of accompanying species, including **specially protected species** and Red List species (see Annex 1) is determined by a specialist typically as part of a specialised survey (biological survey). They include in particular cavity-nesting birds, bats and invertebrates, as well as any other organisms as the case may be.

3.2.6 Presence of **extensive central cavities** can be determined either visually (entirely open cavities, cavities with holes) or using instrumentation (see SPPK A01 001 Tree assessment).

The term **massive damage** refers to cases such as a primary bough or substantial part of the crown broken out, presence of major cracks, extensive historic wounds with signs of decay due to fungi.

[10] characterises an individual in terms of the dynamics of its physiological functions
[11] characterise an individual in terms of its mechanical disruption or damage
[12] assesses the degree of tree failure by windthrow, trunk fracture or break-off of a significant part of the crown.

3.2.7 **Exceptional growth (shape or cultivation)** characterises the tree importance based on, for example, its bizarre appearance or exceptional growth. These include, in particular, trees with branch layering, ones producing strong adventitious roots, etc.

3.3 Basic approach to treatment of senescent trees

3.3.0 The design for cultivation measures has to be made based on a specialised survey (biological survey), the conclusions of which have to be approved, including a suitable setting of dates for implementation. The survey must not be older than 1 year.

3.3.1 The approach to treating senescent trees is characterised by:

- controlled crown reduction (circumference or local reductions, see 3.3.2 to 3.3.4),
- maximum retention of secondary shoots (see 3.3.5),
- crown symmetrization (see 3.3.6),
- retention of stable thick dry branches in the crown (see 3.3.7),
- retention and prevention of layering branches (see 3.3.8),
- distribution of the intervention into several stages (see 3.3.9).

3.3.2 In order to prevent disintegration and to promote crown regeneration, very often a gradual **crown circumference reduction** is performed, which is in accordance with its natural recession.

3.3.3 In order to **promote increased growth** of secondary shoots, crown circumference reduction can be performed by way of reduction of apex branch sections. The purpose is to suppress the hormonal effect of terminal buds and promote sprouting of dormant buds lower in the crown. The size of the wounds in this procedure should be minimal (no more than 50 mm).

3.3.4 In order to **increase tree stability**, circumference reduction can be made involving primarily those parts of the crown that pose a risk of failure (long thick dry branches, cracked or infected branches, significant crown asymmetry, etc.). The size of the wounds so produced may exceed, even significantly, the size recommended in SPPK A02 002 Pruning of trees.

3.3.5 **Secondary shoots** growing lower in the crown, on the trunk and in the area of root tapers is a substitute for the receding crown periphery. It is therefore retained in interventions or only sensitively reduced. In the case of root and stump shoots in particular, requirements for site uses have to be respected.

3.3.6 Asymmetric crowns can be made **symmetrical** by means of reduction. The purpose is to prevent twisting strain. The performance technique corresponds to **local reduction** to achieve stabilisation (PB-RLLR or S-RLLR pursuant to SPPK A02 002 Pruning of trees).

3.3.7 If possible in terms of provision of operating safety, **stable dry branches** or their appropriately reduced parts are left in crowns of senescent trees. In addition to the fall target, the tree taxon and the character of the site are taken into consideration.

3.3.8 **Layering branches** are an opportunity for further vegetative propagation of the tree. If the site makes it possible, it is advisable to protect any layering sections functionally. It is not advisable to unweight or brace lowering branches that will probably make contact with the soil surface.

3.3.9 Any reduction to living parts of the crown associated with removal of assimilation organs is made **in gradual stages** with repetition as defined in the cultivation measure plan. Interventions complying with SPPK A02 002 Pruning of trees (such

as local crown reduction) can be made in a single step while respecting all the rules of the specified standard.

3.3.10 In justified cases, an **intentional zero-intervention regime** can be recommended, leaving the tree or parts of a stand over to natural decomposition.

3.3.11 It is recommended to perform nature-based treatment based on developed **cultivation measure plans**. The client/tree owner submits an existing cultivation measure plan as part of the assignment for implementation of measures or design update.

3.3.12 A cultivation measure plan shall contain:

- tree location,
- site and site condition description,
- dendrological survey (see SPPK A01 001 Tree assessment),
- any other specialised surveys as necessary,
- description of previous interventions (to ensure management continuity),
- conclusions of tree condition inspection and tree response to previous treatment,
- description of target situation,
- design of cultivation measures for tree and site management – design of measures and other recommendations, proposal for intentional zero-intervention regime as the case may be,
- stages of proposed measures, intensity of interventions, urgency of performance, optimum implementation date,
- sources of potential danger, method of protection (tree and surroundings),
- other recommendations,
- photo documentation,
- date of development and any updates.

3.3.13 A cultivation measure plan is typically made for 10 years.

3.3.14 A cultivation measure plan is updated based on new findings after each intervention made, inspection or next tree assessment. The updates are made by qualified persons – measure implementer, consultant, author of cultivation measure plan.

3.4 Torsos

3.4.1 A torso is the result of spontaneous tree crown disintegration or several stages of circumference reduction (S-RO or PB-RO), gradual or one-time crown reduction to achieve stabilisation.

3.4.2 Torsos can be produced deliberately in justified cases (see 2.2) from trees that match the definition of a senescent tree (see 3.2).

3.4.3 One of the following criteria may be a reason for producing torsos[13]:

- increased biological value under 3.2.5 and 3.2.6 connected with significant tree destabilisation,
- absence of potential for stabilisation of a tree of significant dimensions (see 3.2.2) as an alternative to felling,
- great historical value for the site,
- need to preserve authentic elements in a composition.

[13] see Decree no. 189/2013 Coll. on Tree Protection and Felling Permission, as amended

3.4.4 Torsos can be made and maintained as:
- living,
- dead.

3.4.5 **Living torsos** are made and maintained in order to ensure continued existence of valuable trees. Naturally regeneration mechanisms and formation of a substitute crown structure are supported. Besides inspection of their stability, periodic reduction of continuing growth is necessary.

3.4.6 **Dead torsos** are a short-term method for ensuring existence of parts of trunks of high biological or cultural value. Depending on the tree taxon, gradual decomposition has to be expected, notably at the trunk base.

3.4.7 Torsos produced have to be inspected periodically, notably in areas with fall target value of 1-3 (see SPPK A01 001 Tree assessment). Records have to be kept on all inspection.

3.4.8 In the case of dead torsos in particular, it is advisable to consider periodic inspections using diagnostic instruments enabling detection of the extent of internal defects (see SPPK A01 001 Tree assessment).

3.4.9 Retention of torsos on the roadside is governed by SPPK A02 010 Management of woody plants along public transport infrastructure.

3.4.10 In publicly accessible areas, it is advisable to inform about the reasons for keeping the torsos (such as information boards).

3.5 Management of surrounding vegetation and site

3.5.1 Adequate management of site conditions and surrounding vegetation should be considered in an area of a circular shape with a radius equalling 10 times the trunk diameter of the senescent tree or torso with a view to the individual's function, the current character of the site uses and the tree surroundings. Presence of specially protected species should also be taken into consideration.

3.5.2 Management of the site and surroundings of senescent trees is part of the cultivation measure plan (see 3.3.11 to 3.3.14).

3.5.3 The main management areas consist in the following interventions:
- sensitive disengagement of senescent trees and living torsos from the shade surrounding trees,
- assurance of continuity of valuable biotope on the site,
- restriction of access to the immediate surroundings of the tree,
- minimisation of negative external impacts on the tree and its surroundings.

3.5.4 In justified cases, partial or complete denial of access to the trunk base of the entire crown projection can be considered. The purpose is traffic reduction and fall target reduction as well as reduction to further soil surface compaction.

3.5.5 **Denial of access to trees** can be implemented optically (such as low fencing, covering the ground with organic or inorganic mulch, change of vegetation cover, etc.) or using physical barriers (fences) that deny access completely.

3.5.6 **Mulching of the root zone** has to be done in accordance with SPPK A02 007 Modification of woody plant site conditions. An advantage is reduced competition for water against turf or other vegetation cover. The effect on reduced site use intensity is only limited. Crushed branches from the treated individual can be used optimally for the mulching.

3.5.7 **Change of vegetation cover** may include planting of shrubs or other plants in the area. Use of shrubs in particular can significantly assist in reducing the site use, but it may limit the possibility of subsequent tree inspection and increase competition for water. The measure has to be carried out in accordance with the cultivation and composition plan.

3.5.8 Use of climbing plants for the vegetation cover of the soil surface around valuable trees is not recommended.

3.5.9 **Leaving of remains of treated trees** involves placement of branches and trunks within the crown projection or near it. This procedure is particularly useful in rural areas without intensive pedestrian traffic and with increased interest in improving the biological value of the site. A disadvantage is the risk of subsequent weed growth in the area and reduced ability to remove anthropogenic waste.

3.5.10 It is advisable not to remove fallen leaves from the site and leave them to decompose naturally. Other methods of site condition improvement are applied in accordance with SPPK A02 007 Modification of woody plant site conditions.

3.6 Pruning techniques

3.6.1 Management of senescent trees commonly used the standard pruning techniques defined in SPPK A02 002 Pruning of trees. The artificial fracture technique is used beyond them.

3.6.2 In pruning of senescent trees and torsos, the **pruning wound size** is not a critical parameter. It may exceed, even significantly, the maximum sizes recommended in SPPK A02 002 Pruning of trees.

3.6.3 The basic method of removal of larger diameter branches (see 3.6.5) is **artificial fracture**. The technique is applied to both living and dead branches.

3.6.4 The objective of the artificial fracture technique is to imitate natural breaking of branches or trunks, concealing the anthropogenic origin of the wound.

3.6.5 Artificial fracture is used particularly on stable dry branches, dying branches, ones that are overloaded, protrude out of the crown habitus and overload the whole tree.

3.6.6 The artificial fracture technique is applied as part of nature-based work procedures to all branches and trunks that are reduced "at random" and are more than 200 mm in diameter. In trees with hard wood, it can be used on smaller diameter branches and smaller trees.

3.6.7 The performance of the specified pruning techniques is a complicated process in terms of occupational safety. It is necessary to pay extreme attention and provide adequate equipment and work tools to reduce any risks.

3.7 Work procedures

3.7.1 When pruning trees using the following techniques, branches are removed and reduced using the artificial fracture technique (see 3.6.3 – 3.6.6).

3.7.2 In techniques marked with an asterisk*****, the extent of the intervention and the desired resulting state have to be specified.

3.7.3 **PB-RO* – Controlled circumference reduction** (retrenchment) **in order to increase stability** of the tree (see 3.3.8). It is done in a way similar to circumference reduction (S-RO) but allows greater reduction (above 30% of the assimilation organs).

3.7.4 **PB-ROC – Controlled circumference reduction to promote gradual regeneration** of the inner parts of the tree crown (see 3.3.3). It is done by way of very sensitive circumference reduction (up to 10% of the assimilation organs) with removal of terminal shoots. The purpose is to suppress apical control and thus stimulate secondary shoots inside the crown.

3.7.5 **PB-RB – Safety pruning of senescent trees** is made while respecting the rules of S-RB under SPPK A02 002 Pruning of trees, leaving stable parts of dry branches.

3.7.7 **PB-RLLR – Local reduction of senescent trees** is done in order to assure stability. It is designed primarily in cases where there is a need for symmetrization or unweighting of peripheral parts of the crown of an unstable senescent tree or torso.

3.7.8 **PB-SSK* – Secondary crown removal** is done in a way similar to that of SPPK A02 002 Pruning of trees, but allows more significant reductions (above 30% of the assimilation organs).

3.7.9 **PB-RT* – Crown cultivation of cut trees (torsos)** is similar to shaping pruning (S-RTHL and S-RTPP under SPPK A02 002 Pruning of trees). The height of the resulting torso is a mandatory part of the torso design.

3.7.10 **PB-ST* – Crown reduction to a torso**. Decision to produce a torso has to be made with respect to 3.4.

3.7.11 **PB-OU – Management of surrounding woody plant stand** to release the target senescent tree. It can be made as:

- local reduction of crowns of surrounding trees – applies the technique of S-RLSP under SPPK A02 002 Pruning of trees,
- removal of trees with a negative effect on the growth conditions of the target individual – applies the technique SK-PP under SPPK A02 008 Tree stand establishment and management.

3.7.12 **PB-OS – Modification to site conditions**, involving notably:

- modification of tree site conditions according to SPPK A02 007 Modification of woody plant site conditions,
- limitation or change of site use for the tree crown projection area under 3.5.

The intention has to be specified in the technique remarks.

4. Tree preservation treatment

4.1 Purpose of preservation treatment

4.1.1 Tree preservation treatment is aimed at:

- adjusting the appearance of any injuries,
- mitigating negative effects of injuries and promotion of more efficient callus and injury wood formation,
- preventing further damage to trees primarily as a consequence of human activity.

4.1.2 Preservation treatment cannot prevent further colonisation by wood fungi, insects and other organisms involved in tree decomposition.

4.1.3 Preservation treatment does not concern treatment of wounds left by cutting off branches. That follows provisions of SPPK A02 002 Pruning of trees.

4.2 Treatment of mechanical damage

4.2.1 Increasing injuries in order to adjust their shape is inadmissible. It is only possible to smooth injuries in order to remove obstacles to callus formation.

4.2.2 **Fresh extensive surface injuries**, particularly on the trunk, formed during the active cambium period (approximately between March and May) should be treated immediately.

4.2.3 The injury surface is covered with a material that retains moisture (such as moss, clay, etc.) and disables entry of light radiation (dark plastic sheet).

4.2.4 The objective of the treatment is renewed cambium activity on the injury surface. The effect can be inspected within approx. 2 months after the treatment. If a callus layer has not formed, the measure has to be removed.

4.2.5 **Older injuries** are typically not treated. Significant reduction in wood decay dynamics after application of coating has not been documented.

4.2.6 Use of primer coats is possible exclusively on dead wood; callus or other parts with living tissues must not be affected.

4.3 Cavity roofing

4.3.1 Cavities can be roofed in order to prevent access and storage of waste, reduce the fire risk and support animals that use cavities.

4.3.2 Any treatment of cavities must not reduce their biological value and prevent entry of birds, bats and insects into the cavity.

4.3.3 Clearing of cavities, removal of infected wood and adventitious roots or milling of cavity walls is inadmissible.

4.3.4 Covering of cavity openings has to be done sensitively so as to minimise damage to injury wood and substantial disruption to the tree’s natural appearance.

4.4 Tree protection from damage by game

4.4.1 Basic tree protection from damage by game in exposed areas (both urban and rural) is governed by SPPK D02 005 Improvement of forest stand structure.

4.5 Work procedures

4.5.1 **PB-KO** – Preservation treatment of fresh or historic wounds on tree trunk (see 4.2).

4.5.2 **PB-KZ** – Preservation treatment of cavities consisting in roofing or denial of access (see 4.3).

4.5.3 **PB-ZZ** – Installation of protection to adult (senescent) trees from game damage.

5. Tree replanting from its permanent site

5.1 Purpose and justification of replanting

5.1.1 This applies to replanting of trees not grown in nurseries or growing on the site for more than 6 years.

5.1.2 Tree replanting from its permanent site can be done in justified cases with individuals with a long-term outlook, where there is a need:

- to move an inappropriately planted tree to a new site,
- to place a grown individual from a different site to the specific site.

5.1.3 Project documentation has to be developed before the tree replanting, describing notably:

- tree management before lifting,
- replanting process,
- tree relocation logistics,
- management after replanting, including definition of necessary inspection.

5.1.4 A tree for replanting has to show adequate vitality (no more than level 2 under SPPK A01 001 Tree assessment).

5.1.5 Replanting without significant mortality rates is normally possible for trees:

- up to 150 mm in diameter at the contact with soil,
- in the case of larger trunk dimensions, an individual assessment is always necessary, considering the taxon suitability (see Annex 2).

An individual assessment of the individual's condition and replanting capacity is always necessary.

5.1.6 The trunk and primary boughs of a tree for replanting should not show extensive damage or growth defects that cannot be resolved with a cultivation intervention.

5.1.7 The current site of a tree for replanting has to enable preparation of the root ball and the replanting process implementation. It is necessary to make a preliminary check for the location of public technical infrastructure networks and a detailed survey of paved areas within the crown tree projection.

5.1.8 Replanting cannot be performed on sites with a rocky substrate or a share of soil skeleton that would prohibit root ball formation and lifting.

5.1.9 If replanting a tree with a trunk diameter up to 150 mm at the contact with soil, the root ball diameter should be 10 times the tree trunk diameter at the contact with soil. In the case of trees with a larger trunk diameter, the ball size is determined individually.

5.2 Tree preparation

5.2.1 Tree preparation for replanting has to be made at least one growing season (two for larger trees) before the actual replanting.

5.2.2 Replanting using diggers and replanting machines without prior preparation is a crisis solution without any guarantee for the resulting effect, and as such cannot be recommended.

5.2.3 **Crown reduction.** Ideally in a period outside the growing season, a crown reduction is made, removing approx. 25% of the assimilation organs. Branches protruding outside the habitus are removed and the crown is thinned out. The terminal shoot is not reduced. All this is done before any earth works start.

5.2.4 **Preparatory trench excavation.** Ideally in a period outside the growing season, a

trench is dug around the tree at a distance defining the final size of the root ball. The trench, about 1 m deep, has to be made by manual digging and with smooth cutting of roots at the edge of the ball (facing the tree).

5.2.5 If roots over 50 mm in diameter are found excessively, a different replanting technique has to be considered (e.g., increasing the root ball size).

5.2.6 The trench digging can be distributed into two years, with 50% of the planned trench made each year.

5.2.7 **Preparatory trench backfill** is made using quality gardening substrate with an addition of slow-dissolving fertiliser. The edge defining the outer edge of the future root ball is lined with cloth, sacks or other material that slows down rooting outside the trench.

5.2.8 **Tree management before replanting.** During the following growing season before the replanting, the tree condition has to be monitored and water supply has to be provided during dry periods.

5.3 Tree replanting

5.3.1 **Digging around the root ball and lifting the tree** are carried out outside the growing season. A trench is made immediately outside the preparatory trench (away from the tree). The root ball can be dug under either manually and gradually (ideally assisted by a crane), by tripping up using tubes or by cutting up using a steel cable.

5.3.2 **Root ball packaging and fixing** is done using cloth (sacks) and wire mesh and fastening straps. Root ball intactness has to be assured throughout the transport.

5.3.3 **Transport** has to be made as quickly as possible, ideally over short distances. During the transport, the tree has to be protected from drying (roots, buds and leaves), becoming damp (assimilation organs) and freezing. The maximum time in transport before replanting is 48 hours.

5.3.4 The tree can exclusively be handled by the root ball. Fixing the trunk or primary boughs can only be done in order to aim the tree. All places on the trunk or in the crown where attachments are fastened have to be protected from grazing of cover tissues.

5.3.5 The tree can be anchored on its new site if necessary (particularly if the root ball was made without a flat bottom), typically as a combination of aboveground and underground anchors of adequate sizing.

5.3.6 Follow-up management (finishing and development) of the replanted tree follows SPPK A02 001 Planting of trees, or using specific cultivation procedures specified in the project documentation.

6. Resolving conflicts of trees with adjacent structures

6.1 Causes of conflicts

6.1.1 The basic reason for conflicts of trees with adjacent structures is neglected estimate of the final size of the tree planted on a site or location of new permanent structures near existing trees.

6.1.2 Conflicts in the aboveground portion can arise particularly as a consequence of:

- thickness increment of the trunk and branches,
- secondary shoots on the trunk and around the trunk base,
- branch movement due to wind, etc.

6.1.3 Conflicts below ground surface can arise particularly as a consequence of:

- radial increment of existing roots,
- growth of new roots as part of expansion into the rootable area.

6.1.4 Conflicts related to changing hydraulic regime on the site (soil volume changes as a consequence of water consumption for transpiration) are a consequence of tree growth and existence of insufficiently founded structures on geological layers with unstable volume. Procedures for detecting this type of conflict are described in SPPK A02 007 Modification of woody plant site conditions.

6.2 Root barriers

6.2.1 Systems to prevent directional root growth can typically be installed as one-sided. In the case of young trees (physiological age 1-3 according to SPPK A01 001 Tree assessment), at a minimum distance of:

- 1 m from the trunk axis in small-crowned taxa,
- 2 m from the trunk axis in other trees.

6.2.2 In adult trees (physiological age 4), installation of root barriers has to respect SPPK A01 002 Tree protection during construction work and any excavations have to be made outside the protected root area.

6.2.3 Rooting barriers are installed in a trench typically 1-1.5 deep depending on the site pedological conditions.

6.2.4 Root barriers can also be installed locally for protection of selected structures (public technical infrastructure, foundations of building structures, etc.).

6.3 Conflicts in the aboveground portion

6.3.1 In case of presence of unremovable solid obstacles in such a distance from the tree that they are disrupted as a consequence of trunk, branch or root increment, it is advisable to consider felling or replanting of the conflicting tree.

6.3.2 In case of obstacles in such a distance that permits long-term maintenance of the tree, partial conflicts can be resolved using local tree crown reduction (S-RLSP) or shape pruning (S-RTHL, S-RTPP) pursuant to SPPK A02 002 Pruning of trees.

7. Phytopathological tree protection

7.1 Reasons for phytopathological tree protection

7.1.1 Interventions as part of phytopathological tree protection can be considered in valuable individuals in the event of undesirable colonisation by certain diseases or pests or, as the case may be, as a preventive measure, unless it is in contravention of nature conservation interests.

7.1.2 Classification of diseases and pests is made in Annex 3.

7.1.3 Another category of organisms closely related to phytopathological tree protection is **quarantine and harmful organisms**. The approach to these insects and fungi is bound by Czech national regulations[14] and EU regulations[15] at the international level.

7.2 Mechanical protection

7.2.1 A method of mechanical protection from **wood fungi** used in the past was change to physical properties of the environment colonised by the fungus, i.e., the rot itself. Due to possible disruption of the host plant and the environment produced by cavities and rot, preservation interventions of this type are generally undesirable.

7.2.2 Numerous wood fungi in advanced stages of infection produce cavities that lead to recession or even death of the fungus itself (originator) in the case of large extent. If sapwood is not disrupted significantly or if roots and the trunk base are not disrupted, the presence of a cavity in the trunk may not necessarily mean a serious phytosanitary or structural problem.

7.2.3 Mechanical protection from **insect pests** consists primarily in collection and shaking off of moving individuals or developmental stages as well as cutting or breaking off of damaged parts of trees or parts where the individuals can be expected to diapause, hibernate or find a quiescence habitat.

7.2.4 The site can be modified by soil loosening, mulching and, in exceptional and justified cases, more extensive modification of the soil substrate in accordance with SPPK A02 007 Modification of woody plant site conditions.

7.2.5 Flightless insect species can be caught using glue strips, which can be attached to the base section of the tree. Moreover, it enables easier and more reliable information about the numbers of individuals of the pest species on the site.

7.2.6 Another method is destruction of nests and pouches with living caterpillars.

7.3 Chemical protection

7.3.0.1 Chemical protection of trees can be achieved either by surface application (spraying) or system injection.

[14] Act no. 326/2004 Coll. on Phytosanitary Care and on amendment of certain acts, as amended. Decree no. 215/2008 Coll. measures against the introduction of organisms harmful to plants and plant products and against their spread, as amended.

[15] Council Directive 2000/29/EC of 8 May 2000 on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community.

7.3.0.2 It can only use products that are approved for use and specified in applicable legislation and the Register of Plant Protection Products.

7.3.1 Spraying

7.3.1.1 Spraying can only be carried out in case legislative requirements are met, including the use of an appropriate spraying technique and equipment. The following application methods are used most commonly in practice:

- spraying,
- moistening,
- misting.

7.3.1.2 An integral component of the process is compliance with the process protocol specified in the instructions for use of the product and the application equipment.

7.3.1.3 In urban environments, chemical protection products have to be approved by a health protection authority.

7.3.1.4 Chemical plant protection in the form of spraying can be used efficiently primarily against **diseases of the assimilation organs** such as powdery mildews and rusts. The sprays have to be applied to the plant surface before the pathogenic fungus has penetrated the host's tissues. After application, these chemical protection products typically preclude germination of spores and infection.

7.3.1.5 Tree protection from **insect pests** can primarily use products based on synthetic pyrethroids or chitin synthesis inhibitors.

7.3.1.6 Application of any chemical products against **wood fungi** is currently regarded as ineffective.

7.3.2 Injection

7.3.2.1 The tree injection method makes use of the natural transpiration flow as the vehicle for the active substance. A precondition is that the substance must not be toxic for the tree and it has to be guaranteed that any residues meet all public health, phytosanitary and veterinary requirements.

7.3.2.2 Injection is particularly useful for solitary trees in built-up areas or in areas with increased pedestrian traffic due to minimised public health risks compared to spray application.

7.3.2.3 It is important to minimise damage to the tree by the injection application. Possible procedures for minimisation of harmful consequences are as follows:

- minimising the size and number of application holes,
- use of valves ensuring application of the product exclusively in the tree xylem,
- sealing of application holes using a suitable device limiting air intake.

7.3.2.4 Micro- and macro-injection method are currently available, differing in the quantity of substance applied, its type and concentration.

7.3.2.5 **Micro-injection** is a suitable application method for reducing and preventing:

- various species of phytophagous, mining, sap-sucking and bark insects,
- fungal pests active in tree sapwood and phloem (vascular mycoses),
- fungi colonising assimilation organs.

7.3.2.6 Micro-injection uses minimal quantities of the active substance, which is applied in holes at the trunk base.

7.3.2.7 **Macro-injection** is used for:

- temporary tree saturation with missing nutrients or directly with assimilates,

- supplementing microelements the absence of which is detected by analysis of site conditions.

7.3.2.8 Macro-injection uses pressure application of a solution with a large volume of water. The application is more time-consuming and produces larger tree damage due to more boreholes required.

7.4 Management of hemiparasitic shrubs

7.4.1 Hemiparasitic shrubs include the showy mistletoe (*Loranthus europaeus*) and the European mistletoe (*Viscum album*), including subspecies based on host plants:

- pines – subsp. *austriacum*,
- firs – subsp. *abietis*,
- broadleaved trees – subsp. *album*.

7.4.2 These species of shrubs damage trees, reduce their vitality or cause necrosis of infested parts or gradual necrosis of the entire host plant. If they attain heavy weight, the shrubs may also contribute to a structural failure of the tree or its part. The above organisms are typically removed from trees. In the case of *Viscum album* subsp. *austriacum* and subsp. *abietis*, it has to be taken into account that they are endangered Red List species (category LC – least concern)[16], which cause problems rather locally and to differing extent. Their removal therefore has to be considered based on the specific situation.

7.4.3 **Shrub removal by cutting infested branches** can only have a positive effect if done in a timely manner, i.e., when no more than 30% of the crown is infested and while the shrubs only grow on thinner branches at the crown periphery. The effect has been demonstrated in firs and pines. In broadleaved trees, mistletoe frequently tends to recur after removal. Therefore, the intervention has to be repeated as needed.

7.4.4 The cutting is typically done on upper-order branches. The cut is made at a distance of approx. 1 m from the hemiparasite shank in the direction towards the next lower-order branch. The objective is to remove organs deposited under the tree bark (haustoria). Such cases follow provisions of SPPK A02 002 Pruning of trees.

7.4.5 If lowest-order branches are infested, the shrub clusters can be broken out or cut off the primary bough or the trunk. Studies indicate that it is advisable to bind the area with black plastic sheet or coat it with an inhibition product. In justified cases, procedures described in 3.6.3 to 3.6.6 herein can be applied (i.e., reduction beyond SPPK A02 002 Pruning of trees) or the tree can be cut to a torso under 3.4. A justified case refers to the interest in retaining the individual and simultaneous need to increase the biodiversity.

7.4.6 Less important and severely infested trees are better **removed** in order to restrain the dissemination of the mistletoe.

7.4.7 After mechanical removal of the hemiparasite, the suitable system measure is modification of the tree's site conditions, particularly improvement to the moisture conditions. The measure makes sense if its performance is permitted by the site conditions. It follows SPPK A02 007 Modification of woody plant site conditions.

7.4.8 Destruction of mistletoe chemically using sprays with growth inhibitors is possible particularly if there is a risk of degradation of the tree's crown structure or if more trees have to be treated.

7.4.9 The spraying is done outside the growing season to prevent absorption of the

[16] See Red Lists of Endangered Species (https://portal.nature.cz/publik_syst/ctihtmlpage.php?what=1264).

solution by the tree tissues. This method is currently seen as very promising for trees with various extent of colonisation.

7.5 Climbing plant management

7.5.1 A definition of a climbing plant is contained in SPPK A02 003 Planting and pruning of shrubs and climbing plants, including an enumeration of their types.

7.5.2 Some types of climbing plants may negatively affect host trees by suppressing their assimilation organs (shading) and growing into structurally significant elements (typically branching points), which they strangle.

7.5.3 Climbing plant removal is made by cutting off the main axis at the ground without damaging the tree. In justified cases, remaining climbing plant sections can be torn out of the tree without damaging it. Branches mechanically damaged by the climbing plant can then be treated as needed in accordance with SPPK A02 002 Pruning of trees.

7.6 Work procedures

7.6.1 **PB-MH** – Mechanical protection from insect pests according to 7.2.3 to 7.2.6.

7.6.2 **PB-CHP** – Tree protection from insect pests or fungal diseases by spray application (see 7.3.1). Necessary specification of spray type and application time.

7.6.3 **PB-CHI** – Tree protection from insect pests or fungal diseases by micro or macroinjection application. Necessary specification of type of applied chemical.

7.6.4 Removal of hemiparasitic shrubs from the tree crown if only peripheral parts of the crown are infested is done as part of S-RZ (see SPPK A02 002 Pruning of trees).

7.6.5 **PB-JO** – Removal of hemiparasitic shrubs from crowns of massively infested trees. It can be performed together with specialised devitalisation procedures under 7.4.5.

7.6.6 **PB-LO** – Removal of climbing plants growing into host tree crowns under 7.5.3. Climbing plant removal includes tearing off the trunk and primary boughs.

7.6.7 **PB-LR** – Reduction (undercutting) of climbing plants growing into host tree crowns. Climbing plants are only cut off at the ground, leaving their parts in the tree.

Annex 1 Insect, fungus and bat species increasing biological value of woody plants

The annex focuses on specially protected species and Red List species some developmental stages of which are immediately bound to woody plants growing outside forest. These species are taken into account in specialised surveys made as part of tree assessment (see SPPK A01 001 Tree assessment).

Insects use trees for their development – they lay eggs on or in them and their larvae develop there. Attention has to be paid particularly to broadleaved trees, mainly oaks. Most specially protected species are bound to cavities with dry rot. Another sign is finding of larger cylindrical droppings (hermit beetles, rose chafers) or remnants of beetle bodies (hermit beetles, rose chafers, click beetles). Both droppings and body remnants can be found in accessible cavities and at the foot of the tree, where they drop out of cavities (including those inaccessible). Presence of capricorn beetles (great, longhorn) is signalled by large exist holes and characteristic galleries). The majority of specially protected insect species bound to standing trees live in the warmest areas of the country (South Moravia, Elbeland, Central Bohemia); the probability of their presence elsewhere is low.

Following is a list of specially protected and Red List insect species bound to trees growing outside forest.

Common species name	Latin species name	Protection
flower longhorn	*Rhagium sycophanta*	NT
click beetle	*Lacon* ssp.	SPS O, CR/EN
rusty click beetle	*Elater ferrugineus*	SPS SO, VU
sawyer beetle	*Monochamus sartor*	EN
flat-faced longhorn	*Saperda punctata*	SPS O, EN*
weaver beetle	*Lamia textor*	NT
jewel beetle	*Sphenoptera antiqua*	SPS KO, CR
jewel beetle	*Chrysobothris igniventris*	EN
jewel beetle	*Eurythyrea quercus*	SPS KO, CR
jewel beetle	*Buprestis rustica*	VU
jewel beetle	*Lamprodila rutilans*	NT
jewel beetle	*Chalcophora mariana*	SPS O, VU
black fire beetle	*Melanophila acuminata*	EN
jewel beetle	*Capnodis tenebrionis*	SPS KO, RE
jewel beetle	*Anthaxia candens*	EN
jewel beetle	*Anthaxia hungarica*	SPS KO, CR*
ship-timber beetle	*Lymexylon navale*	VU
flat bark beetle	*Cucujus cinnaberinus*	SPS SO, VU
European rhinoceros beetle	*Oryctes nasicornis*	SPS O, NT
hermit beetle	*Osmoderma eremita*	SPS SO, VU
longhorn beetle	*Necydalis major*	VU
stag beetle	*Lucanus cervus*	SPS O, VU

Common species name	Latin species name	Protection
stag beetle	*Ceruchus chrysomelinus*	SPS KO, EN
longhorn beetle	*Rhamnusium bicolor*	EN
longhorn beetle	*Rosalia alpina*	SPS KO, EN*
longhorn beetle	*Purpuricenus kaehleri*	SPS KO, CR
longhorn beetle	*Megopis scabricornis*	SPS KO, EN
longhorn beetle	*Ropalopus ungaricus*	EN
great capricorn beetle	*Cerambyx cerdo*	SPS SO, EN
musk beetle	*Aromia moschata*	NT
longhorn beetle	*Ergates faber*	SPS SO, CR
noble chafer	*Gnorimus* spp.	SPS SO, VU
noble chafer	*Trichius* spp.	SPS O, VU
scarab beetle	*Potosia aeruginosa*	SPS O, VU

Explanations:

SPS KO – specially protected species, critically endangered
SPS SO – specially protected species, severely endangered
SPS O – specially protected species, endangered
RE – Red List species, category regionally extinct
CR – Red List species, category critically endangered
EN – Red List species, category endangered
VU – Red List species, category vulnerable
NT – Red List species, category nearly threatened
* only exceptional presence

Fungi use trees mostly as a source of organic matter or a mycorrhizal partner or they parasite them. Saprotrophic fungal species decompose dead organic matter, mostly wood (lignicolous fungi); these fungal species are dependent on the presence of substrate of their nutrient woody plant, which may be a branch, root or stump in various stages of decomposition. Mycorrhizal fungi live in a symbiosis with trees or shrubs and their presence is dependent on the presence of their host plant. If the tree or shrub is felled, the mycorrhizal fungus disappears as well.

Fungus species that may be threatened by activity done as part of non-forest vegetation management:

Czech species name	Latin species name	Protection
agaric	*Omphalina discorosea*	SPS SO, CR
cork rot	*Phellinus ferrugineofuscus*	CR
cork rot	*Phellinus pouzarii*	CR
crust fungus	*Laurilia sulcata*	CR
oak bracket	*Inonotus andersonii*	CR
slipper toadstool	*Crepidotus crocophyllus*	CR
marsh honey fungus	*Armillaria ectypa*	SPS KO, CR

Explanations:

SPS KO – specially protected species, critically endangered
SPS SO – specially protected species, severely endangered
SPS O – specially protected species, endangered
CR – Red List species, category critically endangered
EN – Red List species, category endangered
* only exceptional presence

Bats seek tree environments primarily for two reasons: they are their hunting grounds (source of food) and numerous species find shelter in tree cavities. They use cavities of various sizes, some species even apertures under loose bark. There are differences among bat species and sexes in terms of use of cavities. Females establish summer reproduction colonies in cavities during spring and bear their young in them at the turn of spring, which they breastfeed inside for about a month. Males hide in tree cavities individually or may be part of the female colonies. Trees are used for hibernation by both sexes.

List of species that may be threatened by activity done as part of non-forest vegetation management:

Czech species name	Latin species name	Protection
greater mouse-eared bat	*Myotis myotis*	SPS KO
Bechstein's bat	*Myotis bechsteinii*	SPS SO
Natterer's bat	*Myotis nattereri*	SPS SO
Brandt's bat	*Myotis brandtii*	SPS SO
Alcathoe bat	*Myotis alcathoe*	SPS SO
Daubenton's bat	*Myotis daubentonii*	SPS SO
Nathusius's pipistrelle	*Pipistrellus nathusii*	SPS SO
soprano pipistrelle	*Pipistrellus pygmaeus*	SPS SO
common noctule	*Nyctalus noctula*	SPS SO
lesser noctule	*Nyctalus leisleri*	SPS SO
western barbastelle	*Barbastella barbastellus*	SPS KO
brown long-eared bat	*Plecotus auritus*	SPS SO

Explanations:

SPS KO – specially protected species, critically endangered
SPS SO – specially protected species, severely endangered
SPS O – specially protected species, endangered
CR – Red List species, category critically endangered
EN – Red List species, category endangered
* only exceptional presence

Annex 2 Division of woody plants by tolerance to replanting from permanent sites

Woody plants unsuitable for replanting (tolerate replanting very poorly):

Betula spp.	birch genus
Carya spp.	hickory genus
Castanea spp.	chestnut genus
Cedrus spp.	cedar genus
Ginkgo biloba	ginkgo tree
Juglans spp.	walnut genus
Juniperus spp.	juniper genus
Larix spp.	larch genus
Pinus spp.	pine genus
Prunus spp.	cherry, plum, almond
Sorbus spp.	rowan genus

Woody plants difficult to replant (mostly tolerate replanting poorly, worse so as they age):

Abies spp.	fir genus
Acer spp.	maple genus
Aesculus spp.	horse chestnut genus
Carpinus spp.	hornbeam genus
Catalpa spp.	catalpa genus
Corylus colurna	Turkish hazel
Crataegus spp.	hawthorn genus
Fagus spp.	beech genus
Fraxinus spp.	ash genus
Gymnocladus spp.	coffeetree genus
Liriodendron spp.	tuliptree genus
Magnolia spp.	magnolia genus
Picea spp.	spruce genus
Pseudotsuga spp.	Douglas fir genus
Pyrus spp.	pear genus
Quercus spp.	oak genus

Woody plants relatively easy to replant (tolerate replanting):

Celtis spp.	hackberry genus
Gleditsia spp.	honey locust genus
Malus spp.	apple genus
Platanus spp.	plane genus
Populus spp.	poplar genus
Robinia spp.	locust genus
Salix spp.	willow genus
Sophora spp.	pagoda tree genus
Taxus spp.	yew genus
Tilia spp.	linden genus
Tsuga spp.	hemlock genus
Ulmus spp.	elm genus

Developed based on:

Harris, R. W. et al.: Arboriculture: Integrated Management of Landscape Trees, Shrubs and Vines, New Jersey, 1999.

Kavka, B.: Zhodnocení hlavních druhů listnáčů v zahradní a krajinářské architektuře. Acta Průhoniciana, 1969.

Hieke, K.: Praktická dendrologie. SZN Praha, 1978

Watson, G. W., Himelick, E.B.: Principles and Practice of Planting Trees and Shrubs, Savoy, 1997

Annex 3 Classification of pests and diseases

Classification of diseases and pests by **damage caused**:

- damaging assimilation organs,
- damaging reproductive organs,
- tracheomycoses (vascular mycoses),
- causing wood decay,
- causing changes in growth and shape of plant tissues,
- damaging whole plant.

Classification of main diseases and pests by **active agent**:

- diseases caused by bacteria (bacterioses),
- diseases caused by fungi,
- diseases caused by insects,
- damage caused by colonisation of parasitic and hemiparasitic plants.

Classification of **insects** by active location:

- phytophagous, devouring plants (phylophagous, rhizophagous, etc.)
- bark-dwelling (cambioxylophagous), combining pests in the cambium and xylem zones, both sapwood and heartwood,
- sap-sucking (phytosugous),
- gall-making (cecidogenous),
- limiting production and successful ripening of seeds and fruits,
- bound to dead wood (saproxylic) and necrophagous (typically not classified as pests).

In most plant **diseases caused by fungal organisms**, the period of presence is not applied due to the continuous course of the disease throughout the year. Exceptions are pathogenic fungal species with multiple host organisms that are alternated in the course of the year. A typical example of such organisms is fungi in the *Uredinales* genus – rusts. These pathogenic fungal species frequently alternate between herbal and woody hosts, often wintering in woody plant tissues, meaning that their presence is limited to autumn, winter and early spring.

In terms of **tree protection from insect pests**, it is important to consider the aspect – the picture of the insect society in the given part of the year. Everything here is related to plant phenology of the site.

Five classes are recognized in this connection:

- spring aspect 10 April – 20 May
- summer aspect 21 May – 12 August
- late summer aspect 13 August – 24 September
- autumn aspect 25 September – 18 November
- winter aspect 19 November – 9 April

Typical **symptoms indicating presence of diseases and pest**:

Diseases caused by fungal organisms:

- fruiting bodies,
- rot,
- necroses,
- tissue discolouring and shape change,
- clogging (obturation) of veins,
- presence of mycelium, syrrocium, rhizomorphs, etc.,

- gummosis and resinosis,
- formation of characteristic structures by the plant in response to rotting (excess thickening of the trunk base, irregular swelling of the trunk and branches).

Insect pests:

- bores, exit holes,
- presence of various fractions of droppings or sawdust in lower parts of the crown, at the trunk base or on the ground,
- nests or waste tubes in crowns,
- remnants of maternal and larval galleries,
- neoplasms (galls),
- presence of devoured parts or characteristic eating traces,
- presence of larval or immature individuals in the crown,
- gummosis and resinosis, sporadically accompanied by characteristic odour,
- presence of other developmental stages or their remnants,
- formation of characteristic structures, for example, as defence against devouring activity (bark roses, etc.).

Annex 4 List of Nature and Landscape Management Standards (Arborist Standards) developed

01 Inspection, assessment, planning

01 001	Tree assessment
01 002	Protection of woody plants during development activities

02 Work procedures

02 001	Planting of trees
02 002	Pruning of trees
02 003	Planting and pruning of shrubs and climbing plants
02 004	Safety bonds and other stabilisation systems
02 005	Cutting of trees
02 006	Protection of trees against lightning strike
02 007	Modification of woody plant site conditions
02 008	Woody plant stand establishment and management
02 009	Special tree treatment
02 010	Management of woody plants along public transport infrastructures
02 011	Care of woody plants along utility lines

Faculty of Forestry and Wood Technology
Zemědělská 3
613 00 Brno

Kaplanova 1931/1
148 00 Praha 11

SPPK
www.nature.cz

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