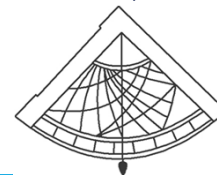




Building Monumental Tree Inventory Using Geographic Information System

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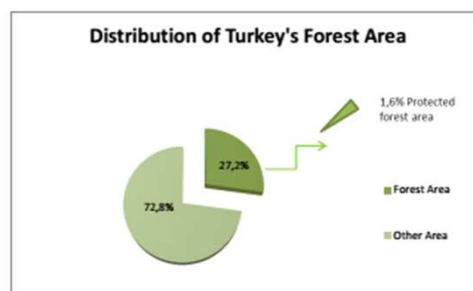
Outline

- Introduction
- Material and Method
- Study Area
- Monumental Tree
- GIS
- Method
- Tree species in the study area
- Conclusion and discussion

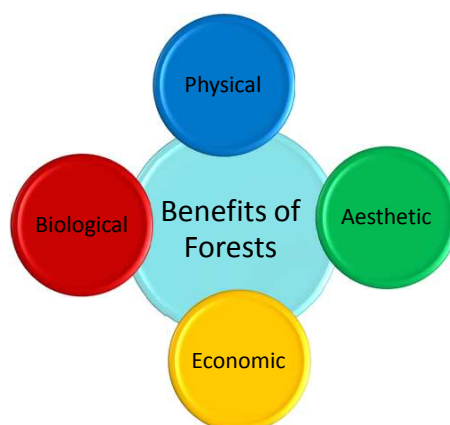
Introduction

A forest can be defined as an area that incorporates all living and non-living things and is dominated by trees that can grow to at least 2 meters high, with a canopy that covers 20% or more of the ground data.

In Turkey, forest and forestland cover 27,2% of total country which corresponds to 27 million hectares. The protected area is approximately 1,6% which corresponds to the total country area.



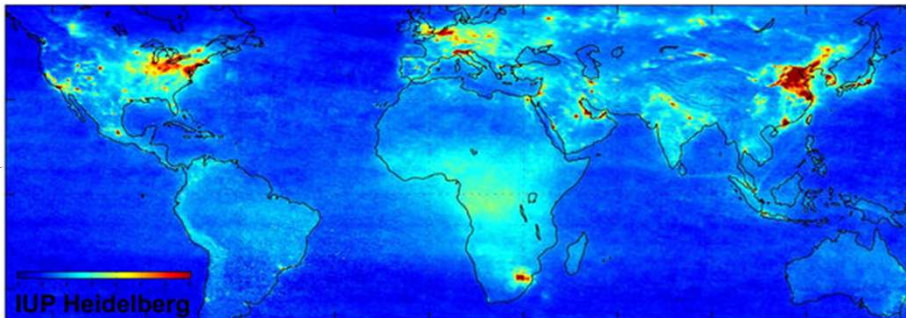
Benefits of Forests



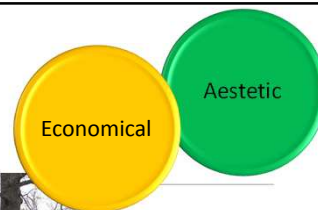


Benefits of Forests

- Reducing air pollution and improving air quality
- Balancing the climate
- Improving water quality
- Decreasing soil erosion and improving soil quality
- Providing habitat for the wildlife and protecting biodiversity
- Buffering and lessening noise pollution

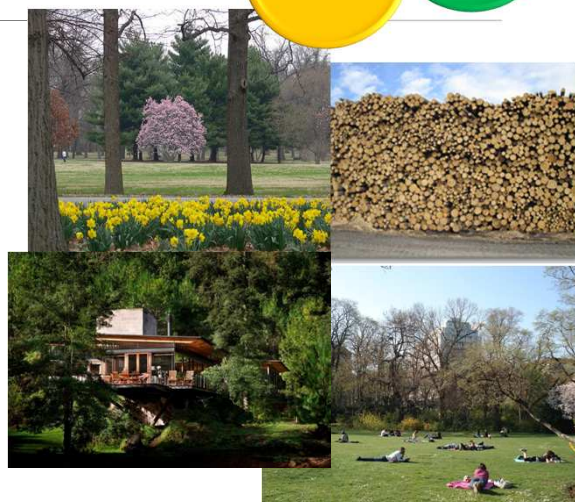


Benefits of Forests



- ❑ Lessening the urban heat effect,
- ❑ pulling down the heating and cooling costs in the urban area,
- ❑ increasing the property values upwards
- ❑ helping communities psychological and social health approaches are the economical and psychological gains of the trees.

Research has shown that trees and forests in the urban areas can mitigate the adverse effects of urban development and improve environmental quality, ecological services, and even economic prosperity.



100 Forest Hot Spots

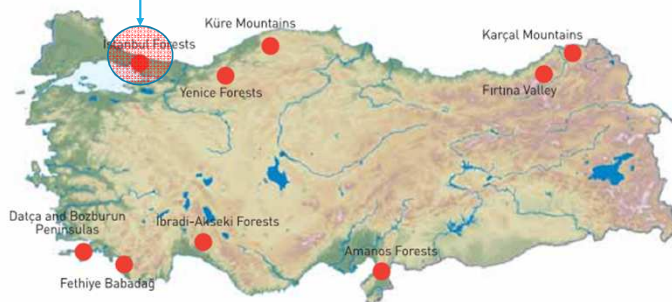
In 1999, World Wide Foundation (WWF) identified 100 Forest Hot Spots which should be protected in Europe.

In Turkey, there are nine important forest areas among these hot spots.

These hot spots are,

- Istanbul Forests,
- Küre Mountains,
- Yenice Forests,
- Karçal Mountains,
- Firtina Valley,
- Amanos Forests,
- Ibradi- Akseki Forests,
- Datça and Bozburun Peninsulas,
- Fethiye Babadag

The Study Area is situated at Istanbul Forests



MATERIAL & METHOD

Study Area

The study area is located in Marmara Region of Turkey, the border of Bogazici University Kandilli Campus in Istanbul.

The Kandilli campus covers 306 acre area.



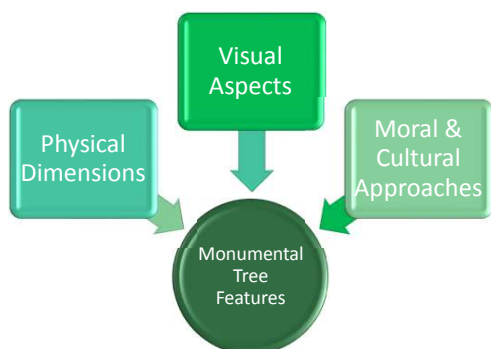
What is Monumental Tree?

Monumental trees mean that trees which have much larger sizes than the common sizes of their species in terms of age, diameter and height, have a special place in the history, culture and folklore of the local and is naturally old enough to provide communication between past and present and also present and future are recognized as "monumental trees"



Bursa Inkaya Monumental tree
600 years old

Monumental Tree Features



Monumental Tree Types

Historical Monumental Trees

Mystic *Monumental Trees*

Folkloric Monumental Trees

Dimensionally Monumental Tree

Monumental Tree Inventory



Forest inventory commonly means the measurements of many important parameters of forests, trees and shrubs to the analysis of abundance, distribution, state, change and trend of forest resources.

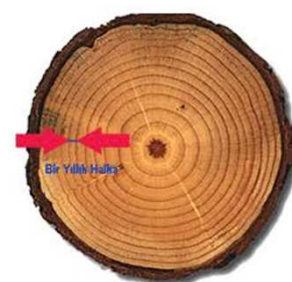
Besides, forest inventory is significant as a basis for sustainable forest management.

The forest inventory process consists of the documents that evaluate and characterize the forest and tree attributes which is a core set of attributes that consists of the type of trees, size, tree height, diameter at the breast height (dbh), condition and also location of the forests, trees and shrubs in the community.

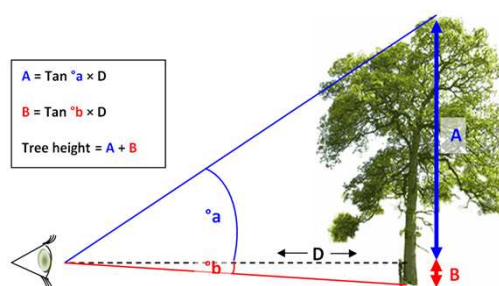
Age Estimation

In order to estimate the trees age, increment borer are used. To get an accurate age of any tree, the rings must be counted near the base (ground) of the tree.

Tree stumps can be used but only just after the tree is harvested. All trees have increment every year. We calculate the tree age with 5-year accuracy. For instance; between 450-454 the age is 450, between 455-459 the age is 455 .



Tree height



- There are two different ways to measure the height of tree.
- First method, we need clinometer which is an equipment that is a vertical angle gauge measuring the slope from the eyes to both top and bottom of the tree.
- The second method is to determine the height by trigonometric method. By using basic trigonometry and laws of similar triangles and right angles, the true height of a tree can be easily obtained.
- The accuracy in the measurement of the height of tree is 50 cm.

Diameter at the breast height

The diameter of tree should be measured in centimeters accuracy at 1.3 m above the ground.

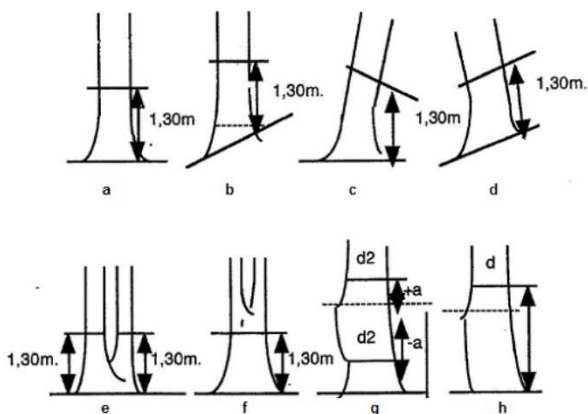
Then the result is divided by Pi number (3,14).

The diameter is achieved.

During the measurement, using a stick is the convenient way in order to get the precise result.

Besides the most accurate method is to measure the diameter is using diameter tape.

Since the diameter tape is calibrated which the circumference measurements are converted precisely and accurately pi number.



Measure the Crown Spread

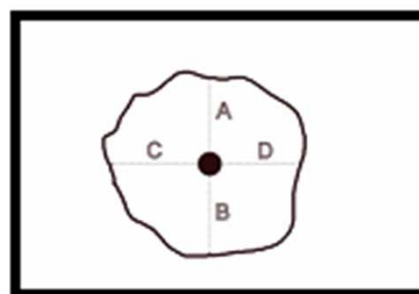
❖ Average crown spread is obtained by measuring the longest and shortest extent of the crown and averaging the figures.

❖ Crown spread is taken independent of trunk position.

❖ Start with your back to the trunk of the tree and measure to the point directly below the end of the furthest limb.

❖ All four measurements (A,B,C,D) are made the same way.

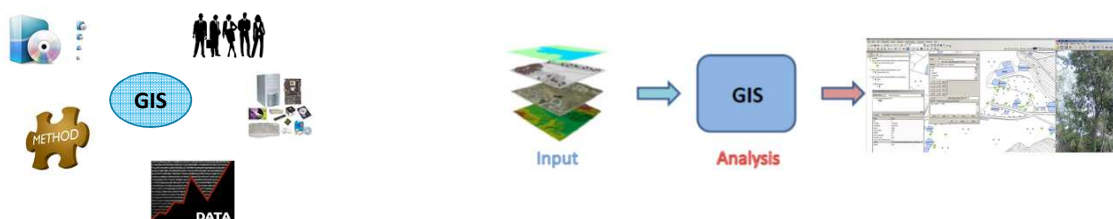
❖ Measure "A" & "B" and find the average. Measure "C" and "D" and find the average. Your final answer will be the average of the two averages already calculated



Method- Geographical Information System

Geographical Information System (GIS) as an integrated, spatial, data handling technological program that collect, store and retrieve data, transform and display them from the real world for a specific set of aims.

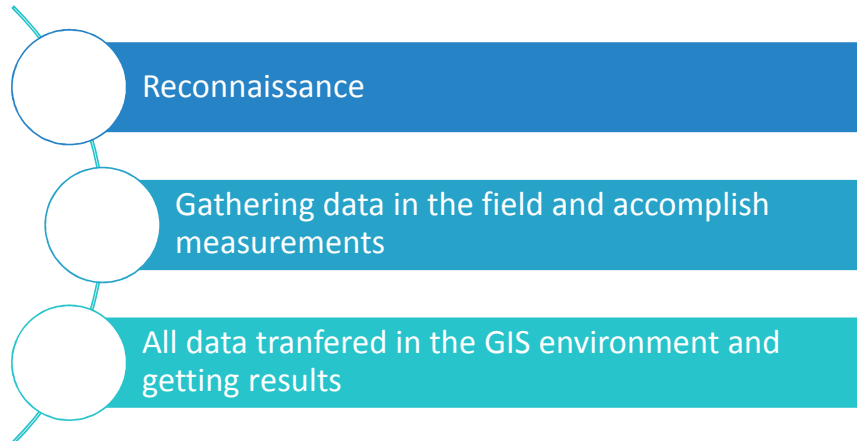
GIS fundamental components are hardware, software, people, data and methods.



No	Latitude	Longitude	Type	Height	Crown Spread	Diameter (m)	Trunk Circumference (m)
1	41,06313	29,06117	Linden tree	185	10	1,21	3,80
2	41,06273	29,06109	Celtis	175	15	0,67	2,10
3	41,06284	29,06088	Stone Pine	160	10	0,83	2,60
4	41,06248	29,06118	Oak	186	15	0,67	2,10
5	41,06343	29,05982	Stone Pine	160	20	0,86	2,70
6	41,06343	29,05992	Stone Pine	160	18	0,78	2,45
7	41,06373	29,05996	Stone Pine	160	15	0,70	2,20
8	41,06371	29,05987	Cypress	185	7	0,57	1,80
9	41,06371	29,06005	Stone Pine	160	15	0,72	2,25
10	41,06369	29,06015	Stone Pine	160	16	0,67	2,10
11	41,06356	29,06064	Stone Pine	160	16	0,89	2,80
12	41,06353	29,06063	Stone Pine	160	17	0,83	2,60
13	41,06337	29,06056	Stone Pine	160	14	0,76	2,40
14	41,06325	29,06052	Stone Pine	160	15	0,89	2,80
15	41,06311	29,06048	Stone Pine	160	10	0,62	1,95
16	41,06330	29,06042	Stone Pine	160	12	0,76	2,40
17	41,06338	29,06011	Stone Pine	160	15	0,89	2,80
18	41,06338	29,05970	Cypress	185	7	0,57	1,80
19	41,06297	29,05879	Cypress	185	8	0,95	3,00
20	41,06296	29,05889	Cypress	185	8	0,78	2,45
21	41,06293	29,05858	Stone Pine	160	20	0,70	2,20
22	41,06276	29,05850	Horse Chestnut Tree	165	20	0,70	2,20
23	41,06271	29,05847	Cypress	185	12	0,84	2,65
24	41,06271	29,05880	Cypress	185	12	0,67	2,10
25	41,06247	29,05856	Plane Tree	180	25	0,70	2,20
26	41,06243	29,05855	Plane Tree	180	25	0,99	3,10
27	41,06222	29,05824	Plane Tree	180	30	0,95	3,00
28	41,06214	29,05793	Cypress	185	8	0,80	2,50
29	41,06208	29,05783	Cypress	185	6	0,54	1,70
30	41,06223	29,05777	Cypress	185	4	0,67	2,10
31	41,06236	29,05777	Cypress	185	6	0,80	2,50
32	41,06239	29,05787	Cypress	185	6	0,89	2,80
33	41,06238	29,05779	Cedar	190	12	0,64	2,00
34	41,06251	29,05788	Cedar	190	10	0,73	2,30
35	41,06258	29,05789	Cedar	190	12	0,70	2,20
36	41,06265	29,05792	Cedar	190	15	0,76	2,40
37	41,06270	29,05794	Cedar	190	12	0,62	1,95

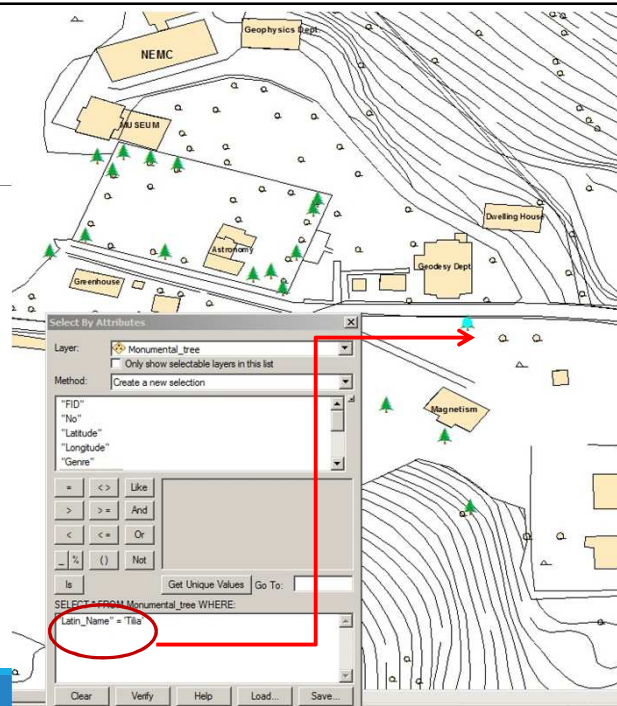
In the study area, the inventory identified 37 monumental trees, belonging to 8 different species.

Study Steps

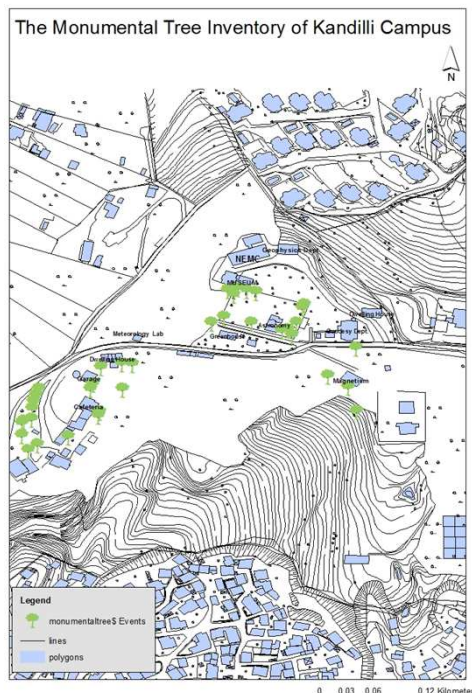


The inventory identified 37 trees, belonging to 8 different species and all visual and verbal data are registered database.

Monumental trees coordinates with genres, types, height, crown spread, diameter and trunk, circumferences are registered in the geodatabase.



Conclusion



Conclusion & Discussion

Most represented species are

Genre	Number
Stone pine (Pinus Pinea)	14
Cypress (Cupressus)	11
Cedar (Cedrus)	5
Plane tree (Platanus)	3
Oak (Quercus)	1
Linden tree (Tilia)	1
Celtis (Celtis)	1
Horse Chestnut Tree	1

In this study, monumental trees that are situated in Bogazici University Kandilli Campus, are determined their location by GPS, assigned the genres, measured trunk circumferences, diameter and crown spread and finally calculated the age of all trees.

All data are registered in ArcGIS. Besides, the inventory identified 37 trees, belonging to 8 different species.

Conclusion & Discussion

An effective and convenient tree inventory database can be created by

- good base map,
- a team of trained people,
- handheld GPS,
- GIS technology.

In our country, monumental tree inventory studies has started in the beginning of 1970s however, these studies was conducted on a small scale and therefore was insufficient.

GIS technology can be provided numerous opportunity in this area

References

- DAFF. 2010. *Forest certification in Australia*, Department of Agriculture, Fisheries and Forestry, <http://www.daff.gov.au/forestry/national/forest-mgmt/certification>
- Frédéric Achard, Hugh D. Eva, Hans-Jürgen Stibig, Philippe Mayaux, Javier Gallego, Timothy Richards, Jean-Paul Malingreau, 2002, Determination of Deforestation Rates of the World's Humid Tropical Forests, *Science*, v297, 5583, pp:999-1002.
- Özhatay N & Kültür Ş (2006). Check-list of additional taxa to the Supplement Flora of Turkey III. *Turkish Journal of Botany* 30: 281-316
- Özhatay N, Kültür Ş & Aslan S (2009). Check-list of additional taxa to the supplement Flora of Turkey IV. *Turkish Journal of Botany* 33: 191-226.
- Özhatay FN, Kültür Ş & Gürdal MB (2011). Check-list of additional taxa to the supplement Flora of Turkey V. *Turkish Journal of Botany* 35: 589-624.
- Anonymous. 2010. Kure Mountains National Park Implementation Site for Enhancing Forest Protected Areas Management System in Turkey Project, http://www.kdmp.gov.tr/KureDaglariMilliParki-ENG_TANITIM_MAT.pdf, 29/05/2014
- Nowak 2006
- Asan, U., 1991, Doğal ve Kültürel Miraslarmızdan Anıt Ağaç ve Ormanlar, *Yeşile Çerçeve Dergisi*, 22-24 (in Turkish).
- Asan, U., 1992, Anıt Ağaçların Birey ve Toplum Psikolojisi Üzerindeki etkileri, *Yeşile Çerçeve Dergisi*, 18, 18-19 (in Turkish).
- Genç, M., and Güner, S. T., 2001, A New Method to Select Monumental Tree Among the Forest Tree Species of Turkey: An Application, *Proceedings International Conference Forest Research: a Challenge for An Integrated European Approach*, 27 August-1 September 2001, Thessaloniki, Greece.
- Waisel Y and Alon A. 1980. "Trees of the land of Israel". Sifriat Hapoalim, Tel Aviv

References

Main Tree; OGM

Vidakovic M 1991, Conifers. In: Brekalo B (eds) Morphology and variation. Graficki Zavod, Hrvatske, pp 129–136

Dirr, M.A. 1990, Manual of woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses. Stipes Publishing Company, Champaign, IL, pp: 1007

Bilgen, B.B., Kurt, Y., Kaya, N. 2012, Mating system in Natural Populations of Taurus Cedar (*Cedrus libani* A. Rich), *Türk J. Agric. For.*, 36, pp:379-387.

Anonymous. 2009, *Aesculus hippocastanum* (Horse Chestnut), *Alternative Medicine Review*, 14, 3, 2009.

(Küstler h. history of landscape in central europe from iceage to present 1999).

Taha Shahat M.A. El-Alfy, Hamida Mohamed A. El-Gohary, Nadia Mohamed Sokkar, Sahar Abd El-Tawab and Dalia Adel Mohamed Al-Mahdy (2011), Botanical and Genetic Characteristics of *Celtis australis* L. and *Celtis occidentalis* L. grown in Egypt, *Bull. Fac. Pharmacy, Cairo Univ.* 48, 37-57.

<http://worldagroforestry.org/>.

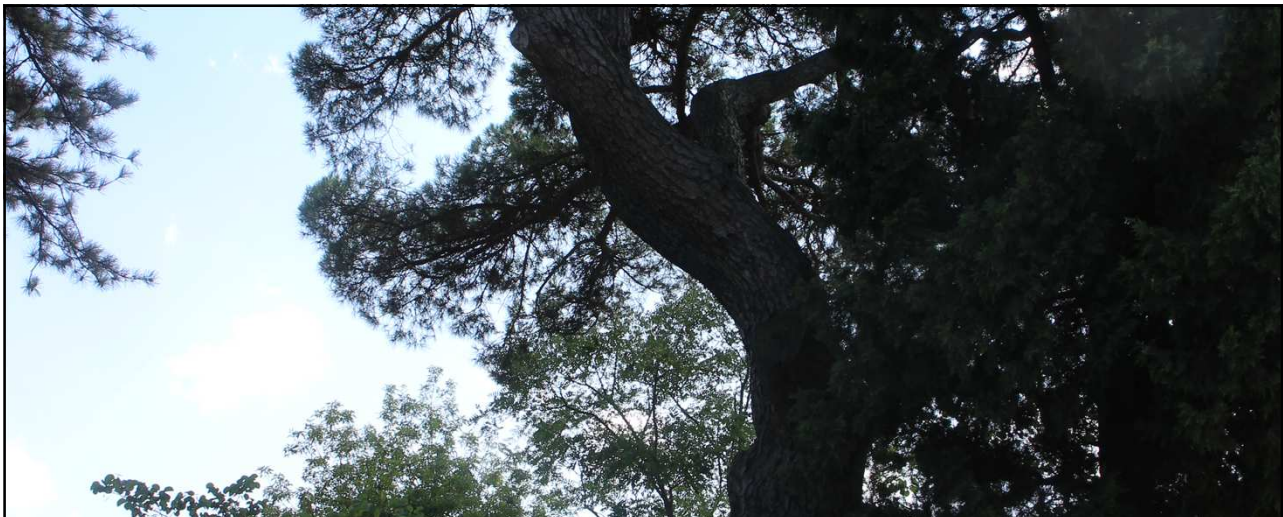
Baytop T (1994). *Türkçe Bitki Adları Sözlüğü*. Ankara: Atatürk Kültür, Dil ve Tarih Yüksek Kurumu Türk Dil Kurumu Yayınları: 578 (in Turkish).

Stephan Diamonds, *Platanus orientalis* a divine gift for Greece, http://www.dendrology.org/site/images/web4events/pdf/Tree%20info%20IDS_04_pp52_53_Platanus.pdf, 29/05/2014.

Mossadegh A (1979). Mini-monograph on *Platanus orientalis* L. in Iran. Technical consultation on fast-growing plantation of broadleaved trees for Mediterranean and temperate zones. FAO-FGB-79-8/2, FAO, Rome, pp. 19.

Panetos K (1984). Genetics and breeding of the genus *Platanus*. Reunion AGRIMED, Antibes (France) 29-30 October 1984.

Zencirkiran M. and Erkan K. 2012, The Effect of Different Times Collecting Cutting and Auxin Treatments of the Rooting in *Platanus Orientalis* L. (Oriental Plane Tree-Cinar), *Journal Animal and Plant Sciences*, 22 (3), pp:764-767.



Thank You For Your Attention

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