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A Database For Orchards With Free GIS Software:

Tekirdag - Isıklar Region Example

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***Abstract*— This study was conducted on 1753 trees in a 10 year old fruit orchard sample (Walnut) with a size of 132 decares in the Işıklar neighborhood of Tekirdağ. Using the Free Geographic Information Systems (CBS) software (Google Drive, Google Earth, QGIS), slope, rug index, shading, appearance and relief maps of the orchard were created.**

In the research area, planted trees are years of 2010 walnut, and their varieties are chandler, fernor, pedro, kaman and franquette. With 8 x 8 planting range most common planted walnut type is chandler. There are a total of 1753 walnut trees including 1128 chandler, 288 pedro, 124 fernor, 105 wedge, 108 franquette.

In the research area, harvesting amounts of walnut trees, annual water quantities, varieties and climate data, soil structure and planting frequencies were processed as a database in OpenOffice Calc which is also a free software. The created database was made available to everyone online and free of charge for accessing, querying and analyzing the data.

***Keywords*— Walnut, GIS, Open Sources Software, Google Drive, QGIS**

I. INTRODUCTION (*Heading 1*)

When evaluating the performances of alternative land use types, assessments made with a single criterion do not usually respond to the desires of decision makers. In general, these requirements are those that have a multifactorial structure for many practical problems associated with resource management. Because of the large amount of data it contains, methods that can respond to such requests are particularly suitable for computer environment [1].

Technology has led to the technical development of Geographical Information Systems (GIS) and the widespread use of it in different disciplines. There are generally two approaches to the definition of GIS: Technologically, GIS is defined as a collection of powerful tools that collect, store, process, convert and display spatial data of the physical world. Theoretical / Institutional point of view, GIS is a system of decision support with the interaction of spatial information. The GIS definition obtained from the merging of both definitions is the form of a digital information system with a decision support function, which collects, stores, processes and displays spatial-spatial data according to the needs of the institution. [2], [3].

GIS is a spatial information system that covers the ground and its surroundings. For this reason, the basic data (point, line and spatially described) is the position data to explain the objects on earth and their relationship to each other (topology). Location data is the data described by the units defined in the national reference system (geodetic reference system, administrative units, property units, addresses, etc.). However, in order to make the system spatial, it is completed by position information, as well as semantic information (descriptive information, attribute information, verbal information, thematic information, etc.) about the defined space. In order for the system components to change and update over periodically, time as date and time as period must be included in the system. It is also necessary to keep information about the data / information contained in the system. All data groups within the system can be visualized cartographically. When the system organization is mentioned, it is aimed that this visualization process will be done automatically depending on the purpose and scale that is queried, analyzed in the system. However, fully automated solutions are not yet possible, but researches on this topic are underway [4].

In recent years, geographic information technologies have evolved from a highly specialized business to technology with a broad impact on society and interaction with nature. Nowadays, GIS applications are used in a wide range from simple direction to critical and complex tasks such as management and forecasting of natural disasters. GIS technology has become part of many new disciplines and industries due to the increasing use of global positioning systems, rapid access to geographically defined data, expanding remote sensing, and simultaneous monitoring. The software component of GIS has a significant impact on the effective use of spatial data. In addition to widely used commercial systems, open and free GIS software plays an important role in the spread of GIS for new approaches and the GIS software provided to those who do not

have or do not want to use commercial software [5], [6].

Free software studies have come a long way in geographic information technologies and about 286 programs and add-ons have been produced. The most successful software, the most widely used GRASS and its integrated QGIS software will be explained briefly.

In this study, a new 10-year-old fruit (walnut) orchard with 132 decares in the Işıklar neighborhood of Süleymanpaşa district of Tekirdağ was mapped with all trees and field as a database set. Free Geographic Information System (GIS) software (Google Drive, Google Earth, QGIS) is used to process all the information of the orchard and the obtained results are aimed to be made available online .

II. MATERIALS

In this section, the material used in the research and the methods used in field and office studies are explained.

The research was carried out on the land of a private company located in Işıklar village which is 20 km away from Tekirdağ city center. The land located in the forest was rented from the state and turned into a closed type walnut orchard. The average height of the study area from the sea is 185 m, latitude 40° 51' North, longitude 27° 21′ East. The location of the research area is shown in Figure 1.

Figure 1. Research area

The irrigation water required for the research area was provided by pressing the surface waters in Tekirdağ-Işıklar Village to a storage pool with a capacity of 7000 m^3 at the highest point of the land.

In the research area, planted trees are years of 2010 walnut, and their varieties are chandler, fernor, pedro, kaman and franquette. With 8 x 8 planting range most common planted walnut type is chandler. There are a total of 1753 walnut trees including 1128 chandler, 288 pedro, 124 fernor, 105 wedge, 108 franquette (Fig. 2).

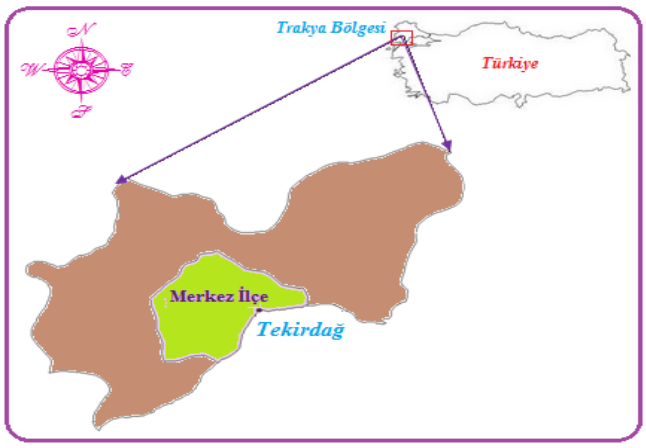

Figure 2. Location of the research area

In this research, Chandler walnut varieties are mainly found. The variety was a Pedro x 56-224 hybrid and was cultivated by the University of California. It is the most important commercial walnut variety in the United States. The trees are moderately strong and can reach 12 m plant height. 700 hours of cooling needed for this walnut type is expected to bloom late . Therefore it is not affected by cold damage, walnut blight and internal worm damage. Chandler, which is a mid-season variety, yields very good fruit (85 - 90%) in the side branches as well as in the end branches. Fruits are large (9 - 13 g), oval, smooth peel, good shell adhesion, weak and fragile peel. In addition, the fruit is 6.5 g, the inner ratio is 52 - 55%, the light color inner ratio is 90 -100% [7].

III. METHODS

The coordinates of each walnut tree in the research area were taken by Chc X91 precision GPS. These coordinates are exported as text format of WGS84 coordinate system. Decimal notations have been corrected individually to convert this data to the appropriate format for the Google Drive application to use.

The type of each walnut tree, planting year, planting frequency, soil type, 2017 plant water consumption and 2017 harvest amounts were transferred to Open Office program which is also free software. Plant water consumption and harvest amounts were monitored and recorded personally by me. Soil analysis was carried out by a private laboratory.

After the information was transferred to Open Office, the resulting database was transferred to Google Drive.

The next step is the interactive visualization of the list of data sets we have created in Google Drive Spreadsheets. The database created in Google Spreadsheets is selected with the Google Spreadsheets option and related data is created on fusion tables and maps.

Using the open source GIS software QGIS, the slope, rug index, shading, appearance and relief maps of the study area were created and the topographic

features of the study area were extracted. In the creation of these maps, the Digital Elevation Model (DEM) map with a resolution of 5 meters was used.

Within the scope of the study, topographic maps with a scale of 1 / 25.000 were combined with the help of QGIS 2.18 software and continuous surfaces were formed. In this context, the slope, aspect and direction distributions were classified from topographic maps covering the boundaries of the study area.

IV. RESULTS & DISCUSSION

The area where the research is conducted is located in a semi-arid climate zone. According to the average of many years, the average annual temperature is 14 ºC. In terms of monthly temperature averages, the coldest month is January with 4.7 ºC and the hottest month is July and August with 23.8 ºC. Although the average annual rainfall is 580.8 mm, most of this occurs between October and April. This information was taken from the local meteorological station in the garden where the research was conducted.

Slope, shadow, aspect and relief maps obtained by QGIS free software were created and evaluated. Figure 3, 4, 5 and 6.

In the data we entered, there were different plant varieties and harvest amounts. Classification of these and properties of each plant in general, mapping analysis at their own coordinate points are presented to all users.

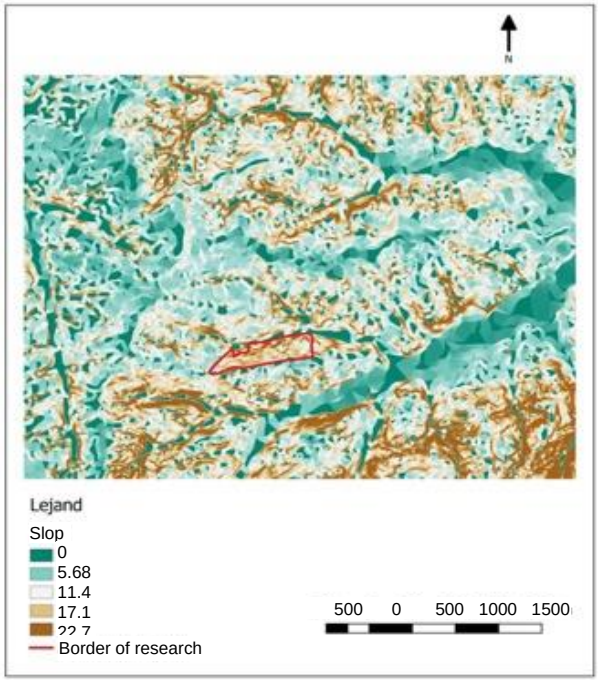

Figure 3. Slope analysis.

After all these procedures, filtering was performed. There are two factors that differ from each other in this database. One of these is the diversity of plant varieties and the other is the amount of harvest according to 2017 varieties. The database we have created has 5 different walnut types. These are Chandler, Pedro,

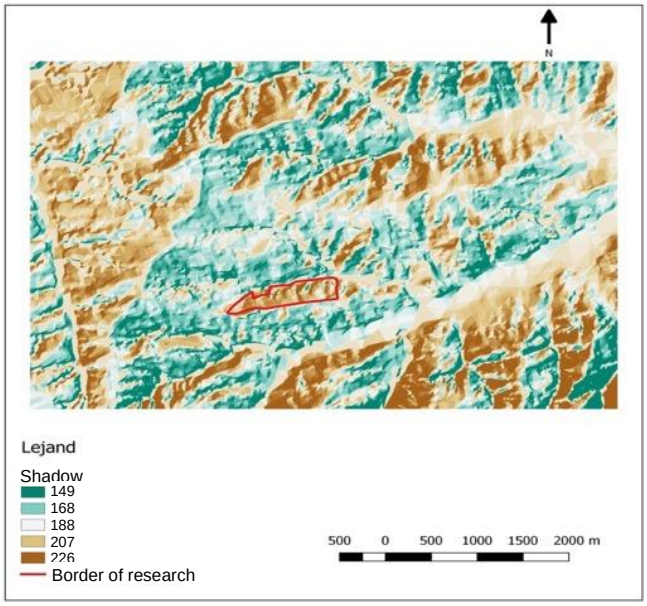

Figure 4. Shadow analysis.

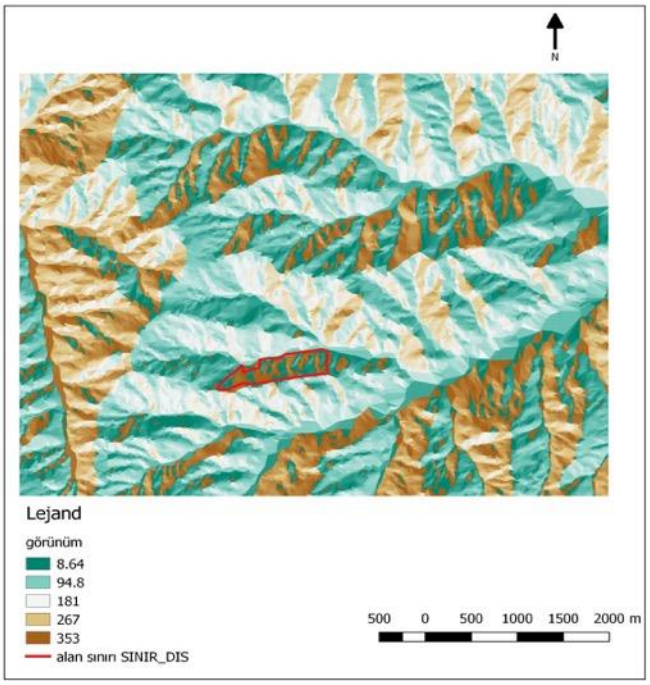

Figure 5. Aspect analysis.

Kaman, Franquette and Fernor. In the database, numbers assigned to the types as Fernor 1, Pedro 2, Franquette 3, Kaman 4 and Chandler 5. Chandler, Franquette and Fernor have 11 kg harvest, 7.1 kg for Pedro and 5.4 kg for Kaman.

After completing the fusion table formation, 5 different types of colorings were made with clicking on ‘’change feature styles ‘’button to ‘’Buckets’’ column to ‘’Column ‘’ tab to ‘’çeşit no ‘’. Chandler is marked green, Pedro blue, Kaman red, Franquette pink and last Fernor is marked yellow. A new filtered map is created after saving (Fig. 7).

After filtering the plant varieties, the number of 5 different varieties was shown separately and the separations were made on the map (Fig. 8).

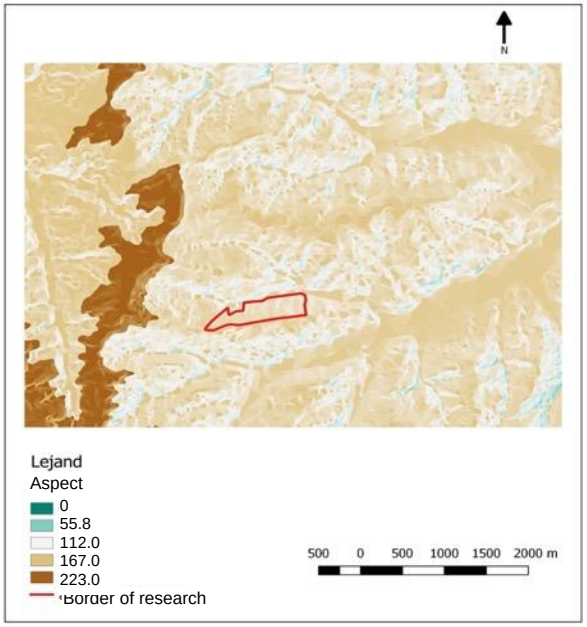

Figure 6. Relief analysis.

Figure 7. Classification of each walnut tree.

Figure 8. Classification according to the amount of each walnut harvest for 2017.

In order to see the harvest amounts written on the database separately on the map, the harvest amounts were colored separately. 5.4 kg was given red, 7.1 kg was blue and 11 kg was green.

V. CONCLUSION

With this study, it is aimed to create a database in small enterprises without any cost. For this purpose, free software which is widely used in recent years has been used.

The database created with this study can be updated at any time, new information can be added and different values can be obtained. It is also possible to publish the results on the internet. Again, no fee is required for this process.

This study conducted in Tekirdag region was shared online and new information could be added anytime. Every year new information will be added to this study, which we leave open to everyone to share.

The fact that all these operations can be done with free software has been registered as an example that no additional financial resources are needed for the similar studies.

Free software can be used in similar studies, it is easier to update, renew and share information, and there is no need for any financial resources.

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