

**Edible Gardens on Sustainable University Campuses\***

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**Abstract**

*This study is about the design and implementation of an edible garden in Zonguldak Bülent Ecevit University Çaycuma Campus. Then, after determining the most suitable area within the campus, a survey was conducted with students and academic-administrative staff to determine the preferences of campus users. It is emphasized that the edible garden approach is an effective tool in strengthening the connection of young people with nature and its role in campus design is evaluated. In the first stage, a survey was conducted with students and staff to determine user preferences. In the second stage, an edible landscape design was carried out in line with the findings obtained; In the third stage, a satisfaction survey was conducted for the application. The results showed that the functionality of the area increased, the level of knowledge about plants increased and the aesthetic perception improved. In addition, the variety of walking paths, sitting areas and plant materials used were evaluated positively by the users. It was determined that this application added prestige to the university and contributed to sustainability criteria such as GreenMetric.*

**Keywords:** Green Campus, Urban Green Infrastructure, Edible Garden, Landscape Design

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## 1. Introduction

The concept of sustainability, which is increasingly important in every aspect of life, has become a frequently emphasized topic for university campuses, which can be considered as small city models. This situation increases environmental and social responsibilities on and off campus. Education and training are the most important tools in fulfilling these comprehensive responsibilities. Universities are seen as innovation centers of sustainable development through education, research and knowledge transfer (UNEP, 2013; Kalaycı Onaç, 2021). In this context, the concept of sustainable university campuses has gained importance. Today, it is seen that university campuses around the world have begun to develop the concept of "edible campus" in line with the goal of making resources efficient based on sustainability. These initiatives primarily aim to provide healthy and sustainable food to users and also to educate university communities about food production and resource use (Grichting & Awwaad, 2015). The use of Edible gardens as a sustainable environmental strategy due to their functions is of particular importance in terms of human health, environmental and climate-compatible development (Benliay & Gezer, 2019). Universities that carry out studies in line with sustainable development goals stand out as places where sustainable development can be practically implemented thanks to their innovative campus designs (UNEP, 2013; Oktay & Küçükyavaş, 2015). In this context, the concepts of "Green Campus" or "Eco-Campus" have emerged. These concepts, which are accepted worldwide, have developed as the product of interdisciplinary studies that require awareness for a sustainable environment (Öktem & Mutdoğan, 2020). Green campuses aim to increase environmental quality by creating healthy living and learning environments with elements such as energy efficiency, efficient use of resources and sustainability-oriented education (Leal Filho et al., 2015; Humblet et al., 2010).

Sustainable campuses include many environmental, social and economic goals such as reducing carbon footprint, using green technologies, adopting human and environment-oriented design principles, supporting green transportation systems, reducing costs and reducing social injustice (Grindsted, 2011). The campus planting process is defined as a process that aims to reduce the environmental impacts arising from campus activities and operations and to increase environmental awareness within university communities (Leal Filho et al., 2015; Humblet et al., 2010). It has been emphasized that universities should not only limit their sustainability efforts within their own borders but also spread them to society (Sapporo Sustainability Declaration, 2008). University campuses play an important role as large institutions that have a direct impact on environmental sustainability (Amr et al., 2016). Planting practices on campuses not only contribute to the support of natural ecosystems (Zhou, 2017; Seitz et al., 2014), but also undertake multifaceted functions such as creating recreational areas for campus users and supporting social and cultural development (Zhou, 2017). In addition, these areas provide significant contributions in terms of physical and psychological recovery (Mennis et al., 2018; Chang & Bae, 2017). The direct link between nature-based activities and mood and well-being has been demonstrated in many studies (Hipp et al., 2016). The effects of campus environments on student well-being and quality of life have been investigated, and it has been determined that students especially prefer waterfronts and areas with dense vegetation (Wang et al., 2023; Lu & Fu, 2019; Foellmer et al., 2021). In addition, the importance of campus landscapes being attractive to users by adapting to seasonal changes has been emphasized (Mahayudin et al., 2015; Hanan, 2013). Campus landscape brings together many functions such as aesthetic evaluation, recreational activities, ecological protection, and contributes to the psychological recovery of university students, offering opportunities for relaxation, socialization, and contact with nature (Maroto et al., 2015; Wang et al., 2021). In addition, Edible garden applications on university campuses provide the opportunity for safe food production. These practices not only combat food insecurity but also provide students with direct food resources (Maroto et al., 2015). In addition, new habitats are created through Edible garden practices, which contribute to the preservation of biodiversity (Rakhshandehroo et al., 2017). Edible landscape practices not only raise awareness about sustainable food systems and food production, but also offer social benefits such as revitalizing campus life and encouraging more active lifestyles (Eigenbrod & Gruda, 2015; Ling et al., 2018). In this context, the example of Stanford University is noteworthy. The university has a one-acre farm area with a large orchard, which is jointly managed by

students, staff, and alumni. Organic gardening workshops are held throughout the year, where produce and flowers are grown, and the products are provided to the campus food service, cooperatives, and various organizations. In addition, these activities provide students with credit (Chen et al., 2008). Similarly, there are currant and apple orchards on the University of Alberta campus. These orchards are managed by undergraduate and graduate students, volunteers, and faculty, and provide fresh, organic, and local foods to students and the Edmonton community. It also aims to promote local production (Chen et al., 2008).

Many universities around the world are making plans to combat climate change by improving their sustainability and measuring their performance through various systems. The evaluation of universities in the field of environmental studies is a relatively new topic (Grindsted, 2011; Suwartha & Sari, 2013). The UI GreenMetric World University Ranking is the first attempt to evaluate the sustainable behavior of universities on a global scale (Grindsted, 2011; Suwartha & Sari, 2013).

In addition, different systems such as the “Green League”, “Environmental and Social Responsibility Index” and “Sustainability Tracking and Evaluation System (STARS)” are also used to measure the sustainability performance of universities. Among these, GreenMetric stands out as the first global measurement system (Grindsted, 2011; Suwartha & Sari, 2013). It is predicted that adverse changes in weather conditions due to climate change may reduce agricultural yields by 13-45% in the next 50 years. In addition, factors such as unplanned urbanization and sea level rise lead to the loss of arable green areas and agricultural lands (Eigenbrod & Gruda, 2015). These developments threaten food security and increase interest in Edible gardening practices (Grichting & Awwaad, 2015; Gittleman et al., 2017). Edible landscapes, as one of the green infrastructure components, not only create productive areas, but also promote social harmony and social development by regulating underused areas, contribute to biodiversity and increase the level of social welfare (Xie et al., 2019). The multifunctional nature of edible plant species allows ecological, cultural, sociological and economic advantages to be presented together in landscape applications (Berezan, 2010). In this context, Edible garden applications stand out as a landscape design approach in which food-providing plants are preferred instead of traditional ornamental plants (Nieman and Ressler, 2012). This approach offers an alternative and innovative solution in land use (Superfisky, 2010). The Edible garden concept creates space for food production in campuses, while also increasing the aesthetics and functionality of the space (Naranja et al., 2011). Plants with unusual colors and shapes further increase the aesthetic value of the area (Rodica et al., 2010). Edible garden applications meet the need for coordination between agriculture and the urban living environment by integrating the functions of agricultural production with the urban landscape (Lin et al., 2022). In addition, Edible garden applications have many sustainable benefits such as providing economic savings, increasing food security, providing better nutrition opportunities and contributing to the formation of healthy societies (Açıkgöz et al., 2014; Çelik, 2017; Nieman & Ressler, 2012). They also provide environmental and social benefits such as creating habitat, protecting biodiversity (Rakhshandehroo et al., 2017) and encouraging social interaction (Ling et al., 2018). Edible garden applications are no different from traditional landscape design; The design process follows the same basic principles and roles (Bhatt et al., 2009). Landscaping arrangements made on university campuses include plants, water bodies, rocks and other natural elements. Plants are considered one of the most important parts of the campus's natural environment; they increase the visual aesthetics with their changing colors throughout the seasons and positively affect the mood of the users by regulating the local microclimate (Song & Gao, 2024). In addition, water elements such as fountains, ponds and artificial lakes are also an indispensable part of the natural structure of the campuses.

As a result, Edible garden applications use all the elements of traditional landscape design and need unifying elements such as hard landscape elements to provide integrity (Rodica et al., 2010). This multifaceted approach, in addition to creating a sustainable environment, has an important place in the urban landscape design of the future by establishing a balanced relationship between aesthetics and functionality.

## 2. Material and Methods

Research aim and scope, study area and method are explained in this section.

### 2.1. Research Aim and Scope

In this study, Zonguldak Bülent Ecevit University (BEUN) Çaycuma Campus located in the Western Black Sea Region of Turkey was selected as the application area. The main purpose of the study is to develop an Edible garden model specific to the Western Black Sea Region in order to create sustainable campuses where the human-nature relationship is emphasized on university campuses. In this context, it is aimed to integrate agricultural production with university campuses within the framework of sustainability activities and to ensure the active participation of campus users in food production processes. The importance of Edible garden applications in this process is the focus of the study.

The main question of the research is how a sustainable human-nature relationship can be established on university campuses. The study aims to draw attention to the Edible garden application in a way that will answer this question and to develop suggestions that will contribute to sustainability on university campuses. At the same time, the introduction and dissemination of the Edible garden concept in educational areas is among the objectives of the study. In the study, it is planned to determine user preferences and to realize the Edible garden design and application in line with these preferences. After the application, the aim is to measure user satisfaction with the Edible garden design. Ethics Committee Approval: Ethics Committee Approval of this study has been taken from Bartın University Social and Human Sciences Ethics Committee with decision number 2022-SBB-0099 and dated 25/03/2022.

### *Conceptual Framework And Research Questions*

The main target question of the research is how a sustainable human-nature relationship can be created on university campuses. In this context, the study focuses on the following research questions:

- What are the perceptions and preferences of users towards Edible garden applications in Çaycuma Campus?
- Has the Edible garden application created awareness among campus users about the concept of edible landscape?
- Have the needs and expectations determined before the Edible garden application in Çaycuma Campus been met after the application?

In line with these three basic questions, the before and after of the Edible garden application in Çaycuma Campus were evaluated; user perception, expectations and satisfaction levels were analyzed. The study adopted a participatory approach within the scope of sustainable campus applications and aimed to include user expectations and satisfaction in the design and application process. This approach reveals the original value of the study with the suggestions developed for creating a model for similar applications and disseminating it. Within the scope of the study, the Edible garden design and application is suggested as a method of increasing campus sustainability by providing campus users with access to fresh and local food through urban agriculture. The application was carried out with the voluntary participation of students and academic and administrative staff studying at Çaycuma Food and Agriculture Vocational School (MYO) and Çaycuma Vocational School. Thus, significant contributions were made to the target group's knowledge and awareness levels regarding Edible garden applications.

In this study, based on edible landscape examples in the world, edible plants were used in the campus where Çaycuma Food-Agriculture Vocational School and Çaycuma Vocational School are located. Garden design and implementation was carried out. As a matter of fact, with this application, it is aimed to contribute to the process of sustainable campus design and implementation at BEUN.



## 2.2. Study Area

Çaycuma is a district of Zonguldak City which has a coastline on the Black Sea in its east side. Çaycuma is 52 km from Zonguldak City and 43.7 km from Bartın City. BEUN Çaycuma Campus is 6 km away from Çaycuma district center. Çaycuma is located among the slopes in the Filyos River valley (URL-1 2021). The total area of Çaycuma Campus is 740 decares (URL 2 2021) (Figure. 1).

Çaycuma Food and Agriculture Vocational School has 3 departments consisting of 4 associate degree programs. There are 2 Assoc. Prof. Dr., 4 Asst. Prof. Dr. and 12 Lecturers total of 18 academic staff and 8 administrative staff at Çaycuma Food and Agriculture Vocational School. In addition The School has 366 actively enrolled students as of the 2021-2022 academic year. There are a total 2192 active students in both vocational schools, which constitute core of the research.

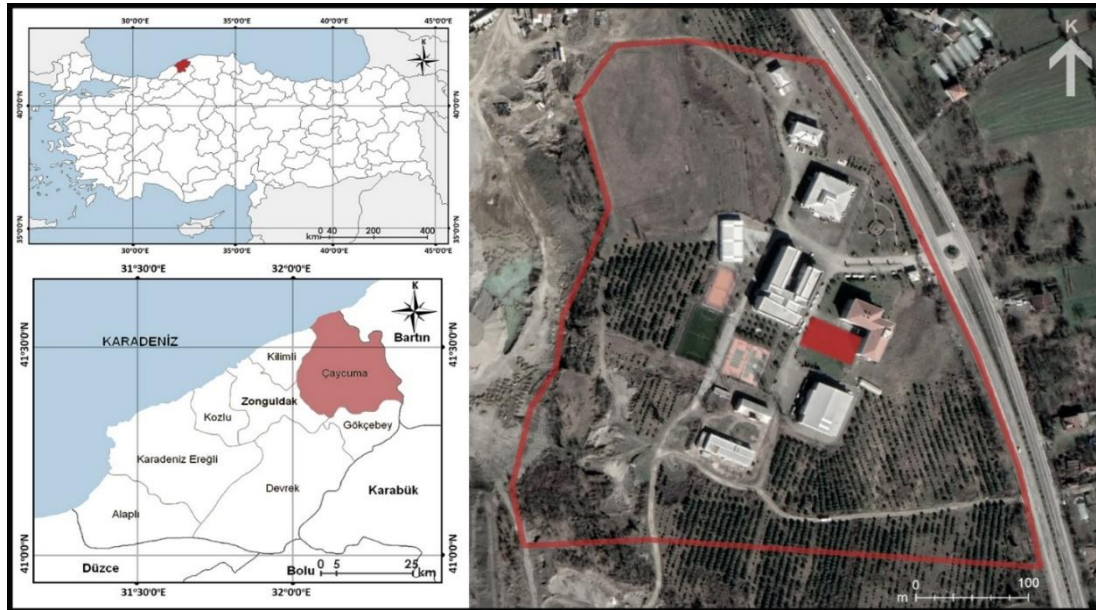


Figure 1. Location of the research area (Original, 2021)



Figure 2. Zonguldak Bülent Ecevit University Çaycuma Campus (Original, 2021).

Edible For the garden, the application area opposite Çaycuma Vocational School, next to the Sports Hall and in front of Çaycuma Food-Agriculture Vocational School was chosen as the application area (Figure. 2). As stated below, the visibility of the area as well as the suitability of natural conditions were effective in the selection of this area.

The study area is 2100 m<sup>2</sup> in size, has a slope of 2%, is partially flat and does not have any pits, hills or rocks. There are 12 *Platanus* sp. in the area. It is a partially sheltered area located in front of Çaycuma Food-Agriculture Vocational School. The main gate of the campus is on the entrance road and is on the busiest road route of the campus. The study area can be easily seen from Çaycuma Vocational School and Çaycuma Food-Agriculture Vocational School buildings.

### 2.3. Method

The method consists of 3 main stages;

- i) Edible Pre-application survey regarding the garden,
- ii) Landscape design process,
- iii) Post-implementation satisfaction survey.

The universe of this research; It consists of students, academic and administrative staff from Çaycuma Vocational School and Çaycuma Food-Agriculture Vocational School operating in Çaycuma district of Zonguldak province. In 2021-2022, when the research was conducted, there are a total of 1891 people in both schools, including 1820 students and 71 academic and administrative staff. A process of determining a sample from the universe was used, taking into account factors such as the COVID-19 pandemic, response rate and time. The following formula was used for the sample size.

Based on the formula above, it was determined that 318 students were sufficient for 1891 people, with a 95% confidence interval and a 5% margin of error ( $p < 0.05$ ). However, in order for the research results to be considered more realistic, the data obtained from a total of 588 people were subjected to statistical analysis.

#### *i) Pre-Implementation Survey Regarding the Edible Plants Garden*

A survey study was conducted in order to measure the knowledge and awareness levels of Çaycuma Vocational School (Vocational School) and Çaycuma Food-Agriculture Vocational School students and academic and administrative staff regarding the Edible garden application and to determine their opinions and suggestions regarding the application area. The survey was created via Google Form and applied between April 1–30, 2021. The prepared survey was designed to consist of three parts.

- **The first part** includes a total of 5 questions to determine the demographic characteristics of the participants.
- **The second part** includes a total of 17 questions that measure awareness about edible landscaping and opinions about the elements that should be included in landscaping, which can be answered as yes/no.
- **The third part** includes a 14-item question group that evaluates attitudes towards the concept of edible landscaping and is answered with a 5-point Likert-type (strongly agree - strongly disagree) scale.

The questions in this section were created by scanning national and international literature. In preparing the research questionnaire, studies by Childs (2011), Wang (2016), Farrington (2015), Hopkins (2017) and MacKelvie (2014) were used.

#### *ii) Landscape Design Process*

During the design process; a literature study was conducted on the subject and similar applications in domestic and foreign university campuses were examined. In addition, analyses were conducted on the climate data of the area, existing plant texture, soil structure, land characteristics, socio-cultural structure,

area-building and area-environment relations. In addition to all these analyses, user requests were also taken into consideration. In the landscape design process, a survey was conducted to determine the opinions and suggestions of students and academic and administrative staff, and data was obtained on which design elements should be included in the area. Following the survey studies carried out at this stage, a suitable location was selected for the project area; Concept plan, preliminary master plan, final project, structural and plant application projects and detailed maps were prepared by focusing on the most appropriate solution in line with the survey results and environmental analyses. In addition, 3D models were created for the visualization of the design. In the design process, studies by Cengiz et al. (2012), Yılmaz & Yılmaz (2000) and Yılmaz & Irmak (2012) were used. Drawings and visual presentations of the Edible garden project were prepared using AutoCAD, Lumion 3D Vusion 4.1, SketchUp and Photoshop CS6 Extended programs.

### *iii) Post-application satisfaction survey for edible plants garden*

In the landscape design process, after the stain, preliminary and application projects were drawn and the structural and plant applications were made, a survey was conducted to determine the satisfaction of the participants. The survey was conducted between April 1 and May 15, 2022. The satisfaction survey consists of 3 parts.

- **The first part** includes 5 items on demographic characteristics,
- **The second part** includes 19 items on satisfaction with edible landscaping, functional variables in landscaping and yes/no answers,
- **The third part** includes 11 items on satisfaction with edible landscaping that can be answered on a 5-point Likert type (strongly agree-strongly disagree).

A total of 588 students, administrative and academic staff from Çaycuma Vocational School and Çaycuma Food-Agriculture Vocational School participated in the survey. The data obtained were analyzed with SPSS 20 statistical package program

## **3. Results**

Results of the study are explained in this section.

### **3.1. Findings of the Survey Study to Determine Pre-Implementation User Preferences Regarding Edible Plants Garden Landscaping**

In this part of the research, the results regarding the demographic characteristics of the people who participated in the survey were evaluated. In this part of the research, the results regarding the demographic characteristics of the people who participated in the survey were evaluated. Of the people participating in the research, 73.4% (157 people) were women and 26.6% (57 people) were men. Of the male and female participants, 86.9% (186 people) are students, 8.9% (19 people) are academic staff and 4.2% (9 people) are administrative staff. 80.8% (173 people) of the participants are 17-25 years old, 8.9% (19 people) are 26-35 years old, 7.5% (16 people) are 36-45 years old, 2.8% (6 people) are aged 46 and over. In terms of educational status, 51.9% (111 people) are secondary or high school graduates, 39.7% (85 people) are university graduates, and 8.4% (18 people) are graduate graduates. 19.6% (42 people) of the participants live in villages, 55.6% (119 people) in districts and 24.8% (53 people) in cities. Of these, 50.5% (108 people) are apartments, 37.4% (80 people) are detached houses, 11.2% (24 people) are apartments in a complex and 0.9% (2 people) are apartments, dormitory etc. lives in places. Considering the duration of use of the campus by the participants; It is seen that 86.9% (186 people) have been using it for 5 years or less, 4.2% (9 people) have been using it for 6-10 years, and 8.9% (19 people) have been using it for 11 years or more. Of the 214 participants, 65.9% (141 people) grew up in a family with a vegetable and fruit garden. 34.1% (73 people) of the participants stated that they had farm experience, but 65.9% (141 people) stated

that they had no farm experience. It was determined that 31.8% (68 people) of the participants participated in urban agriculture activities, while 68.2% (146 people) did not participate.

In this part of the research, the answers given by the people who participated in the survey to information about Edible garden were evaluated. In Table 1, 28% (60 people) of the people who participated in the research have knowledge about edible landscapes. 29.9% (64 people) do not have any knowledge about edible landscaping.

**Table 1.** Thoughts on edible plant garden landscaping.

<b>Do you know about edible landscape gardening?</b>	<b>n</b>	<b>%</b>
Yes	60	28.0
No	64	29.9
Not Enough	90	42.1
<b>What do you think of the edible landscape garden?</b>	<b>n</b>	<b>%</b>
A great idea	141	65.9
I don't know	67	31.3
It has no place in the city	6	2.8
<b>Do you care about the aesthetics of your environment?</b>	<b>n</b>	<b>%</b>
Yes	210	98.1
No	4	1.9
<b>Do you think the campus area needs to be redesigned and renovated?</b>	<b>n</b>	<b>%</b>
Yes	188	87.9
No	5	2,3
No idea	21	9.8
<b>Do you think there is a need for an edible landscape garden on campus?</b>	<b>n</b>	<b>%</b>
Yes	173	80.8
No	9	4.2
No idea	32	15.0
<b>Would you like a garden with fruit trees, vegetables, ornamental plants and medicinal aromatic plants in the university campus where you live?</b>	<b>n</b>	<b>%</b>
Yes	204	95.3
No	5	2,3
No idea	5	2,3
<b>Do you think that creating an edible landscape garden in a certain area of the campus can attract the attention of those who use the space?</b>	<b>n</b>	<b>%</b>
Yes	208	97.2
No	6	2.8
<b>Would you like to visit such a garden?</b>	<b>n</b>	<b>%</b>
Yes	208	97.2
No	one	.5
No idea	5	2,3
<b>Do you want to spend your free time in the edible landscape garden?</b>	<b>n</b>	<b>%</b>
Yes	201	93.9
No	13	6.1
<b>Do you want a walking path to an edible landscaping garden?</b>	<b>n</b>	<b>%</b>
Yes	209	97.7
No	5	2,3
<b>Would you like to supply plants for an edible landscape garden?</b>	<b>n</b>	<b>%</b>
Yes	173	80.8
No	41	19.2
<b>Want to see a water element in your edible landscaping garden?</b>	<b>n</b>	<b>%</b>
Yes	208	97.2
No	6	2.8
<b>Would you like to see seating units in the edible landscape garden?</b>	<b>n</b>	<b>%</b>
Yes	201	93.9
No	13	6.1
<b>Want to harvest in an edible landscaping garden?</b>	<b>n</b>	<b>%</b>
Yes	153	71.5
No	61	28.5



**Table 1 Continued**

If you have children, would you take them to an edible landscaping garden?	n	%
Yes	198	92.5
No	16	7.5
<b>Total</b>	<b>214</b>	<b>100.0</b>

The campus users regarding the preferred items in Edible garden are given in Table 2. It is seen that the elements that the campus users want to see most in Edible garden are the flowering of the plants in the spring (78.5%), abundance of greenery (73.4%), and the presence of different types of plants (69.6%).

**Table 2.** Preferred elements in edible plants garden landscaping.

Like this what makes you happiest in a garden?	n	%
Flowering status of plants in spring	168	78.5
Harvesting fruits and vegetables	112	52.3
Lots of flowering plants	141	65.9
Autumn leaf colors	112	52.3
Having lots of green	157	73.4
Having tall trees	104	48.6
Too many plants in shrub form	48	22.4
Seeing seasonal changes in plants	105	49.1
Protecting animals and creating areas where they can shelter	128	59.8
Presence of different types of plants	149	69.6

Participants' opinions on the edible plants garden landscape survey items are given in Table 3. edible when the opinions regarding the garden arrangement are examined in general, it can be said that the opinions of the participants are positive.

**Table 3.** Participants' views on the edible plants garden landscape in the campus area.

	Strongly Agree		Agree		Neither Agree nor Disagree		Disagree		Strongly disagree		$\bar{x}$	SS
	n	%	n	%	n	%	n	%	n	%		
1. Edible plant material must be used on university campus.	41	19.2	104	48.6	46	21.5	9	4.2	14	6.5	3.69	1.03
2. Edible plant materials in the campus create aesthetic quality.	47	22	110	51.4	34	15.9	10	4.7	13	6.1	3.78	1.03
3. Edible plants on campus are an important part of reducing energy inputs and protecting the environment	44	20.6	116	54.2	31	14.5	9	4.2	14	6.5	3.78	1.03
4. Edible plants make life easier because they are fresher and more accessible	57	26.6	118	55.1	16	7.5	10	4.7	13	6.1	3.91	1.03
5. Edible landscaping could reduce our dependence on foods with unknown production systems	35	16.4	102	47.7	47	22	18	8.4	12	5.6	3.60	1.03
6. I would appreciate the use of edible plants on the university campus.	59	27.6	117	54.7	17	7.9	10	4.7	11th	5.1	3.94	1.00
7. Edible landscape plants on university campus are the reason to go there	36	16.8	95	44.4	52	24.3	18	8.4	13	6.1	3.57	1.05
8. The presence of edible plants on university campus may be beneficial for human health	55	25.7	115	53.7	22	10.3	8	3.7	14	6.5	3.88	1.04

**Table 3 Continued**

9. I consume edible landscaping products.	47	22	110	51.4	37	17.3	7	3.3	13	6.1	3.79	1.01
10. Edible landscaping products increase water and energy consumption.	29	13.6	88	41.1	56	26.2	25	11.7	16	7.5	3.41	1.09
11. Edible landscaping is a form of urban agriculture that pays for water, fertilizer, and time with food.	29	13.6	102	47.7	62	29	7	3.3	14	6.5	3.58	0.98
12. People who try to use edible landscape plants unconsciously may damage the plant.	41	19.2	121	56.5	31	14.5	9	4.2	12	5.6	3.79	0.98
13. Edible landscaping is educational (a natural educational area for child-nature interaction)	65	30.4	114	53.3	21	9.8	4	1.9	10	4.7	4.02	0.94
14. Social activities can take place in the edible landscape garden	55	25.7	120	56.1	16	7.5	11th	5.1	12	5.6	3.91	1.01
<b>TOTAL</b>											<b>52.72</b>	<b>11.82</b>

Edible the findings regarding the comparison of the items desired to be seen in the garden according to gender are given in Table 4. When the table is examined, when comparing the items that campus users want to see in Edible garden according to gender, only the abundance of flowering plants ( $\chi^2=6.075$ ;  $p=0.014$ ) and autumn leaf colors ( $\chi^2=5.880$ ;  $p=0.015$ ) differ according to gender. It appears that other edible landscape elements do not differ according to gender. It can be said that there are more female campus users than men in terms of the presence of flowering plants and autumn colors, in other words, the gender factor is an important variable on these items in the edible plants garden.

**Table 4.** Comparison of desired items in the edible plants garden by gender.

Like this what makes you happiest in a garden?		Yes	No	Chi Square Value
		n	%	
Flowering status of plants in spring	Woman	128	29	$\chi^2=3.194$ ; $p=0.074$
	Man	40	17	
Harvesting fruits and vegetables	Woman	83	74	$\chi^2=0.066$ ; $p=0.797$
	Man	29	28	
Lots of flowering plants	Woman	111	46	$\chi^2=6.075$ ; <b><math>p=0.014</math></b> *
	Man	30	27	
Autumn leaf colors	Woman	90	67	$\chi^2=5.880$ ; <b><math>p=0.015</math></b> *
	Man	22	35	
Having lots of green	Woman	116	41	$\chi^2=0.082$ ; $p=0.775$
	Man	41	16	
Having tall trees	Woman	80	77	$\chi^2=1.311$ ; $p=0.252$
	Man	24	33	
Abundance of plants in shrub form	Woman	36	121	$\chi^2=0.085$ ; $p=0.771$
	Man	12	45	
Seeing seasonal changes in plants	Woman	78	79	$\chi^2=0.090$ ; $p=0.765$
	Man	27	30	
Protecting animals and creating areas where they can shelter	Woman	99	58	$\chi^2=2.581$ ; $p=0.108$
	Man	29	28	
Presence of different types of plants	Woman	112	45	$\chi^2=0.816$ ; $p=0.366$
	Man	37	20	

### 3.2. Landscape design application

#### I. Concept Plan

According to the survey results obtained, a concept plan was created by preparing a requirements program in line with user needs and expectations.

#### II. Preliminary master plan

Master plan was prepared by taking into account the land use patterns and spatial diversity, which were evaluated according to the concept plan determined to be used in the design. The master plan was handled in three stages: the pond and its immediate surroundings (Phase I), the walking path (Phase II), and the planting areas (Phase III). The design was approached with a holistic approach, but each stage was focused separately.

#### III. Structural and Herbal application process

##### Structural implementation process

The decisions developed during the preliminary plan phase were transferred to the final project. After this stage, the structural application project and the vegetative application project were prepared and detail sheets were produced. For the herbal application project, the natural plants of the region were taken into consideration. Selected plants edible It has been included in the design according to its functional, aesthetic and economic features in line with garden design principles (Figure. 3).

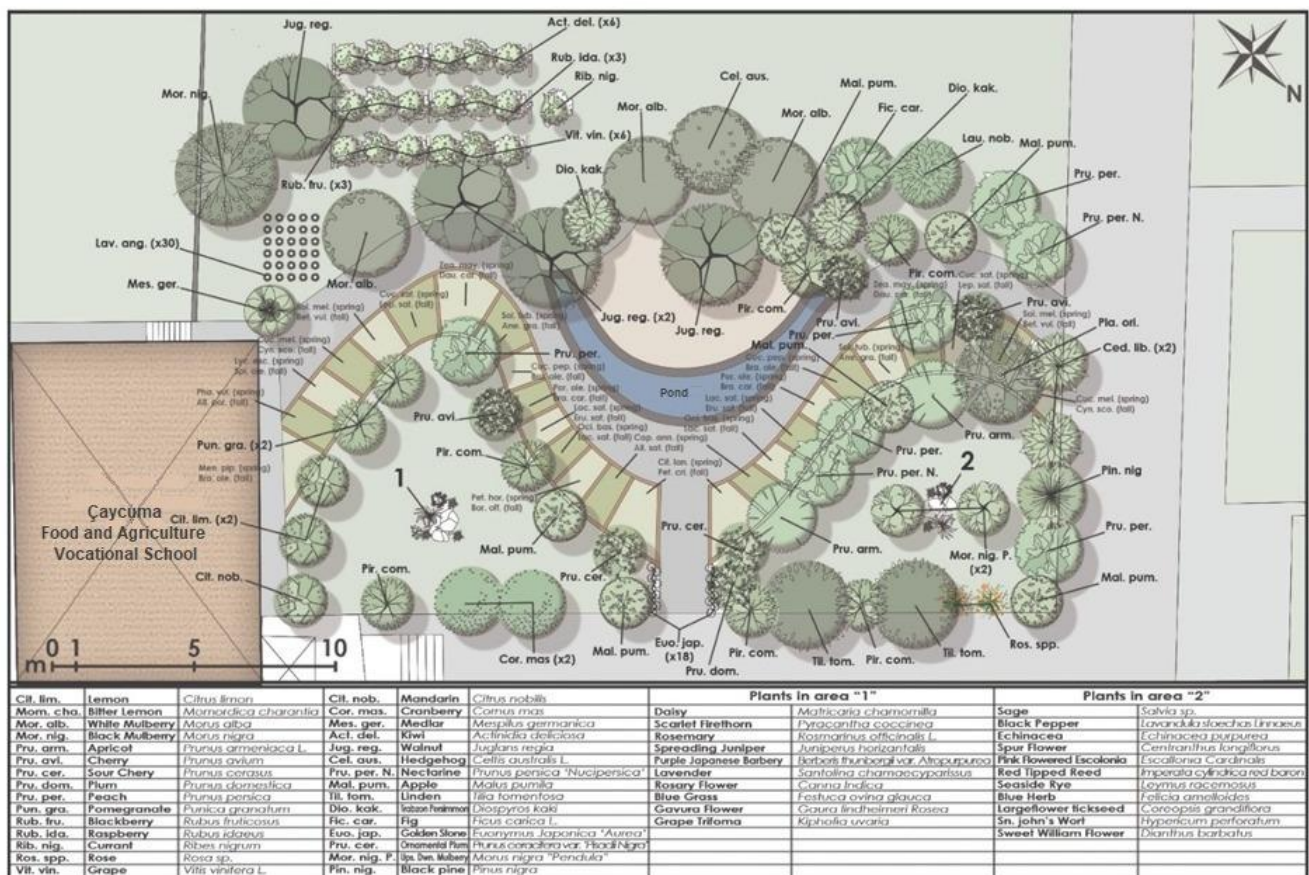
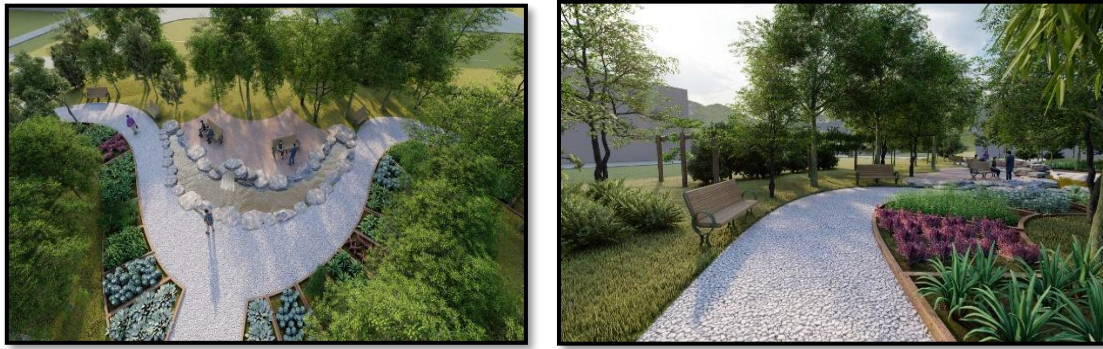


Figure 3. Edible plants garden herbal application project (Original, 2021).

Edible garden application project Autocad, Lumion 3D Vusion 4.1, Sketch Up was prepared and visualized using Photoshop CS6 extended programs (Figure. 4)



**Figure 4.** Edible General view from the garden design project.

Within the scope of the application project, the area was leveled and the construction of the pond was carried out, and natural rock stones collected from the streamside with the help of a scoop were placed around the pond with the help of mortar. A submersible pump was placed in the pond to circulate the water. In the next stage, a walking path was built and vegetable plots were separated.

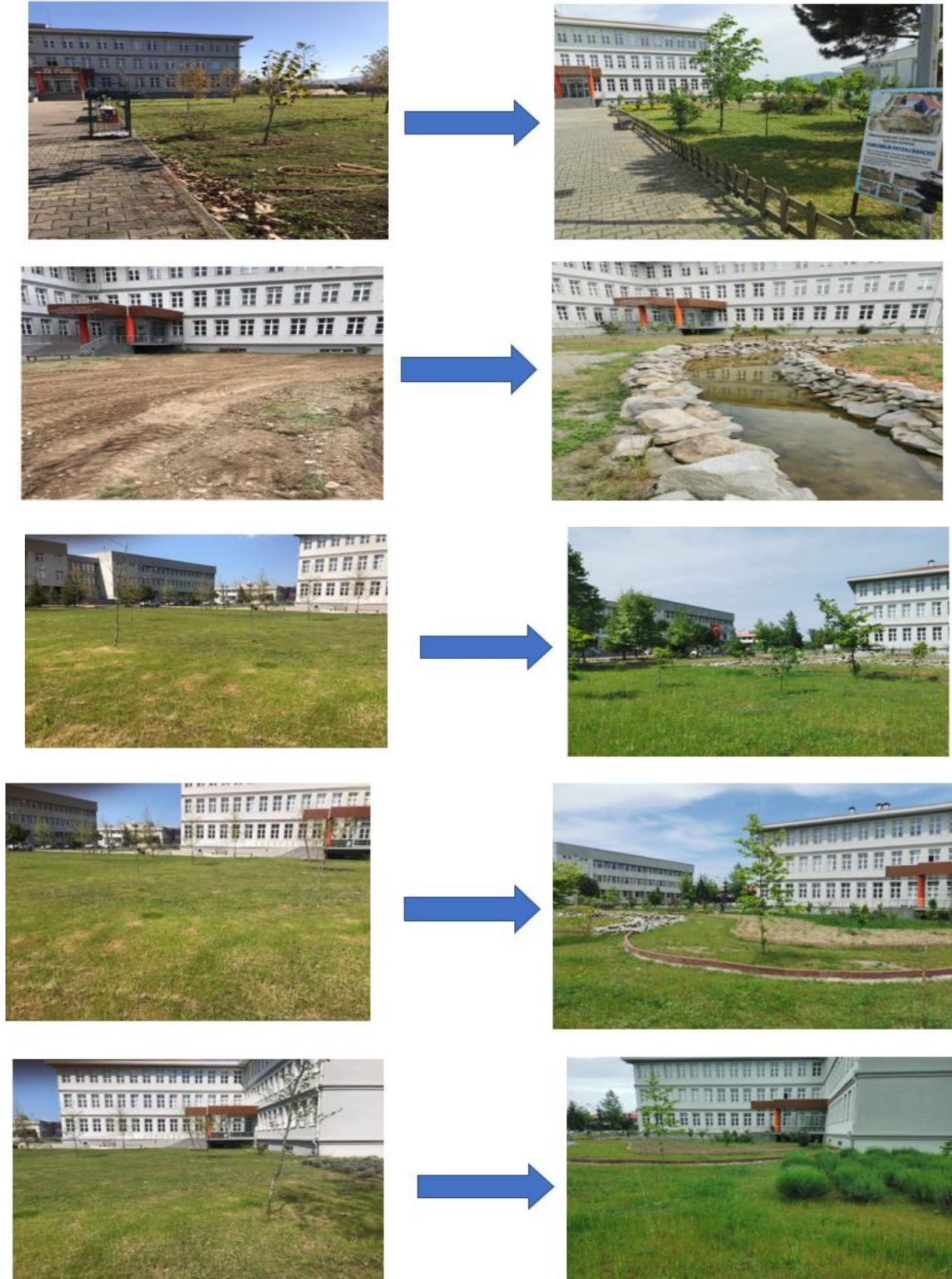
### 3.3. Herbal Application Process

Then, soil was brought to the area and spread, the vegetative application phase began. Edible The garden herbal application process started in May-June 2021. Fruit trees and vegetables planted in the area; *Cornus mas*, *Elaeagnus spp.*, *Prunus Armeniaca L.*, *Prunus avium*, *Prunus cerasus*, *Prunus domestica*, *Prunus persica*, *Rosa canina*, *Arbutus unedo*, *Crataegus monogyna*, *Cydonia oblonga*, *Mespilus germanica*, *Pyrus communis L.*, *Pyrus malus L.*, *Ziziphus zizyphus*, *Juglans spp.*, *Castanea Mill.*, *Celtis australis*, *Corylus avellana*, *Vitis spp.*, *Fragaria vesca*, *Morus alba*, *Morus nigra*, *Ribes grossularia*, *Ribes nigrum*, *Rubus fruticosus*, *Rubus idaeus*, *Vaccinium myrtillus*, *Citrus lemon*, *Actinidia deliciosa*, *Citrus fortunella*, *Diospyros kaki*, *Ficus carica L.*, *Momordica charantia*, *Punica granatum*, *Allium cepa*, *Allium sativum*, *Anethum graveolens*, *Anthriscus cerefolium*, *Beta vulgaris L. ssp .*, *Beta vulgaris var. cicla*, *Boraga officinalis*, *Brassica carinata A. braun*, *Brassica oleracea*, *Brassica oleracea gemmifera*, *Cynara scolymus*, *Eruca vesicaria*, *Lactuca sativa*, *Lepidium sativum*, *Petroselinum crispum*, *Raphanus sativus*, *Spinacia oleracea L.*, *Lycopersicon esculentum*, *Capsicum annuum*, *Citrillus lanatus ( Thunb .)*, *Cucumis melo*, *Cucumis sativus L.*, *Cucurbita pepo L.*, *Cucurbita sp.*, *Phaseolus vulgaris*, *Pisum sativum L.*, *Portulaca oleracea L.*, *Solanum melongena*, *Solanum tuberosum*, *Zea May* these are plants. (Figure 5). The same framing pictures of the application area taken before the project was implemented and the same framing pictures taken after the application are shown in figure 6.



**Figure 5.** Pictures of products grown in the garden (Original, 2021).





**Figure 6.** Evaluation of before and after pictures of the garden from the same frame

### 3.4. Findings of the Post-Implementation Satisfaction Survey on Edible Plants Garden Landscaping

In this part of the research, the results regarding the demographic characteristics of the people who participated in the survey were evaluated: In this part of the research, the results regarding the demographic characteristics of the people who participated in the survey were evaluated. In addition, photographs of the garden before and after were evaluated from the same frame, as shown in Figure 5. Of the people participating in the research, 63.8% (375 people) were women and 36.2% (213 people) were

men. 96.8% (569 people) of male and female participants are students, 2.6% (15 people) are academic staff and 0.7% (4 people) are administrative staff. 93.2% of the participants (548 people) are under 25 years old, 4.6% (27 people) are 26-35 years old, 1.9% (11 people) are 36-45 years old, 0.3% (2 people) are aged 46 and over. In terms of educational status, 57.3% (337 people) are secondary school graduates or below, 39.8% (234 people) are university graduates, 2.9% (17 people) are graduate graduates. Considering the duration of use of the campus by the participants; It is seen that 93.4% (555 people) have been using it for 2 years or less, and 6.6% (33 people) have been using it for 3 years or more.

In this part of the research, participants Edible The results of the frequency analysis conducted to determine their opinions about the garden were examined (Table 5).

**Table 5.** Functional variables.

<b>The usability of the study area in the Çaycuma campus has increased with its new form.</b>	<b>n</b>	<b>%</b>
Yes	425	72.3
No	46	7.8
Partially	117	19.9
<b>My knowledge about edible landscape gardening has reached a sufficient level.</b>	<b>n</b>	<b>%</b>
Yes	339	57.7
No	87	14.8
Partially	162	27.6
<b>The combination of fruit trees, vegetables, ornamental plants and medicinal aromatic plants gave the garden an aesthetic appearance.</b>	<b>n</b>	<b>%</b>
Yes	468	79.6
No	32	5.4
Partially	88	15
<b>Walking paths in the edible landscaping garden are sufficient</b>	<b>n</b>	<b>%</b>
Yes	389	66.2
No	100	17
Partially	99	16.8
<b>Seating areas in the edible landscape garden are sufficient</b>	<b>n</b>	<b>%</b>
Yes	279	47.4
No	191	32.5
Partially	118	20.1
<b>In the area where the study was carried out in the Çaycuma campus, different plant designs were used compared to the previous ones.</b>	<b>n</b>	<b>%</b>
Yes	441	75
No	50	8.5
Partially	97	16.5
<b>The plants used in the Çaycuma campus edible landscape garden have a variety of textures and shapes.</b>	<b>n</b>	<b>%</b>
Yes	425	73.3
No	48	8.2
Partially	115	19.6
<b>The plants used in the edible landscape garden of Çaycuma campus include plants showing the beauty of fruits and flowers.</b>	<b>n</b>	<b>%</b>
Yes	388	66
No	68	11.6
Partially	132	22.4
<b>The plants used have a visual appearance in terms of flower, fruit and leaf colors.</b>	<b>n</b>	<b>%</b>
Yes	411	69.9
No	64	10.9
Partially	113	19.2
<b>The number of plants in the Çaycuma campus edible landscaping garden is sufficient</b>	<b>n</b>	<b>%</b>
Yes	328	55.8
No	110	18.7
Partially	150	25.5



**Table 5 Continued**

<b>The plants in the Çaycuma campus edible landscape garden are well-groomed.</b>	<b>n</b>	<b>%</b>
Yes	398	67.7
No	49	8.3
Partially	141	24
<b>There is sufficient grass area in the edible landscaping garden of Çaycuma campus.</b>	<b>n</b>	<b>%</b>
Yes	403	68.5
No	83	14.1
Partially	102	17.3
<b>I was pleased with the harvest of fruits and vegetables in the edible landscaping garden.</b>	<b>n</b>	<b>%</b>
Yes	376	63.9
No	76	12.9
Partially	136	23.1
<b>The green areas in the Çaycuma campus edible landscape garden are in harmony with the hard ground.</b>	<b>n</b>	<b>%</b>
Yes	422	71.8
No	52	8.8
Partially	114	19.4
<b>The ornamental pool in the edible landscape garden has a cooling and relaxing effect.</b>	<b>n</b>	<b>%</b>
Yes	343	58.3
No	116	19.7
Partially	129	21.9
<b>Çaycuma campus edible landscape garden has become an area where you can spend your free time.</b>	<b>n</b>	<b>%</b>
Yes	381	64.8
No	86	14.6
Partially	121	20.6
<b>I think the study area adds prestige to the campus.</b>	<b>n</b>	<b>%</b>
Yes	417	70.9
No	52	8.8
Partially	119	20.2
TOTAL	558	100.0

When the arithmetic mean values of the answers to the satisfaction survey are examined, it is seen that the scores vary between 3.32 and 3.71. In the survey, it is seen that the average values of the answers given to the first item " *Adequate levels of edible plant materials are used on the university campus* " and the eighth item " *Edible landscaping products on the campus consume more water and energy* " correspond to the "undecided" range, while the other items correspond to the "agree" range (Table 6). It can be said that the average of the items regarding the satisfaction survey is above the middle value (3), but not very high.

**Table 6.** Satisfaction level regarding the edible plants garden landscaping in the campus area.

	Strongly agree		Agree		Neither Agree nor Disagree		Disagree		Strongly disagree		$\bar{x}$	SS
	n	%	n	%	n	%	n	%	n	%		
1. A sufficient amount of edible plant material was used on the university campus.	58	9.9	245	41.7	180	30.6	57	9.7	48	8.2	3.35	1.05
2. Edible plant materials in the campus have created aesthetic quality.	66	11.2	284	48.3	141	24	65	11.1	32	5.4	3.48	1.01
3. I think that edible plants on campus reduce energy inputs and protect the environment.	81	13.8	314	53.4	102	17.3	48	8.2	43	7.3	3.58	1.05
4. I think that the edible plants produced on campus make life easier because they are fresher and more accessible.	82	13.9	272	46.3	135	23	61	10.4	38	6.5	3.50	1.06
5. I think the edible landscape on campus reduces our dependence on foods with unknown production systems.	68	11.6	266	45.2	155	26.4	65	11.1	34	5.8	3.45	1.02

**Table 6 Continued**

6. I was pleased with the use of edible plants on the university campus.	102	17.3	298	50.7	97	16.5	52	8.8	39	6.6	3.63	1.07
7. I think having edible plants on the university campus could be beneficial for human health.	113	19.2	299	50.9	100	17	45	7.7	31	5.3	3.71	1.03
8. Edible landscaping products on campus consume more water and energy.	61	10.4	236	40.1	166	28.2	83	14.1	42	7.1	3.32	1.06
9. I think that necessary precautions should be taken because people who unconsciously try to benefit from edible landscape plants on the campus will damage the tissue.	107	18.2	288	49	111	18.9	42	7.1	40	6.8	3.64	1.07
10. I think that the edible landscape established on the campus has an educational quality (it is a natural educational area for child-nature interaction).	84	14.3	310	52.7	112	19	49	8.3	33	5.6	3.61	1.01
11. I think that the edible landscape garden established on the campus is a suitable place for social	84	14.3	290	49.3	114	19.4	63	10.7	37	6.3	3.54	1.06
<b>TOTAL</b>											<b>38.86</b>	<b>9.45</b>

Stanford University has a one-acre farm that includes a large orchard. As well as many student plots managed collectively, the farm also has individual plots maintained by its various members. Crops and flowers are grown. Community workshops on organic gardening and farming are held throughout the year, and produce is also donated to various organizations. They provide their products to campus catering, local fresh, organic produce vendors, and cooperatives. Students who pursue farming receive credit as part of a complete liberal arts education. Stanford's professors, staff, and alumni also participate in the maintenance of these gardens. These gardens also serve as an interdisciplinary laboratory (Chen et al. 2008).

There are currant and apple orchards on the University of Alberta campus. The campus garden is managed by undergraduate students, graduate students, volunteers and faculty members. The purpose of this garden is to provide organic, fresh and nutritious food for the students and school as well as the community of Edmonton. Also, Edmonton It encourages its people to grow local, durable and easily produced vegetables (Chen et al. 2008).

#### 4. Discussion and Conclusion

The edible landscape approach is gaining more and more importance in the establishment of sustainable green infrastructure systems by providing significant contributions in terms of biodiversity and environmental aesthetics, in addition to the direct benefits it provides to individuals through the use of edible plants in settlements. However, it is seen that there are limited scientific and practical studies on this subject in our country. In this context, this study fills an important gap in terms of creating a model at a regional scale and contributing to the literature. Today, environmentally sensitive and environmentally protective agricultural practices are gaining more and more importance, and the need to support environmentally focused agricultural approaches comes to the fore. Edible landscape designs can be integrated into urban fabrics in the context of the planning hierarchy, and more successful applications can be made possible by including them in the land use and development agenda of cities at the institutional level (Bhatt & Farah, 2009). The model developed in this study has been shaped with a design approach suitable for environmental protection and sustainable environmental practices. The use of edible plants in landscape design; In addition to providing health, aesthetic and economic benefits, it also contributes to the revitalization of social life by increasing the interaction of individuals with nature. Cultivation of edible plants on campuses provides significant gains in many aspects such as fresh product production, increasing product diversity, interaction with nature, and strengthening social sharing opportunities (Cengiz et al., 2018).

If the necessary precautions are taken, edible garden applications with an edible landscape design approach on campuses will provide significant benefits to campus users and cities. These benefits can be listed as follows;

- The use of edible plants in the planting design of campuses will provide an aesthetic appearance that varies periodically due to the leaf, flower and stem structures that vary seasonally.
- Edible garden application areas on campuses also offer spatial opportunities in terms of socialization of campus users.
- Campuses are an educational area, especially for students. For this reason, edible plant species on campus will contribute to students' knowledge of plants and the fruits they have, while at the same time providing human-nature interaction during the process of witnessing the growth of plants and the formation of fruits.
- In addition to the aesthetic and functional benefits of the campuses, the fact that individuals also benefit from edible plants will enable individuals to embrace the campuses and protect these areas.
- Edible garden will contribute to the sustainability of urban biodiversity by creating a living space for urban flora and fauna.
- The designs for edible garden will also contribute to the development of green infrastructure systems of cities thanks to their economic and ecological benefits.

The edible garden project implemented in Çaycuma Campus has become a successful model for the effective use of limited urban areas by selecting plant species appropriate to climate data. It is very important to choose species compatible with Çaycuma climate on the campus. Edible garden, implemented in Çaycuma Campus, serves as a model for effective and alternative ways of using limited areas in an urban environment. At the same time, it promotes the perception of the importance of local food production by increasing students' awareness of access to safe food and sustainability. Edible garden; It has contributed to the establishment of an environmentally friendly identity, provided recreational opportunities for campus users and played an important role in students' interaction with the environment. The aim of the Edible garden application is to increase biodiversity and serve to develop a healthy ecosystem. It is increasingly accepted that edible landscaping provides a wide range of advantages and contributes to sustainability. However, vandalism, climate change effects and maintenance problems may also be encountered. Among the results obtained is that the positive information of users about edible plant gardens is related to the support they give to edible landscaping.

In the light of all this information, the more frequent use of edible garden applications in landscape architecture will seriously and positively affect both the professional discipline and the livability levels of urban areas. In the aim of creating green and environmentally friendly campuses that have been carried out in BEUN in recent years, it is important to see the results of investments aimed at energy saving, projects related to waste management and elective courses aimed at environmental awareness in all educational units, social responsibility projects and other efforts in terms of sustainable campus designs and applications. Quality is the priority in the services that BEUN offers to its students and all stakeholders. As an indicator of this understanding, initiatives to increase the quality of life in the campuses and the city continue. Creating environmental awareness and providing livable environments to students and staff is an indicator that a culture of respect for the environment has been established at BEUN. With this application, a new one has been added to the environmental improvement and sustainability studies carried out on the campus and a common sustainability culture has continued to be created on the campus.

The edible garden application area of the Çaycuma Campus is located in the most central part of the university. Since approximately 70-80% of the university campus is located around this area, designing the area to accommodate intensive use is of great importance for the target audience; students, academic and administrative staff. In this context, the vehicle road between the Çaycuma Vocational School and

Çaycuma Food and Agriculture Vocational School buildings was closed to traffic and the usage and impact area of the pedestrianized edible plants garden was expanded, and its integration with the open sports areas on the other side of the road was ensured, and its connection with the other green areas of the campus was strengthened. At the same time, the impact area of edible garden has been expanded in terms of sustainability and development by using the sitting units within the application area along the pedestrianized road.

Edible garden application was made in BEUN Çaycuma Campus with the survey conducted to determine the user opinions and preferences regarding the establishment of edible garden in BEUN Çaycuma Campus. Then, the results obtained from the surveys applied to determine user satisfaction were compared and according to the obtained data, the satisfaction level obtained for the determined expectations of the student, academic and administrative staff revealed that the expectations were realized.

For the Sustainable and Green Campus goal for the BEUN Çaycuma Campus Green University Strategic Action Plan;

- Prioritizing the concept of “sustainability” in technical and social decision-making processes • Increasing environmental awareness on campuses, reducing negative impacts and risks on the environment
- Being an example to the society and local stakeholders and assuming a guiding role
- Ensuring the transition from environmental education to environmental learning by ensuring that students take part in environmental learning as a living laboratory on the campus
- Establishing a university-local government cooperation framework at national and international levels is important.

As a result; It has been determined that the satisfaction of students, academicians and administrative staff from the Çaycuma Campus Edible garden design project is at a high level. Since the effect of the plant design in particular will be better revealed in different seasons, it is expected that the satisfaction level regarding the edible garden application area will increase even more. Surveys can be conducted for the edible garden application area in spring, autumn and winter periods to determine satisfaction levels. In addition, warning signs and awareness-raising activities should be carried out to avoid agricultural pesticides as much as possible in applications to be made in public areas and to consume edible species after taking the necessary cleaning measures. In addition, warnings should be created about accidents such as falling, etc. that may occur during the fruit collection phase of tree-formed plants, and about not damaging the plant during fruit collection.

Universities undertake important responsibilities in order to provide a livable environment and protect the environment. When evaluated on a national and regional scale, the main purpose of sustainable campus applications, which play an important role in universities' relations with the environment, should be to serve this goal. Therefore, the projects implemented by universities in order to develop sustainability culture and awareness directly affect not only the individuals within the university but also the society. Although a university campus seems to serve only its students, when such applications are evaluated on a larger scale, they also contribute to the spread of sustainability culture at the social level. In this context, edible plant garden projects implemented on university campuses are of special importance in terms of increasing the experience of universities to gain a greener, livable and sustainable campus identity. In addition, the dissemination of such applications in urban areas will provide significant social, economic and ecological contributions to sustainable development on a national, regional and local scale. Within the scope of the study, the edible plant garden application implemented on BEUN Çaycuma Campus has revealed unique processes and results in terms of being implemented based on the demand and satisfaction levels of campus users. With this study carried out on a local scale, it was aimed to raise awareness about the sustainable and ecological identity of the campuses of the universities, which are

rapidly increasing in our country, in the new construction process. In addition, it is of great importance to apply and spread this model in other university campuses.

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