# MONUMENTAL TREES INVENTORY OF THE PROVINCE PISTOIA, ITALY

R. Ferretti*, M. Giachini, D. Giorgi**, M, Vannuccini ***

* *Executive of Territorial Resources Planning Service, Pistoia Province*
** *Independent professional*
*** *Independent professional, Studio Tecnico Eureco*

## 1. Introduction

Monumental trees are a multifunctional resource, due to their naturalistic and historical relevance and to the important impact on landscape. In Tuscany, the value of monumental trees heritage has been recognized by the local law L.R. 60/1998. This law identifies the status of monumental tree, defines the rules for trees protection and valorisation and establishes a regional catalogue of monumental trees.

The Territorial Resources Planning Service of the Province Pistoia, back in 1989, set up an inventory by which forty-one trees were identified, that according to their extraordinary age or size could be considered as "monumental". Most of them are located in the mountain area of the province. The inventory was although not exhaustive, since it only took into account a part of the provincial territory: the lack of data and information about the wide district of municipalities of Pistoia, Montale, Pescia, Montecatini etc., leads to think that a consistent monumental trees heritage is still to be identified, also by taking in consideration the local dense *historical villas* system. In accordance with law 60/98 the opportunity to program protection and valorisation measurers is also given. These measures can although be only implemented on the basis of updated and consistent information on quantitative (morphometrical and dendrological data) and qualitative (physiological and sanitary conditions) characteristics of the trees and also about the changes of the area in which trees are located (Shigo, 1993). In the frame of the new Co-ordinate Territorial Plan (P.T.C.), which considers monumental trees within the list of environmental resources of the province's territory, a new initiative was taken in order to extend the inventory on the whole province and herewith establishes an exhaustive data base in relation to the trees' consistency and health conditions, which will be integrated in provincial administration's Geographical Information System. Particular attention will be given to geo-referencing trees' locations, as a necessary premise to their correct identification on site.

## 2. Available information

The available knowledge on the amount and conditions of monumental trees of the province Pistoia arise from four different sources which, at different times and with different criteria, attempted to assess the situation of the province's green patriarchs.

The first inventory, promoted by the National Forest Service (C.F.S.) in 1982, concerned the whole national territory. As far as the province Pistoia is concerned, thirteen monumental trees were singled out. Out of the twenty-two municipalities of the province Pistoia, only eight were represented, within the inventory, by at least one tree of extraordinary historical or monumental value. Municipalities such as Pistoia, Pescia and Quarrata, which represent a remarkable portion of provincial territory, contributed with no tree, whereas six monumental trees were identified in the territory of San Marcello Pistoiese. In 1989 the Provincial Administration of Pistoia performed an inventory by which forty-one monumental trees were identified, mainly located in the mountain area of the province and, in specific, in the territories of San Marcello Pistoiese, Sambuca Pistoiese and Abetone.

In spite of the knowledge that was acquired through these census initiatives, only one tree of the province Pistoia (located in the municipality Lamporecchio), is actually inscribed in the Monumental Trees Regional List ex L.R. 60/98, out of a total of forty-nine trees setting up the list itself. In order to update and enrich the Regional List, the Regional Administration of Tuscany, in co-operation with the W.W.F., promoted the "Monumental trees in Tuscany" school contest in the school-year 2002-2003, addressed to the students of Tuscany's schools. Thanks to this initiative, one-hundred and twenty-five trees were identified, eleven of which in the province Pistoia.These inventories, for several reasons, failed to give a global and exhaustive picture of the real situation of the monumental trees heritage on the wide territory of province Pistoia. If a comparative evaluation of all actions undertaken till now is performed, a basic incommunicability between different lists comes up. In other words, the regional list seems not to completely take into account the results of previous inventories. As a consequence, the Provincial Administration of Pistoia called out for an overall inventory which foresees the detailed analysis of the provincial territory, while updating and harmonising the information from previous initiatives. In particular, the lack of

knowledge about municipalities as Pistoia, Montecatini, Pescia and Quarrata, having a high incidence of remarkable villas and historical gardens, leads to think that a substantial monumental trees heritage is still to be identified.

## 3. Monumental tree inventory

With reference to intervention measures foreseen by the regional regulations, which are put into effect by a specific action in the regional Rural Development Plan (P.S.R., Reg. 2057/99 EU), the present research and inventory initiative was set up according to some fundamental requirements:

- Accurate trees' geo-referencing, in order to obtain a certain tree identification on site, both for management and for eco-tourism activities.
- Exhaustive description of sanitary and physiologic tree conditions, necessary to plan care and management measures.
- Collecting exhaustive information about naturalistic, historical, traditional and landscape aspects related to each tree, in order to give to the regional Scientific Commission ex L.R.49/1995 (competent for evaluation of proposals for the admission to the regional list) as much information as possible, supporting the tree-candidates that will arise through the inventory.
- Create an integrated management tool in accordance with the provincial Geographical Information System.

The complete information collected throughout the inventory will be filed into a dedicated data base, developed in a Ms Access environment, linked to a point theme in shape format which stores spatial information (i.e. geographic location of each tree).

## 4. Research and documentation

A preliminary documentation and research phase is essential for singling out monumental trees. Analysis of individual mentions, archive research, etc, will be collected and evaluated with the aim to obtain a wide range of preliminary knowledge.

The primary information source is of course the provincial inventory of 1989, which will be eventually integrated with the results of the C.F.S. national inventory, and furthermore updated by recent acquisitions from the school contest organised by the regional administration and the W.W.F. Taking into account that a large portion of the province's territory was not involved in the mentioned initiatives, it is of utmost importance to investigate documentary sources, which may lead to obtain remarkable information on monumental trees. For instance, the wide bibliography on historical villas and gardens is supposed to give suitable information, while also performing an analysis on local place's names: quite often these names are originated by trees that were considered remarkable under a certain point of view.

In order to collect direct mentions, a dedicated form was prepared, through which anyone can bring remarkable trees to notice. The form, which is accompanied by a short guide containing the requirements to which a monumental tree must be conforming, foresees that the user reports useful information for localisation of the tree and for a first screening of the received forms. The call for mentions will follow both institutional channels (municipalities, mountain communities, C.F.S. stations, etc.) and preferential channels in co-operation with environmental or cultural associations or any other institution having a direct interest on the territory. The inventory will also be promoted on Internet, by means of a web page linked to the web sites of the province, municipalities, and any involved association.

## 5. Monumental tree database

In order to collect and file both field information and geographic data, a dedicated Geographical Information System was set up. Alphanumeric information, which means all quantitative and qualitative information, is managed by a data base developed in Access environment; spatial data (which means a point vector theme in *shape* format) is linked to the database via Windows ODBC protocol, and therefore the information can be managed directly in a GIS environment.

The database is provided of proper forms for data input and visualisation, which allows a prompt data recall and change by the user. Data is recalled through several pages of access, each containing following information:

- Tree identification, containing dendrological data and all useful information for the tree characterisation and localisation;
- Tree conditions, containing morphometric data and a general description of physiological and biomechanical aspects;

- Sanitary conditions: the form contains specific information about a possible stress situation caused by biotic and/or non biotic factors and about identified pathologies, where applicable;
- Management: the form contains a short report that summarises threats against the tree's conservation, and technical and operative notes, in order to achieve a correct tree management and protection;
- Monumental value: the form collects all available information about the historical, naturalistic, cultural and landscape values of the tree.

Available data concerning the tree's overall conditions (health and physiological status, biomechanical information) are also summarised on an analytical form, containing standard information, which is used both to obtain descriptive statistics about tree populations and also as a summary report that allows the field technician to keep the information during any future periodic inventory up to date.

## 6. Database contents

In order to obtain information in the most standardised way as possible, a proper inventory form was prepared for field data collection, in which actual tree conditions are recorded. The inventory form is made up of keys recalling the tree characterisation and check, as well as indicators concerning tree location, structure, morphology and sanitary conditions.

### Tree identification

The form concerning the tree identification (Figure 1) reports some general information (identification code, species, date of first inventory) and the related photographic documentation. Furthermore, particular care is given to the tree localisation; as a matter of fact, geo-referencing the tree is of utmost importance in regards to the objectives of this work; therefore, an instrument assuring a high precision level in determining point location was chosen.

The geographic location of each tree is therefore acquired by a Global Positioning System, transferred to a GIS software and finally reported in the regional technical cartography (CTR).

The form contains:

- Municipality, locality and eventually (for trees located in a garden or near a house) the street and the number of the house;
- Gauss Boaga coordinates of the tree location;
- Section of the regional technical map (CTR 1:10.000);
- Land-registry references (sheet and parcel number): these references are requested within the authorisation procedures for different kinds of human activities, having an impact on the territory; therefore they represent an important control tool to check for possible modifications of the site.

Finally, the property is identified (public or private) and references on the owner or the manager are recorded.


Figure 1. Tree identification form

## Tree conditions

The tree conditions form (Figure 2) reports, first of all, dendrological and dendrometrical main parameters, as circumference, diameter at breast height (this is actually a redundant data, but on the other hand the diameter allows to better assess the trunk size), height, height at which the green crown base starts (i.e. height of first living branch) and crown width (this is defined by the radius in the four directions, perpendicular one to each other).

Some general information concerning the specimen to be preserved is also recorded: this can be an individual tree or a bio-group, which intended as a group of individuals originated by a single mother-plant and which cannot be classified as a single tree. The tree's overall conditions are assessed through short descriptive reports concerning the location in which the tree lives (planting site), each of the tree's main apparatuses (root system and collar, trunk, crown) and eventually recent management interventions.

The soil and planting site aspects are of utmost importance for the evaluation of the roots' water supply and the possibility to exchange gases. Therefore, some related aspects are put into evidence, as the kind of ground coverage, the soil compactness, eventual limitations to the root system's development, morphological root anomalies, root decay symptoms, damaged roots, basal cavities etc. In reference to the trunk, some information about the morphology is registered and, eventually, damages and structural anomalies. In regards to the morphological aspects, the trunk inclination from the vertical axis is taken into account, as also any peculiar aspect such as V-shaped crotches, crooks, etc. Damages and anomalies due to factors having either a biotic and/or a non biotic origin are recorded, as indicators of pathologies or symptoms of reduced vigour or loss of mechanical wood stability.

For instance, the following data is recorded:

- Wounds on both bark or wood;
- Emergence holes made by bark and wood miners;
- loose bark or bark necrosis;
- Cavities, of different depths and healing stadiums, due to pruning, wounds, wood decay and mechanical damages;
- Wood decay fungi fruiting bodies, as symptoms of decaying wood, or visible wood decay;
- Foreign body inclusions.

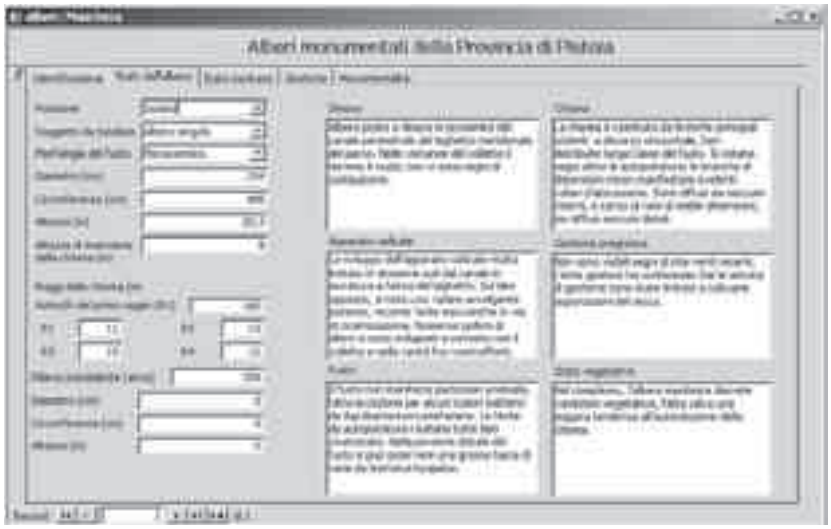

Figure 2. Tree condition form

In regards to the crown, all remarkable aspects are recorded, in order to describe tree's physiological conditions and to make a precocious diagnosis of suffering conditions:

- Presence of cavities, decaying wood and fungi fruiting bodies on branches;
- Presence of dead or compromised branches;
- Presence of pruning scars and wounds on main branches;
- Presence of epicormic branches;
- Stress symptoms due to pathologies of biotic or non-biotic origin, as leaves chlorosis and colour loss, leaves necrosis, cancers, microphyllia, crown dieback etc.

Finally, some conclusive consideration on physiological and sanitary conditions are reported (in the section vegetative state) as a synthetic description of actual tree state.

All collected information by means of descriptive reports, can be viewed in a synthetic way through the *analytical form* (Figure 3), which allows to export data in an Excel file for statistical analysis or in order to produce final reports about the whole tree population. The analytical form consists of standard voices which allow to define the tree's overall conditions.

Figure 3 Analytical form

**Health condition**

This section contains a report about tree's sanitary conditions, with a particular look at pathogens. The form contains photographic documentation related to present pathogens (insects, fungi, bacteria, etc.) and also any possible non biotic damage. The contents of this section can be viewed in the analytical form, too.

**Management**

The section related to tree management contains the guidelines about the proposed future tree management interventions, while also putting in evidence any need to go into further depth on specific aspects. The reported interventions can be determined either by an immediate need for safety assurance or by a long-term planning, which, for instance, might be a site environmental improvement. Here below the possible intervention measures are reported:

- Hazard tree assessment, which may be applicable for all trees located in areas with a high frequency of visitors and whenever symptoms of reduced carrying capacity are present (Matheny & Clark, 1994). The mentioned assessment is therefore strictly restricted to risk situations which require extraordinary management measures (Breloer & Mattheck, 1998);
- Pruning is foreseen either as an extraordinary measure where a risk condition is given, or in case a clear negligence on planned intervention measures is assessed. Pruning prescriptions go always together with detailed operative technical notes and also specific photographic documentation;
- Consolidations: these arboricultural tools are intended to prevent branch collapse through the use of moorings and supports, while also preventing from branch injuries occurring during branch fall, which is obtained by establishing predetermined falling directions;
- Site improvement management measures; for instance, waterproof paving removal, soil improvement through agronomic interventions, etc.
- Preventive or corrective sanitary treatments.

This section also reports the main biomechanical parameters taken into account by the S.I.A. (Static Integrated Assessment) method. S.I.A. allows the assessment of some tree static characteristics by simply surveying dendrometrical parameters, as, for instance, tree height, dbh and crown shape. Once this data is assessed, through statistical models which were identified for each tree species, the base carrying capacity can be determined (a parameter that concerns the tree structural dimensioning), as well as residual wall thickness which is required in order to have a trunk with a 100% base carrying capacity (below this value the tree is under-dimensioned towards the crown loading).

S.I.A. parameters were addressed within this work in order to obtain a first evaluation about the tree static characteristics and also to have a base reference for any future deepening needs on the hazard tree assessment. Up to present, S.I.A. models are available only for certain tree species, while static-morphologic mathematical relationships for many Mediterranean species (helm, cypress, etc.) are still to be investigated.


Figure 4. Management guidelines form

**Monumental value**

In the last section all information related to naturalistic, historical, architectonic and landscape aspects or reference to local use and traditions linked to the trees is collected. According to Regional Law 60/98 a monumental tree is not only a tree of extraordinary size or age, but also a tree having a precisely defined reference to historical events or to local traditions. The documentation related to these specific aspects is therefore necessary to sustain trees' candidates for the insertion in the regional list. This is moreover useful information for the tree valorisation (by means of informative activities) and for promoting the province's natural heritage in the frame of environmental tourism.

## 7. Conclusions

The described research and inventory programme on monumental trees in the province Pistoia is, at present, the most complete and exhaustive experience in the Tuscany region.

This inventory, which is based on a solid arboricoltural basis, does not only allow to identify and register monumental trees, but it permits also to obtain a wide knowledge base, which is a useful tool for any management, protection and valorisation activity.

Under a technical point of view, the collected information will provide a useful basis to develop a management disciplinary tailored on each tree, which can then be put into practice thanks to financial measures that are foreseen by regional laws, but which are also taken into account very seldom. Taking into consideration that monumental trees can be considered as a rural landscape promoting tool, the set of information that was collected can be used to promote environmental tourism and educational initiatives. The available digital archive, would in any case find in the web its natural divulgation mean.

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