

## GIS BASED DOCUMENTATION OF THE MONUMENTAL TREE INVENTORY IN ISTANBUL

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**ABSTRACT:** The monumental trees are the natural heritages that must be preserved carefully. They have non-customary dimensions of their species in terms of age, diameter and length and they have a special place in the local folklore, culture and history. These trees have such a long life to communicate between the past and the present. For this reason, documentation of monumental trees requires technical and rational planning, and management. The creation of the database with the help of GIS, and the examination of these data are important for the future of the monumental trees. There are 554 monumental trees in Istanbul and the data was provided by Istanbul Metropolitan Municipality. In this study, semantic analyzes were performed to classify the trees according to their species, age, height, body diameters and circumference. The SRTM (Shuttle Radar Topography Mission) maps were used to get elevations of trees because there are no elevation values for trees on the obtained data. This study is a preliminary GIS based documentation of the monumental trees in Istanbul. There are 311 trees in Anatolian side and 243 in European side. The districts with the most monumental trees are Beykoz with 119 trees, Usküdar with 115 trees and Sarıyer with 87 monumental trees. The average height of the monumental trees is 52 meters; besides, the tree at the highest elevation is calculated as 238 meters and the lowest elevation is 2 meters. There are 46 different monumental tree species, and *Platanus orientalis* is the most common one with 173 units.

### 1. INTRODUCTION

Due to three sides of Turkey covered by seas, it has a variety of climatic conditions and rich natural habitat which is one of the leading countries in the world. Protecting and preserving such a rich environment has always been a challenge for humanity, but with the help of advancing science and technology, observing and analyzing of the natural habitats is becoming easier. Due to their development and protection has been one of the most important parts of natural life, trees are always have priorities when this issue is considered. Especially research and studies should be carried out related to monumental trees. The monumental trees have attracted the attention of societies throughout the history of mankind. Moral and cultural values, Folkloric aspects, Mystical aspects, Historical aspects, Mythological aspects and Contribution

to the culture and art are the most important contribution of these trees to social and economic life of them. Examining the scientific data behind the lives of hundreds of years will enable people to work more efficiently to protect the natural environment in the future. Monumental trees are also considered as the bridge between past, present and future.

Although some trees may have very large dimensions, they are not considered as monumental trees because their natural life is too short. However, they are considered as “worth to preserve” status with their physical characteristics. On the other hand, old plants, which are in the form of shrubs and dwarf trees and which are not satisfactory in terms of physical measurements regardless of their long life span and which are not important in terms of local culture and history, are not considered as monumental trees. However, considering their scientific importance, these trees should be considered in the “Worth to Protect” status (Sisman, 2014).

The most important features that make a tree a monumental tree are; physical dimensions, visual privileges, cultural values, historical aspect, folkloric aspect, mystical and mythological aspect. Physical characteristics such as diameter and height that directly appeal to the eye have been the most decisive feature in this regard. In addition, due to genetic disorders or due to various external influences, trees, which have an interesting appearance, have attracted attention because they evoke different feelings in human mind. In addition, there should be a feature that can affect the psychology of society. The fact that they have a positive and negative reputation in local culture and folklore, that there are some events in the historical process and that they are in a mystical holy place are examples of these situation (Seker, et al., 2019).

In this study, with 39 districts Istanbul province has been selected as the study area. In the study, the monumental tree inventory obtained from Istanbul Metropolitan Municipality were examined. SRTM data were also used to calculate the height of the trees which are not registered in inventory in a GIS environment. Spatial distribution of the monumental trees were analyzed and related maps were produced.

## **2. METHODOLOGY USED**

In the study 554 of monumental tree data were taken website of the Istanbul Metropolitan Municipality. In this file, together with the coordinates of the trees, the name of the district, type of the trees, registration number, address, age, height, diameter, perimeter, qualification such as physical or cultural and continent of the location such as European and Asia were listed. Using this file, a new geodatabase has been created in a commercial GIS software which holds geographic data sets as rows and columns.

The monumental tree data obtained from the municipality was arranged in accordance with the table structure of the software database and added as a new point layer. The distribution and coordinates of the points were checked by using Google Earth Pro. In the added data; ID, address and district information, registration number given by the municipality, species in Turkish and Latin, tree age (year), diameter (cm), length (m), circumference (cm), the nature of the monument tree and many types of information such as coordinates has taken place.

Although there were X and Y coordinates in the monumental tree data, there was no elevation data. SRTM data was used to add elevation value of each tree. SRTM uses synthetic aperture radar mounted on a space shuttle to obtain Earth surface data with remote sensing technology. This data is converted to elevation data called the digital elevation model (Jaxa Space Station). Within the study, 4 SRTM maps cover the whole of Istanbul were used. These 4 maps are made into a single map combined with the Mosaic command in the used software. SRTM data of Istanbul together with the distribution of the point layer are given in Figure 1. Elevation of the trees were calculated from SRTM data with the “Extract Values to Points” command software.

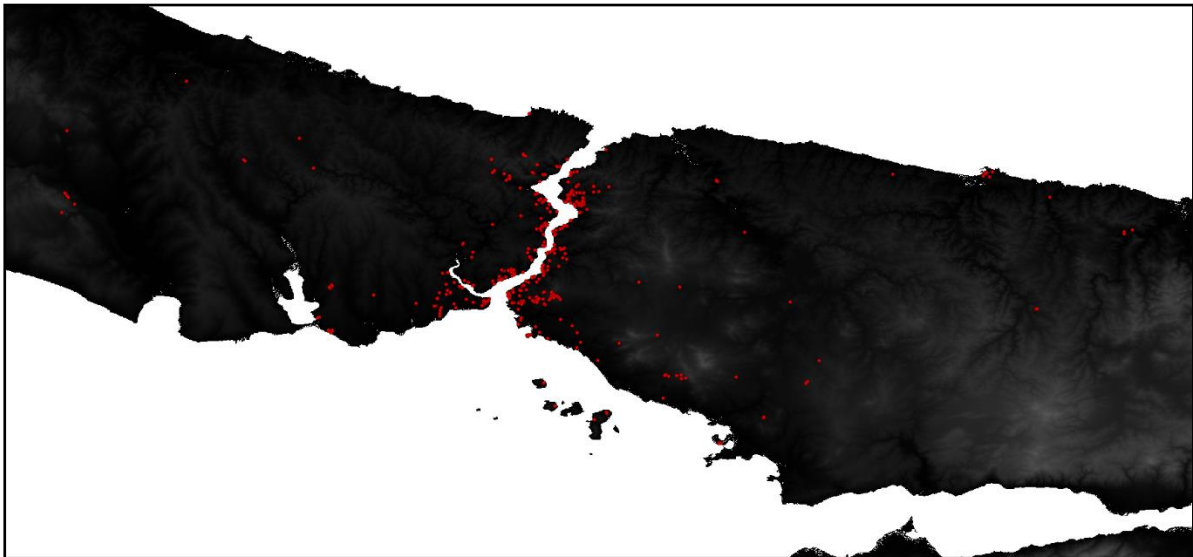


Figure 1. SRTM data and distribution of the trees as point layer.

### 3. RESULTS

There are 554 monumental trees which are registered in this category throughout Istanbul. 311 of them are located in Anatolia (Asia) and 243 are located in European side of Istanbul. Beykoz is the districts with the maximum number of monumental trees with the amount of 119. Other districts which has the higher number of monumental trees are Uskudar with 115 trees and Sariyer with 87 trees. District base distribution of the monumental trees are given in Figure 2. As it can be seen from the figure, 23 of the 39 districts have monumental trees inside their administrative boundaries.

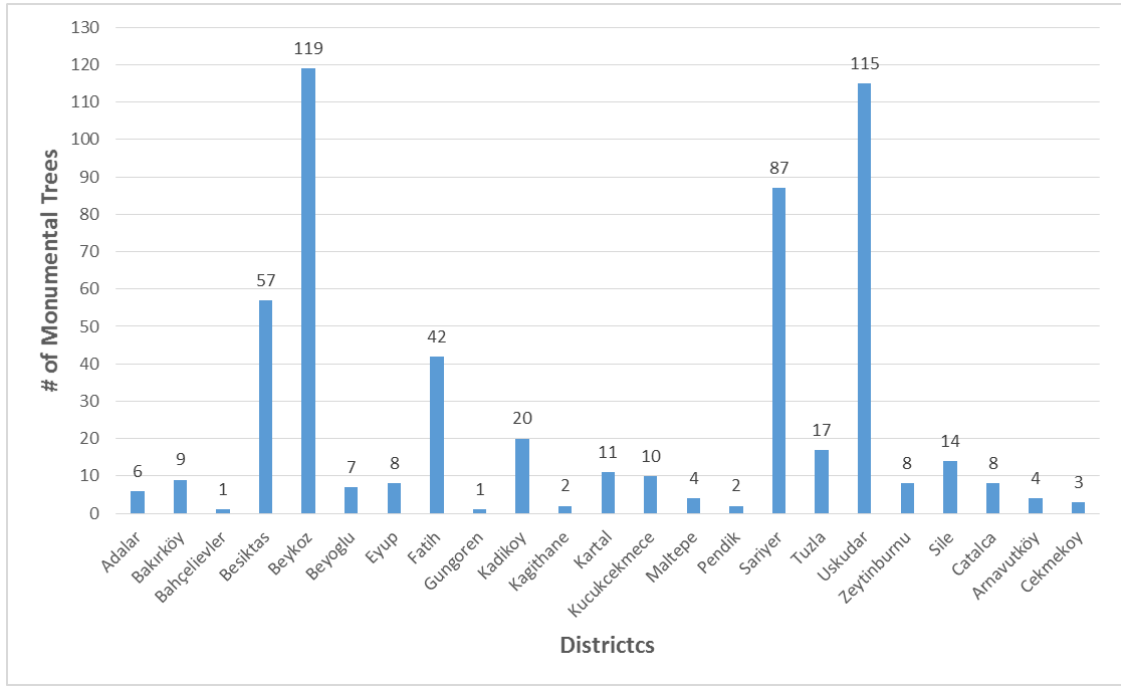


Figure 2. District base distribution of monumental trees.

The calculated average height of the monumental trees in Istanbul is 52 meters above sea level. The highest point of the tree at 238 meters, the lowest tree is located at 2 meters. There are a total of 46 different types of monumental trees. The amount of the *Platanus Orientalis* is the type of the tree which has the highest amount in Istanbul. Age distribution of the monumental trees are given in Figure 3.

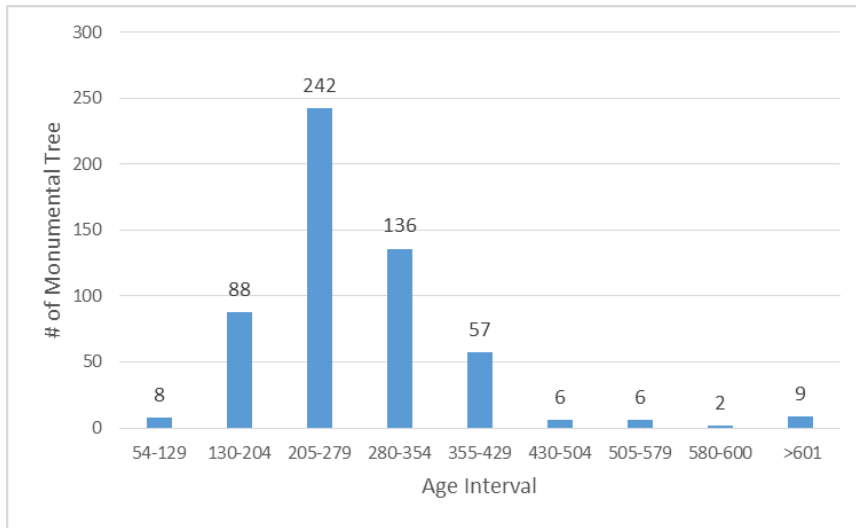


Figure 3. The age distribution of the monumental trees in Istanbul.

Additionally, height of the monumental trees of Istanbul was examined and obtained results was presented in Figure 4. It is seen on this figure that height distribution of the monumental

trees have similarities to the normal distribution and height of the majority of trees lie on 16-20 m interval.

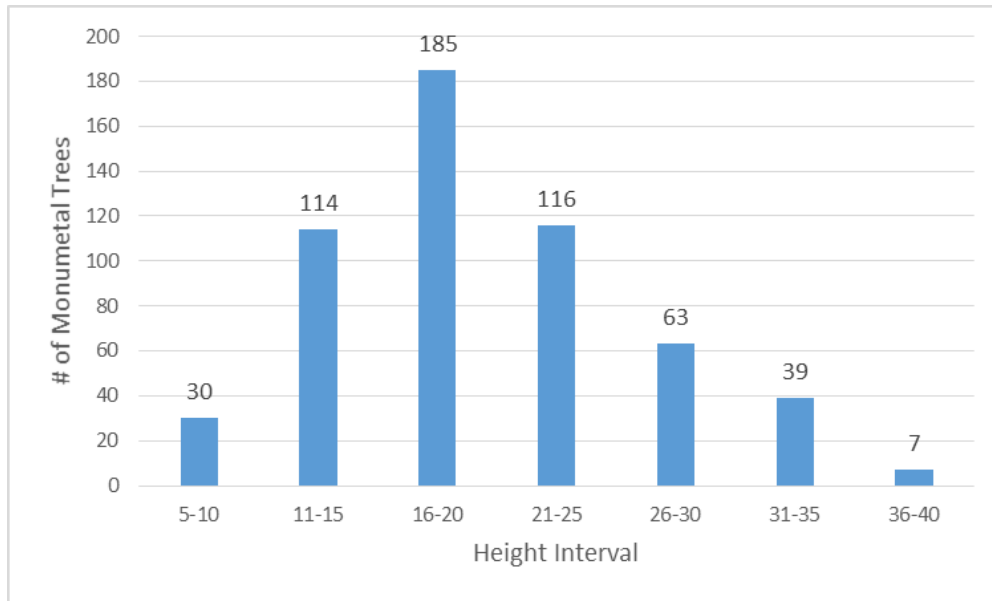


Figure 4. Height distribution of the monumental trees.

Genera and spatial distribution of monumental trees are mapped by using GIS software and given in Figure 5.

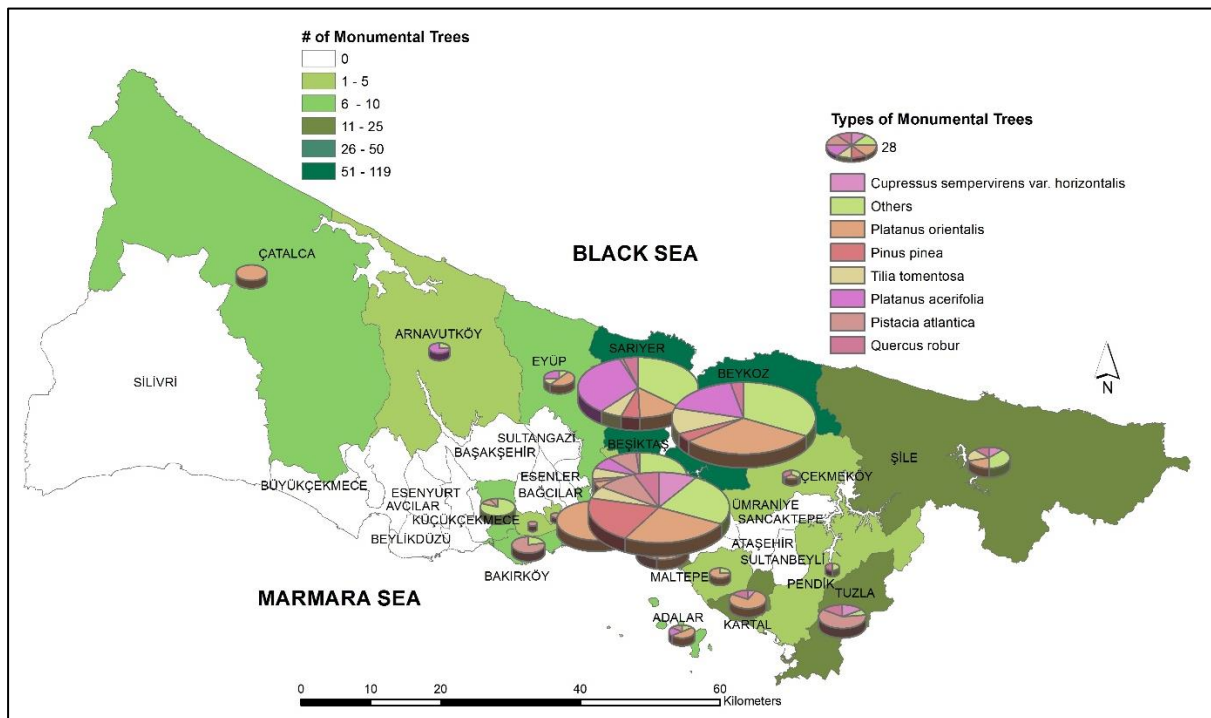


Figure 5. Genera and spatial distribution of the monumental trees of Istanbul Province.

#### 4. CONCLUSIONS

This study, which is one of the pioneering researches in Istanbul, will be a step for future projects. Together with monumental trees, all trees need protection especially from human induced effects. Natural genera and spatial distribution of the monumental trees in Istanbul were analyzed and visualized in this study. This study is one of the pioneer studies in this field in Turkey and it might be helpful to be used as a guideline for the future researches and studies.

Every year, many new monumental trees are discovered or destroyed. For this reason, documentation studies should be continued with the help of modern analysis and visualization techniques such as Remote Sensing and GIS. The classification and analysis of monumental tree inventory is an important process for documentation. In this way, both detailed information was obtained about trees and scientific data were produced to be used for the future of natural habitats.

It is proposed that a national survey of monumental trees should be realized and necessary policies and necessary instruments should be urgently defined to protect these trees. Documentation process should regularly continue with the help of technological tools such as GIS.

#### 5. REFERENCES

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