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The availability of local laser technique in forest management planning

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ABSTRACT

Studies in forestry in Turkey have great importance between humanity and life. In this direction, many forestry studies are carried out. The purpose of these studies is to protect forest areas and to ensure their continuity. The forestry organization continues to work urgently in line with this purpose. As a result of the researches, it is seen that old methods are lacking in time and cost in the forest management plan and many forestry studies. Nowadays, researches have been made on the use of the old methods, the use of terrestrial laser technology, which is seen as costly but actually offers positive opportunities at a low cost in line with the purpose to be used. In this study, how the methods used in forest management plans can contribute to the forestry sector with terrestrial laser scanning, which is one of today's technologies, and the sensitivity of devices and software that can be used in this direction are scrutinized. The data obtained as a result of the study were compared with the old methods and the usability of the terrestrial laser scanning method was examined.

1. INTRODUCTION

Turkey has rich forest areas where the various types of wood. The importance given to forest areas in Turkey are progressing in the past with today's sustainable and innovation studies. As a result of research conducted in the presence of Turkey Forests, Global Forest Resources Assessment prepared a 5 year (Global Forest Resources Assessment-FRA) in 2020 according to the report; While it rises to 27th place in the world ranking in the forest existence ranking, it is ranked 1st in Europe and 6th in the world among the countries that increase forest existence (URL-2; URL-3). Forest assets in Turkey in the past 18 years, 2.1 million hectares have been increased. Turkey's 2023 target is visionary in forested areas are planned to correspond to 30% of my area of the country. The areal value of this ratio corresponds to approximately 23.4 million hectares (URL1).

Forestry adversely affected to Turkey's contribution to the protection of forest ecosystems is needed in many areas.Forest management; It is a science that investigates how, when and in what criteria forests can be used and how to obtain more efficiency from forests in order to ensure continuity of forests (Kaplan and Şeylan 2007).

Referring to the historical development of forest management in Turkey when there is no regular continuity until 1857. With the reform edict issued in 1856, many studies were carried out in many areas. When these studies were found, it was desired to benefit from forestry movements to contribute to the conditions. In order to ensure the continuity of developments in the field of forestry, schools for educational purposes were opened and the personnel to work in this field were technically trained. Important steps have been taken in the field of forestry by bringing foreign experts from other countries in order to enact the necessary legislation for the implementation of innovations (Eler 2008).

Despite all these steps taken; It is known that there are problems in determining forest boundaries, preserving, managing and transferring current forest assets to future generations and in preparing forest management plans. In this context, studies to be carried out in forest areas are of utmost importance. Today, in parallel with the advancing technological developments in these studies, different and new methods have been used in addition to the classical methods from the past. Among these methods are remote sensing and Geographic Information Systems (GIS), photogrammetry and LIDAR (light detection and ranging / Laser Imaging Detection and Ranging).

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The LIDAR method offers high resolution data regardless of the sparse and frequent forest areas. In this context, the study was completed with the terrestrial laser scanner using the LIDAR technology in the study area determined in the study, and the data belonging to the area were obtained precisely and quickly. By processing these data, the usability of the terrestrial laser scanner in forest areas was examined and the results were examined.

1.1. Study Area

As a study area, measurements were carried out in a forested area within the campus of Mersin University.

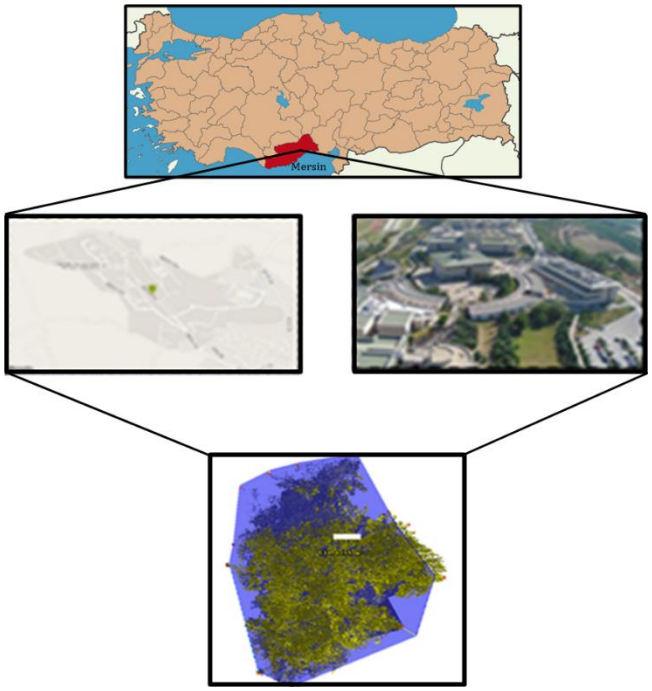

Figure1. Study Area

2. METHOD

The terrestrial laser scanning (YLT) method was used in the study. The distance between the object and the device is measured with the laser beam emitted from the laser scanner device. Thus, the point cloud of the scanning area can be obtained and three (3D) models of the desired object can be produced (Kaya et al. 2021; Çelik et al. 2020;; Kaya and Yiğit et al. 2020; Yiğit and Ulvi 2020; Yakar et al. 2015). The distance between the laser scanning device and the object can be determined by means of the optical source, which is called the laser beam. It has properties (monochromaticity, compatibility, divergence, reflection, density) that distinguish the laser beam from normal light. Thanks to these features, data about the shape and size of real objects can be easily collected and analyzed.
By means of mirrors, also known as laser optical scanning mechanism, the scanning of the object or the surface is performed by directing the laser beam in horizontal and vertical directions. The capacity of a laser scanner to deflect the laser beam in horizontal and vertical directions is given as the viewing angle in the technical information. In order to create a three-dimensional model of an object, it may be necessary to use more than one scanning station with different viewing angles. The result obtained as a result of scanning is a point cloud consisting of millions of points that vary in proportion to the product measuring distance. Information such as point cloud data, location information, density information, RGB value, scan angle, number of reflections, reflection size.

Figure 2. TLS method

In the TLS method, measurement can be performed from one point or several points with the terrestrial laser scanner. Although the measurements made from a single point are very practical, they are not preferred much in practice. Since scanning is performed from only one direction, it is highly possible that complete and healthy data regarding the scanned object cannot be obtained. Therefore, this application is not used except in compulsory cases. Instead, it is scanned from more than one point (Ulvi et al. 2020; Ulvi et al. 2019; Watt and Donoghue 2005;). In this study, scanning was not carried out from a single point, the scans were carried out at more than one station point. Scan data has been processed in point cloud and a variety of commercial and open source software that enables 3D modeling.

2.1. Data Collection and Pre-Processing

The determined working area was realized with the terrestrial laser scanner faro focusS 350 model. A forest area has been chosen as the study area. Testing the applicability of the ylt method played an important role in selecting such a field. As a result of the literature research, it was concluded that there are mainly pine trees in the forests in the Mediterranean region and the trunk length of these trees is long and therefore the tree branches will not prevent scanning. Therefore, the application was carried out in the pine area located in the Mersin University Çiftlikköy campus. The laser scanner was positioned to take the trunk parts of the trees from every angle with frequent sessions, and the measurement process was completed by performing a total of 11 sessions (Figure 3).

The perimeter of the tree trunk was measured from the reference points determined with the help of a rope by marking the reference points at 50, 100, 150 cm heights of the tree trunks and the values were measured with the help of a steel tape measure (Figure 4).

Figure 3. Study area scanning examples

Figure 4. Field Work / reference height applications taken from trees

The necessary data for the processing of the data were obtained by field measurements. FARO SCENE software which is a commercial software and various programs were used in the process of data processing. The scans made by processing the data in the software were combined. The point cloud of the study area was obtained as a result of the merging. A solid model was created through the obtained point cloud. Body circumferences and diameter values of the tree were measured on the 3D model.

Faro Scene software used for data processing has been developed to process scans obtained from all laser scanning devices.

The software offers opportunities such as automatic object recognition of objects found in scans, technical features such as recording and positioning in scans. It was transferred to the software after the scans made.

First, the process operation was applied. At this stage, the process of merging data with cloud to cloud point merging method has been completed. Considering the combined data, a simpler data was obtained by deleting the noise pollution data found in scans other than what was desired. This process is the noise removal process and as a result of the process, it provides the user with the opportunity to obtain a simpler and more usable data. After this stage, solid model (mesh) was created from the generated point cloud.

3. CONCLUSION

In this study, since a forested area was preferred, the point cloud obtained was combined with high resolution and low error, and a point cloud and solid model were obtained. However, it has been determined that a single software is not sufficient for software. On the other hand, since the surface shapes in the study area have various geometric shapes and the leaf regions in the upper parts of the tree are scattered and thin coniferous, a healthy data could not be obtained in the point cloud.

The sensitivity of the laser scanner used in this study was examined by comparing the measurements of the reference points marked on the body parts of the tree with a steel tape measure and the measurements made from the 3D solid model produced from the scans.

With the results obtained, error values were calculated and values very close to the results obtained by local methods were obtained. Since more area can be scanned in a short time in the Ylt method and the volume calculations of the trees will be calculated more easily with the software used, the use of the Ylt method is envisaged.

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