


# Importance, Tools, and Challenges of Protecting Trees

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**Abstract:** Trees are the most important landscape architects of our planet, not only in forests but also in countless other ecosystems, including human-fabricated habitats. Due to their significance in the majority of terrestrial ecosystems, trees play an important role in maintaining biodiversity and providing food and habitat for countless microorganisms, fungi, climbers, invertebrates, and vertebrates. Trees are also indispensable for the development of human societies and are important for our survival today and in the future. Trees therefore have an inestimable scientific, economic, social, cultural, and aesthetic value. In addition, they were and are playing an essential role in myths, rituals, and cultures of nearly all indigenous and modern societies. Despite these facts, the protection of trees is insufficient, both globally due to climate change and deforestation, but also locally, for example in the big cities through deterioration of soils or improper care. In industrialized countries, only recently has the need for targeted protection efforts for tree species or even for individual trees been recognized. Our review starts with the differentiation and definitions of forests and trees. Furthermore, we present the main categories and subcategories of trees, each of them possessing different functions in their ecosystems and for human societies and thus needing specific legal protection measures. The second part of our review presents the most important tools for improving the protection of trees. On the one hand, there exist a series of international initiatives, conventions, and agreements, and on the other hand, there are numerous legal tools, such as red lists, lists of protected species, and legislation for the protection of monument and habitat trees. The main challenge of the 21st century is to find a solution to make the development and growth of modern human societies compatible with the protection of natural resources such as forests. The large number of tree species, as well as the large proportion of threatened tree species, makes this problem even larger. Finally, the most recent and controversial approach of attributing trees the rights as legal persons is discussed.

**Keywords:** biodiversity loss; conservation priorities; exploitation of nature; forestry; monument trees; red lists; trees as legal persons; trees outside forests (TOFs)



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## 1. Introduction

There are only a few groups of plants that exert a similar charisma and influence on humans as trees, be it because of their utility, scientific value, beauty, longevity, or because of their dimensions [1]. However, especially regarding conservation efforts, trees, and more generally plants, do not have an easy life. Many international organizations use as their flagship species and subjects for their logos mostly colorful and impressive animals such as toucans, tigers, pandas, and tree frogs. This bias is part of a phenomenon known as *plant blindness* [2]. It is astonishing since plants, especially trees and other woody species, are the backbone of life on Earth [3]. Since their origin nearly 400 million years ago [4,5], trees have changed not only the appearance but also the dynamics of terrestrial habitats [6,7]. Trees are the most important landscape architects of our planet, not only in forests but also

in countless other habitats, from savannahs and semideserts to boreal taiga [1]. Recent estimations show that approximately 45% of vascular plants are woody species [8]. Moreover, the number of tree species worldwide is estimated to be between 60,000 [9] and 73,000 [10]. Additionally, among all 453 described vascular plant families, 191 are entirely woody (42%) [1]; thus, trees and other woody plants constitute more than 70% of the total biomass on Earth [8,11]. Due to this importance and domination of most terrestrial ecosystems, trees play an important role in maintaining biodiversity, providing food and habitat for countless microorganisms, fungi, climbers, invertebrates, and vertebrates [12–14]. Furthermore, trees were also indispensable for the development of our own species and are important for our survival today and in the future [9]. Billions of people depend on trees and shrubs for fuel, medicine, food, tools, fodder for livestock, shade, watershed maintenance, and climate regulation [9]. Trees therefore have an inestimable scientific, economic, social, cultural, and aesthetic value [1,15–18].

However, the protection of trees is insufficient, both globally [3,19] and locally [20]. This is rather surprising, knowing that in the past millennia, trees were playing an essential role in the myths, rituals, and culture of nearly all ancient cultures and are still important in many indigenous societies. The most famous examples of veneration and protection of trees are known from ancient Indo-European societies (e.g., [21–23]) and from the Aboriginal traditions in Australia [24]. In industrialized countries, only recently has the need for targeted protection efforts for individual tree species [1,25] or even for individual trees been recognized [26–29]. Moreover, the importance and value of trees is now recognized as an essential element of wellbeing and psychological development in modern and highly urbanized human communities [30,31].

## 2. Tree Versus Forest: Definitions and Typology

In the law and in the literature, the forest is more often mentioned than the tree itself. Historically, policymakers, local and national administrations, and lawyers have concentrated almost exclusively on forests, and only recently have individual trees attracted greater attention [32,33]. For further discussion, although trees and forests are intrinsically linked, it is necessary to distinguish these two objects and to examine their definitions [26,27].

There is no universally accepted definition of a tree. The main characteristic that separates this life form from other plants is a woody stem or trunk, unbranched from the base, that lives for many years [27]. The Global Tree Assessment [34] uses the following definition: a tree is “a woody plant usually with a single stem growing to a height of at least two meters, or if multitemmed, then at least one vertical stem five centimeters in diameter at breast height” [3]. Similarly, there are many definitions of a forest or a wooded area. The Food and Agriculture Organization of the United Nations provides the following definition: a forest is a “land spanning more than 0.5 hectares with trees higher than 5 m and a canopy cover of more than 10%, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use” [35]. However, in some countries, the thresholds for the definition of forest cover can be lower than 10% (e.g., in Iran) or much higher (e.g., in Costa Rica: 75%) [32]. Moreover, in many countries, forest is defined by principal land use and refers to all areas covered by natural and cultivated forests, including treeless land that may be reforested. Finally, in some countries, the given area is defined as forest by law (e.g., in Gabon) and not by its structure or function [32].

Both forests and individual trees possess three major functions for the environment as well as for human societies (Figure 1): (1) ecological, (2) economic, and (3) social functions [27]. Generally, the individual tree presents stronger economic and social functions, whereas the forest is centered on ecological and economic functions. Due to their importance, forested areas already possess well-developed legal protection in most countries. An example can be seen in the Federal Forest Law in Germany [36] and the Forest Law of the People’s Republic of China [37]. In many countries, such forest protection laws are very old. This is, for example, the case in Switzerland. The Forests Inspectorate Act launched in 1876, placed Swiss forests under strict protection and laid down the principles of sustainable

management for the first time. The Act was a reaction to various flooding disasters in the 19th century, resulting from the massive overexploitation of the forests [38]. The protection of individual trees or groups of trees outside forests is, in contrast, much more recent and needs more conceptual and legal considerations, depending on the classification of different categories of trees [32]. The following categories of trees can be differentiated (Figure 1), each of them possessing different functions and thus needing specific legal protection measures [26,27,32,39]:



**Figure 1.** Genus *Zelkova* (Ulmaceae): example of diverse typology of trees within one genus with different functions and protection levels. (A) Forest tree of *Z. carpinifolia* growing in the strictly protected Ajameti National Reserve (Georgia). (B) Urban trees of *Z. serrata* growing in Hibiya Park protected by the municipality of Tokyo (Japan). (C) Rural trees of *Z. carpinifolia* growing on a private pasture next to Vani village (Georgia). (D) Roadside trees of *Z. carpinifolia* protected by the national road administration (Ianeti, Georgia). (E) “Rackham tree”: monument tree of *Z. abelicea*, dedicated to the famous geographer and expert of Cretan landscape, Oliver Rackham (1939–2015), protected by the local municipality (Crete, Greece). (F) Habitat tree of *Z. abelicea* (Crete, Greece). Pictures: E. Kozłowski (B) and G. Kozłowski (A,C–F).

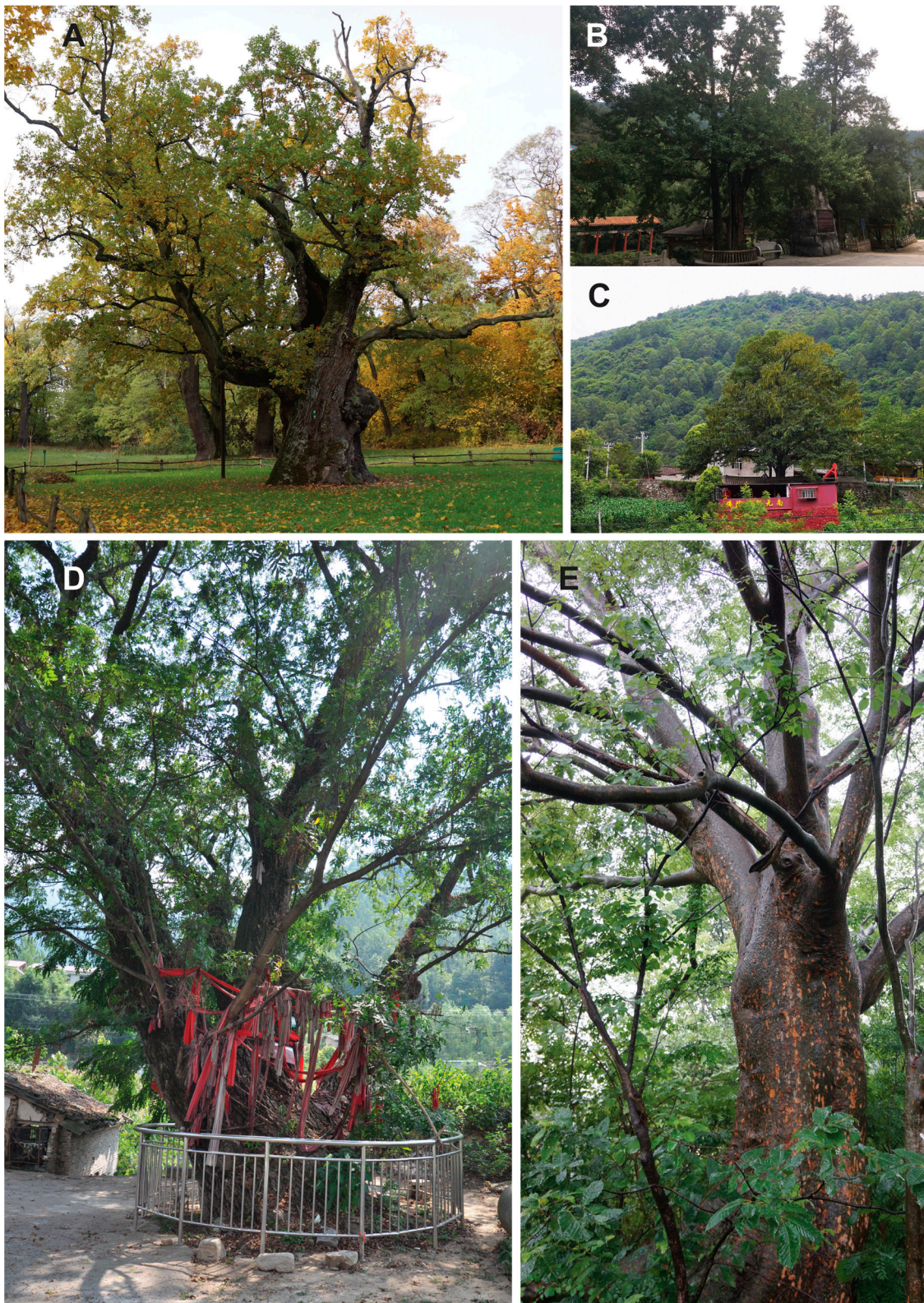


- A. Forest trees (Figures 1A and 2C): These are multifunctional trees located in a forest and form an ecosystem with other plants and organisms. They have a triple ecological, economic, and social function. The protection of these trees is directly linked with the forestry law of a provided country or an administrative unit (e.g., governmental administration, ministry of environment, national park administration, etc.) [32,38].
- B. Trees outside forests (TOF): This term, coined in the 1990s, encompasses all trees that are not growing in a forested area [32]. They are often overlooked and undervalued, and they are not regularly included in local or national inventories and laws [40]. The following subcategories of TOF can be differentiated [27]:
  - B.1. Urban trees (Figure 1B): They are distinguished from forest trees on the one hand because of their geographic location but also because of their tendency to monofunctionalism. In other words, they are trees with a monofunctional tendency located in the city or its periphery, planted or preserved as a result of a human decision with a social or an ecological aim (e.g., embellishment of cities, urban orchards, and fight against temperature rise and pollution). The protection of these trees has gained more attention in recent decades and is largely organized by territorial planning (municipal council, administrations of cities, etc.) [41,42].
  - B.2. Rural trees (Figures 1C and 2A): Trees growing in a rural landscape. They are isolated trees or groups of trees located in agricultural areas and whose existence is linked to a human decision, exploited for the various products that can be obtained. However, unexploited isolated trees or tree groups that grow spontaneously and possess various ecological and social functions also belong to this category, e.g., hedges and landscape elements [43].
  - B.3. Road trees (Figure 1D): Roadside trees, often forming road alleys, are multifunctional features usually planted to mark roads and paths. They possess various ecological (e.g., pollution control and corridors connecting habitats) and social functions (e.g., road layout, landscape elements, and educational value) [44,45]. Since multiple road authorities claim that tree-lined routes pose a threat to traffic safety, they are often a cause of conflict between the safety of humans and biodiversity protection [46].
- C. Monument trees (Figures 1E and 3): This category transcends the four categories and subcategories listed above, in the sense that forest, urban, rural, or road trees can be classified as so-called landmarked, heritage, veteran, holy, or monument trees. Their protection is in certain countries and societies very ancient and has often been embodied in the law of environmental protection and nature conservation [47–49]. Each country possesses its own denomination and criteria in selecting such trees (e.g., in Germany “denkmalgeschützte Bäume”, in Poland “drzewa pomnikowe” and in France “arbre remarquables”). One of the criteria can be the rarity, endemism, or conservation status of a provided tree species. More often, however, monument trees are selected due to their dimension, age, or spiritual value [20,29,31,50–53]. This category also encompasses small groups of old trees or preserved small patches of forest, such as sacred groves, remnants of ancient traditions and pagan religions in Europe [23], or *fengshui* woods in China (Figure 3E) [54,55].
- D. Habitat trees (Figures 1F and 2B): This category also transcends the categories and subcategories listed above. A habitat tree is a living or dead standing tree that bears at least one microhabitat [39]. Tree-related microhabitats (abbreviated as TreMs) are very small-scale or specially delimited habitats supported by the individual tree. Thousands of different, sometimes highly specialized, animal, plant, lichen, and fungal species depend for at least part of their life cycle on these structures [14,56]. Although the concept of habitat trees was developed nearly 200 years ago [49], this category has only recently been officially recognized in several European countries and is an object of national or local laws and regulations (e.g., in Germany, Switzerland, France, etc.) [39].



**Figure 2.** Genus *Acer* (Sapindaceae): example of diverse typology of trees within one genus with different functions and protection levels. (A) Rural tree of *A. pseudoplatanus* growing in a private pasture (Ziebegg, Fribourg, Switzerland). (B) The same individual is an important habitat tree. (C) Forest tree of *A. velutinum* growing in a protected area within the Hyrcanian National Park (Azerbaijan). The tree has at the same time the status of a monumental and habitat tree and is surveyed and protected by the local authorities. Pictures: G. Kozłowski.





**Figure 3.** Examples of monument trees, sacred trees, and protected small tree groups. (A) Monument tree called “Rus”, ca. 800-year-old *Quercus robur* (Fagaceae) in Rogalin (Poland). (B) Protected old trees of *Ginkgo biloba* (Ginkgoaceae) in Yin-Shu-Gou (Henan, China). (C) Sacred tree of *Pterocarya macroptera* (Juglandaceae) in Moxi (Sichuan, China). (D) Sacred tree of *Pterocarya stenoptera* (Juglandaceae) in Dong-Jia-Ba (Shaanxi, China). (E) Old *Zelkova sinica* (Ulmaceae) growing in a protected *fengshui* wood in Gu-Tan-Gou (Henan, China). Pictures: E. Kozłowski (A), G. Kozłowski (B,E), and Yi-Gang Song (C,D).



### 3. Tools and Initiatives for the Protection of Trees

#### 3.1. International Initiatives

One of the leading initiatives worldwide is the Global Trees Campaign [57]. It was established in 1999 by Fauna & Flora International [58] and the Botanic Gardens Conservation International [59]. To date, action plans, scientific exploration, and conservation measures for over 400 tree species have been developed and implemented [3]. Additionally, the GTC launched numerous national conservation programs and, more recently, Global Conservation Consortia for eight priority tree genera or taxonomic groups: *Acer*, cycads, dipterocarps, *Erica*, *Magnolia*, *Nothofagus*, oaks, and *Rhododendron* [60]. The main aim of the consortia is to mobilize a coordinated network of institutions and experts to develop and implement conservation strategies. Furthermore, the IUCN Species Survival Commission (SSC [61]) established the Global Tree Specialist Group (GTSG [62]), a global network of experts working in their own regions and institutions for the conservation of globally threatened tree species. The GTSG has over 140 members from botanic gardens, herbaria, universities, and both governmental and nongovernmental organizations worldwide [3]. Additionally, numerous smaller initiatives exist dedicated to the research and conservation of selected tree genera or families, for example, the networks *Zelkova* and *Pterocarya* [63] of the Botanical Garden of the University of Fribourg in Switzerland and of the Shanghai Chenshan Botanical Garden in China [16,17]. These two interdisciplinary and international initiatives focus their research, conservation, and outreach activities on threatened woody species, with special attention to relict trees, mainly from the families of Ulmaceae, Fagaceae, Pinaceae, and Juglandaceae (e.g., [1,18,64–69]).

#### 3.2. International Conventions and Agreements

The most significant global convention providing a broad framework for the conservation of all components of biodiversity, and thus also trees, was the Convention on Biological Diversity (CBD, [70]). The convention was opened for signature at the Earth Summit in Rio de Janeiro in June 1992 and entered into force in December 1993. It contains 196 signatory countries today. Various programs and strategies developed in the framework of the CBD are beneficial for tree conservation; for example, the Forestry Program, Protected Area Program, Sustainable Use Program, and the Global Strategy for Plant Conservation (GSPC, [70]). Another important global agreement is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, [71]), which came into force in 1975. The aim of this convention is sustainable management and trade in threatened species. Over 560 tree species are currently included in the Appendices, encompassing some of the most threatened timber and trees traded for their medicinal or other valuable properties. Very prominent examples are members of the genera *Dalbergia* (rosewood, Fabaceae) and *Aquilaria* (agarwood, Thymelaeaceae) but also less-known trees such as *Oreomunnea pterocarpa* (Juglandaceae) and *Pinus koraiensis* (Pinaceae) [17,72].

#### 3.3. Red Lists

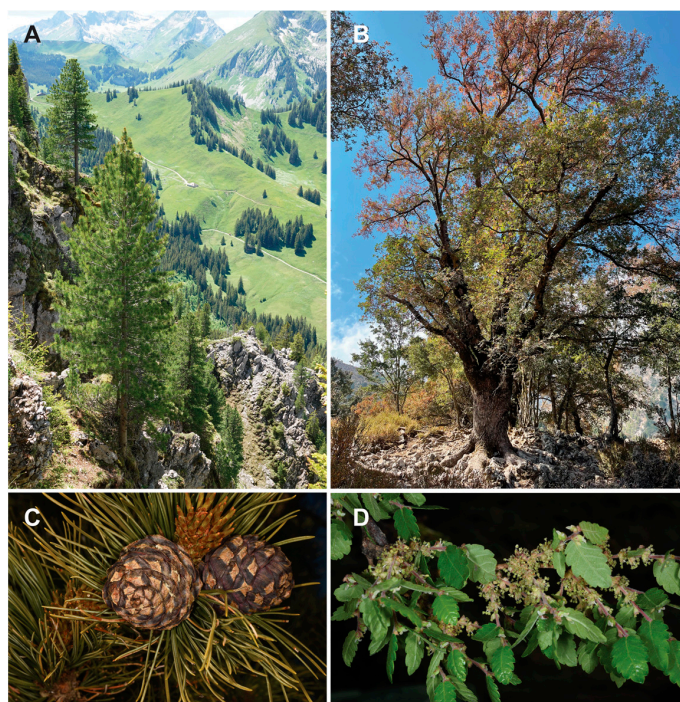
Red lists are comprehensive inventories of the conservation status of species. The tool was developed by the International Union for Conservation of Nature (IUCN, [73]) and was founded in 1964. The global red list using a set of precise criteria to evaluate the extinction risk of thousands of taxa is named the Red List of Threatened Species, or simply IUCN Red List [74]. Since then, the methodology and criteria of the IUCN have been universally accepted and used by many countries and administrative units for their own local red lists. In numerous countries, red lists are today the main tool for priority setting and for the development of national conservation programs [75]. This is, for example, the case in Switzerland [76] at national but also at lower administrative levels (e.g., red list of vascular plants of the Swiss canton of Geneva, [77]). This provides an opportunity to protect locally threatened species that are not threatened on a larger geographic scale. For example, *Sorbus domestica* (Rosaceae) is not threatened at the continental level in Europe (category least concern (LC) [78]) but is endangered (category EN) in Switzerland [76]. Rare are cases

where trees such as *Ulmus glabra* (Ulmaceae) are threatened globally (category vulnerable (VU)) but were assessed locally as not threatened (category LC in Switzerland).

Worldwide, as mentioned above, the number of tree species is estimated to be between 60,000 [9] and 73,000 [10]. The Botanic Gardens Conservation International (BGCI), supported by the Global Tree Specialist Group (GTSG) and the International Union for Conservation of Nature (IUCN), launched an ambitious project called Global Tree Assessment (GTA, [34]) a few years ago to assess the IUCN conservation status of all known tree species on Earth. The project was achieved in 2021 and published in a detailed report entitled *State of the World's Trees* [3]. According to the authors, 30% of all trees are threatened with extinction, and at least 142 trees are already extinct. However, for more than 20% (ca. 13,000 spp.) of all tree species, the IUCN assessment was not possible due to incomplete or inexistent knowledge of their distribution or threats. New approaches are necessary to assess the remaining and poorly known tree species [79]. Another solution is to concentrate the available resources on selected taxonomic groups and/or regions with a high diversity of trees. This approach resulted, for example, in red lists with all species of the entire tree genera *Acer* (Sapindaceae), *Quercus* (Fagaceae), and *Zelkova* (Ulmaceae) [16,80,81]; tree families such as Betulaceae [82]; and exhaustive red lists of trees of a country, for example Madagascar [83] and Guatemala [84].

### 3.4. Lists of Protected Species

At a larger geographic scale, for example in Europe, there are several legislations, laws and agreements listing strictly protected species. An example is The Convention on the Conservation of European Wildlife and Natural Heritage (also known as the Bern Convention), which is a binding legal instrument for all signatory European and some African countries [85]. However, in Appendix I (strictly protected flora species) there are only a dozen trees and shrubs, mainly endemic to Mediterranean islands, such as *Abies nebrodensis* (Pinaceae), *Phoenix theophrasti* (Arecaceae), and *Zelkova abelicea* (Ulmaceae, Figure 4B,D).



**Figure 4.** Examples of legally protected and red-listed tree species. (A) *Pinus cembra* (Pinaceae). The tree is placed on the list of protected species of the Swiss canton of Fribourg [65,86]. (B) *Zelkova abelicea* (Ulmaceae) is protected both nationally by Presidential Decree 67/81 [16,85] and internationally [64,74,85,87,88]. (C) Cones of *P. cembra*. (D) Flowers of *Z. abelicea*. Pictures: E. Kozłowski (A,C,D) and G. Kozłowski (B).



Furthermore, the European Union in its Council Directive 92/43/EEC from 1992 [89] enumerates protected plants, providing nearly the same strictly protected woody species as in the Bern Convention. Additionally, nearly all countries possess their own laws enumerating integrally or partially protected plant, animal, and/or fungal species. China, for example, one of the most plant-rich countries in the world, published the first version of the List of National Key Protected Wild Plants (LNKPWP) in 1999. The Chinese government updated the LNKPWP in 2021 and strengthened the protection law to better regulate uncontrolled plant utilization and to raise public awareness [90,91]. In Switzerland, the list of protected species is provided in the Ordinance on the Protection of Nature and Cultural Heritage (NCHO) from the year 1991 (last adaptation in 2017, [92]). However, in the 133 protected plants, there are very few protected trees and woody species at the federal level (e.g., *Sorbus domestica*, *Daphne alpina*, and *D. cneorum*). Additionally, each Swiss canton possesses laws protecting its own fauna and flora. For example, the cantons of Fribourg (*Arrêté* from 1973, [84]) and Neuchâtel (*Arrêté* from 1965, [93]) legally protect several additional tree and shrub species at the local level, e.g., *Pinus cembra* (Figure 4A,C), *P. mugo*, all *Salix* species and *Corylus avellana*. These lists, however, are very often based on the attractiveness of a given species or local traditional uses of trees rather than on effective threats or biogeographic criteria. For this reason, many countries and regional administrations are currently using the red lists and their criteria rather than the lists of legally protected plants for the elaboration of conservation priority lists and action plans.

### 3.5. Monument Trees

Old and large trees have been venerated and protected since the very beginning of human civilization. However, only recently has the protection of remarkable individual trees been integrated into national legislation. One of the most important triggers of monument tree conservation was the United Nations Conference on the Environment held in 1972 in Paris and the resulting World Heritage Convention [94]. The aim of the convention was the protection of precious objects both of culture (cultural heritage) and nature (natural heritage) [49]. The trees compose part of category III (natural monuments). Consequently, the protection of ancient, monument, or habitat trees and small tree groups is currently integrated into the laws and legal regulations of the majority of countries [47]. In Poland, for example, the official integration of natural monuments and monument trees into the nature protection law was made in 1949 (last adaptation in 2004, [95]). In 2009, more than 35,800 natural monuments were registered in Poland, the overwhelming majority of which were isolated trees (Figure 3A) but also groups of trees and alleys [96]. Similarly, in Germany, the monument trees are legally protected based on the 28th article of the federal nature protection law from 1976 [97], and in Czechia, monument trees are protected based on the 46th article of the nature and landscape conservation law from 1992 [98]. In China, the legal protection of monument trees started in 2001 [99], and the legislation policy was reinforced in 2016.

### 3.6. Trees as Legal Persons

The idea of a non-human entity existing as a legal person owes its genesis to the influential work of Christopher D. Stone entitled *Should Trees Have Standing?* [100]. In all modern law systems, only a person can bring a case to court. Stone argued that trees “should be allowed to file lawsuits and to enjoy legal rights that can be enforced through law”. Until recently, law has taken very little notice of non-human entities. They are treated as objects or as property [101]. Margaret Davies, in her publication entitled *The Consciousness of Trees* [102], asks an important question: “what becomes of our concepts of law and property when tree is understood as being a subject, rather than as an object?”. What Stone himself described as “frightening” recently became reality. In March 2014, the Te Urevera area (previously a national park) was declared a legal entity, and in 2017, the Whanganui River (both in New Zealand) was granted the status of a legal person [103]. More recently, in 2019, Lake of Erie in North America also gained legal personhood [104]. Supporters of this

new approach argue that current legal frameworks have failed to prevent the degradation of nature and that treating species and living organisms such as people rather than property is the best solution. However, assigning rights to nature, and more specifically to trees, would require the development of new rational and legal frameworks [101].

#### 4. Challenges of Tree Protection

##### 4.1. Large Number of Tree Species

Two shortfalls need to be resolved in the next few decades for trees: the Linnean shortfall and the Wallacean shortfall [105]. Recent studies show that there are approximately 60,000 known tree species worldwide [1,84]. However, nearly 10,000 tree species are probably waiting to be discovered and described [10]. The Linnean shortfall refers to such extremely limited knowledge of the overall diversity on our planet and the total number of species [106]. Even in very well-studied regions and in relatively well-known groups such as trees, the Linnean shortfall is an important deficiency [107]. Rather, the general tendency at universities is to weaken the support of taxonomic studies. This recent negligence of taxonomy is inexplicable and stands in direct contradiction to the international biodiversity agreements mentioned above. The Wallacean shortfall, as it was named by Lomolino and Heaney [108], refers to our inadequate knowledge of the global, regional, and even local distribution of a provided taxon. The two shortfalls are typical for species-rich organismic groups [105]. The elaboration of efficient protection measures for all trees is only possible by improving taxonomic and biogeographic knowledge.

##### 4.2. Large Number of Threatened Tree Species

Worldwide, there are more than 17,500 tree species threatened with extinction, and approximately 4000 more are possibly threatened [3]. Recent studies have shown that these numbers are underestimated [79]. Additionally, due to accelerated global land use and climate change, the number of threatened species will even increase in the near future. Confronted with these large numbers of threatened species, many more resources must be allocated, both globally and locally, to improve conservation planning, the in situ and ex situ conservation of trees and the capacity building of large members of the public, politicians, and lawyers. New approaches in the legal protection of trees and new international and legally binding conventions must be developed.

##### 4.3. Protection of Forest Trees

The main challenge of the 21<sup>st</sup> century is to find a solution on how to make compatible the development and growth of modern human societies with the protection (or at least with the sustainable use) of natural resources such as forests. Today, more than 40% of forest trees are threatened by habitat loss (mainly for agricultural use), and nearly 30% of forest tree species are threatened by exploitation (mainly for timber by logging) [3]. Legal forest protection in existing protected areas such as national parks and nature reserves must be strictly applied and controlled, both internationally and locally. Additionally, new and large protected forest areas must be selected and established.

##### 4.4. Protection of Trees Outside Forests

There is a strong need to internationally unify and strengthen legislation for the protection of individual trees and small groups of trees growing outside of forested areas. At the moment, each country and even each local administrative unit (such as municipality or country province) are using different denominations and typologies of trees, different criteria in choosing trees meriting protection, and thus finally different laws [47]. Additionally, new rational and legal frameworks must be developed (e.g., taking into consideration the replacement value or ecosystem service value) in order to improve the efficiency of tree protection. For particularly valuable trees (or tree groups), such as monument, veteran, or habitat trees, assigning special rights should be taken into consideration (e.g., giving the status of a legal person).



## 5. Conclusions

Trees are among the most important organisms that shape the Earth's biosphere. They are not only the backbone of global biodiversity but also vital for the long-term flourishing of human civilization. Not only their number but also their diversity, particularly their genetic diversity, is of high importance [109,110], an issue which was not discussed since it exceeds the scope of the present review. It is all the more surprising that the protection of trees is insufficient. Trees can be divided into two main categories: forest trees and trees outside forest (TOF). The protection and laws for forest trees are better regulated nationally and internationally than for individual trees or groups of trees growing in cities, rural landscapes, or along roads. Since the middle of the 20th century, numerous international conventions, agreements, and initiatives have been trying to protect biodiversity (and thus also trees and forests). Among the most important conventions besides the Convention on Biological Diversity (CBD) are the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the UNESCO World Heritage Convention (WHC). Moreover, the Global Trees Campaign (GTC) and Global Conservation Consortia (GCC) for selected tree species and families, are examples of the most important international initiatives that focus on trees. In contrast, there is a lack of coordinated international agreements, laws, and norms to efficiently protect the trees outside of forests. Faced with an unprecedented loss of biodiversity, alternative and more radical means should be considered. For example, the attribution to particularly valuable and irreplaceable trees and groups of trees a legal person status.

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