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PRESERVATION OF MONUMENTAL TREES AS A CULTURAL AND ENVIRONMENTAL HERITAGE

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Abstract. *Since long time, ancient and special individual trees have been recognized by humans as part of their history as well as natural monument to be respected and preserved, nevertheless the development of intensive agriculture and urbanization caused the lost of large part of this heritage. The value of the "monumental", "ancient" or "veteran tree" is now commonly accepted everywhere, and systematic recognitions and recording, studies and protection initiatives are increasing more and more everywhere. This paper gives an overview about the current approaches for the preservation of monumental trees, referring to the main implemented programs & projects, organizations or governmental bodies, selection criteria, recording systems, data base and national laws promulgated to protect the ancient tree. Monumental trees as a card of the landscape-cultural mosaic is discussed.*

Keywords: *veteran tree; ancient tree; natural heritage; legislation; management; preservation; biodiversity*

Introduction

The "Monumental Trees", among the biggest organisms on the Earth, are individuals or belongs to a group of individuals with a special cultural, landscape or nature conservation value because of its great age, legends, size, environmental contest or historical significance. They may occur in different situations, but more commonly in human settlements (e.g. private urban park), woodland or protected natural areas. Our ancestors valued these trees both as an element of subsistence and as an object of religious or social interest, but now in our more urban society only few individual trees "have become tourist attractions because of their historical connections, but most are forgotten and neglected. Many more have already been lost, felled to make room for development, intensive agriculture and forestry, or for safety reasons" (Davis et al., 2000). However, "population of large old trees are rapidly declining in many parts of the world, with serious implication for ecosystem integrity and biodiversity" (Lindenmayer et al., 2012). It is evident and urgent to develop measures, both technical and legal, to recognized and preserved the monumental trees as parts of our cultural heritage, as indicators of past land management and for their ecological value. "Ancient and other veteran trees are a vital and treasured part of our history, and our natural and cultural landscape" (Ancient Tree Forum, *http://www.ancienttreeforum.co.uk* accessed on 15 Sept 2017).

Historic and cultural value of monumental trees

The long life of monumental trees, more than their dimension, inspire respect and represent an historic link between generations and with the events that happened around them. "An ancient tree is evidence of long relationship between humans", a place full of memories and emotions (Cannizzaro et al., 2014). They have not only an aesthetic value, but are also important for their history as well as for cultural and natural aspects. "Trees may be of interest not because of their age but because of their historical significance. They may reflect past land use, be connected with a person or an event or be part of a designed landscape" (*https://vetree.eu/nl/page/98/Veteran+tree+definition*, VETREE page accessed on 27 February 2017). Monumental trees, indeed, easily awaken emotions and are often perceived as important landmarks, for example stimulating childhood memories to individuals or being planted as living memorials of died persons (Blicharska et al., 2014). Heritage trees can be considered the individuals planted on the occasion of an event or by important persons like a king (Dafni, 2006).

In many cities some old trees are considered as important elements of cultural identity that have "crucial inherited and inheritable connotation" and "trans-generational significance" (Jim, 2005). Ancient trees may be used as an important source of information on historic cultural practices to be preserved as a cultural heritage: this is the case, for example, of scars discovered on culturally modified trees resulting from bark-peeling practices and blazes from marking borders in northern Sweden around Sami settlements (Ostlund et al., 2003).

Monumental trees and forest are also linked to myths and legends beyond the rational thinking and proven facts. The novel of Robin Hood and the Sherwood Forest is a well known example of a legend linked to a monumental forest. Cannizzaro et al. (2014) reported the legend of one of the world's oldest monumental tree, the chestnut of the Etna called as 'of hundred horses' which owes its name to the popular narration about the recovery of Princess Giovanna d'Aragona and her hundred escort horsemen suddenly threatened by a violent storm: the tree canopy was enough large for covering all troop of cavaliers!

Big and old trees infuse a sense of mystery and they are associated with particular myths referring to an individual, a single species, or a geographical area. Mythology deal with the capability to discover the secrets of real world and monumental trees offer to humans a living reminder of possible happy or terrible events, often beyond human comprehension. The boundary between myth and religion is often difficult to identify: according to Shinto belief, a god descended to a high pine on volcanic mountain, to exist in a large old tree (Omura, 2017).

Monumental trees and religion

Large and old trees are usually perceived as special entities that awaken imagination and emotions, both positive and negative, and they are treated with reverence in many cultures being protected and secured for religious reasons (Haberman 2013). The deep connection between men and trees is well reported, for example, in the book "Sacred Trees" (Altman, 2000). As reported by Frese & Gray (1995) old trees are the object of rituals of religious nature, and in some cases may be a source of material used in traditional activities or religious ceremonies: "Trees are a form of nature that represent life and the sacred continuity of the spiritual, cosmic, and physical worlds. A tree is often used to symbolize a deity or other sacred beings, or it may stand for what is sacred in general... ". Religious and social meetings took place under the tree: it may commemorate events in the lives of saints, or to be a site where a prophet was buried, for example. A typical sacred tree is large old fig (*Ficus religiosa*), often located in sacred groves of India. Its leaves are utilized in religious ceremonies, while other materials collected from it are used to produce medicines for a whole spectrum of disorders and infections (Singh et al., 2011).
Monumental trees and biodiversity at certain religious sites had been long protected in name of spiritual beliefs, but only 20 years ago the ecological study of sacred places gained real momentum and the expression "sacred natural site" was adopted by the International Union for the Conservation of Nature (IUCN) to identify "areas of land or water having special spiritual significance to peoples and communities" (Wild et al., 2008).

Environmental role of old large tree

It is well known that monumental trees provide various ecological functions in many different environments, and that their on-going decline can have substantial consequences for both biodiversity and the integrity of ecosystems worldwide (Lindenmayer et al. 2012, 2017). Their characteristics, ranging from extensive buttressing to large and numerous cavities, large crowns, large lateral branches or deeply fissured bark, make them the habitat of an incredible number of species, be they microorganisms, plants or animal. For example 42% of the mammals and 28% of the reptiles in south-eastern Australia depends on large old trees (Lindermayer et al., 2017). They have influences on many critical ecosystem processes such as hydrological regimes or nutrient cycles, facilitate ecosystem recovery after fire or overgrazing, maintain biodiversity particularly in critical habitat like a desert. Furthermore, since accumulating biomass they play an important role in maintaining carbon stocks. A quite exhaustive list of the ecological roles played by large and old trees is reported by Lindenmayer & Laurance (table 2, 2017).

Aesthetic and economic value of big and old tree

It is commonly accepted and reported in many studies that the aesthetic value of many parks and the attractiveness of particular areas is directly related to the presence of trees of large dimensions (Blicharska et al., 2014). Single large old trees, tree rows, and tree alleys in urban environments and in the countryside are highly valued by local people and visitors, which generally prefer scenic views with larger fewer stems than views with many small dimension tree stems (Buhyoff et al., 1984). The aesthetic value of monumental trees in the landscape intermingles with emotional perceptions linked to personal sentiments and a "sense of place". In the urban environment the people prefer vegetated areas, especially areas with trees, over areas with no vegetation, where trees of large sizes being highly appreciated: consequently, the presence of old trees often influences property prices. It is also true that the presence of large old trees in urban areas may be perceived negatively since such trees often drop dead branches or are associated with deadwood on the ground, being one of the cause of the elimination of a relevant number of monumental trees.
No many data are available regarding the economic estimation of a monumental trees. A tentative to establish a current economic value for large old trees has been done by Beker & Freeman (2009) through the Contingent Value Method based on the payment card (PC) procedure and survey of both forest visitors as well as a representative sample of the general population. This study values the use and non-use benefits associated with old and ancient trees in Israel, establishing that those trees are used less for active recreation but has an important role in the heritage of the country. An annual value ranging between 2.35 and 19.9 million Euros depending to the old tree project's beneficiaries has been calculated. In addition, monumental trees provide humans with long-term benefits and services that are based on a sustainable utilization of their products (resin, flowers, fruits, nuts, etc.) or part of them (for medicinal purposes, twigs for production of baskets or other tools, etc.). It is also well known, for example, the ancient utilization of these big and old trees for beekeeping. All these benefits can be delivered from individual trees for hundreds of years. Anyway, the most important economic value should be referred to its heritage and ecological role.

Denomination & Classification

This paper adopts mainly the term "monumental tree" since it is comprehensive and largely utilized, but a common definition to indicate these ancient and outstanding trees is actually lacking. Each country generally utilizes its own definition/s. The term "monumental trees" appears in many international websites and data bases. It appears also in the Italian environmental legislation since 1939, within the law no. 1497 on the natural heritage protection (Lisa,

2011). In Spain the definition of "arboles monumentales" is often replaced by "arboles singulares" which is the name of a special working group within the Spanish Society of Forest Sciences (*http://secforestales.org/grupos/arboles-singulares*). The "arbre remarquable" is the definition adopted in France as reported, for an example, in documents and web-site of the Forest National Office-ONF in charge for the forest management (*http://www.onf.fr*). The term "champion tree" appears in the United States, where are also utilized definitions as "old", "ancient" and, in particular, "large old tree" that are used interchangeably on the international scientific literature too.
In Great Britain the definition "veteran tree" is the most used to indicate these old and outstanding trees, but terms as "ancient" and "notable" are also utilized in many contests. Forest Research, the research agency of the Forestry Commission, adopts the term "veteran" and, rarely, "veteran/ancient" (*https://www.forestry.gov.uk/)*. Since the terms "ancient" and "veteran" have been used interchangeably the Ancient Tree Forum-ATF, one of the most active and influent organization on this matter, proposed a more rigorous classification as indicated in the Table 1 (ATF, 2008).

Table 1

Categories of old trees as defined by the Ancient Tree Forum (ATF, 2008)

Tree	Characteristics
Ancient	Great age tree – depending on the species and growing contitions - in comparison with others of the same species; they have three key features: retrenched crown with a low, fat and squat shape; a wide trunk compared with others of the same species; hollowing of the trunk
Veteran	Unlike an ancient trees, can be any age, but they are trees which shows ancient characteristics such as those above that may result from management or natural damage; therefore, ancient trees are all veterans, but not all veterans are ancient
Heritage	Trees connected with specific historic events or people, being part of our history and culture; trees with particular appeal because of their appearance, landscape character or architectural setting, having therefore become well-known landmarks in their local communities; trees valued for their great botanical interest are also considered as "heritage" trees
Champion	The tallest tree, or that has the widest girth, of its kind in a specific area
Notable	A tree significant, at local level only, compared with the trees around it; it is usually mature, but not always

Afterwards a tentative to distinguish plants according these definition has been made by Lonsdale in the preliminary chapter of his book (Lonsdale, 2013), but the conclusion was not definitive: "More precise and universally accepted definitions of ancient and veteran are probably unachievable, since these terms are to some extent subjective. It is, however, possible to state the general principles by which the above list of characteristics has been derived".

The age of trees

In principle all trees grow continuously in their life, but only some individuals achieve a very long age and impressive dimension (over 100 meters). As reported by a reliable US data base, the world's oldest trees are individuals of *Pinus longaeva* species. The most famous of them is *Methuselah* which is growing on the White Mountain of California since 4,845 years ago but recently another Pine growing in the same area has been calculated as 5,067 years old (*http://www.rmtrr.org/oldlist.htm* , OLDLIST data base accessed on 15 February 2017). In Japan the title "yaku sugi" is given to trees over 1,000 years old, and the oldest of these ancient tree is *Jomon sugi*, with an age estimated between 2200 and 7200 years old (*http://www.yesyakushima.com/facts-about-yakushima/yakushima-yakusugi/*). In Europe the yew tree (*Taxus baccata*) growing in a cemetery of North Wales has been estimated to be over 5,000 years old, exceeding the America's pines, but this fact is not universally accepted and needs some qualification. The Fortingall Yew in the churchyard of the village of Fortingall in Scotland has been estimated between 2,000 and 3,000 years old. A Swedish Professor declared in 2008 that the world's oldest known living tree was a Norway spruce (*Picea abies*) discovered in Sweden, the root system of which has been growing for 9,550 years as calculated by radiocarbon measurement (Owen J., 2008). Another very ancient tree is the "Castagno dei 100 cavalli", a chestnut tree growing around the Etna volcano in Sicilia, Italy, that has been estimated between 3,000 and 4,000 years old (data base accessed on 27 February 2018, *https://www.monumentaltrees.com*).
The abovementioned data base OLDLIST reported five types of tree ages recognized for each individual: XD, "crossdated" age through recognized dendrochronological procedures; RC, ring counted derived by simple ring counts and may contain errors in age due to missing or false rings, etc.; EX, "extrapolations" derived by regression from age/size relationships or other mathematical or graphical methods; HI, historic record based on some sort of historic reference to the tree; C14, radiocarbon dated wood samples from a tree.

Programmes and Organizations for Veteran Trees

The main organizations active on studying and protecting the monumental trees are summarized in the Table 1. The "Veteran Trees Initiative", one of the earliest and most active in Europe to preserve the old trees, was launched in 1996 by English Nature, the United Kingdom government agency that promoted the conservation of wildlife, geology and wild places throughout England. The main results of the project were the handbook "Veteran Trees: A guide to good management" (Read, 2000), the "Specialist Survey Method" (Fay et al., 1997) and a series of publications which offer guidance on good practice, a range of demonstration and training workshops at different veteran tree sites.

"Woodland Trust" is the largest woodland conservation charity in UK with over 500,000 members and more than 1,000 sites, covering over 26,000 hectares. American Forests, established more than 140 years ago, is the nation's oldest conservation organization. It is a network of local partners who have deep understanding of the forest, collaborating with federal and state agencies, like the U.S. Forest Service, National Park Service and the U.S. Fish and Wildlife Service, to advance large-scale restoration on public lands. It is the home of the Champion Trees National Register, one of the well known data base. The Rocky Mountain Tree-Ring Research-RMTRR is a nonprofit research organization founded in 1997; it is the home of OLDLIST database. The European Champion Tree Forum - ECTF is an informal organization with more than 100 friends and colleagues representing groups, scientific societies and institutions from Europe, mainly from Ireland, Finland, Romania and Spain.

Table 2

Main organizations and initiatives on monumental trees

Denomination	Website	Note
Veteran Tree Initiative, UK	*www.gov.uk/government/organisations/natural-england*	Since 1996
Ancient Tree Forum, UK	*www.ancienttreeforum.co.uk*	since 1993
Woodland Trust, UK	*https://www.woodlandtrust.org.uk/*	About woodland
American Forest, US	*http://www.americanforests.org/*	
Rocky Mountain Tree-Ring Research, US	*http://www.rmtrr.org/index.html*	Home of OLDLIST
The European Champion Tree Forum, EU	*http://www.championtrees.eu/*	Informal organization
BIGTREES4LIFE, ES	*https://www.facebook.com/sosarbolessingulares*	EU Life project 2013-15
Veteran Tree Network, BE, ES, SE, RO, UK	*https://vetree.eu/*	EU Natura 2000 project 2012-14
Eremita Meadows, LT	*http://www.eremita-meadows.lv/*	EU Life project
Tree of the Year-Europe: BG, CZ, HU, PL, RO, SK	*https://www.treeoftheyear.org/ETY-2018/Home.aspx*	East-EU project

The "Veteran Tree Network" is a project, under the EU programme "Natura 2000", coordinated by Inverde a forum for green expertise, acting for the Flemish Government's Nature and Forestry Agency. The general objective of this project is to spread the knowledge about veteran tree management as widely as possible. The general objective of "BIGTREES4LIFE - The key role of big trees and mature forests in biodiversity conservation", a project carried out during 2013-15 under the EU programme Life 11, was to improve the conservation of large trees and mature forests in the Spanish Natura 2000 network and the Spanish Network of Natural Protected Areas. Another EU-Life project is "Eremita Meadows" that developed a comprehensive ecological

management system of the Fennoscandian wooded meadows, and two rare beetle species that are dependent on old-growth trees and undisturbed forest habitats. "Tree of the Year-Europe" is a project of searching for the tree with the most interesting story in Europe, launched by Environment Partnership Association-EPA, a consortium of six East-European foundations aiming to protect the environment and support local communities and society. Many other projects were done or are underway on monumental or ancient trees, but is out of the scope of this paper to give an extensive report of that.

Selection criteria, Recording system, Data base

The first step towards cherishing and preserving the monumental trees is to achieve a better understanding of their number, location and other characteristics. To this aim is firstly necessary to establish a number of selection criteria, then a survey method, finally a recording system resulting in a data base accessible to policy makers as well as to a wider audience of stakeholders and population. A common system is lacking and each country adopted its own selection criteria and recording system for monumental or ancient trees.
"If you asked 10 different people to define a veteran tree, you would probably get 10 different definitions, all of which contain at least a grain of truth." (*https://vetree.eu/nl/page/98/Veteran+tree+definition*, VETREE page accessed on 27 February 2017). The Ancient Tree Forum's initiative gave an important contribution to systematise veteran tree data recording in the UK through the publication of the VTI Specialist Survey Method (Fay et al., 1997), developing a comprehensive and consistent method of survey as an agreed standard for the recording of veteran trees, which inspired many other countries. As result, a database is normally adopted as the means for collecting tree survey information. It facilitates recording, collation and analysis of information and good report production and presentation. The less expensive and potentially versatile recording system is using a spreadsheet facility for both working in the field, and on desk analysis and exporting. Spreadsheets require good design and ideally refined construction equal to that of a database.
The Ancient Tree Forum in partnership with the Woodland Trust and The Tree Register run the initiative "Ancient Tree Hunt" aiming to collect data and to populate the Ancient Tree Inventory which is a living database of ancient trees in UK with over 150 000 trees recorded to date.
Beyond the official databases managed by governmental agencies, there are a number of unofficial sites that you can meet on internet. "Monumental Trees", administered by a Belgian passionate living in Ghent, is an open international database where everybody can upload new trees without strict minimal criteria. It includes over 32,000 trees.

Table 3

Data Base on Monumental Trees

Name, Country	Website	Note
Ancient Tree Inventory, UK	*http://www.ancient-tree-hunt.org.uk/*	Managed by Woodland Trust
Monumental Trees, BE	*https://www.monumentaltrees.com/en/*	independent
OLDLIST, US	*http://www.rmtrr.org/oldlist.htm*	Under RMTRR
Champion Trees National Register, US	*http://www.americanforests.org/explore-forests/americas-biggest-trees/champion-trees-national-register/*	Under American Forest
National Register of Big Trees, AUS	*https://www.nationalregisterofbigtrees.com.au/*	Australia only
Association ARBRES, FR	*https://www.arbres.org/arbres_remarquables.html*	Criteria and data France only
PARISDATA, FR	*https://opendata.paris.fr/explore/dataset/arbresremarquablesparis2011/*	Paris only, 184 trees
INVENTAIRE DU PATRIMOINE NATUREL	*http://arbres-inventaire.irisnet.be/*	Bruxelles only
Elenco Nazionale Alberi Monumentali d'Italia	*https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/11260*	Italy only

A more reliable international database is OLDLIST, running under the Rocky Mountain Tree-Ring Research-RMTRR, were the method of age calculation is indicated and includes radiocarbon system as abovementioned. The "Champion Trees National Register" is a national database managed by the American Forest organization. Points are indicated for each enlisted tree and they are calculated by tree circumference, height and crown spread. The same system is adopted by the "Australian National Register of Big Trees", closely linked with all Federal and State Forestry/Environmental Departments and related entities, such as National Parks, that have interests that parallel the Objectives of this Register. On the Table 3 are reported other national or local databases as examples of the existing initiatives in Europe.

Management of Monumental Trees

Two main aspects of the old tree management, closely related among them, are the establishment of an appropriate legislation/rules and the definition of good conservation practices. During the human history tree conservation was closely associated with forest management. One of the oldest preserved orders stipulating forest management and punishments for damaging forestland is the "Law of Conrad II Otto, Duke of Bohemia" dating back to approximately 1189, but the preservation of individual tree as a relevant "monument" for the human community it has been matter of national laws and rules more recently. In Italy, for example, the first law which deal with the monumental trees goes back to

1939, although specific provisions about selection criteria, recording of data and management are quite recent (Lisa, 2011). International frameworks of old tree protection are the Convention on Biological Diversity (UN 1992) that underlines the need to preserve traditional knowledge and practices as well as the lifestyles of indigenous and local communities, and The Aarhus Convention (UNECE 1998) that introduces an obligation to involve the general public in environmental decision making. It is also to report the special status of UNESCO World Heritage No. 662 given to Yakusugi Forest in Japan where are living individuals of *Japanese cedar* over 1,000 years old. A European frameworks clearly focused on the preservation of large and old trees doesn't exist, but the European Landscape Convention (Council of Europe 2000) that defines landscape and its values largely based on people's perceptions and states that ought to be protected as natural and cultural heritage, as well as the Habitat directive of 1992 that established the network of protected Natura 2000 sites, including ancient forests, can works as reference documents. Anyway, in order to build a common protection strategy, Wild Europe (WE) and the EU Committee of the Regions organised the "Conference for protection of old-growth forest in Europe" on September 2017 in Brussels.
The "multidisciplinary approach" to the monumental tree management, which regards the tree as inherently linked to its ecological context, "is now beginning to inform mainstream arboricultural thinking and practice" (Fay, 2002). Referring to the good care practices for old trees, is to recall the handbook "Veteran Trees: A guide to good management" (Read, 2000) developed under the Veteran Tree Initiative with the contribution of many experts. It gives practical advice on all aspects of veteran tree management, their habitats and dependent species. It has been recently translated in Spanish. The two key points of old tree management are: to ensure that the threats, identified before, do not cause loss of the tree and the value associated with it; to check regularly the tree and its situation around, carrying out management care only if it is necessary.

Conclusion

Monumental trees have relevant cultural and social significance, as well as important ecological functions. Therefore, policies and management guidelines that support maintenance of large old trees "for ecological reasons also support maintenance of aesthetic, symbolic, religious and historic values" (Blicharska et al., 2014). The restoration of large old trees takes a long time and requires particularly long-term thinking in management and conservation activities. Large and old trees are essentially "irreplaceable" structures in many ecosystems, making offset policies for them flawed or at best highly limited in effectiveness (Lyndenmayer et al., 2017). To protect large old trees, policies need to go beyond the traditional individual species-based approach to conservation. For example, trees of certain species above a particular height,

age, and dimension could be included in the European Union Habitat Directive (EEC 1992) as "habitats of community interest" being considered as complex structural elements of the environment that support numerous species, while provisioning people with elements of great social and cultural value (Blicharska et al., 2014).

The conservation and continuity of old trees in the landscape depends on better informed management, which takes into account their intrinsic values as well as the legal implications (Davis et al., 2000). Many veteran trees and the fragile habitats they support are under threat from inappropriate management, often resulting from changes in the use of surrounding land. The recognition of the social benefits large old trees deliver and of their importance to people worldwide is a necessary step toward building capacity for managing their global decline.

Sommario

L'uomo ha da sempre posto attenzione ad alberi vecchi e maestosi, per il loro valore sia estetico/naturalistico sia storico per esser stati testimoni di eventi passati, proteggendoli e rispettandoli. Ciononostante, lo sviluppo dell'agricoltura intensive e l'urbanizzazione ha causato la perdita di una buona parte di questi monumenti. Il valore degli alberi "monumentali", "antichi" o "veterani" è oggi comunemente accettato in tutto il mondo, e sono in pieno sviluppo iniziative tese alla loro studio e alla loro tutela, a partire da una sistematica ricognizione e trascrizione in apposite banche dati. In questo lavoro è presentata una panoramica sugli approcci alla tutela degli alberi monumentali presenti, in particolare, nella regione europea e nordamericana. Vengono presi in esame i principali programmi e progetti, nonché le più attive organizzazioni e le istituzioni pubbliche che trattano della gestione di questi alberi. Viene poi considerata la legislazione legata alla protezione degli alberi monumentali con particolare riferimento ai criteri di selezione, alle modalità di registrazione, alle banche dati. E' discusso il ruolo degli alberi monumentali quale tessera del mosaico paesaggistico-culturale.

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