ARBORICULTURAL STANDARDS

European Tree Pruning Standard	**2020**

EN : Tree Pruning

DE : Baumschnitt

CZ : Řez stromů

SK : Rez stromov

PL : Cięcie drzew

CRO: Orezivanje stabala

IT : Potatura degli alberi

NL: Snoei van bomen

FR: Taille d'arbre

SE : Trepleie

LT : Medžių genėjimas

LV: Koku kopšana

RU : Обрезка деревьев

ESP: Poda de árboles

CAT: Esporga d'arbres

This standard is intended to define the technical procedures used for tree pruning of ammenity trees.

Standard draft:
Working group "Technical Standards in Treework – TeST"

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1. Purpose and content of the standard

1.1 Purpose

1.1.1 This standard was published by the working group of the TeST project (Technical Standards in Tree Work) in cooperation with the EAC (European Arboricultural Council) and has become available in March 2021.
In the text of the standard following formulations are being used:

- where the standard says "can", this refers to possible options,
- where the standard says "should", this refers to a recommendation,
- where the standard says "must", this refers to mandatory activities.

1.1.2 The purpose of the standard is to present the common techniques, procedures and requirements related to tree pruning with the aim to manage public safety and preserve the integrity of trees. The standard presents common fundamental practices used among European countries.

1.1.3 Standard provisions apply to trees growing outside forests in development stages from young to veteran and also includes mutilated or mismanaged trees.

1.1.4 The standard does NOT apply to pruning in the following context:

- forest management,
- fruit trees intended for fruit production.

In general, we disapprove of tree pruning for the following reasons (non exhaustive), as these destroy ecosystem services delivered by the tree for trivial reasons and often lead to unstable trees and unnecessary follow-up work:

- shading of installed solar panels,
- (alleged) interference with TV or mobile signal reception,
- leaf and fruit fall,
- allergic nuisances etc.

1.1.5 The standard provides safety criteria for arborists and other workers engaged in arboricultural operations. This standard serves as a reference for safety requirements for those engaged in tree pruning or maintaining.

1.1.6 Each person shall be responsible for his or her own safety on the job site and shall comply with the appropriate federal or state professional safety and health standards and all rules, regulations that are applicable to his/her own action. Each person also must read and follow the manufacturer instructions of tools, equipment and machinery that he/she uses.

1.2 Tree pruning objectives

1.2.1 Outside the forest, trees are being pruned for different reasons. The most important are following:

- safety of traffic,
- clearance for traffic, buildings, constructions etc.,
- guiding trees to get most benefits at a responsible low cost,
- for special reasons with special maintenance,
- prevention and management of pests/diseases.

1.2.2 People for their well being need trees in the urban area for many (health) reasons. For example:

- need of a better living environment in urban conditions,

- combat the city heat island,
- filtering of dust,
- preservation and management of (old) green structures,
- designing green public area's/spaces where people can recreate.

1.2.3 It is important to acknowledge that trees generally do not need pruning. Most pruning is done for objectives related to human needs, as defined in the following paragraph.

1.2.4 The general objectives of pruning trees are following:

- adapting of the individual tree's structure to the limitations imposed by the space it grows in (e.g. road clearance),
- increasing of the aesthetic value of the specimen and its surroundings,
- retaining of the biological value of trees and their specific features (microhabitats),
- avoiding of the shedding of branches, that could cause damage to people and property,
- limit the risk of failure of the whole tree or its parts,
- minimise conflicts of trees or parts of trees with adjacent structures (power lines, buildings etc.),
- remove parts of trees, affected by pests or diseases.

1.2.5 Tree pruning results in injuries that can increase the dynamics of wood colonisation by fungi and cause energy-consuming wound reactions.

1.2.6 Tree pruning should be limited to cases where the positive effect of the work carried out clearly exceeds the extent of the resulting injuries. Otherwise, it is preferable to continue with the status check and retain the non-intervention mode.

1.3 Biosecurity

1.3.1 People professionally involved in pruning trees belong to a group at high risk of transmitting pests and diseases and thus should apply appropriate biosecurity procedures to limit this risk.

1.3.2 To reduce the risk of transmitting pests and diseases, cleaning and disinfecting tools and other equipment must be part of the daily maintenance.

1.3.3 Metal tools and kit should be disinfected after cleaning, with specialised desinfectants, denatured alcohol (> 70%) or isopropylalcohol (> 70%). All other kit should be cleaned and disinfected according to the manufacturers guidelines.

1.3.4 Especially the cutting tools must be disinfected on a daily basis. Hand saws are the tool of choice for most pruning operation due to the ease of disinfection. Chain saws must be cleaned, and the cutting parts disinfected.

1.3.5 When working on trees with a high probability of being infected with contagious pests and diseases, increased biosecurity standards must be applied, such as cleaning and disinfecting cutting tools between trees.

2. Normative references

2.0 This standard is complementary to other EU standards and national/regional regulations.

2.1 Qualification

2.1.1 Tree pruning and related arboricultural operations are a professional activity that can only be performed by a suitably trained and experienced worker or by a trainee under supervision.

2.1.2 Generally accepted proof of arborist qualification is established by international or national certifications. Within the EU, the following certification shemes are recognised for practising arborists:

- European Tree Worker (EAC),
- ISA Certified Arborist,
- VETcert Veteran Tree Specialist.

2.1.3 Meeting the standards of professional qualification includes continuous professional development/lifelong learning.

2.1.4 National qualifications reference may be recognised localy. These are listed in the national annexes to this standard.

2.2 General safety requirements

2.2.1 Tools and equipment must conform to the requirements of CE and EN standards and certificates.

2.2.2 A job briefing and last minute risk analysis must be communicated to all workers by the qualified arborist.

2.2.3 Traffic and pedestrian control around the job site must be established prior to the start of all arboricultural operations.

2.2.4 Arborists and other workers working next to traffic and having temporary traffic control zone must be trained in temporary traffic control techniques, device usage and placement, and how to work next to traffic.

2.2.5 Arborists and other workers exposed to risk of roadway traffic must wear high-visibility safety apparel meeting the requirements of national regulations.

2.2.6 Arborists and other workers who use any equipment, tools and machinery must be familiar with safe work practices and appropriate PPE usage according to manufacturers' instructions of these tools, machinery and equipment.

2.3 Emergency protection and readiness

2.3.1 Arborists and other workers must be instructed as to the specific location of following equipment and information:

- emergency phone numbers,
- work place address,
- first aid kit.

2.3.2 Instruction must be provided in the identification, preventive measures and first-aid treatment of common poisonous plants, stinging and biting insects and other pests found in the area in which work is to be performed.

3. Pruning techniques

3.1 Introduction

3.1.1 Before any pruning work, it is necessary to follow the main prerequisites:

1. tree assessment was carried prior to any work on a tree,
2. a clear objective for pruning was defined,
3. prior to any pruning works, it is necessary to evaluate the tree's ability to respond to the wounds caused by pruning cuts.

3.1.2 The aim is to achieve wound closure as soon as possible, and pruning should not negatively influence life expectancy. Therefore optimum conditions for pruning include good vitality, overall good health (lack of significant damage that already weakens tree's physiology), lack of major pests and diseases and suitable environmental conditions (no drought, frost etc.).

3.1.3 Conditions that are considered as not preferable for pruning include poor vitality, poor health, including significant damage, a prolonged period of drought, hard frost. In that case, if possible, pruning should be postponed until the tree recovers or the environmental conditions are suitable.

3.1.4 Pruning of trees is preferably carried out by hand tool (hand saws or pruning shears/secateurs). Chainsaws can be used to prune branches with diameter over 5 cm.

3.1.5 All tools must be sharp, clean and suited to the task being performed.

3.2 General rules

3.2.1 The **size of pruning wounds** must be minimised by removing the minimal proportion of the crown necessary to meet the objectives of the particular pruning intervention. It is often preferable to perform multiple small cuts further away from the trunk than a small number of large cuts lower in the crown or directly on the stem.

3.2.2 In order to keep pruning interventions minimal, pruning must start as early as possible (in case of predictable issues) and be repeated regularly, in suitable time intervals.

3.2.3 When pruning trees, the influence of the altered crown shape on aerodynamics must be considered, especially the changed biomechanical impact on the pruned tree and the surrounding trees.

3.2.4 It is advised for wound sizes not to exceed a maximum diameter of:

- 5 cm in tree species with weak compartmentalisation,
- 10 cm in tree species with good compartmentalisation.

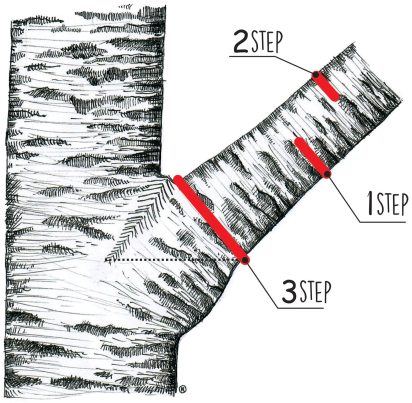
Exceptions can apply in case of:

- pruning of dead branches,
- branch removal due to safety reasons.

3.2.5 The following principles are to be followed when pruning ornamental trees.

3.2.5.1 To prevent ripping of the tissues below the pruning level, it is advisable to perform a **step cut** (three-step-cut) when removing larger branches. In general the first cut is done on the underside of the branch (approximately 1/4 to 1/3 of the branch diameter, depending of the tree species) at 10-30 cm from the branch collar. The second cut is on the top side of the branch slightly away from the first cut, until the branch is dropped. The remaining stump is removed by target pruning or any other appropriate method. Depending on the target, tree species, branch size and branch direction, the positioning of

the cuts can differ.



PICTURE 1 : Step cut

3.2.5.2 When removing multiple branches in one area on the trunk ("stacked branches" growing in pairs or rings), it is necessary to spread the cuts in time, to leave enough space between the cuts in order to avoid a significant bottleneck in the tree's vascular system and overlapping reaction zones and dysfunction in the parent stem. It is advisable to leave an intact "bark bridge" between multiple wounds in the same area, at least as large as the bigger of the two wounds. If this can't be achieved, the cuts should be spread in time, over multiple years.

PICTURE 2 : Bark bridge

3.2.6 **Dead branches** are a natural part of a tree crown. In some species dead branches have their part in damping the movement of living branches (especially the thin twigs in the external part of the crown). On the other hand dead branches are often partially decayed and can easily can break and fall down (note that some dead branches don't fall off readily, e.g. dead limbs without bark in *Quercus* and *Castanea*, dead limbs in some *Pinus* species).

3.2.7 If dead branches must be removed, leaving the base of the dead branches (stubs) can give a more natural apearance to the tree (specially if are made breaking the branch),

and support biodiversity.

3.2.8 Deadwood management during structural pruning significantly differs depending on tree status and type of pruning.

TABLE 1 : General rules of approach to deadwood by pruning

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 deadwood needs to be removed, this applies to branches with a diameter exceeding 3 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)	Deadwood 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 soil surface), while keeping risk at an acceptable level.

3.2.9 The optimal **pruning season** is determined by the aim of minimising physiological stress and supporting natural wound reactions and/or regrowth of trees. Pruning should NOT be performed in the folowing periods:

- Post-dormancy – period between bud breaking until full development of leaves,
- Pre-dormancy – period when leaves start to color (autumn) until they are shed or fully disfunctional.

3.2.10 The optimal pruning season is determined by the aim of minimising physiological stress and supporting natural wound reactions and/or regrowth of trees. From this reason long periods of drought should be prevented.

3.2.11 The optimal pruning season depends on the type of pruning.

TABLE 2 : Optimal pruning seasons

Structural pruning	Pruning during the growing season is prefered, but the dormant period is acceptable as well.
Lateral crown reduction	
Upper crown reduction	Optimal season cannot be specified, as this depends on local habits in relation to specific conditions (see national annexes).
Shaping	Pruning is generally done during the dormant period. Shearing can be done during the growing season.
Restorative pruning	Pruning during the growing season is prefered, but the dormant period is acceptable as well.

In any case, avoid long periods of drought.

3.2.12 Recommendations for optimal pruning season may differ depending on tree species and climate (e.g. periods of drought or frost).
Legislative restrictions may apply in some countries.

3.2.13 The **pruning interval** must be carefully considered in relation to the risk of affecting valuable micro-habitats or, specific associated organisms that inhabit the tree and its surroundings.

3.2.14 General pruning intervals:

- Young tree: regular pruning, small interventions,
- Semi-mature tree: interval becomes longer, tree is allowed to develop more freely,
- Mature tree: only intervention when really necessary,
- Veteran tree: only intervention when really necessary.

3.2.15 During any pruning operation, be aware of any impact on biodiversity. For biodiversity reasons, the timing, technique or amount of foliage removed might need to be adapted.

3.2.16 Tree pruning is usually not a one-off action and must be controlled and repeated regularly, at intervals depending on the development stage of the tree and the type of intervention. Ideally all (future) pruning operations are defined in a long term tree management plan.

3.2.17 Wound dressing after the cut must not be applied. In general the negative consequences are more detrimental than the positive effects.

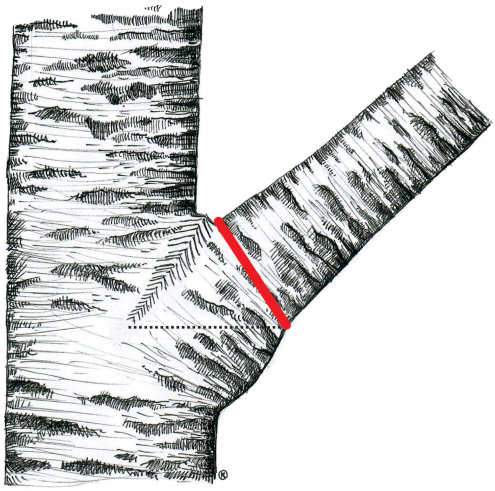
3.3 Branch removal methods

3.3.1 Main **branch removal methods** are described in the following paragraphs and their possible use is defined in concrete pruning techniques.

3.3.2 **Target pruning** is removal of a side (lateral) branch just beyond the branch collar without damaging the branch colar.

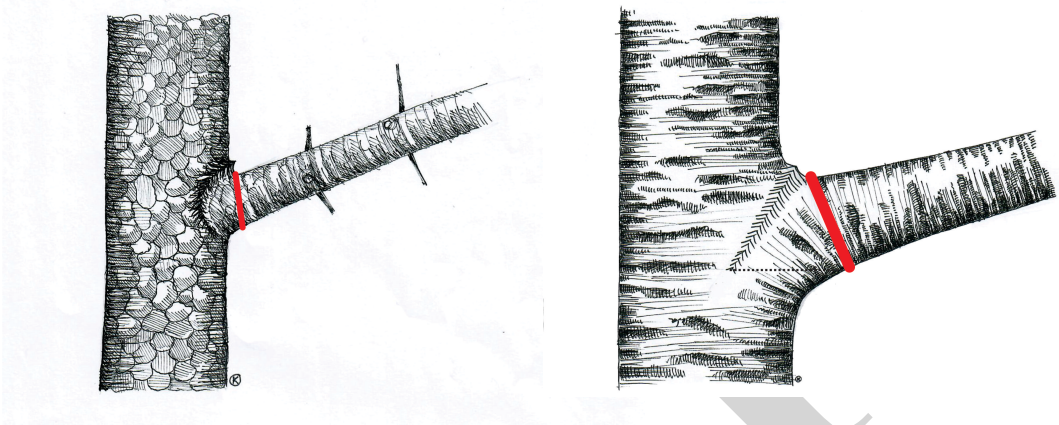
The main purpose of this technique is to remove a branch while minimising regrowth and the extent of dysfunction and supporting natural processes of wound reaction.

PICTURE 3 : Target pruning



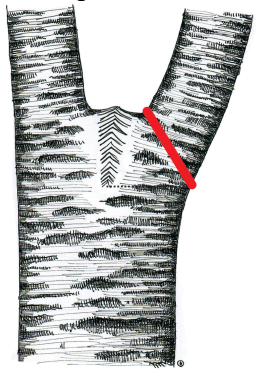
3.3.2.1 If a branch colar is **not clearly visible**, the cut must be positioned outside of the branch bark ridge without damaging it. The cut should be made as small as possible.

PICTURE 4 : Pruning of branch with non-visible branch colar



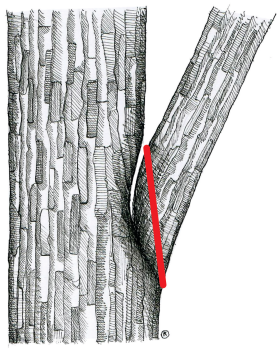
3.3.2.2 When removing a codominant leader, the cut must be positioned outside of the bark ridge without damaging it, as close as possible to shoot that is left. The position of the bark ridge determines the cutting angle. If possible, suppression of the codominant shoot takes place by pruning to lateral.

PICTURE 5 : Pruning of codominant leader



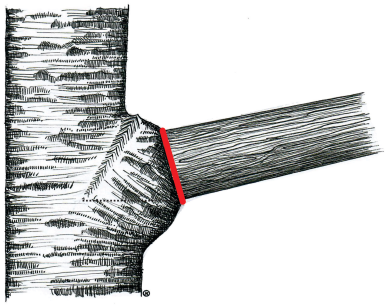
3.3.2.3 **Included bark** is the condition whereby inner and outer bark forms between the branch and the trunk or between codominant shoots in V-shaped forks. If included bark is present between branch and stem, a cut must be made as close as possible to the latter, without injuring stem tissue above the branch base.

PICTURE 6: Pruning of branch with included bark



3.3.2.4 On the basis of **dead branches**, a swollen branch collar is naturally formed, which must not be damaged when removing these branches, even if this means cutting at a distance from the main stem. Removal of dead branches can also be done by breaking them, leaving a stable stump with a natural tear.

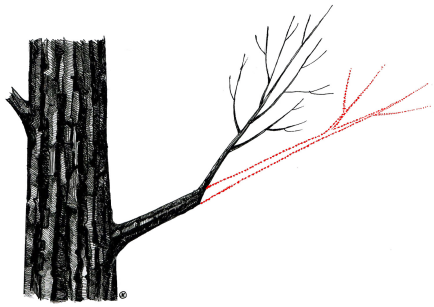
PICTURE 7: Pruning of dead branches



3.3.3 **Pruning to lateral** (head cut) is removal of the main axis (leader) of the branch/limb leaving a living side (lateral) branch to sustain the remaining branch. It is recommended to leave a vigourous lateral branch with a diameter of at least 1/3 of pruning wound. The lateral branch must form a logical extension of the parent stem, so this branch removal technique must not lead to significant changes in the direction of the branch axis or to biomechanically unstable joints (e.g. “dog leg”).

Pruning to a lateral branch of insufficient diameter or to epicormic branches is considered to be stub cutting.

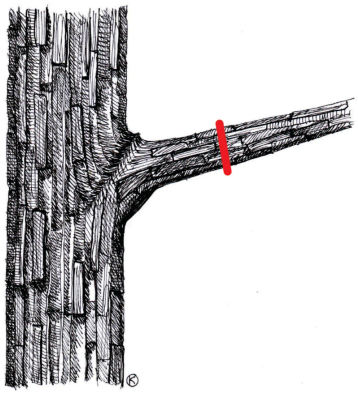
PICTURE 8: Pruning to lateral



3.3.4 **Stub cutting** (internodal cut) is removal of a branch/limb leaving behind a stub and without leaving a lateral leader of sufficient size. When carrying out the cut, the branch tissues must not be torn out. The cut is perpendicular to the axis of the branch.

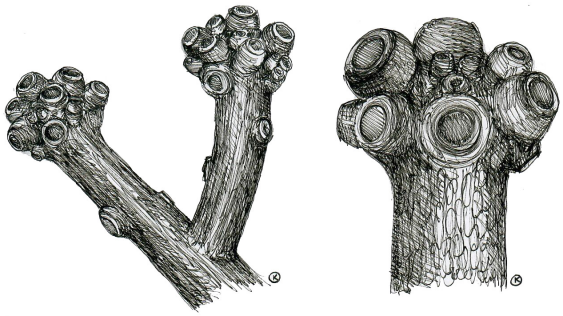
If small lateral branches or epicormic branches are present, these should be retained when making the final cut.

PICTURE 9: Stub cutting

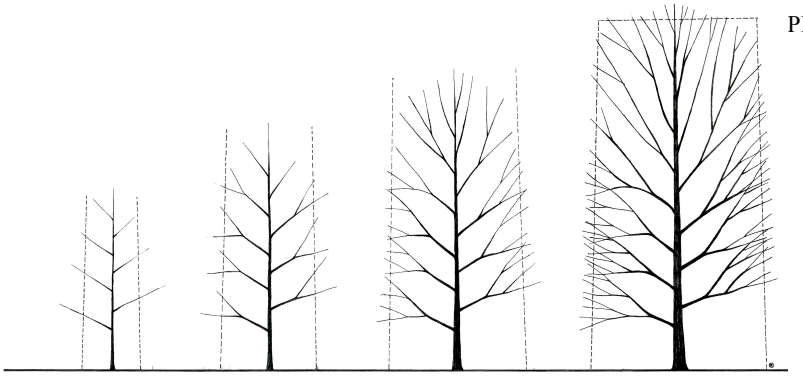


3.3.5 **Knuckle cut** is a regular (repetitive) removal of epicormic shoots on very short stubs (usually about 1 cm in length) with retention of dormant buds in the branch base.

PICTURE 10: Knuckle cut



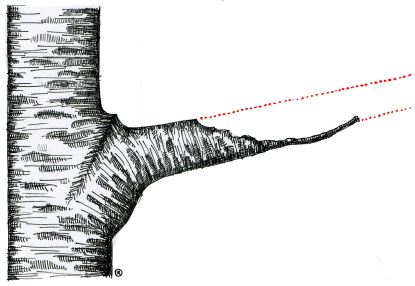
3.3.6 **Shearing** – branch removal method used in cases of pruning trees into formal shapes and hedges, when annual shoots are being removed / reduced using hedge shears, trimmers and similar mechanisms. In this case, the cut is optimally made perpendicular to the axis of the shoot, creating a small, smooth wound.



PICTURE 11: Shearing

3.3.7 **Rip cut/controlled breakage** is a branch removal method in which a branch is broken off, often after making a preliminary partial cut on the upper side of the branch. The purpose is to create a tear that follows the natural breaking patterns as much as possible. With this branch removal method, we aim to support biodiversity and mimic the aesthetics of natural breakage (natural shedding of branches).

PICTURE 12: Rip cut



3.4 Main pruning operations

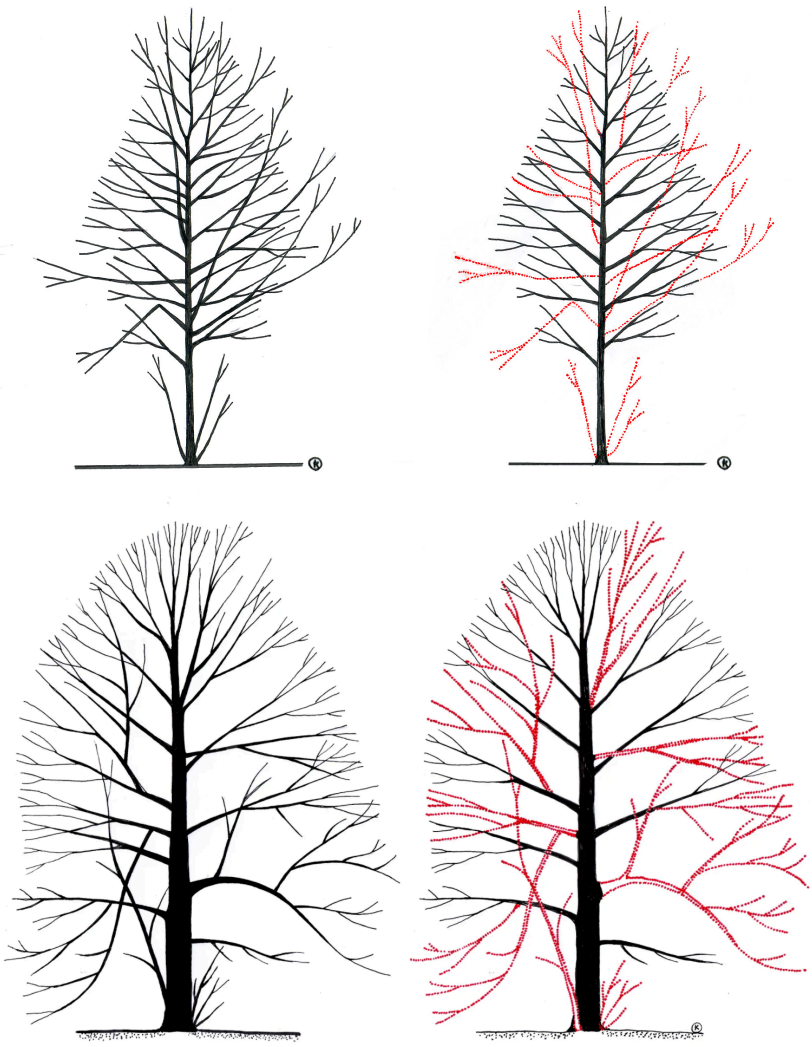
3.4.1 Structural pruning

3.4.1.1 **Objectives:** Focused on intervening in the crown structure and shape of the tree to establish its desired, stable structure (for example with elimination or reduction of branches with weak forks[1]).

3.4.1.2 Reasons for structural pruning can be:

- establishing a single dominant trunk,
- suppression of overgrowth secondary shoots,
- limitation of rubbing branches,
- removal/reduction of unstable damaged or decayed branches,
- removal/reduction of branches colonised by pests or diseases,
- establishment of good branch distancing,
- deadwood management.

PICTURE 13: Structural pruning on young and mature tree



[1] Weak fork – V-fork with included bark.

3.4.2 Lateral crown reduction

3.4.2.1 **Objectives:** This intervention is aimed at the reduction of the side or lower parts of the crown. A lateral reduction does not intervene in the top of the crown and does not alter the height of the tree.

3.4.2.2 Reasons for this intervention are mainly:

- improving tree stability (i.e. correcting crown assymetry, reduction of top-heavy crowns, correcting destabilized branches),
- conflict with surrounding structures, which can not be removed (branches vs. power lines, building facades or windows etc.),
- maintaining clearance for traffic.

PICTURE 14: Lateral crown reduction

3.4.2.3 All pruning cuts should be as small as possible to achieve the intended outcome.

3.4.2.4 It is necessary to consider regrowth as a reaction to the intervention. Therefore, lateral reductions will often have to be repeated periodically, to manage the regrowth of the tree.

3.4.2.5 In cases of excessive crown lifting problems with stability of the tree can occur due to raising of the center of gravity.

PICTURE 15: Increase of mechanical loading of a tree due to elevation of the center of gravity

3.4.3 Upper crown reduction

3.4.3.1 **Objectives:** Reduction of the apical, upper part of the crown. This is a less common type of pruning intervention that should always be connected with a need to mechanically stabilise the whole tree or follow natural crown retrenchment.

3.4.3.2 This is an intervention that often irreversibly affects the architecture of the crown and the physiology of the whole tree. Before doing so, it is always necessary to consider possible alternatives to achieve the desired mechanical stabilisation.

PICTURE 16: Upper crown reduction

3.4.3.4 The new outline of the upper crown must respect the original shape of the tree crown or the tree group, taking into account aerodynamics.

3.4.3.5 Upper crown reduction must always be part of a long-term tree management plan.

3.4.3.6 After making the upper crown reduction an inspection within 3-5 years should establish:

- have the desired stabilisation objectives been met?
- how has the tree responded, what is the tree's regrowth dynamic?
- what is the extent of dieback and bark necrosis (e.g. sun burn)?

Based on this monitoring, the next steps in the tree management plan will be defined or modified.

3.4.3.7 The level of necessary upper crown reduction is defined in meters of height reduction.

3.4.3.8 If the level of the upper crown reduction can be limited by additional stabilisation by other means (e.g. cabling/bracing etc.), it is advisable to consider a combination of stabilisation measures.

3.4.3.9 It is not advisable to combine an upper crown reduction with simultaneous removal of branches in the lower crown volume in order to maintain the maximum possible amount of leaf area.

3.4.4 Crown shaping

3.4.4.1 **Objectives:** Shaping trees (shearing, pollarding etc) is a set of interventions that irreversibly alter the tree's natural crown architecture. It must be started when a tree is young and must be sustained for the rest of its life.

3.4.4.2 There are two basic types of tree shaping:

- **pollarding** (knuckle cutting) – repetitive pruning back to the same point(s) with the formation of swollen "knuckles",
- **shearing** – establishment of formal hedge-like trees.

These two basic types can have many variants.

3.4.4.3 Interventions take place at short intervals (often every year). Therefore, it is necessary to consider the cost / benefit balance before establishing tree shaping.

3.4.4.4 It is impossible to start tree shaping when a tree reaches maturity or later because it will cause extensive injuries and an imbalance between the leaf area and the root system.

3.4.4.5 Establishing an artificial shape in a tree, especially by pollarding, can be confused with topping. In order to establish a pollarded shape, a young tree needs to be topped. The main difference is that shaping trees is started when the tree is young and it is done with a clear, long-term objective: to establish a fixed, artificial crown structure that is preserved and reinforced with every pruning intervention.

3.4.4.6 The origin of shaped trees can be historically found in functional tree use, e.g. for fruit or wood production. Long ago these functional pruning styles have evolved to 'ornamental' pruning styles, establishing artificial tree forms that are not necessarily functional, but rather have an aesthetic value.

3.4.4.7 The main differences between shaping and topping are:

- establishment in a young tree,
- generally high frequency of pruning (below 3 years)
- small cuts (below 4 cm).

In the case of maintaining pollards, pruning intervals can be longer (generally 3–10 years) and size of cuts can be bigger (usually below 10 cm), but the goal of establishing a fixed structure is clearly recognisable as a cultural habit.[2]

3.4.4.8 Topping of (semi-)mature trees without the intent of establishing a fixed, artificial form for amenity reasons and without planned and repetitive pruning interventions is bad tree work and must at all times be avoided. This leads to large pruning wounds and the associated dysfunction and decay. Topped trees are mutilated trees.

[2] National/regional specifics apply. See the national annexes.

3.4.5 Restorative pruning

3.4.5.1 Is carried out exclusively on trees, which have been dramatically affected in their physiological functions (e.g. because of loss of a substantial part of the crown) either due to a natural disaster (e.g. heavy winds) or inappropriate management (e.g. topping, root damage).

3.4.5.2 Trees on which restorative pruning is carried out generally fall into the following categories:

- mismanaged – the tree is damaged by inappropriate management interventions,
- lapsed – the tree suffers from an absence of necessary care (neglect),
- mutilated – the tree is damaged due to a natural disaster.

Standard pruning techniques cannot be applied to these trees.

3.4.5.3 **Objectives:** If there is a possibility to convert the tree crown to one of the standard types of care over time (see 3.4.1 – 3.4.4), this approach is preferred. Otherwise, cost-effective solutions are chosen to ensure tree stability and the longest possible life expectancy, taking into account the tree's benefits on the site.

3.4.5.4 If the benefits of the tree at the site do not justify the cost of its management, the optimal solution could be its removal with compensation by adequate new planting.

3.4.5.5 With age (development stage), the possibility to convert mismanaged/mutilated trees to one of the conventional types of tree management decreases.

3.4.5.6 Mismanaged or mutilated trees may host protected species (mammals, birds, insects, lichens etc.). Their occurence may change the objectives of the pruning intervention and long-term plans for the tree's retention or removal.

3.4.5.7 When reducing outgrown secondary crowns, reductions below the previous cutting or breakage level should not to be performed.

4. Tree classification

4.1 Classification according to objective

4.1.1 For purposes of defining tree pruning interventions, trees are characterised by their status in relation to management objectives.

4.1.2 In order to correctly define pruning operations, it is important to work with long term objectives in order to install a desired 'final image' of what the tree should like in the future. This can either be:

- a (semi-) natural tree, which can freely develop, apart from formative pruning of the young tree to adapt it to restrictions imposed by its surroundings (e.g. road clearance),
- an artificially shaped tree, which is trained to grow in an artificial form through intensive and regular pruning during its entire its life, starting from young age.

4.1.3 Trees can also be neglected (e.g. necessary pruning operations were not performed), mismanaged (e.g. inappropriate and harsh pruning) or mutilated (e.g. damage by storm events). This is most often not a desirable situation and the objective for these trees will be to try to manage them towards being a semi-natural or artificially shaped tree.

4.2 Development stage

4.2.1 For the purposes of this standard, development stages of trees are defined as follows:

TABLE 3 : Development phases of trees as used in this standard

Young tree: characterised by strong apical dominance and hierarchy (the architecture may vary depending on the species)
Semi-mature tree: characterised by weakening of apical dominance, natural appearance of (safe) codominance in the upper canopy, but the tree has not reached its final height and crown spread yet.
Mature tree: characterised by having reached its maximal height and typical dimensions (species and site specific).
Veteran tree: characterised by considerable size / age for a given species, an advanced life stage and high social, cultural and biodiversity values.

4.2.2 Characteristics of development phases may vary between tree species.

4.2.3 **Young and semi-mature trees** have not reached their final height and crown spread, as opposed to mature trees. This distinctive characteristic is used to evaluate the appropriateness of different pruning interventions.

4.2.4 **Mature tree** is characterised as a tree that has reached the maximum crown spread (height and diameter) for particular taxon, at the specific location and in the growing context.

A mature tree is reaching its maximum level of benefits for the community. The ultimate interest is to maintain it as long as possible with a focus on balancing risk and the increasing ecosystem service value of the tree.

4.2.5 Within the framework of this pruning standard, a **veteran tree** is characterised as a tree that[3]:

- has reached significant size for the given species,
- has reached significant age for the given species, taking into account its growing conditions and location,
- shows significant increases in biodiversity value (cavities, wood decay etc.),
- may show changes in the crown architecture and a gradual process of natural crown retrenchment (transition from the primary to a secondary crown lower down on the stem and main branches).

Veteran trees often enjoy formal protection in a given country or region.

4.2.6 Veteran trees are inherently connected with their surroundings, on which they rely for their physiological processes. During pruning and related operations, any changes in site conditions must be carefully considered and minimized if possible.

4.2.7 Application of special **„veteranisation“ techniques** must not be applied on veteran trees. This kind of management is possible only on the basis of a long-term ecosystem management plan (provided by a specialist) on nearby younger trees. Interventions of this nature are beyond the scope of this pruning standard and must be the subject of specific definition.

4.3 Temporary vs. permanent crown

4.3.1 Depending on the objectives, we can distinguish between two major crown parts:

- **temporary crown** consists of all branches that are not going to be part of the permanent tree structure. In semi-natural trees these are the branches below the desired clearance height.
- **permanent crown** consists of all branches that are supposed to be part of the permanent tree structure. In semi-natural trees these are the branches above the desired clearance height.

4.3.2 Pruning operations and techniques will be different in temporary crown and the permament crown (see Tree Pruning Matrix, 5.1)

4.3.3 Note that the desired single stem will generally be higher than the clearance (see 5.2).

[3] For VETcert the following definition of **veteran tree** is used, which includes the common features of veteran trees in all partner countries:

- great chronological age for their species,
- in an advanced life stage where they may show retrenchment and have been through phases where they have demonstrated resilience,
- often large for their species,
- showing a complex structure or architecture with hollowing, decay, roots inside the trunk, a colony-tree structure/multiple functional units being common features,
- have high biological/ecological values.
- Have a high cultural or heritage value – but this alone does not make a tree a veteran (for example a recently planted tree by a famous person is not a veteran)

Be aware that national and/or legal definitions might be more specific or vary from this definition. It is important to assess each veteran tree individually and to adapt any management to the important features of that specific tree.

PICTURE 17: Temporary vs. permanent crown

4.4 General considerations

4.4.1 Trees are inherently connected with their surroundings, on which they rely for their physiological processes. During pruning and other management operations, any impact on or changes in site conditions must be carefully considered and minimised if possible.

4.4.2 A necessary part of tree management planning is monitoring for the occurrence of protected species (mammals, birds, insects, lichens etc.) on the tree and in its surroundings, including the definition of measures to safeguard their habitat. This will be increasingly important as trees age.

5. Tree Pruning Matrix (broadleaved tree species)

5.1 Introduction

5.1.1 In order to classify the tree pruning system in relation to a tree's status and the pruning objective, a "**Tree Pruning Matrix**" was defined. Its purpose is to create a systematic approach to define the appropriate pruning techniques.

5.1.2 General pruning intervals might differ depending on the tree's development phase and pruning objective. In general:

- Formative pruning: regular pruning, small interventions;
- All other types of pruning of (semi-)natural trees: only intervention when necessary;
- Artificially shaped tree: periodic pruning with fixed interval.

5.1.3 During any pruning operation, be aware of the impact on biodiversity. For biodiversity reasons, the timing, pruning technique, amount of foliage removed, or any other pruning aspect might need to be adapted.

5.1.4 The basic Tree Pruning Matrix generally applies to broadleaved tree species. For a specific approach to palms see chapter 6.

TABLE 4 : Pruning Matrix

		TREE DEVELOPMENT STAGE AND CROWN STATUS				
FINAL IMAGE	**PRUNING OBJECTIVE**	**Young/semi-mature tree with temporary crown**	**Young/semi-mature tree with only permanent crown**	**Mature tree (only permanent crown)**	**Veteran tree**	**Neglected/ mismanaged/ mutilated tree**
Semi-natural tree	**Structural pruning**	1/A	2/A	3/A	4	5
	Conflict resolution	-	2/B	3/B		
	Biomechanical stabilisation	-	-	3/B or 3/C		
Shaped tree	**Shaping**	1/D	2/D			6

Notes:

- Trees can be mutilated, neglected or mismanaged as a result of inappropriate human activity or extreme climatic events. However, this is generally not a desired state. The primary objective for these trees is to restore them as a (semi-)natural or shaped tree through **restorative pruning**.
- **Veteran tree management** is a specialised activity carried out on trees of high cultural, social and biodiversity value. It is recommended that this type of work is specified and carried out by professionals certified as Veteran Tree Specialist.

5.2 1/A – Formative pruning

5.2.1 **Objectives:** takes place within the temporary crown of young and semi-mature trees, generally to ensure sufficient clearance while supporting the development of a dominant stem and work towards a stable and sustainable permanent crown.

5.2.2 Minimum clearance is differentiated for:

- pedestrians, cyclists ..... 2,5 m,
- cars ..... 4,5 m.

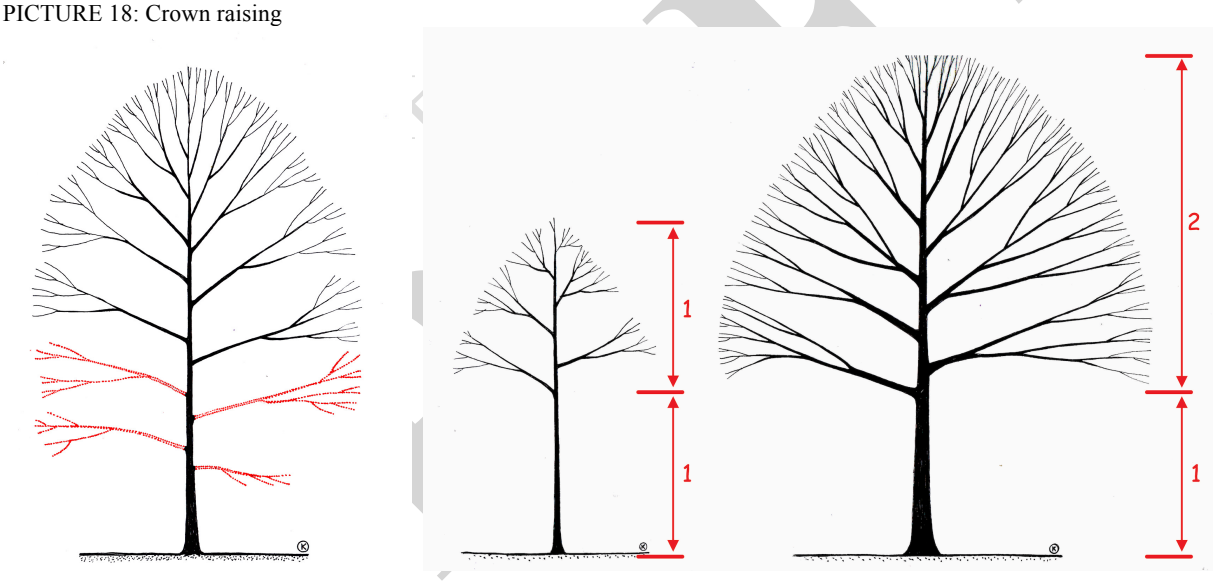
Considering the tendency of branches to bend down over time, it is advisable to aim for a single stem of 3 m (pedestrians) and 5-7 m (cars) with respect to the location and tree species in question.

5.2.3 Crown raising should take place in successive steps, respecting an acceptable ratio between crown and trunk, ideally:

- not below 1 : 1 for newly planted trees,
- not below 2 : 1 for trees with a stem circumference of 20 cm or more,

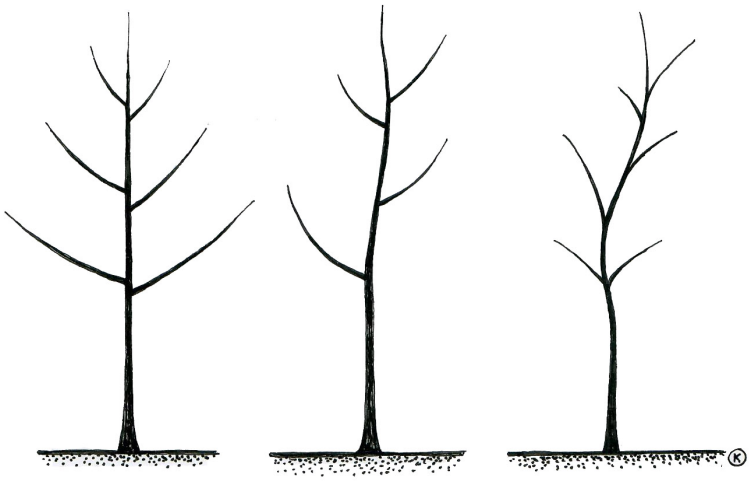
It is preferable to leave a larger proportion of the crown.

PICTURE 18: Crown raising



5.2.4 If present, the dominant leader should always be retained and supported in the temporary crown. Depending on the hierarchy strategy of the tree species, the dominant leader can have several basic forms (see annex 3 for a list of tree species according to the hierarchy strategy of a young tree).

PICTURE 19: Various forms of dominant leader architecture



5.2.5 When pruning, the following branches are considered problematic in the temporary crown and should be removed (in order of priority):

- broken, dead or dying branches,
- persistent codominant branches, competing with the dominant leader (note that depending on the tree species specific architecture, temporary codominant branches can be a normal and transitory phenomenon).
- branches colonised by pests or diseases,
- branches with developing/developed weak forks (V-shaped union),
- rubbing branches,
- epicormic shoots growing on the stem of trees in good physiological condition (for trees in bad physiological condition, these can be managed if necessary, but not removed),
- shoots growing below the grafting level,
- thick branches (aspect ratio branch/parent stem over 1/3) in the temporary crown.

Only when the above branches have been pruned, priority is given to crown rising.

5.2.6 If branches grow in pairs or rings, they are removed selectively (not all at once) and/or reduced (awaiting full removal) with respect for the minimal bark bridge (see 3.2.5.2).

5.2.7 If permanent crown is present, pruning interventions in the permanent crown must follow guidelines in 2/A (see 5.3).

5.2.8 **Pruning interval:** Formative pruning should start as soon as the tree is established, generally 3 years after planting at the latest.

5.2.9 Formative pruning of young trees is periodical, and pruning should be repeated every 2-3 years, based on growth speed and objectives.

5.2.10 **Optimal season:** pruning during the growing season is preferred, but the dormant period is acceptable as well. Formative pruning should NOT be performed in periods of post- and pre-dormancy. Also avoid long periods of drought.

5.2.11 **Methods:** Target pruning is the main branch removal method (3.3.2). Pruning to lateral (3.3.3) is accepted in justified cases.

5.2.12 Leaf area removal should not exceed 30 %. The maximum percentage depends on the physiological condition of the tree and the tree species.

5.2.13 **Critical errors:**

- Late start of the pruning interventions.
- Excessive hit rate (large volume of leaf area removal).
- Massive trimming of branches in the crown periphery (stub cuts).

5.3 1/D Crown shaping – establishment

5.3.1 **Objectives:** To create an artificial form of the entire crown of a young tree according to the desired image of the tree:

5.3.1.1 For **pollard-style trees,** the objective is to establish a fixed and permanent structure by cutting back branches to the same point, where swollen knuckles arise.

5.3.1.2 For **hedge-style trees,** the objective is to establish a dense, hedge-like artificial form by clipping or shearing.

5.3.1.3 Other artificial shapes are possible.

5.3.2 Shaping trees is a set of interventions that irreversibly alter the tree crown architecture and must be performed in short intervals for the rest of the tree's life. Therefore, before establishing an artificial form, a cost/benefit analysis is required.

5.3.3 Crown raising may be necessary as part of shape establishment. Due to the development of epicormic shoots on the stem, this will probably have to be regularly repeated.

5.3.4 **Pruning interval:** Pruning cycle is defined by national annexes based on climatic conditions and cultural habits.

5.3.5 **Optimal season:** Ideal season depend on the desired shape.

5.3.5.1 For **pollarding** the optimal season is the dormant period.

5.3.5.2 **Shearing/clipping** is often repeated several times per year, optimally in the growing season.

5.3.6 **Methods:** For establishing a **pollard-style shape** stub cutting (3.3.4) is the prevailing method. Target pruning (3.3.2) is used for complete branch removal.
For establishing **hedge-style trees** shearing cut (3.3.6) is used.

5.3.7 Usualy, majority of the leaf area is being removed.

5.3.8 **Critical errors:**

- Large pruning wounds.
- Lapsed pruning cycle.

5.4 2/A Crown maintenance – young and semi-mature trees

5.4.1 **Objectives:** crown maintenance takes place in the permanent crown, intervening in the crown architecture, with the objective of establishing a sustainable and stable crown structure, as close to the natural tree shape as possible with respect to the tree species.

5.4.2 Naturally occurring codominance is tolerated in the permanent crown (depending on tree species and environment). Nevertheless, the top of the crown (dominant leader(s)) is always to be retained and supported (no reductions).

5.4.3 When pruning in the permanent crown, the following branches are considered problematic and must be removed or reduced (in order of priority):

- broken, dead or dying branches,
- branches colonised by pests or diseases,
- branches or codominant shoots with (developing) weak forks (V-shaped

unions),
- overextended branches, in order to prevent future biomechanical problems,
- shoots growing below the grafting level.

Depending on tree species and context, also rubbing branches can be considered problematic.

If branches grow in pairs or rings, they are removed in successive steps (not all at once) and/or reduced.

5.4.4 Epicormic shoots in the permanent crown should be left or managed with respect to the tree species, physiological condition and growing context.

5.4.5 **Pruning interval:** pruning is not repetitive, but occasional. On average, the pruning interval will not exceed 5-10 years, depending on the objectives and risk assessment.

5.4.6 **Optimal season:** Ideal season is the vegetative period, but the dormant period is accepted as well. Crown maintenance should NOT be performed in in periods of post- and pre-dormancy. Also avoid long periods of drought.

5.4.7 **Methods:** Target pruning (3.3.2) and pruning to lateral (3.3.3).

5.4.8 Leaf area removal should not exceed 20 %.

5.4.9 **Critical errors:**
- Excessive hit rate (large volume of leaf area removal),
- Lion's tailing (clearing of all inner parts of the crown),
- Over raising of the crown,
- Pruning wounds over 10 cm diameter.

5.5 2/B Lateral crown reduction – semi-mature trees

5.5.1 **Objectives:** This intervention is aimed at the reduction of the side or lower parts of the permanent crown. A lateral reduction does not intervene in the top of the crown and does not alter the height of the tree.

5.5.2 This pruning technique is usually used in combination with 2/A.

5.5.3 **Pruning interval:** regrowth is to be expected as a reaction to the reduction. Therefore, interventions will often have to be repeated periodically every 3-7 years (depending on tree species and situation), together with control of the effect of the previous step until reaching the desired aim.

5.5.4 At this stage of development, it is usually still possible to influence the architecture of the crown and to permanently resolve or minimise the identified conflicts.

5.5.5 **Optimal season:** Ideal season is vegetative period, but the dormant period is accepted as well. Lateral crown reduction should NOT be performed in periods of post– and pre–dormancy. Also avoid long periods of drought.

5.5.6 **Methods:** the following branch removal methods can be used:
- target pruning (3.3.2),
- pruning to lateral (3.3.3),
- stub cutting (3.3.4) in rare justified cases,

5.5.7 It is advisable to keep the maximum leaf area removal below 20 %, which applies to the total leaf area removed, even when combining multiple techniques.

5.5.8 **Critical errors:**
- Excessive hit rate (large volume of leaf area removal).
- Creating a significantly asymmetric crown or branches.
- Late intervention.

5.6 2/D Crown shaping – maintenance

5.6.1 **Objectives:** Maintain the established crown shape at a defined level (which may slightly increase with each intervention).
5.6.2 Shaping must not be performed below the level of previous pruning point[4].
5.6.3 Removal of epicormic shoots on the stem is carried out as part of the intervention.
5.6.4 The dead parts of the crown (stubs) are removed.
5.6.5 **Pruning interval:** Pruning cycle is defined by national annexes based on climatic conditions and cultural habits.
5.6.6 **Optimal season:** Ideal season depend on the objectives.
5.6.6.1 By **pollarding** is the optimal season dormant period.
5.6.6.2 By **hedging** is the reduction often repeated several times per year with optimum in the growing season.
5.6.7 **Methods:** For maintaining a **pollard-style shape** a knuckle cut, leaving a short stub (3.3.5), is the prevailing method. For some traditional cultural types of shaping a rip cut (3.3.7) may also be used.
For maintaining **hedge-style trees** shearing cuts (3.3.6) are used.
5.6.8 Usualy, most of the leaf area is being removed.
5.6.9 **Critical errors:**

- Large pruning wounds.
- Lapsed pruning cycle.
- Leaving a large amount of longer stubs.

5.7 3/A Crown maintenance – mature trees

5.7.1 **Objectives:** to support the sustainable existence of a stable permanent crown structure and as close to natural tree shape as possible with respect to the tree's environment. The focus is on ensuring adequate stability and an acceptable risk.
5.7.2 The following branches must be considered when pruning:

- branches colonised by pests or diseases,
- branches with developed weak forks (V-shaped union) or other mechanical defects. Given their probable large size, it is often better to reduce these rather than remove them,
- top-heavy branches are to be weight-reduced,
- epicormic shoots in the central crown should be left with respect to the tree species, vitality and growing context.

5.7.3 **Pruning interval:** Pruning is generally not repetitive, but occasional. On average, the pruning interval can vary between 1 year (e.g. for deadwood management) to 5-10 years, depending on objectives and risk assessment.
5.7.4 **Optimal season:** Ideal season is vegetative period, but the dormant period is accepted as well. Crown maintenance should NOT be performed in periods of post- and pre-dormancy. Also avoid long periods of drought.
5.7.5 **Methods:** the following branch removal methods can be used:

- target pruning (3.3.2),
- pruning to lateral (3.3.3),
- stub cutting (3.3.4) and rip cut (3.3.7) may be considered in rare cases.

5.7.6 Leaf area removal should not exceed 10 %.

[4] Exceptions with consideration of tree species and cultural habits apply.

5.7.7 In rare cases (e.g. diseased branches) it might be necessary to remove large living branches (diameter greater than 10 cm). The preferred method for this is reduction, leaving a large (between 1–3 meters) stub. In these cases, the finishing cut can be a stub cut or a rip cut.

5.7.8 **Critical errors:**

- Excessive hit rate (large volume of leaf area removal),
- Lion's tailing (clearing of all inner parts of the crown),
- Over raising of the crown.

No upper crown reduction is to be performed as part of crown maintenance.

5.8 3/B Lateral crown reduction – mature trees

5.8.1 **Objectives:** This intervention is aimed at the reduction of the side or lower parts of the permanent crown. Lateral reduction does not intervene in the top of the crown and does not alter the height of the tree.

5.8.2 Permanent conflict resolution in mature trees may be limited due to the already completely developed main limb structure.

5.8.3 The physiological and structural impact of the planned lateral crown reduction must be weighed against the value of the tree and the importance of the conflict.

5.8.4 This pruning technique is usually used in combination with 3/A.

5.8.5 **Pruning interval:** regrowth (epicormic) is to be expected as a reaction to the reduction. Therefore, interventions should be repeated periodically every 5-10 years together with control of the effect of the previous step until reaching the desired aim.

5.8.6 **Optimal season:** Ideal season is vegetative period, but the dormant period is accepted as well. Lateral crown reduction should NOT be performed in periods of post– and pre–dormancy. Also avoid long periods of drought.

5.8.7 **Methods:** following branch removal methods can be used:

- target pruning (3.3.2),
- pruning to lateral (3.3.3),
- stub cutting (3.3.4) and rip cut (3.3.7) may be considered.

5.8.8 It is advisable to keep the maximum leaf area removal below 10 %, which applies to the total leaf area removed, even when combining multiple techniques.

5.8.9 **Critical errors:**

- Excessive hit rate (large volume of leaf area removal).
- Creating a significantly asymmetric crown or branches.
- Late intervention.

5.9 3/C Upper crown reduction – mature trees

5.9.1 **Objectives:** Exceptional type of intervention on mature trees, which must always be driven by the need to biomechanically stabilise the particular tree. It is important to justify the necessity of the upper crown reduction based on evidence of destabilisation of the whole tree.

5.9.2 An upper crown reduction must be specified as a result of a calculated stabilisation need. The intervention must be limited to the minimum necessary to achieve the desired stabilisation effect and an acceptable level of risk (use of a standardised calculation method[5] is recommended).

5.9.3 This is an intervention that often irreversibly negatively affects the architecture of the crown and the physiology of the whole tree.

5.9.4 Using additional or alternative stabilisation techniques (cabling/bracing) as part of the tree stabilisation process, even if only as a temporary measure, must be considered.

5.9.5 **Pruning interval:** expect dynamic regrowth as a reaction to the reduction. The tree's reaction to the intervention should be assessed within 3-5 years, with control of its effect.

5.9.6 **Optimal season:** Is not generally defined and depends on the specific situation and tree species (see national annexes). In each case avoid long periods of drought.

5.9.7 **Methods:** the following branch removal methods can be used:

- target pruning (3.3.2),
- pruning to lateral (3.3.3),
- stub cutting (3.3.4),
- rip cut (3.3.7) may be considered.

5.9.8 The leaf area removal is limited to the calculated stabilisation need. It is advisable to keep the wound sizes under diameter of 10 cm if possible.

5.9.9 Combination with simultaneous raising of the crown or structural pruning can lead to the massive loss of leaf area and should thus be avoided.

5.9.10 **Critical errors:**

- Excessive hit rate, in this case more than the minimal intervention calculated.

5.10 4 Veteran tree management

5.10.1 **Objectives:** Interventions in the veteran tree crown must always be well thought out and specified. Typically, they focus on the following objectives:

- weight removal or reduction for biomechanical reasons,
- management of epicormic shoots (secondary crown).

5.10.2 Pruning of veteran trees must only be conducted in the context of long-term veteran tree management planning. It is specialist work, to be conducted by professionals certified for work with veteran trees. (see 2.1.2)

5.10.3 As a rule, the intervention is aimed at preserving the internal structures of the crown, including epicormic shoots with respect to the development phase and the habitat features of the tree.

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[5] SIA – Statisch Integrierte Abschätzung - https://sia.simgruppe.de/sia.php
WLA – Wind Load Analysis - http://www.wla.cz/
AdBiAn – Advanced Biomechanical Analysis - https://www.adbian.cz/

5.10.4 The intervention must not adversely affect the major microhabitats and the biodiversity value of the tree and its surroundings.

5.10.5 **Methods:** the following branch removal methods can be used:

- pruning to lateral (3.3.3),
- stub cutting (3.3.4),
- rip cut (3.3.7).

Use of target pruning must be carefuly considered, since this can involve making larger pruning wounds.

5.10.6 It is advisable to keep the size of the pruning wounds as small as possible. On the other hand, making larger wounds might be necessary to reach the objective, taking into account the fact that it can result in additional disfunction and decay in the wound area.

5.10.7 **Optimal season:** Ideal season is vegetative period, but the dormant period is accepted as well. Crown maintenance should NOT be performed in in periods of post- and pre-dormancy. Also avoid long periods of drought.

5.10.8 The pruning interval must be carefully considered in relation to the risk of affecting valuable micro-habitats or specific associated organisms that inhabit the tree and its surroundings.

5.10.9 **Critical errors:**

- Excessive hit rate (large volume of leaf area removal),
- Complete deadwood removal,
- Avoidable removal of habitat features (e.g. deadwood, hollows etc.)

NO crown lifting or removal of epicormic growth in the lower parts of the crown is allowed as part of this intervention.

5.11 5 Restorative pruning to restore (semi-)natural tree form

5.11.1 **Objectives:** to restore a mismanaged, neglected or mutilated tree to re-establish a (semi-)natural tree form. Depending on the tree status, development phase and the extent of neglect or damage to the tree, work will be done in the temporary and/or the permanent crown. In each case, the aim is to minimise long term negative effects of neglect or damage.

5.11.2 Main objectives and techniques comply with categories 1/A, 2/A, 3/A and 4, depending on the tree status and development stage. Differences in pruning approach are dependant on the extent of neglect or damage and cannot be defined in general.

5.11.3 If the extent of branch defects, physiological or mechanical damage to the tree prohibits the possibility of re-establishing a (semi-)natural tree form, consider the possibility to establish an artificial tree shape (see 5.9 – 5.10) or evaluate the benefits of the tree in its environment and either retain it at minimal cost or replace it.

5.11.4 **Pruning interval:** Pruning cycle can vary between 1 and 5 years, depending on objectives and tree development stage.

5.11.5 **Optimal season:** pruning during the growing season is prefered, but the dormant period is acceptable as well. Formative pruning should NOT be performed in periods of post- and pre-dormancy. Also avoid long periods of drought.

5.11.6 **Methods:** the following branch removal methods can be used:

- target pruning (3.3.2),
- pruning to lateral (3.3.3),

- stub cutting (3.3.4),
- rip cut (3.3.7).

5.11.7 Leaf area removal is dependant on what is necessary in order to reach the objectives. In general, this should not exceed 10 % in mature trees, 20% in semi-mature trees and 30% in young trees. In cases of heavily lapsed pruning in vigorous young trees this may be increased up to 40%. In case of trees with low vitality the hit rate must be carefuly considered and in each case lower than the above.

5.11.8 **Critical errors:**

- re-occurrence of the neglect or mismanagement that led to the damage of the tree

5.12 6 Restorative pruning to establish an artificial shape

5.12.1 **Objectives:** to restore a mismanaged, neglected or mutilated tree to re-establish an artificial tree shape. Depending on the tree status, development phase and the extent of neglect or damage to the tree, work will be done in the temporary and/or the permanent crown. In each case, the aim is to minimise long term negative effects of neglect or damage.

5.12.2 Main objectives and techniques comply with the category 2/A or 2/B, depending on the tree status and development stage. Differences in pruning approach are dependant on the extent of neglect or damage and cannot be defined in general.

5.12.3 If the extent of branch defects, physiological or mechanical damage to the tree prohibits the possibility of establishing an artificial tree shape, evaluate the benefits of the tree in its environment and either retain it at minimal cost or replace it.

5.12.4 **Pruning interval:** Pruning cycle can vary between 1 and 5 years, depending on objectives and tree development stage.

5.12.5 **Optimal season:** Ideal season depend on the desired shape.

5.12.6

- For **pollarding** the optimal season is the dormant period.
- **Shearing/clipping** is often repeated several times per year, optimally in the growing season.

5.12.7 Usualy, majority of the leaf area is being removed when establishing an artificial shape.

5.12.8 **Critical errors:**

- re-occurrence of the neglect or mismanagement that led to the damage of the tree.

6. Taxon specific approach

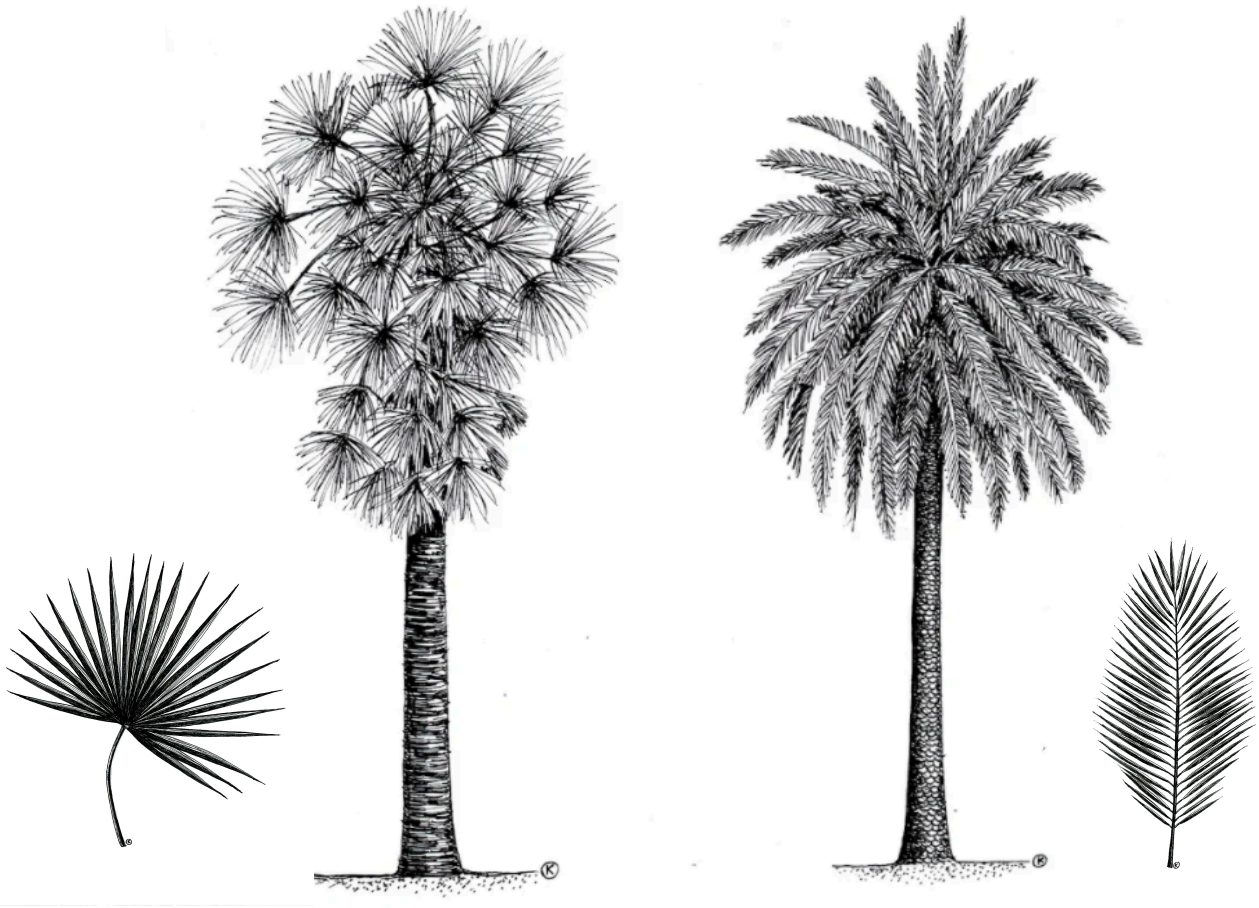
6.1 Palm trees

6.1.1 Introduction

6.1.1.1 Palms do not have the secondary growth effected by the same kind of vascular cambium. This explains the cylindrical shape of the trunk. The trunk is composed by old dried petiole bases tightly stacked on each other and has no bark. Before a young palm gains in height, a certain trunk diameter must first be achieved. Therefore, young palms grow much slower than older ones. Some species have a stem covered with fibrous threads between the petiole bases, others may lose these fibres on the older parts of the trunk.

6.1.1.2 Palms always develop one new leaf or “frond” at a time.

PICTURE 20: Variety of basic leaf structure by palm trees



6.1.1.3 Following pruning methods are not necessarily valid for the maintenance of palm trees used in indoor landscaping, or palm trees whose main objective is the production of fruits, or other products.

6.1.1.4 It is not recommended to use palm tree species with a height of less than 2 m along roads and places with the necessary technical profile.

6.1.2 Pruning techniques

6.1.2.1 By pruning of palm trees are being removed only leaves and their remnants, flowers and fruits. The terminal bud must never be damaged.

6.1.2.2 The specific objectives of pruning and cleaning ornamental palm trees are mainly focused on maintenance and cleaning as follow:

- avoid the shedding of leaves or dry fruits of certain species, that could cause damage to people and property,
- limit weight of palm trees with risk of falling or breaking,
- make the palm tree less vulnerable to fires and vandalism,
- remove leafs that in windy days can touch power lines, street lamps, buildings etc.,
- increase the aesthetic value of the specimen and its surroundings,
- remove leaves affected by pests or diseases,
- open an access to facilitate inspections,
- adapt the individual tree to the needs of use of the space where it grows.

6.1.2.3 Knowledge of the biology of a specific palm species is required for a quality palm maintenance.

6.1.2.4 **Dead leafs removal** shall be carried out by a clean cut without affecting the living tissues in such a way as to prevent outflow. On the leaf basis are left those parts of petiole that are firmly connected and do not spontaneously fall off. The length of left petiole remnants of the individual leaves should be uniform. Choice of the length is based on local habits and selected aesthetic effect of the pruning.

6.1.2.5 Stem cleaning from dead leaves and their remnants must be carried out in order to prevent fires and limit the occurrence of rodents and snakes.

6.1.2.6 **Living leafs removal** is performed only exceptionaly wherein at least one frond (cluster of leaves) is left in the apex of the crown around the central bud. The pruning should not be done systematically, as each individual usually requires an individual approach.

6.1.2.7 By sensitive palm species should not be cut off live leaves as they are more likely to be attacked by pests and diseases. If it is necessary for other reasons, a subsequent phytocarantine inspection and irrigation of the entire crown volume must be carried out.

6.1.2.8 **Palm cleaning** is carried out typicaly on *Phoenix dactylifera* palms. It includes removal of dry or unwanted inflorescences and fruits incl. their rudiments. Especially in pedestrian zones, gardens and around swimming pools, there is a risk of falling fruits and violation of operational safety.

6.1.2.9 In defined areas with quarantine diseases and pests and in sensitive palm species, cleaning must always include phytosanitary measures throughout the enrite crown volume.

6.1.2.10 **Stem cleaning** is carried out for aesthetic and safety reasons in justified cases. The trunk must not be cleaned to a greater extent than is necessary to achieve the desired effect, up to the area, which is already free of leaf residues and their petioles. These are removed only to the extent that they separate themselves or with ease.

6.1.2.11 Cleaning must be carried out free from injuries, which may be a gateway for the penetration of diseases and pests.

6.1.2.12 For some palm species (*Phoenix dactylifera*), this operation may have a negative effect, as the dry cover provides protection against erosive environmental influences (eg in coastal zones).

6.1.2.13 Removal of the fiber cover of a strain of species such as *Trachycarpus fortunei* is generally counterproductive and can only take place in justified cases (eg as fire prevention).

6.1.2.14 Waste from the incision should be removed from the site without delay in order to prevent the spread of diseases and pests. If waste has to be left on site for a short time, free public access should be prevented.

6.1.3 Time of pruning

6.1.3.1 In subtropical and tropical climatic zones, pruning of palm trees can be carried out at any time of the year.

6.1.3.2 In temperate climatic zones, palm pruning is carried out outside the freezing season and in colder znes optimally during the summer months.

6.1.3.3 If the pruning involves removal of green leaves, the treatment should preferably take place during the summer months.

6.1.3.4 Palm pruning in areas with quarantine pests (especially *Rhychnophorus ferrugineus* and *Paysandisia archon*) must take place outside the flight of adults – optimally from December to February, event. with immediate application of approved phytosanitary treatment[6].

6.1.3.5 Cleaning of palm trees must be carried out after the inflorescence has been established.

[6] Legislative restrictions may apply.

7. Planning and site management

7.1 Introduction

7.1.1 Qualitative pruning work can be completely invalidated by bad planning and bad site management during and after tree pruning operations. This chapter will highlight the main aspects to consider.

7.2 Soil impact

7.2.1 During pruning work, impact on soil quality, which is essential for tree health, must be taken into account throughout the whole operation, including cleaning of arisings. Soil compaction and soil degradation must be avoided or mitigated if impossible to avoid.

7.2.2 In order to avoid soil compaction and degradation, clearly plan the following:

- access on and off the work site,
- location of fuelling station,
- parking/positioning of equipment (chipper, truck, trailer etc.) and more specifically MEWP positioning, if appropriate.

7.2.3 Avoiding soil compaction and degradation might require changing the timing (e.g. outside of the wet season) or work plan (e.g. type of MEWP used) for the pruning operations.

7.2.4 If soil compaction and degradation cannot fully be avoided, mitigation measures must be put in place.

7.3 Arisings

7.3.1 The treatment of arisings (branches, leaves etc.) is an integral part of the pruning operations. These can be removed, chipped, stacked on site, processed for firewood, etc. The treatment of arisings must be part of the planning process for the pruning operations.

7.4 Impact on neighbouring trees

7.4.1 When planning pruning operations, the impact on neighbouring trees must be taken into account. These should not be negatively affected by the pruning operations, e.g. by unacceptably changing wind load distribution. This impact must be taken into account when planning and performing the pruning operations.

7.4.2 If the impact on neighbouring trees cannot be avoided, mitigation measures must be put in place.

ANNEX

No. 1 Tree species according to ability to compartmentalise pruning wounds

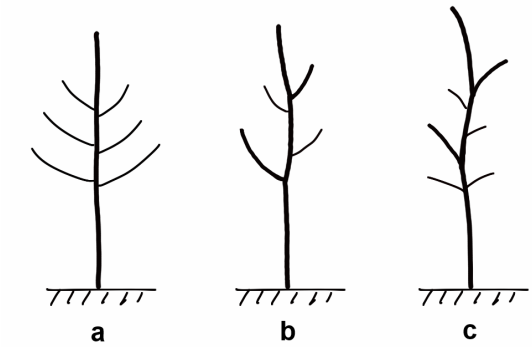
Tree species	Compartmentalisation
Acer campestre	Good
Acer negundo (Negundo aceroides)	Weak
Acer platanoides	Weak
Acer pseudoplatanus	Good
Acer rubrum	Good
Acer saccharinum	Weak
Aesculus spp.	Weak
Ailanthus altissima	Weak
Alnus spp.	Weak
Betula spp.	Weak
Carpinus betulus	Good
Castanea sativa (C. vesca)	Weak
Cedrus spp.	Good
Celtis spp.	Good
Corylus colurna	Good
Crataegus spp.	Good
Fagus sylvatica	Good
Fraxinus spp.	Weak
Gleditsia triacanthos	Good
Juglans spp	Weak
Larix decidua (L. europaea)	Good
Malus spp.	Weak
Paulownia tomentosa (P. imperialis)	Weak
Picea spp.	Weak
Pinus spp.	Good
Platanus ×hispanica (P. ×acerifolia)	Good
Populus spp.	Weak
Prunus spp.	Weak
Pseudotsuga menziesii	Good

Tree species	Compartmentalisation
Quercus petraea	Good
Quercus robur (Q. pedunculata)	Good
Quercus rubra (Q. borealis)	Weak
Robinia pseudoacacia	Good
Salix spp.	Weak
Sequoiadendron giganteum (S. gigantea)	Good
Sophora japonica	Good
Sorbus spp.	Weak
Taxus spp.	Good
Thuja spp.	Weak
Tilia spp.	Good
Tsuga spp.	Weak
Ulmus spp.	Good

No. 2 Woody plant species with intensive spring sap flow

Tree species
Acer spp.
Betula spp.
Carpinus spp.
Celtis spp.
Corylus spp.
Cotinus coggygria
Juglans spp.
Liquidambar styraciflua
Morus spp.
Populus simonii
Ulmus spp.
Vitis spp.

No 3. Tree species according to the basic hierarchy strategy in the young tree



Model A	Model B	Model C
Fraxinus excelsior	*Quercus robur*	*Ulmus* spp.
Populus spp.	*Acer saccharum*	*Gleditsia triacanthos*
Salix alba	*Acer saccharinum*	*Robinia pseudoacacia*
Prunus avium	*Fraxinus pennsylvanicum*	*Acer pensylvanicum*
Aesculus spp.	*Ailanthus altissima*	*Albizia julibrissin*
Alnus spp.		*Morus* spp.
Betula spp.		*Nothofagus antarctica*
Castanea sativa		*Phellodendron amurense*
Acer pseudoplatanus		*Pterocarya fraxinifolia*
Juglans spp.		*Tilia* spp.
Platanus spp.		*Carpinus* spp.
Abies spp.		*Fagus* spp.
Pinus spp.		*Toona sinensis*
Liriodendron tulipifera		*Zelkova serrata*
		Tsuga canadensis

General implications for formative pruning of young trees according to different strategies:

- Tree species with **strategy A** naturally have a strong apical dominance, with a single and upright dominant leader building the stem. If codominant forks appear in the temporary crown of a young tree, this is generally accidental (e.g. damage to the top of the tree).
  During formative pruning tolerance for codominance in the temporary crown should be low: accidental forks should be removed as soon as possible.

- Tree species with **strategy B** build a single stem by transferring the dominance between upright axes, giving rise to transitory ‚temporary forks‘ in the top of the tree. Generally apical dominance is rapidly restored as one axis takes over dominance and the others are dominated. The resulting stem of the young trees can temporarily be wavy, less straight than in model a.
  During formative pruning, temporary forks in the top of the tree should not automatically be considered problematic, as their appearance and subsequent resolve are often predictable. Persistent codominance in the top of the tree can be resolved by supporting the most dominant axis and reduce the others. Persistent (remains of)

temporary forks lower down should be reduced or removed, as would be done with any other big, low branch in the temporary crown.

- Tree species with **strategy C** are characterised by the lack of an upright dominant leader: the apex of the tree is slanting. The young tree builds a stem by secondarily erecting the basal part of its apex and potentially also by transferring dominance between axes. The dominated axes may remain as thick low branches. The resulting stem of the young trees can (temporarily) be wavy.
  During formative pruning, a slanting apex and an apparent lack of dominance in the top of the tree should not automatically be considered problematic, as this is considered to be part of normal development. Persistent codominance in the top of the tree can be resolved by supporting the most dominant axis and reduce the others. Persistent (remains of) dominated main axes lower down should be reduced or removed, as would be done with any other big, low branch in the temporary crown.

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