



## Evaluation of Wooded Area in University Campuses: The Case of KTÜ Kanuni Campus in Trabzon<sup>[\*]</sup>

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**Abstract:** Universities are the ones that highlight the social-economic structure, cultural and political characteristics of the society they are in and have a significant potential to create alternative green spaces in cities. With these features, campuses are an important component of living ecosystems. In addition to the social and economic benefits provided by the city, the campuses, which is located in wider areas compared to other institutional structures, provides ecological, aesthetic, economic and psychological benefits to the city and its users with its open and green areas. For this purpose, Karadeniz Technical University campus, located in the city center of Trabzon, was chosen as the study area. Within the scope of the study, the plant inventory in the KTU campus, which has natural and organism plant taxa richness and plant diversity, was determined, the use rate of native taxa and exotic taxa and the intended use rates in the use content. When the plant taxa determined by on-site observation and evaluation method are examined: a total of 211 woody taxa, 83 Gymnospermae and 128 Angiospermae, were observed in the area. The results, which include 163 exotic species, 36 native species, 9 exotic cultures, 1 native culture and 2 naturalized species in the campus. As a result of the obtained data, suggestions were developed for the use of native plants in campus areas.

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**Keywords:** Exotic taxa, floristic diversity, KTU campus, native taxa, Trabzon.

## Üniversite Yerleşkelerindeki Koruluk Alanların Değerlendirilmesi: Trabzon KTÜ Kanuni Yerleşkesi Örneği

**Öz:** Üniversiteler, içerisinde yer aldıkları toplumun sosyal-ekonomik yapısını, kültürel ve siyasi özelliklerini ön plana çıkartan ve kentlerde alternatif yeşil alanlar oluşturmak için önemli potansiyele sahip olan alanlardır. Bu özellikleriyle yerleşkeler kentsel ekosistemlerin önemli bir bileşenidir. Kente sunduğu sosyal ve ekonomik faydaların yanı sıra diğer kurumsal yapılara göre daha geniş alanlarda konumlanan yerleşkeler açık ve yeşil alanlarıyla kente ve kullanıcılarına ekolojik, estetik, ekonomik ve psikolojik faydalar sağlamaktadır. Bu çalışmada, Trabzon kent merkezinde yer alan Karadeniz Teknik Üniversitesi yerleşkesi, çalışma alanı olarak seçilmiştir. Çalışma kapsamında, doğal ve egzotik bitki taksonlarıyla zengin bitkisel çeşitliliğe sahip KTÜ yerleşkesinde yer alan bitkilerin envanteri çıkarılarak, doğal taksonlar ve egzotik taksonların kullanım oranı ve kullanım yoğunlukları belirlenmiştir. Yerinde gözlem ve değerlendirme yöntemiyle tespit edilen bitki taksonları incelendiğinde; 83 Adet Gymnospermae ve 128 adet Angiospermae olmak üzere toplam 211 adet odunsu taksonun yer aldığı tespit edilmiştir. Yerleşkede, 163 adet egzotik tür ile 36 adet doğal tür, 9 adet egzotik kültür, 1 adet doğal kültür ve 2 adet doğallaşmış türün yer aldığı belirlenmiştir. Elde edilen sonuçlar neticesinde yerleşke alanlarında doğal bitki kullanımına yönelik öneriler geliştirilmiştir. KTÜ yerleşkesi, Trabzon, Doğal takson, Egzotik Takson, Floristik çeşitlilik

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**Anahtar kelimeler:** KTÜ yerleşkesi, doğal takson, egzotik takson, floristik çeşitlilik, Trabzon.

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## INTRODUCTION

Architectural structures and open green spaces that make up the components of the city are the elements that ensure the integrity of the city. The urban landscape, which has a dynamic structure, is in constant change and this change is provided by the plants that make up the living material in urban open green spaces (Acar et al., 2007; Çorbacı et al., 2020).

Open green spaces are public spaces that positively affect the social, physical and psychological state of the individual (Öztürk, 2013; Tarakçı Eren & Var, 2016). In parallel with the increasing urbanization, open green spaces that balance the relationships between human and nature and that increase the quality of life by providing recreational opportunities are very important areas for cities (Konaklı & Önder, 2005; Grahn & Stigsdotter, 2010; Wu, 2010; Güneroğlu & Bekar, 2018).

At the same time, these spaces, which are aesthetically and functionally planned and designed for the physical and psychological needs of the city users, provide an integrity with the structural and plant elements and increase the quality of the environment in landscape architecture practices (Gül & Küçük, 2001; Yang et al., 2005; Bayramoğlu, 2016). Vegetable materials are considered as a natural element that develops and enriches the environment they are in with their aesthetic and functional properties (Eroğlu et al., 2016).

The inclusion of nature in landscape design is essential for sustainable development. Thus, the importance of natural design approaches and spaces that can protect the natural structure is constantly increasing (McHarg, 1969). The use of native taxa in planting design helps maintain the balance and beauty of natural ecosystems. Using native species can result in landscapes that mimic traditional landscapes and require less maintenance. Türkiye has a very rich floristic diversity, but this potential is rarely used. Within the scope of sustainability, native species with ornamental plant potential should be utilized in landscape design in urban and rural areas (Sarı & Acar, 2015; Ercan Oğuztürk & Bayramoğlu, 2020). Native taxa with a high landscape potential remained in rural areas, except for a few taxa, and could not be included in the urban landscape despite suitable temperature, precipitation and soil conditions.

Although cities face continuous fragmentation and consequent spatial reduction, they still contain a variety of mosaic structures that have come together from natural and highly valuable habitats and species. Many studies have noted that the number of non-native species tends to increase along the urban-rural range towards the urban centre. The increase in the number of non-native species towards the city center is the result of human influence (Kowarick, 1995; Acar & Sarı, 2010; Pulatkan et al., 2022).

Cities are made up of structural areas and the functional areas surrounding them. The environment, other than the built areas, includes open and green areas that are semi-natural and/or created by humans. University campuses, which have a significant open and green space potential for urban areas, are indispensable elements of cities with the environmental, social, and economic benefits they provide for the city and its users (Çetinkaya & Uzun, 2014; Ekren & Çorbacı, 2022). Many benefits can be listed as reducing air pollution with light green areas of campuses, regulating micro-conditioning, providing life environment for wild animals, carbon retention, energy saving, reducing noise, erosion control and space creation (Trowbridge & Bassuk, 2004; Küçük & Gül, 2005; Gülçin & Van den Bosch, 2021; Karaşah, 2021, Akten & Yücedağ, 2022; Çorbacı et al., 2022; Sarı ve Karaşah, 2023).

In order for plants to reveal the expected benefits (ecological, aesthetic, psychological, etc.) and to help create livable spaces, especially in urban areas, their characteristics (form, color, size, texture, etc.) should be used correctly in design (Gülgün et al., 2014; Birişçi et al., 2017; Kösa, 2019). However, when the plant design studies in open and green areas in cities and campuses are examined in studies on the subject in our country, it is understood that many plant taxa are selected by keeping only their form, color and aesthetic characteristics in the foreground. It is not taken into consideration that the taxa used are species that will adapt to the ecological conditions of the region (Başer & Yıldızcı 2011; Yücedağ et al., 2017; Sarı & Karaşah, 2018; Çorbacı et al., 2022).

Success in this matter will only be possible if the land use decisions are taken correctly, and landscape architects and planners perform their duties by ensuring ecological integrity. Making land use decisions and determining the appropriate planning and management style during the use of natural resources is related to the correct interpretation of the floristic potential of the area by analyzing it. In addition, the detection of the presence of plants increases the possibilities of using these plants in various fields. The use of native plants in landscape planning and design studies, which is one of these uses, not only increases the chances of success, but also ensures the integrity of the campus with the city and its immediate surroundings (Ekici, 2010).

Pulatkan, (2001) also mentioned the contribution of native species production to the country's economy in her study. Yalçınalp, (2005) on the other hand, revealed in his study that plants are the most important natural resource in the plateau; however, native species are neither protected in the area nor used in landscaping applications in the immediate vicinity of the existing facilities. Karaşah and Sarı, (2018) stated that determining the natural plant species that can reflect the character of each region and using them

in urban planting designs will contribute to the urban identity in terms of aesthetics and ecology. Considering the time we are in, producing, researching and focusing only on species with economic value will not mean protecting other species. The world is moving towards the protection of biodiversity.

University campuses are areas that highlight the social-economic structure, cultural and political characteristics of the society in which they are located. The native plants used in the plant designs of the campuses that provide alternative green spaces for the cities are economically and ecologically very important (Güneroğlu & Bekar, 2018; Yıldız, 2020; Oğuztürk & Pulatkan, 2022). By making an inventory of the plants in the open green areas of the campus, the usage rate and usage intensities of exotic taxa among the native taxa were determined, and as a result of the results, suggestions were developed for the use of native plant species in the campuses.

## MATERIAL AND METHOD

**Study Area:** The main material of the research is the existing plants in the urban open green areas of Trabzon province. All trees and shrubs that make up the plant existence in urban open green areas were included in the study. At the same time, the literature on the research area, site plans of the areas, maps and various photographs of plants were also evaluated as research material.

The study area consists of Karadeniz Technical University (KTU) Kanuni Campus, which is within the borders of Ortahisar district of Trabzon province, located in the Eastern Black Sea region of the Black Sea region. The green areas of KTU Kanuni Campus, located in the coastal part of Trabzon province, were determined as the study area (Figure 1).

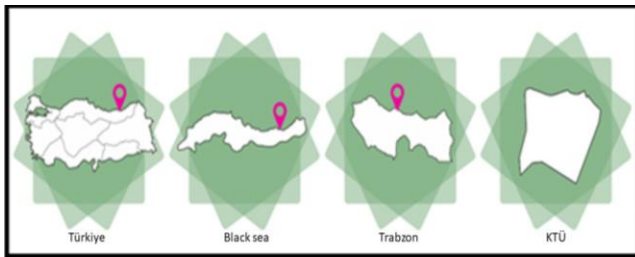


Figure 1. Study area location map

**Method:** As a method for the evaluation of the plant inventory in the open green areas of the KTU campus, the collection of data, the determination of the native exotic status and usage intensities of the data, their evaluation and systematic classification and tabulation constitute. The research was carried out in three stages as preliminary survey studies, field studies and office studies.

**1. Data Collection:** Literature review for the study areas, collection and evaluation of data related to the land were carried out. In this context, the literature on the field

and the subject has been examined. The data used in the study were obtained from various public institutions, and the satellite images of the areas were taken from Google Earth. The study of Anşın and Terzioğlu, (1998) was also used while determining the plant list and locations.

**2-Determination and Evaluation of the Native Exotic Status of the Data and their Usage Intensities:** Plant taxa and usage frequencies in urban open and green areas of KTU campus were determined.

**3. Tabulation of Data by Systematic Classification:** All data obtained as a result of field studies were transferred to the computer environment. Office programs were used to store and query the data in computer environment.

## RESULTS

The results obtained in the study can be listed as follows: (i) Identification and classification of existing green spaces, (ii) Determination of native exotic status of plant taxa and evaluation of their intensity of use.

(i) Identification and classification of existing green spaces.

KTU Kanuni Campus, chosen as the study area, was divided into three zones as protection zones defined in terms of plants in previous studies (KYSMP, 2016):

1. Areas that must be protected,
2. Plant protection zones of moderate importance and
3. Areas that are not objectionable for different uses in terms of plant resources.

**1. The characteristics of the regions that must be protected:**

- Finding herbaceous and woody species from the time the university campus was established until today (1955-2022),
- The presence of rare or unseen species in our country and Black Sea region,
- Including natural rocky area habitats,
- It can be listed as the presence of production plots and exotic species in and around the Faculty of Forestry greenhouse. In addition, the areas in the southern part of the Landscape Architecture Department are reserved as areas that must be protected in terms of being planned as a plant collection area containing herbaceous and woody species of the Black Sea region, which some departments (Landscape Architecture, Forest Engineering and Biology Departments) use especially for applied courses.

Areas defined as absolute protection zones generally include the areas on the main transportation line within the campus area, the green areas in the south of the Landscape Architecture Department and in the C gate area (KYSMP, 2016).

**2. Regions of moderate importance:** These are the areas where the plants in the area can be evaluated by

moving them to different points when any different area use is planned for the campus area (KYSMP, 2016).

3. *Non-inconvenient areas*: When different uses are needed within the campus, this region is a region that does not mind in terms of plant resources (KYSMP, 2016).

Within the scope of this study, the green areas within the campus were examined as 5 different regions (grove areas, active green areas, rocky area habitats, greenhouse production area, open green areas) (Figure 2).



Figure 2. Green areas in the campus

(ii) Determination of Native Exotic Status of Plant Taxa.

Plant species are divided into “conifers” and “broad-leaved” and classified as trees, shrubs, shrubs and ground covers. The plants in the KTÜ Kanuni campus were evaluated according to 7 classes. These classes; they are designated as broad-leaved trees and shrubs, coniferous trees and shrubs, broad-leaved shrubs, coniferous shrubs, citrus fruits, palm trees, huggers and climbers. There are 211 taxa belonging to 52 families in the green areas of KTÜ Kanuni campus, 36 of which are native, 163 are exotic, 9 are exotic-culture, 1 is native-culture and 2 are naturalized form plants. A total of 211 different taxa were identified: 83 taxa of coniferous trees and shrubs, 70 taxa of broad-leaved trees and shrubs, 48 taxa of broad-leaved shrubs, 3 taxa of citrus fruits, 2 taxa of palm trees, 5 taxa of climbers and climbers.

- 65 out of 83 taxa in coniferous trees, shrubs and shrubs are exotic (78%),
- Out of 70 taxa in broad-leaved trees, shrubs and shrubs, 13 are native (19%), 57 are exotic (81%),
- 1 of 10 taxa is native (10%), 8 is exotic (90%),
- 36 of the 211 taxa were native (17%) and 163 were exotic (83%) (Figure 3).

It was determined that the taxa in the Kanuni campus of KTU belonged to the Pinaceae, Cupressaceae, Rosaceae and Sapindaceae families in the highest number (Figure 4).

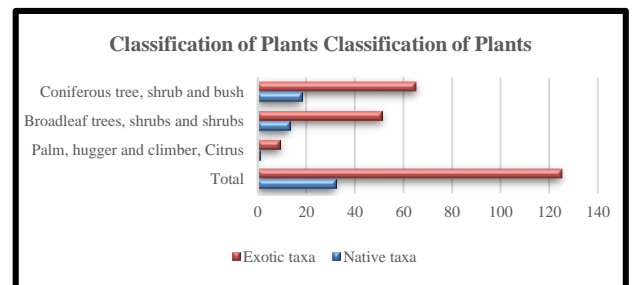


Figure 3. Map of the number (number) and native-exotic (number) status of plant taxa according to plant classes in the open green areas of KTU Kanuni campus

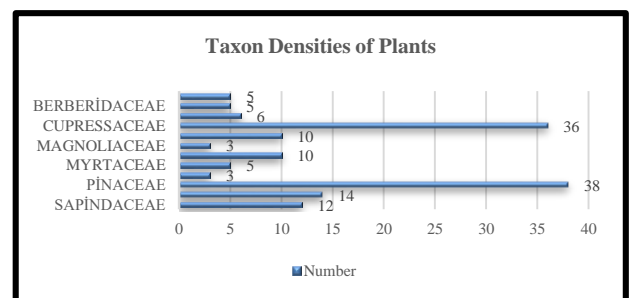


Figure 4. Family densities of taxa used in KTU Kanuni campus

**Wooded Areas in KTU Campus:** There are 4 wooded areas of different sizes within the borders of the KTU campus (Figure 5). The plants in these wooded areas were identified and their native-exotic status was determined.



Figure 5. Wooded areas within the campus area

1 native and 10 exotic taxa were identified in the detection study in Grove No.1. It has been observed that *Pinus brutia* Ten., (Red Pine), which is the native plant of Türkiye, is found in the area intensively. In the woodland, native taxa include *Cedrus libani* A. RICH, *Pinus pinea* L., *Alnus glutinosa* (L.) Gaertn. (Alder), *Fraxinus excelsior* L., *Liquidambar orientalis* Mill., *Mespilus germanica* L., *Platanus orientalis* L., *Populus tremula* L., *Tilia platyphyllos* Scop and *Ulmus glabra* HUDSON, exotic taxa *Cedrus deodara* (Roxb.) Loud., *Cryptomeria japonica* (Thunb. ex L.f.) D. Don., *Cupressus arizonica* Greene, *Sequoia sempervirens* D. Don Endl., *Acer negundo* L., *Koelreuteria paniculata* L., *Laburnum vulgare*, *Liquidambar styraciflua* L., *Nerium oleander* L. and *Robinia pseudoacacia* L (Fig. 6).

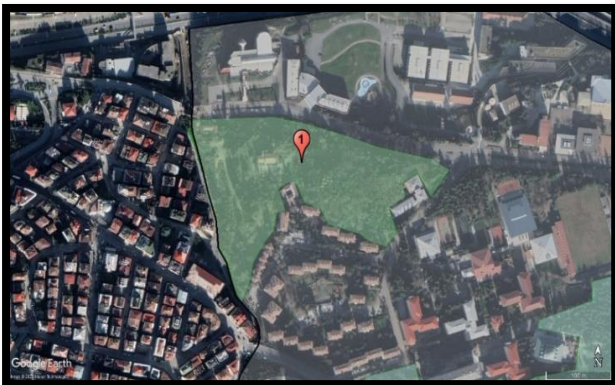


Figure 6. Woodland No. 1

In the detection study carried out in the grove no. 2, 16 native taxa and 5 exotic taxa were determined in the area. It has been determined that *Pinus pinea* L., which spreads native in Türkiye, is the dominant tree species in the area. It has been observed that the woodland area is mostly composed of taxa that are native for this region.

Along with this taxon, the native taxa in the grove are *Picea orientalis* (L.) Link, *Abies nordmanniana* (STEV.) SPACH, *Cedrus libani* A. RICH, *Fagus orientalis* Lipsky, *Platanus orientalis* L., *Cedrus orientalis* Lipsky (Eastern Beech), *Platanus orientalis* L., *Ulmus glabra*, HUDSON, *Acer pseudoplatanus* L., *Laurus nobilis* L., *Liquidambar orientalis* Mill., *Populus tremula* L., *Pinus sylvestris* L., *Pinus nigra* J. F. ARNOLD, *Fraxinus ornus* L., *Carpinus orientalis* MILLER, taxa. In addition, along with native taxa, *Robinia pseudoacacia* L, *Thuja occidentalis* L., *Eucalyptus globulus* Labill., *Pinus pinaster* Ait., *Sequoia sempervirens* D. Don Endl., exotic taxa are also found (Figure 7).



Figure 7. Wooded area numbered 2

6 native taxa and 2 exotic taxa were identified in the wooded area no. 3. The plant density of the area constitutes *Pinus pinea* and *Pinus sylvestris* L., which are native spread in Türkiye. Besides these plants, *Pinus pinaster* belongs to native plants., *Cupressus sempervirens* L., *Quercus robur* L., *Fraxinus ornus* L., and exotic plants *Pinus pinaster* Ait., *Robinia pseudoacacia* L. are the taxa in the grove (Figure 8).

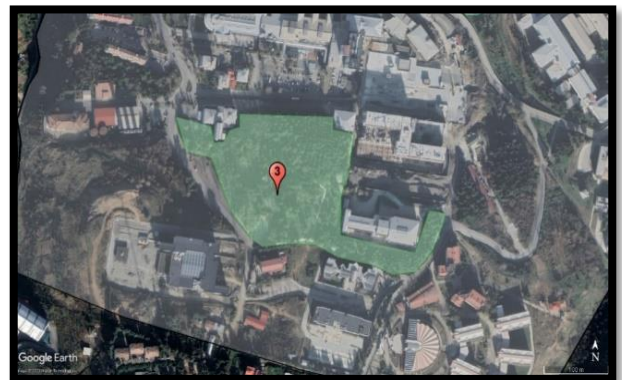


Figure 8. Wooded area numbered 3

As a result of the observations in the wooded area 4, 4 native taxa and 2 exotic taxa were identified. It has been determined that the dominant tree species of the area is *Pinus pinea*, which is the native plant of Türkiye. *Pinus pinea*, *Pinus brutia* TEN., *Quercus robur* L., *Fraxinus ornus* L., *Populus tremula* L. taxa. Along with these, *Eucalyptus globulus* Labill from exotic plants, and *Robinia pseudoacacia* L taxa are also found (Figure 9).

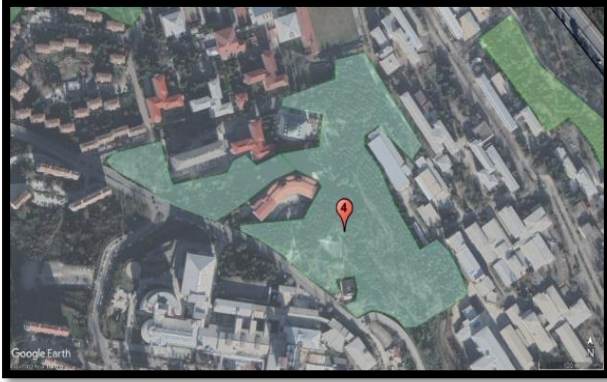


Figure 9. Wooded area number 4

## DISCUSSION

Plants, which have an important place in human life with their characteristics throughout history, are also very valuable in terms of aesthetics and functionality in plant design studies today. In this study, it has been determined that there are a total of 211 woody taxa, 83 Gymnospermae and 128 Angiospermae, in the KTU Campus, while 36 of the 211 taxa are native (17%) and 163 are exotic (83%). According to these data, it has been determined that species naturally found in the Eastern Black Sea region are not used in the KTÜ Kanuni campus.

Looking at the wooded areas that have existed since the establishment of the campus, it is seen that native species predominate. It was determined that the preference of exotic plants in the landscaping areas built later in the campus caused the number of exotic species to be high throughout the campus. While creating these data, in addition to our determinations, Anşin and Terzioğlu's (1998) study was used.

Plants used in urban open green areas are important with the benefits they provide to the city and users. The purpose of use, density, type of plants used in cities varies according to various parameters (climate, geographical structure, socio-economic structure, etc.). The ability of plants used in cities to fulfill the expected functions is possible with a good knowledge of their biological characteristics and growing desires. All kinds of planting, maintenance and protection works will be carried out in a healthy way in line with the management plan that can be created for urban open green spaces (Önder & Akbulut, 2011). While there are approximately 12.000 plant taxa in the European Continent, which is 15 times larger than Türkiye, there are more than 12.000 taxa in Türkiye (Güner et al., 2012). In the study on plant existence in Türkiye, it was determined that there are 13,211 taxa belonging to 163 families in Türkiye. Accordingly, there are a total of 10754 native taxa, including 1168 genera, 8988 species, 1683 subspecies and 1074 varieties, 298 hybrids, and 3708 endemic taxa. The endemism rate among plant taxa is 34.5% (Davis et al., 1988; Çorbacı et al., 2020;

Yıldırım et al., 2022). In the herbal research carried out in the Eastern Black Sea region, 220 endemic plant taxa were determined (Anşin, 1982). There are 2239 plant taxa that are rarely seen in the Eastern Black Sea region, and 440 of them are rare in Türkiye. 514 of the plants detected in this region are endemic taxa, and the endemism rate of 41 was determined to be 23%. Of the endemic taxa, 428 are very rare and 300 are rare plants in Türkiye (Yaldız et al., 2010; Çorbacı et al., 2020).

## CONCLUSION

While our country and the Black Sea region are so rich in terms of plant life, the use of exotic plant species in urban landscapes not only causes waste of national wealth but also has a negative ecological and economic impact on the urban environment. Trabzon province is known as one of the greenest cities of our country in terms of its geographical location and climate characteristics. This green texture forms a whole with the natural vegetation in rural areas and green areas in urban areas. University campuses are also of great importance for the city in terms of open green areas in urban areas. University campuses are an important component of urban life. Campuses located in larger areas, in addition to the social and economic benefits they provide to the city, also contribute to the ecology of the city with their open and green areas. It is also important to use native plant species in these areas in order to increase ecological contributions.

Depending on the climatic conditions of the region, many plant taxa grow native. There are many native plant taxa that can be used instead of exotic plant taxa in the campus areas and contribute to the area in terms of aesthetics and functionality. In this context;

- The use of native plants should be preferred in campus landscape designs.
- Production planning should be done by researching the existing plant taxa in the areas.
- Local governments should encourage the use of native taxa.
- In this context, plant management plans should be prepared as a result of the plant inventory in the open green areas of KTU Kanuni campus.
- The sustainability of green areas should be ensured and campus users should be informed about this issue.

As a result, university campuses are important green areas for cities. These areas are of great importance for campus and city users. Since the correct planning of these areas will contribute to the city in ecological and economic terms, preparing the inventories of the areas in terms of correct planning is important as it will form a basis for other studies.

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