EUROPEAN ARBORICULTURAL STANDARDS

TREE VALUE CALCULATION STANDARD
FOR ARBORISTS

2024

BG:	Икономическа оценка/ Оценка на значимостта на дърветата
CS:	Oceňování stromů
DA:	Værdisætning af træer
DE:	Gehölzwertermittlung
EL:	Αποτίμηση δένδρων
EN:	Tree Valuation
ES:	Valoración económica de los árboles
ET:	Puude väärtuse hindamine
FI:	Puiden arvon määrittäminen
FR:	Valorisation d’arbre
GA:	Luacháil crann
HR:	Procjena vrijednosti stabala

HU:	Faértékelés
IT:	Valutazione economica dell'albero
LT:	Medžio kainos nustatymas
LV:	Koku vērtības noteikšana
MT:	Stima tal-valur ekonomiku tas-siġar
NL:	Boomwaarde
PL:	Waloryzcja drzew
PT:	Valoração de árvores
RO:	Evaluarea valorii copacilor
SK:	Oceňovanie stromov
SL:	Ocena stanja drevesa
SV:	Vrednotenje dreves
UK:	Оцінка стану дерев

This standard is intended to define the approach to value calculation of amenity trees.

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European Arboricultural Council

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1 PURPOSE AND CONTENT OF THE STANDARD 4
1.1 Purpose 4
1.2 Main objectives 4
1.3 Stakeholders 5
2 NORMATIVE REFERENCES 6
2.1 Links to general documents 6
2.2 Qualification 8
3 VALUES OF AMENITY TREES 9
3.1 Introduction 9
3.2 Economical categories 10
3.3 Damage and loss of value 10
3.4 Environmental (ecological) loss 11
3.5 Methods to tree value calculation 12
3.6 Property value of trees 12
3.7 Repair cost 13
3.8 Replacement cost 13
3.9 Tree ecosystem services 14
3.10 Biodiversity (wildlife) value 15
3.11 Disservices 17
3.12 Economies of Scale 18
4 APPLICATION OF VALUES IN TREE MANAGEMENT 19
4.1 Introduction 19
4.2 Repair or replacement 19
4.3 Felling licenses 21
4.4 Approach to groups of trees 21
4.5 Best practices 21

5 ANNEX 1 - TREE RIGHTS DECLARATION..23

6 ANNEX 2 - AXIOLOGY..24

7 ANNEX 3 – CASE STUDIES..25

8 REFERENCES...29

1 Purpose and content of the standard

1.1 Purpose

1.1.1 This standard was published by the working group of the ECoST project (European Consulting Standards in Tree Work) in cooperation with the EAC (European Arboricultural Council) and has become available in …………..

1.1.2 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.

1.1.3 The aim of this standard is to showcase modern approaches of articulating the values of amenity trees, highlighting aspects that should be considered in determining the overall worth of an individual tree. This standard embodies common practices adopted throughout European countries.

1.1.4 The standard offers methodological guidance specifically tailored for individuals actively involved in arboricultural consulting and tree value calculation.

1.2 Main objectives

1.2.1 The primary goal of calculating tree value is to identify factors that should be considered when determining the worth of a tree whose value isn't derived from timber production.

1.2.2 This standard is intended to assist individuals and organizations in recognizing and understanding the diverse values associated with trees. It aims to ensure that the significance of trees in different settings is appropriately acknowledged and appreciated.

1.2.3 Standard provides guidelines to help make informed decisions in tree management. It ensures that choices made are beneficial for the trees and the environment while considering the broader impact on the community and ecosystem.

1.2.4 Standard emphasizes the fundamental principle that every tree possesses inherent value. Regardless of its size, age, or location, each tree contributes uniquely to the environment and the ecosystems it inhabits.

1.2.5 Certain trees, distinguished by their age, appearance, or historical significance, warrant special attention. Such trees are recognized as biocultural heritage and should be given a superior status, urging humans to protect them as "natural monuments".

1.2.6 Trees should be designated within preservation zones, ensuring their enhanced protection for aesthetic, historical, or cultural reasons. Details can be found in EAS 06:2024 – European Standard for Protecting Trees by Development Activities.

1.2.7 While the value of trees is often quantified in monetary terms, this approach does not capture their full value. Trees offer a variety of benefits, many of which transcend mere financial metrics.

1.2.8 The primary constraints of tree valuation methods are that they cannot assign a value to every aspect of trees, and some models may undervalue specific types of trees, such as ancient or veteran trees.

1.2.9 Humans continuously evaluate and make choices, discerning between good and bad. While all living beings make survival-based decisions, humans uniquely pursue deeper understanding, as seen in scientific research. Despite money being a prevalent measure, human decisions often transcend monetary value (more information on axiology in Annex 2).

1.3 Stakeholders

1.3.1 In the valuation of amenity trees and the subsequent management actions, each party involved has a distinct and crucial role to ensure the holistic well-being and appropriate valuation of trees:

1.3.2 **Regulatory bodies (courts, government):** should acknowledge the broader significance of tree values and encourage legislators, insurance providers, and other entities to incorporate this understanding.

1.3.3 **Tree Owner/Manager (public or private):** The tree owner or manager is responsible for ensuring that the tree is maintained in a safe condition and can deliver its ecosystem services effectively. The final decisions regarding any management actions or interventions rest with the tree owner or manager.

1.3.4 Tree managers/owners should recognize their trees as economic entities and incorporate them as tangible assets within their financial frameworks. It's advisable for them to reference this standard in their Asset Protection Values[1], tree regulations, and contractual agreements.

1.3.5 **Appraiser:** The tree appraiser's primary responsibility is to employ suitable valuation methods to determine the value of the tree. They should also propose relevant recommendations for tree management, if required. In situations where specialized knowledge is needed, the appraiser should consult with tree consultants to enhance their understanding, observations, and analysis.

1.3.6 **Tree Consultant:** Understands the diverse values of trees, considering their mechanical integrity, physiological condition, and how they fit into their growth environment, especially when evaluating potential management actions. Their expertise guarantees that when determining the value, both the inherent and external worth of trees are given primary consideration.

1.3.7 **Tree Worker/Arborist:** The tree worker or arborist is tasked with implementing the management recommendations provided by the appraiser or tree consultant. If the tree worker's observations or analysis differ, it is imperative to consult with either the appraiser or tree consultant or the tree owner/manager to seek clarification and ensure alignment in approach.

[1] **Asset Protection Values** (APV) typically refer to the monetary worth or importance assigned to assets, especially in the context of protecting them from potential threats or damages. This can be in the form of insurance, risk management strategies, or other protective measures to ensure the preservation of the asset's value.

2 Normative references

2.1.1 This standard is complementary to other EU standards and national/regional regulations. It serves as a guide to ensure a consistent approach to the valuation of trees, while recognizing the diverse practices across the European Union.

2.1.2 Within the European Union, there is no unified practice for the valuation of trees. The approach to this subject varies significantly among member states, reflecting their unique ecological, cultural, and economic contexts. This diversity in approach underscores the importance of a standard that can harmonize practices while allowing for regional specificity.

2.1.3 To address the variability in practices across member states, national annexes have been attached to this standard. These annexes provide detailed insights into the specific practices, regulations, and guidelines followed by individual countries in the EU. Users of this standard are encouraged to consult the relevant national annex to gain a comprehensive understanding of the valuation practices in a specific country.

2.1.4 It is necessary to ensure, that the valuation of trees is conducted in a manner that is both consistent with EU-wide practices and sensitive to national and regional specificities. By defining general approaches to this issue, this standard aims to promote best practices, enhance the quality of tree valuation, and foster collaboration among member states.

2.1 Links to general documents

2.1.1 The European Union's political landscape, particularly the **Green Deal** and other related initiatives, has significantly influenced the perception and valuation of amenity trees.

2.1.2 The European Green Deal, introduced by the European Commission, aims to make Europe the first climate-neutral continent by 2050. It encompasses a set of policy initiatives targeting various sectors, including biodiversity, clean energy, and sustainable agriculture.

2.1.3 Within the Green Deal, trees, especially those outside forest environments, are recognized for their multifaceted contributions. They play a pivotal role in urban cooling, carbon sequestration, enhancing biodiversity, and improving air quality. This acknowledgment has elevated the importance of valuing these trees appropriately.

2.1.4 The **EU's Biodiversity Strategy for 2030** emphasizes the importance of green infrastructure, including non-forest trees, in creating resilient ecosystems. The strategy's goals indirectly promote the preservation and appropriate valuation of trees in urban and peri-urban areas.

2.1.5 Various EU directives and policies encourage member states to develop urban greening plans. These plans often highlight the economic, social, and environmental value of trees in urban settings, further emphasizing their importance in sustainable urban development.

2.1.6 The EU's political activities have underscored the need for a holistic approach to tree valuation. Beyond their economic value, trees are now increasingly recognized for their ecological and social contributions.

2.1.7 The influence of the Green Deal and other EU initiatives necessitates a standardized approach to tree valuation across member states. While regional specificities are essential, a unified framework ensures that trees' multifaceted values are consistently recognized and preserved.

2.1.8 The European Commission introduced the **Nature Restoration Law** to improve ecosystems for people and the planet. This unique European law is a key part of the EU Biodiversity Strategy. It focuses on fixing damaged ecosystems, especially areas that store carbon and help lessen the effects of natural disasters. Main goals:

- Restore ecosystems, habitats, and species throughout EU's terrestrial and marine regions.
- Ensure the sustainable recovery of a biodiverse and resilient environment.
- Support the EU's climate change mitigation and adaptation goals.
- Fulfil international obligations.

2.1.9 The **3-30-300 rule** offers straightforward benchmarks for tree presence in urban areas:

3 : Each person ought to have a view of at least three large trees from their home, given the psychological well-being advantages of surrounding greenery.

30 : A neighbourhood with at least 30% tree canopy offers benefits like cooling, improved microclimates, and better mental and physical health. Cities globally aim for this canopy target, emphasizing the importance of outdoor interaction for social health.

300 : Proximity to recreational green spaces, ideally within 300 metres, promotes physical and mental health. The World Health Organization emphasizes easy access to such spaces, adjusting for urban density.

2.1.10 Implementing the 3-30-300 rule enhances urban forests, promoting overall health, well-being, and resilience, thereby elevating the perceived value of trees in urban settings.

2.1.11 The **Sustainable Development Goals**[2] are a set of interconnected objectives as a blueprint for global peace, prosperity, and sustainability. These goals, ranging from eradicating poverty to climate action, highlight the intertwined nature of environmental, social, and economic sustainability. In the context of tree value perception, the emphasis on environmental sustainability, particularly in goals like "Life on land" (SDG 15), underscores the importance and value of trees in achieving these global objectives.

2.1.12 **Tree Rights Declaration**[3], is a new, not generally accepted activity in the perception of trees by humans, emphasizing that every tree has a distinct value and should be acknowledged as such. They are sensitive to environmental shifts and should not be viewed as mere objects but as beings with rights to both above and below-ground spaces essential for their growth. Trees deserve respect throughout their long lifespans, which often exceed human lifetimes, and have the right to grow, reproduce, and die naturally. More information in Annex 1.

[2] **The Sustainable Development Goals** (SDGs), also known as the Global Goals, are a set of 17 interconnected objectives established by the United Nations General Assembly in 2015.

[3] Tree Rights Declaration, French National Assembly, 5 April 2019

2.2 Qualification

2.2.1 The process of calculating tree value is a multidisciplinary, specialized task that necessitates the expertise of a professional who has undergone appropriate training and possesses significant experience in the field. This ensures that the valuation is accurate, comprehensive, and reflective of the tree's multifaceted contributions to the environment and society.

2.2.2 There is currently no internationally recognised qualification scheme for tree value calculation.

2.2.3 National qualifications reference may be recognized locally. These are listed in the national annexes to this standard.

2.2.4 From the perspective of arboriculture these are examples of qualifications on international (EU) level, which can help with tree-related questions connected with tree value calculation:

- European Tree Technician (EAC),
- VETcert Veteran Tree Specialist (Consulting level),
- ISA Board Certified Master Arborist.

2.2.5 Utilizing this standard necessitates a comprehensive understanding of trees and their maintenance. Inappropriate application of these guidelines and the associated calculation models may result in significant discrepancies in results, potentially leading to avoidable legal disputes.

3 Values of amenity trees

3.1 Introduction

3.1.1 The valuation of trees in urban and natural landscapes is a complex process, influenced by various factors.

3.1.2 Trees offer a range of services, some of which might be challenging to quantify in terms of monetary value. Below is a list of possible services linked to trees:

- **Ecological Service**: Trees play a crucial role in maintaining ecological balance. They provide habitat for various species and contribute to biodiversity.
- **Environmental Service**: Trees help in providing shade and reduce the urban heat island effect.
- **Carbon Storage and Sequestration Service**: Trees absorb carbon dioxide and help mitigate the effects of climate change.
- **Stormwater Management Service**: Trees reduce runoff and help in groundwater recharge.
- **Aesthetic Service**: Trees enhance the beauty of a landscape, making spaces more appealing and increasing property values.
- **Health Service**: Trees improve air quality, reduce noise pollution, and have been linked to reduced stress levels in humans.
- **Social Service**: Trees offer spaces for recreation, contribute to mental well-being, and can have cultural, heritage, scientific or historical significance.
- **Economic Service**: Trees can provide timber, fruits, and other products. They can also increase property values and attract tourism.
- **Structural Service**: This refers to the replacement cost of a tree, considering its size, species, and condition.
- **Energy Saving Service**: Trees can reduce energy costs by providing shade, which reduces the need for air conditioning in summer.
- **Conservation Service**: Some trees might be rare or endangered, adding to their conservation value.

3.1.3 Each area aims to provide a holistic perspective, ensuring that tree valuation is conducted with precision, fairness, and a deep understanding of the tree's role in the broader ecosystem based on above listed services.

3.1.4 Amenity tree services[4] refer to the environmental advantages and services that trees provide to human society. Recognizing and quantifying these services is crucial in the tree value calculation process, ensuring a comprehensive understanding of a tree's worth.

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[4] The **Convention on Biological Diversity** describes an ecosystem as a combination of living beings and their physical environment in a specific location. Essentially, it's a local web of interrelated plants, animals, and their surroundings. Humans are deeply connected to ecosystems, deriving both direct and indirect advantages, termed as "ecosystem services," a concept highlighted by the Millennium Ecosystem Assessment. The Convention on Biological Diversity (CBD) is the international legal instrument for "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" that has been ratified by 196 nations.

3.2 Economical categories

3.2.1 **Tree Value:** Tree value encompasses the holistic worth of a tree, considering both tangible and intangible benefits. For instance, a tree's ecological value might be based on its role in carbon sequestration, habitat provision, and soil erosion prevention.

3.2.2 **Tree Monetary Value:** This refers specifically to the quantifiable economic worth of a tree, expressed in monetary terms. It represents the amount of money or its equivalent for which a tree or its associated benefits can be traded or valued in the market. This might include the cost of timber if the tree were to be harvested, the value of the property it sits on due to its presence, or the estimated economic benefit of its environmental services, such as air purification or stormwater runoff reduction.

3.2.3 In contrast, while tree value considers a broad spectrum of benefits and contributions a tree offers, tree monetary value focuses solely on the economic aspect, translating those benefits into a monetary figure.

3.2.4 **Cost**: Cost refers to the amount of money that is used to produce something or the price paid to obtain something. It can be understood in terms of monetary expenditure, resources consumed, or lost opportunities. Costs are often used to determine the value of products and services and play a crucial role in decision-making processes in businesses and personal finances.

3.2.5 The monetary expression of tree values is referred to as tree costs. This means that the quantifiable economic worth of the benefits and contributions a tree offers is represented as its cost in monetary terms. Tree costs are frequently considered when assessing the value of trees and their ecosystem services and play a pivotal role in decision-making processes for urban planning, forestry management, and individual landscaping choices.

3.2.6 **Timber Value**: Timber value refers to the economic worth of the wood derived from trees. This value is determined by various factors, including the type of wood, its quality, and the demand for it in the market.

3.2.7 Timber value primarily pertains to the economic worth derived from trees grown for their wood, especially those in forests intended for logging. However, when considering amenity trees the concept of timber value must not be the primary consideration.

3.2.8 Timber value can be significant only in the context of property value when trees on a property are not just damaged but are completely stolen or harvested.

3.3 Damage and loss of value

3.3.1 Damage to trees refers to any harm or adverse impact on a tree's structure, health, or vitality, which can result from factors like physical injury, disease, pests, environmental stressors, or human activities.

3.3.2 Damage to a tree (above and below ground) can be caused for example by:

- Vehicular collisions;
- Improper maintenance activities, such as incorrect pruning or mowing;
- Acts of vandalism;

- Construction-related disturbances, both above and below ground, including drilling;
- Infrastructure installations like cables, sewage systems, pipelines, and more;
- Alterations in height of the soil, whether by removing, decreasing, or raising the soil level;
- Shifts in groundwater levels or flooding;
- Exposure to chemicals, including road salts, herbicides, gas emissions, water pipe ruptures, toxins, and the like;
- Development plans or felling permit applications that prioritize other interests over tree preservation.

3.3.3 Methods to determine form and extent of tree damage are described in European Tree Assessment Standard.

3.3.4 In instances of tree damage, the guiding principle is that any harm sustained due to a damaging event may qualify for compensation.

3.3.5 Valuation report age limit: For the damage to be officially recognized by any involved party, the valuation report should not exceed an age of 6 months.

3.3.6 Statutory interest: In cases where there's a delay from the time the damage is reported, a statutory interest might be applied to cover the period that has elapsed since the initial damage report.

3.4 Environmental (ecological) loss

3.4.1 Environmental loss refers to the negative effects on ecosystems and the environment resulting from tree damage or removal.

3.4.2 This aspect plays a crucial role in the tree valuation process, ensuring that the broader ecological implications and regulatory frameworks are considered.

3.4.3 When a tree is removed or permanently damaged, it's not just the tree that's lost. The broader ecological implications include:

- Habitat disruption: Trees provide shelter and food for various species.
- Soil degradation: Trees prevent soil erosion and maintain soil health.
- Water cycle disruption: Trees play a role in groundwater recharge and water purification.
- Loss of carbon sequestration**:** Trees absorb and store carbon dioxide.

3.4.4 Approaches to valuation of environmental loss

- Direct assessment: Quantify the immediate ecological services lost due to tree removal.
- Replacement cost method: Calculate the cost of restoring the ecological services to their original state.
- Opportunity cost approach: Evaluate the potential ecological benefits that would have been accrued if the tree had not been removed.

3.4.5 Challenges and limitations

- Quantifying ecological loss: It's challenging to assign a monetary value to some ecological services.
- Subjectivity**:** Different experts might arrive at different valuations for the same ecological loss.

3.5 Methods to tree value calculation

3.5.1 Within the framework of tree value calculation, there are following distinct methods to articulate these values:

- Property value associated with trees,
- Repair value of trees,
- Replacement value of trees,
- Value tied to biodiversity (wildlife),
- Value of ecosystem services provided by trees.

3.5.2 In many countries, only specific methods mentioned above are currently in use or recognized by legislation/industry standards. To ensure no tree values are overlooked, it's advised to consider all four principles and apply the most suitable one for each specific case.

3.6 Property value of trees

3.6.1 The property value of trees refers to the enhancement in the monetary worth of a piece of land or property due to the presence of trees.

3.6.2 As a result, properties with well-maintained trees often have higher market values compared to similar properties without trees.

3.6.3 Trees not only enhance the value of residential properties but also elevate the worth of commercial properties, parks, and urban areas.

3.6.4 The evaluation model of property value is closely tied to real estate appraisal or property valuation, which is the process of developing an opinion of value for real property, usually its market value.

3.6.5 Different techniques for assessing tree value within the context of property value are employed across various countries. These methodologies are detailed in the respective national annexes.

3.6.6 When considering property value assessment, the value of timber can be included even for amenity trees, especially when trees on the property are not merely damaged but entirely stolen or harvested.

3.7 Repair cost

3.7.1 The repair cost encompasses the entire expense associated with addressing the permanent damage. This cost is relevant when a tree can feasibly be restored following damage.

3.7.2 The foundational tenet of compensation law is the restoration of the injured party to their prior (property) state before the damaging event occurred. This restoration is achieved through the reimbursement of costs that arise from the damage.

3.8 Replacement cost

3.8.1 Replacement cost, in relation to trees, refers to the total expense associated with replacing removed with a new tree of similar function, size, species, and quality at the same location. This cost includes the removal of the original tree, site preparation, purchasing a new tree, planting, and any initial care or maintenance required to establish the new tree.

3.8.2 This method is uniquely suited to trees that primarily serve as botanical specimens without taking in account certain specific services, they provide. The utilization of this valuation method is constrained due to the difficulties associated with replacement certain values of trees within foreseeable future.

3.8.3 When a tree incurs significant damage that doesn't immediately suggest complete failure, a comprehensive investigation is mandated. This assessment will ascertain if the tree remains safe and manageable or if preservation is no longer feasible.

3.8.4 For instances where the damage is irreversible or becomes so over time, the replacement may be considered as an adequate method. Trees that are removed due to planning, felling, construction endeavours, re-development, or reconstruction are deemed as lost.

3.8.5 **Approach 1: Actual replacement cost of a comparable tree.** The genuine cost of replacing a removed/damaged tree with a similar tree or trees (over the next 5-10 years) – when considering the substitution of a tree by planting multiple new individuals, which will naturally continue in growing and increasing their value and functionality.

3.8.6 The replacement evaluation method is typically suited for tree species with small crowns, fruit trees and grafted trees. The same applies to shaped trees. These trees without natural crown development can usually be directly replaced by a comparable specimen from the market.

3.8.7 For the actual replacement cost of a comparable tree, tree technical feasibility is a prerequisite.

3.8.8 **Approach 2: Replacement cost calculation model.** A conceptual replacement cost calculation model derives from the investments needed to secure a similar tree in the identical location. These investments include not just the expenses for acquiring, planting, and taking care of a young tree, but also the oversight costs leading up to the task's execution.

3.8.9 The aforementioned sequence is hierarchical. The most tangible actual reaplacement method holds priority (when applicable) over more conceptual replacement cost calculation model.

3.9 Tree ecosystem services

3.9.1 Ecosystem services refer to the many benefits that humans derive from natural environments and healthy ecosystems. These services are essential for human well-being and in context of tree value calculation are categorized into four main groups:

- **Provisioning Services**: These are the tangible products obtained from trees, such as food, water, timber, and medicinal products.
- **Regulating Services**: These are the benefits obtained from the regulation of ecosystem processes, including climate regulation, disease control, and the purification of air and water.
- **Supporting Services**: These services are necessary for the production of all other ecosystem services. They include nutrient cycling, soil formation, and primary production.
- **Cultural Services**: These are non-material benefits people obtain from ecosystems. Examples include recreational, spiritual, and aesthetic values, as well as opportunities for research and education.

3.9.2 **Blue-green infrastructure** refers to the harmonious integration of water management systems (blue) with natural and semi-natural landscapes (green) to create sustainable urban environments. Trees, in this context, serve as natural sponges, absorbing excess rainwater and mitigating the risks of urban flooding.

3.9.3 The value and benefits derived from ecosystem services can directly impact human livelihoods or influence broader environmental conditions that indirectly affect humans.

3.9.4 Among these, there are primary ones to which we can in the process of tree value calculation assign a value:

- Temperature regulation: Trees provide shade and release water vapor, cooling urban environments.
- Carbon sequestration: Trees absorb carbon dioxide, mitigating the effects of climate change.
- Air quality improvement: Trees filter pollutants, providing cleaner air.
- Water regulation: Trees help in groundwater recharge and reduce runoff, preventing erosion.

3.9.5 When assessing a tree's ecosystem services, several factors come into play:

- Species: Different tree species offer varying ecosystem services.

- Age and size: Older and larger trees typically provide more significant ecosystem services.
- Mechanical integrity and physiological condition: Healthy trees contribute more effectively to their environment.
- Location: Urban trees might have enhanced value due to their role in combating urban heat islands.

3.9.6 Approaches to ecosystem services valuation:

- Quantitative analysis: Use tools and software to quantify ecosystem services like carbon storage, air pollution removal, and stormwater interception.
- Ecosystem service valuation: Assign a monetary value to the ecosystem services provided by the tree, such as water purification, soil conservation etc.
- Societal value assessment: Evaluate the tree's contribution to societal well-being, including mental health benefits, aesthetic value, and property value enhancement.
- Cost avoidance method: Calculate the costs avoided due to the tree's ecosystem services, such as reduced energy bills from shade or decreased health costs due to improved air quality.

3.9.7 Ecosystem services multipliers: After the initial valuation, apply ecobenefit multipliers based on the tree's environmental significance. For instance:

- Trees in polluted areas might have a higher multiplier due to their role in air purification.
- Trees in urban settings might have enhanced value due to their cooling effects.

3.10 Biodiversity (wildlife) value

3.10.1 Biodiversity, the variety of life in a particular habitat or ecosystem, is a basis of the overall health and functionality of ecosystems. Trees, as primary components of many ecosystems, are vital contributors to biodiversity on the Earth.

3.10.2 Biodiversity encompasses three distinct components:

- Genetic diversity: variations within the genetic makeup of individuals within a species,
- Species diversity: variety of different species present in a particular area,
- Habitat diversity: relates to the range of different habitats or ecosystems in given region.

3.10.3 In the context of tree valuation, our primary focus is on habitat biodiversity. This is because trees play a pivotal role in shaping and sustaining diverse habitats, providing shelter, food, and essential resources for various organisms. Evaluating trees from this perspective allows us to appreciate their intrinsic value in maintaining ecological balance and supporting a wide array of life forms.

3.10.4 If integrating biodiversity into tree valuation, it's essential to understand its significance:

- Ecological importance: Trees support various flora, fauna and fungi, acting as habitats and food sources.

- Genetic diversity: Older trees, in particular, can be repositories of genetic material that might be rare in younger, more commercially grown trees.
- Resilience: Biodiverse ecosystems are more resilient to pests, diseases, and climate change effects.

3.10.5 When assessing a tree's biodiversity value, several factors come into play:

- Age and size: Older and larger trees typically support more species than younger, smaller ones, which holds true for naturally distributed age classes in tree canopies as well.
- Native vs. non-native: Native trees often support a wider range of local wildlife.
- Location: Trees situated close to natural ecosystems such as forests, meadows, or wetlands may possess an increased biodiversity value owing to their linkage with these habitats. Conversely, standalone trees in urban settings can also hold significant value in terms of biodiversity.
- Connectivity: Trees that contribute to ecological corridors or connectivity between fragmented habitats can be of significant biodiversity value.
- Species: Diversity of tree species in a specific location.

3.10.6 Approaches to biodiversity valuation:

- Species inventory: Conduct a thorough inventory of species (flora, fauna, fungi) supported by the tree. The more species a tree supports, the higher its biodiversity value.
- Habitat quality assessment: Evaluate the tree's habitat quality, considering factors like canopy density, deadwood availability, and presence of nesting and sheltering sites.
- Connectivity analysis: Assess how the tree enhances connectivity between habitats, facilitating wildlife movement and gene flow.

3.10.7 Biodiversity multipliers: After the initial valuation, apply biodiversity multipliers based on the tree's biodiversity significance. For instance:

- Trees supporting endangered species might have a higher multiplier.
- Trees in biodiversity hotspots or ecologically sensitive areas might also have enhanced value.

3.10.8 While biodiversity valuation is crucial, it comes with challenges:

- Quantification: Biodiversity's intrinsic value can be hard to quantify in monetary terms.
- Dynamic nature: Biodiversity is not static. Seasonal changes, for instance, can affect the species a tree supports.

3.10.9 Best practices:

- Regular monitoring: Conduct regular biodiversity assessments to keep the valuation updated.
- Collaboration: Work with ecologists and biodiversity experts for accurate assessments.
- Holistic approach: Consider the tree's entire ecosystem, not just individual species it supports.

3.10.10 While various regional and local approaches might exist, there is no universally acknowledged methodology on a global scale that provides a comprehensive assessment of the biodiversity value of individual trees. This underscores the complexity of biodiversity metrics and the unique contributions of individual trees to their respective ecosystems. The absence of such a method highlights the need for further research and collaboration among experts to develop a universally accepted approach.

3.11 Disservices

3.11.1 While trees undeniably offer a large variability of ecological, aesthetic, and economic benefits, they can also present certain disservices or negative impacts.

3.11.2 Recognizing and incorporating these disservices into tree valuation is essential for a comprehensive and balanced assessment.

3.11.3 Tree disservices refer to the potential negative impacts or inconveniences caused by trees. These can range from structural damages to health concerns, for example structural damage, allergens, maintenance cost, visibility and safety, invasive species, water consumption, reduced output of solar panels, subsidence problems.

3.11.4 The monetary value of a tree is derived from a cost/benefit analysis that weighs its benefits against its disservices. When a tree presents more drawbacks than advantages, its valuation is correspondingly diminished. Thus, a comprehensive assessment ensures that the tree's value accurately reflects its net impact on the environment.

3.11.5 Valuation implications:

- Property value: While trees generally increase property value, potential dis-services can offset or reduce this value.
- Maintenance and repair costs: The potential costs of addressing tree-related damages should be factored into the valuation.
- Health and safety concerns: Trees that pose significant health risks might have their value adjusted accordingly.

3.11.6 Approaches to valuation of tree disservices:

- Cost-based approach: Directly calculate the costs associated with addressing the disservices.
- Comparative analysis: Compare properties with and without the tree disservices to determine value differences.
- Stakeholder surveys: Engage local residents or stakeholders to understand perceived inconveniences and their willingness to pay for mitigation.

3.11.7 Mitigating tree disservices

- Regular maintenance: Assessing and proper tree care can prevent many potential issues.
- Public awareness: Educate the public on the benefits of trees so they can better understand and tolerate the associated disservices.

3.11.8 Challenges and limitations:

- Subjectivity: Perceptions of disservices can vary among individuals.
- Quantifying disservices: Unlike direct benefits, some disservices are harder to quantify in monetary terms.
- Balancing services and disservices: It's essential to weigh the positive contributions of trees against their potential negative impacts.

3.12 Economies of Scale

3.12.1 In the context of tree value calculation, Economies of Scale can be understood as the cost efficiencies gained when valuing multiple trees as opposed to a single tree. It also pertains to the modification of the financial value assigned to trees that are closely situated and compete for resources under a shared canopy cover.

3.12.2 When assessing the value of a large number of trees, for example using the replacement cost method, certain fixed costs (like transportation costs) can be spread out over many trees, reducing the per-tree value.

3.12.3 When a tree is removed from a group, the impact or loss in value is likely less significant in proportion to the value of the entire tree group than the removal of a standalone tree of the same size or species. This is because similar trees within a group often share and distribute their ecological and aesthetic contributions collectively. The absence of one tree in such a setting might be compensated for by the presence of its neighbours.

3.12.4 However, removal of a single tree from a group/canopy can have adverse effects on the entire assembly, particularly impacting the trees in close proximity. This is because trees in a group often share resources, support each other, and maintain a balanced ecosystem, and removing one can disrupt this balance.

4 Application of values in tree management

4.1 Introduction

4.1.1 This section transitions from theoretical valuation to practical management strategies, emphasizing the effective use of tree values in decision-making. It's essential for professionals and users of this standard, to understand and apply these values for optimal tree management.

4.1.2 Ecosystem service values play a pivotal role in understanding and quantifying the variety benefits that natural systems offer to humans. To effectively use these values, it's essential to first identify and categorize the services a particular ecosystem provides, be it provisioning, regulating, supporting, or cultural services.

4.1.3 Once categorized, a monetary or non-monetary value can be assigned to each service, using various valuation methods. The specific valuation procedure or regulation for a given situation is defined by the national annex.

4.1.4 These quantified values can then inform policy decisions, land-use planning, and conservation strategies. By integrating ecosystem services values into decision-making processes, stakeholders can make more informed choices that balance development with conservation, ensuring that the contributions of ecosystems are recognized, preserved, and optimized.

4.2 Repair or replacement

4.2.1 The decision to choose between repair or replacement value following tree damage (real or potential) is a critical aspect of management. Such decisions not only influence the immediate response to the damage but also have long-term implications for the health and sustainability of the tree, the surrounding environment, and associated costs.

4.2.2 For tree value calculation:

- Repair cost transparency: Any costs associated with repairing damage should be clearly outlined. Financial settlements, for instance, can be finalized shortly after an incident occurs. This represents an abstract cost calculation related to safety measures and/or repairs.
- Replacement cost assessment: If a tree cannot be salvaged due to damage or if it must be removed for planning purposes, replacement costs are incurred.

4.2.3 To be able to distinguish between repair cost and replacement cost calculation methods, 4 levels of tree damage can be defined:

4.2.4 **Repairable without Measures:** When a tree sustains damage but doesn't necessitate any repair or compensatory actions, it is considered "repairable without measures." In this case the appraiser should only account for the initial, direct value loss. The damage extent in this situation:

- poses no safety threats,

- doesn't result in a reduced lifespan for the tree and doesn't reduce its future functions,
- there are no associated monitoring costs or future management expenses,
- there are no significant changes in the conditions of the growing site.

4.2.7 **Repairable with Management Measures:** When a tree incurs damage that potentially affects its lifespan or safety but doesn't necessitate its replacement. There are no significant alterations in the growing site conditions.

4.2.8 In the case of repair with management measures it's essential to ascertain the costs related to management and/or oversight.

4.2.9 Further Investigation in Case of Doubt: When the viability of a tree is uncertain advanced assessment, i.e., whether it can be safely recovered or if it's beyond salvage, a more in-depth examination is mandated. This may involve specialist tree or soil research to ascertain if the tree can be preserved. The objective is to determine if the costs associated with treatment and future management are justified compared to the costs of replacement.

4.2.10 **Irreparable Damage – Replacement**: Upon thorough assessment, if a tree is found to be irreparably damaged, it signifies that the tree cannot be safely recovered or its original form and appearance cannot be restored. Such trees are deemed as completely lost. This level of damage also encompasses trees that are removed due to planning, felling, construction activities, redevelopment, or reconstruction.

4.2.11 For trees that fall under this damage level, the damage assessment primarily focuses on determining and quantifying the costs required to replace and establish a similar tree at the original location.

4.2.12 Key principles to consider are:

- Replacement and repair: Any component that can and should be replaced will be replaced. Compensation may encompass costs associated with measures to encourage and support the self-repair of the timber stand, as well as other direct costs stemming from the damage.
- Concrete calculation: Damage should be quantified as precisely as possible. However, an abstract calculation might be employed when considerations of efficiency and reasonableness dictate.
- Liability and reimbursement: A party deemed liable is obligated to cover either the replacement costs or the repair costs. It's essential to note that measures promoting repair might be deemed appropriate even if their costs surpass those of replacement.
- Additional compensation rights: Beyond the primary damages, also the right to compensation for various ancillary damages should be recognised. These can include costs to mitigate or prevent further damage, research expenses, extrajudicial collection fees, valuation costs, and accrued interest.

4.3 Felling licenses

4.3.1 Felling licenses represent formal authorizations provided by regulatory authorities, permitting the removal of trees within specific guidelines. These licenses are not just administrative formalities; they are integral to ensuring that urban and rural landscapes are managed sustainably.

4.3.2 Serving as essential regulatory instruments, felling licenses:

- Advocate for the conscientious and informed removal of trees, ensuring that each felling is justified and carried out with minimal harm to the environment.
- Act as a safeguard against indiscriminate tree removal, thereby helping to maintain ecological balance and biodiversity.
- Often come with stipulations that necessitate actions to counterbalance the environmental void left by the felled trees. This can include mandates for replanting, ensuring that for every tree removed, another is planted, or compensatory afforestation, where multiple trees might be planted to compensate for the loss.

4.3.3 The introduction and enforcement of felling licenses underscore the importance of trees in our environment. By regulating their removal, these licenses ensure that tree felling is a last resort, only undertaken when absolutely necessary and always followed by measures to restore the green cover. This approach not only preserves the ecological integrity of an area but also emphasizes the intrinsic value of trees in urban planning, development, and overall environmental health.

4.4 Approach to groups of trees

4.4.1 The majority of the assessed values are derived from canopy coverage rather than the count of stems. Thus, valuations should prioritize the extent of canopy loss over the mere number of trees being removed, especially in activities like thinning.

4.5 Best practices

4.5.1 Recognizing the multifaceted nature of amenity trees, the tree value calculation process underscores the importance of a holistic approach, requesting application of variety of approaches.

4.5.2 **Interdisciplinary Collaboration for Sustainable Urban Development**: Foster a robust interdisciplinary collaboration by involving not only urban planners, ecologists, and local communities but also architects, sociologists, economists, and other experts in the valuation process.

4.5.3 **Adaptive Management for Tree Valuation**: Incorporate adaptive management principles into the process of calculating the value of trees within urban environments. Recognize that the value of trees is not static, and it evolves over time due to changing environmental conditions, urban development, and societal needs.

4.5.4 **Community Engagement and Empowerment:** Go beyond simply involving local communities and empower them as essential stakeholders in the valuation process. This can be achieved through participatory decision-making processes, educational initiatives, and community-driven projects that align with ecological goals.

4.5.5 **Data-Driven Approaches:** Leverage technology and data analytics to facilitate collaboration among different disciplines. Utilize Geographic Information Systems (GIS), remote sensing, and big data analytics to gather and analyse information that informs decision-making, helping urban planners and ecologists work together more effectively.

4.5.6 **Policy Development and Advocacy:** Engage legal experts and policymakers to translate the interdisciplinary insights into actionable policies and regulations. By working together, these stakeholders can create a legal framework that supports sustainable urban development, incentivizes eco-friendly practices, and enforces responsible land use.

4.5.7 **Long-Term Monitoring and Adaptation:** Establish mechanisms for continuous monitoring and adaptive management of urban projects. Ecologists and local communities can play a pivotal role in tracking the ecological impacts of development over time, allowing for adjustments and improvements as needed to maintain the balance between urban growth and environmental preservation.

5 Annex 1 - Tree Rights Declaration

5.1.1 Tree Rights Declaration[5] suggests that every tree should be recognized and assigned a specific value.

5.1.2 Trees are living entities that simultaneously inhabit two environments: the atmosphere and the ground.

5.1.3 Trees utilize roots to absorb water and minerals from the ground and a canopy in the atmosphere to capture carbon dioxide and solar energy.

5.1.4 Due to their dual environment occupation, trees play an essential role in maintaining the planet's ecological balance.

5.1.5 Trees, being sensitive to environmental changes, must be recognized and respected as living beings.

5.1.6 Trees shall not be treated as mere objects. They possess inherent rights to the airspace and underground space necessary for their growth.

5.1.7 Trees are entitled to the preservation of their physical integrity, including their aerial (canopy, trunk) and underground (roots) components.

5.1.8 Any disruption to these components or exposure to harmful substances, such as pesticides, can significantly weaken trees.

5.1.9 Recognizing the longevity of trees, which often surpasses that of humans, they must be respected throughout their entire life cycle.

5.1.10 Trees have the right to grow, reproduce, and experience natural death, irrespective of their location (urban or rural).

5.1.11 Trees shall be recognized as legal entities, subject to laws that also govern human property.

[5] This text is established based on the declaration made in the French National Assembly on 5 April 2019. It aims to provide guidelines on the rights, respect, and protection of trees in various environments.

6 Annex 2 - Axiology

6.1.1 Axiology, derived from the Greek word "axios" (meaning worthy), is a modern philosophical discipline that delves into the evaluation and understanding of values.

6.1.2 Human beings, unlike mere observers, are constantly evaluating and making choices, distinguishing between what's good and bad, better, or worse.

6.1.3 Every living being, to the extent of its ability to influence its fate, must make choices based on evaluations (e.g., seeking food, avoiding danger).

6.1.4 Sensory tools primarily serve living organisms, including humans, for practical purposes, ensuring survival through choices and evaluations.

6.1.5 Only humans can abstain from evaluations and strive for theoretical knowledge, as seen in scientific endeavours.

6.1.6 The concept of evaluation, especially in an economic context, was further developed by theorists like Adam Smith and Jean-Baptiste Say, examining human preferences, trade-offs, and value attributions.

6.1.7 Money serves as a universal medium for economic valuation. However, humans frequently make choices in contexts where monetary value isn't the primary metric.

7 Annex 3 – Case studies

Following text is intended to consider specific examples of tree forms and respective management situations. Such examples can illuminate the considerable variability of trees, when determining their value.

For context, the reference point for all tree evaluations should be a park tree that has grown consistently in a single location.

7.1.1 Pollarding

Pollarding is a pruning system in which the upper branches of a tree are removed to promote a dense head of foliage and branches. Pollarding is typically started once a tree reaches a certain height, and then repeated at regular intervals, with new shoots growing from the stubs left after the previous pollarding. This practice has been used for centuries as a way to produce small-sized timber, firewood, or fodder for livestock. Over time, regularly pollarded trees develop a distinctive, gnarled appearance with thickened trunks and a crown of dense branches and foliage.

- Maintenance expenses rise due to frequent pruning.
- The harvested items can offer advantages.
- Hardly replaceable (based on age and size).
- Enhanced biodiversity value, related to age and size.
- Reduced crown size may lead to a diminished ecological benefit value.

7.1.2 Shaped trees (topiary)

Shaped trees, commonly referred to as topiary, involve the horticultural practice of training and pruning perennial plants by clipping the foliage and twigs of trees, shrubs, and subshrubs to develop and maintain clearly defined shapes, whether geometric or fanciful.

- Maintenance expenses rise due to frequent trimming.
- Elevated replacement cost due to premium prices at nurseries.
- No direct influence the biodiversity value, depended on the tree's location and size.
- Reduced canopy size but with a denser Leaf Area Index (LAI).

7.1.3 Veteranisation

Veteranisation of trees refers to the deliberate process of accelerating or introducing features of veteran or ancient trees on younger trees. The objective of this practice is to create or enhance habitats quickly rather than waiting for natural processes to take decades or even centuries. Veteran trees, by nature, have unique ecological and aesthetic values because they provide specialized habitats for various fauna and flora, especially certain rare and endangered species.

- Goal is to increase biodiversity value, which may have potential impact on other values.

7.1.4 Thinning of canopies

When a tree is removed from a group, the impact or loss in value is likely less significant than the removal of a standalone tree of the same size or species. This is because trees within a group often share and distribute their ecological and aesthetic contributions collectively. The absence of one tree in such a setting might be compensated for by the presence of its neighbours.

7.1.5 Specific forms of veteran/ancient trees

In this scenario, we refer to the diverse shapes that trees take on during advanced stages of ontogenetic development. At this stage, trees begin to exhibit distinct features, such as separated functional units, layered branches or stems, and what's known as fenix regeneration. For those without specialized knowledge, identifying these forms can be challenging. Determining the value of such trees requires a comprehensive, holistic approach in every instance.

- Typically, these trees exhibit exceptionally high biodiversity and can also possess significant cultural value.
- Based on the location, there may be increased management expenses due to site maintenance, inspections, and other factors.
- Essentially, the replacement of older trees is not feasible due to their unique characteristics and age.

7.1.6 Stabilised trees

Stabilized trees refer to trees that have undergone specific interventions to enhance their structural integrity and stability. This includes:

1. Upper Crown Reductions: This is a pruning technique where the top or outer canopy of a tree is reduced to decrease leverage on the tree's structure, potentially reducing the risk of branch or stem failure. By doing so, the tree's overall height may be reduced to a more manageable and stable size, especially if the tree has been previously compromised.

2. Installed Cabling/Bracing: Cables and braces are hardware systems installed in trees to provide supplemental support to branches or trunks that may be structurally weak or compromised.

Stabilized trees, therefore, are those that have been modified or supported using these techniques to ensure their longevity, safety, and health.

- Elevated maintenance expenses due to frequent inspection cycles, monitoring, and potential replacement of cabling/bracing.
- Determining the replacement cost can be a very complex task.
- Likely reduced canopy size.
- Possible reduced disservices, such as a decreased likelihood of breakage or collapse.
- Aesthetics might be compromised to some degree.

7.1.7 Special plantings

Special plantings of trees refer to specific and often advanced techniques and setups used to plant trees in environments where traditional planting might be challenging or where there's a need to address specific issues, like urban environments with limited soil volume or potential for soil compaction. Examples of such solutions are soil cells and bunkers:

1. Soil Cells: Modular systems made of rigid plastic or other materials, designed to support surface loads (like sidewalks or roads) while providing uncompacted soil volume for tree roots beneath the surface. By using soil cells, urban trees can have access to a larger volume of soil, promoting healthier growth in an environment that would otherwise be hostile to large tree growth due to soil compaction and limited space.

2. Bunkers: In the context of tree planting, "bunkers" refer to specialized pits or containers that are designed to protect tree roots from adverse conditions, such as poor drainage, heavy compaction or potential contamination. They could also be structures meant to prevent tree roots from interfering with nearby infrastructure, such as sidewalks or building foundations.

These special plantings are essential tools in the modern arborist's and urban planner's toolkit, allowing for the integration of healthy trees into challenging or non-traditional environments. They help in ensuring that trees get the necessary nutrients, water, and root space to thrive even in urban or constrained settings.

- The cost of replacement largely depends on the specific type of special measure employed, generally being on the higher side.
- These measures are often difficult to identify visually. It is necessary to consult the tree owner and/or the described history of the tree in question (tree management system).

7.1.8 Crown lifting (traffic)

Crown lifting, also known as crown raising, is a tree management practice that involves the removal of the lower branches of a tree's crown to increase the clearance between the ground and the lower canopy. When used along roads, the primary objective of crown lifting is to ensure that traffic, including vehicles and pedestrians, can pass beneath the tree without obstruction.

- Elevated maintenance expenses.
- Increased replacement cost value.
- Typically reduced canopy size.
- Fewer disservices, such as eliminating traffic interference.

7.1.9 Deadwood in tree crowns/dead trees

Deadwood refers to the parts of a tree, such as branches or sections of the trunk, that have died but remain attached to or within the tree. Deadwood in tree crowns can be a result of natural aging, disease, environmental stress, or damage.

- Maintenance expenses vary based on the site.
- Deadwood serves as a crucial habitat for diverse species like birds, insects, fungi, and lichens, all of which contribute significantly to ecosystem health and nutrient circulation.
- As a disservice, dead branches in tree canopies can be hazardous, especially in populated areas, due to the potential of falling and causing harm to individuals or property.

7.1.10 Transplanted large trees

Transplanted large trees refer to mature trees that have been moved from their original growing location to a new site. Transplanting is typically done for a variety of reasons such as landscape design, construction needs, or conservation efforts.

- Property value comprises the inherent value of a standard tree plus the additional expenses associated with transplantation.
- It's often challenging to identify visually. It is necessary to consult the tree owner and/or the described history of the tree in question (tree management system).

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