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Determination of Ecological Footprint of SIU-Faculty of Agriculture and Evaluation in Terms of Landscape Architecture

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ABSTRACT

In this study, ecological and carbon footprints of students who have undergraduate education in 8 different departments of Siirt University Faculty of Agriculture were calculated. In the research, online "Ecological Footprint Survey" was used as material. Descriptive statistics such as average and standard deviation were used in the analysis of the data. In this context, a survey was applied to 132 students. According to the results of the questionnaires, the average ecological footprint of the students was 3.5 gha and the average of carbon footprint was 8.9 tons. The departments of the Faculty were analyzed among themselves and according to the parameters of gender, age, number of family members, but there was no statistically significant difference. According to the results, the students' ecological footprints were found on the average of Turkey and the world. Determining the ecological footprints of individuals living in a region is also important for the landscape architecture studies to be carried out there. The low or high ecological footprint is an indication of the use of natural resources in the region. Contributions to be made to the preservation or formation of the natural balance can be determined with this indicator. In short, landscape studies in the region can be shaped with ecological footprint data.

RESEARCH ARTICLE

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INTRODUCTION

Since the existence of the world, human who has lived a life intertwined with nature has interacted with the environment throughout history, has learned to fulfill his needs from the environment and has tried to gain control over a wide area until he reaches farming, domestication, production and finally genetically modified foods. Nature is mostly seen as a "boon" and excessive consumption or excessive use have destroyed nature. The rate of damage to the environment has increased with the industrial revolution. While using the environment, people have could not predict the harms of

this in the following periods. The unconsciously used environment and excessive consumption have started to harm both the natural environment and the human being that is a part of it. The number of diseases related to environmental pollution has increased (Abdalla, 2018).

Climate change and global warming are among the most discussed environmental issues in recent years. The effects of environmental problems, especially global warming, are increasing each year. Therefore, the concept of ecological footprint has bandied about in order to measure the use of natural resources.

Ecological footprint is a concept that shows which natural resources are used for human activities and how much natural production area is required to replace each one (Seçme, 2019). The ecological footprint is a concept that shows how much space individuals use with their consumption habits and how much space they will need while maintaining these habits, and can present data that can help organize the habits in favor of the environment (Öztürk, 2010).

Sustainability - Environment – Ecology

In 1980, World Conservation Strategy: Living Resource Conservation for Sustainable Development had emphasized the fact that natural resources and the ecosystem's carrying capacity are limited due to the use of natural resources and economic development. It had emphasized that the interests of future generations should be protected (Seçme, 2019). With the Brundtland Report (Our Common Future) published in 1987, sustainability has been an important issue worldwide. According to the report, sustainability had defined as “meeting today's needs without compromising the possibilities of future generations”. Considering that almost all needs are met from nature / environment, the link between environment and sustainability is more clearly understood.

According to Seçme (2019), considering the common aspects of the many definitions made, the environment is the place where the assets maintain their relationships in their habitats and realize the biological, physical and social contexts between them. In other words, environment is the place in which beings are in a certain interaction system in natural, artificial and social sense. As a result, the environment is seen as the relationship between all living and inanimate beings and the whole of different factors that affect the life of living things.

Today, the concepts of human, environment and ecology are considered as a whole. The term ecology, first introduced by the German biologist Haeckel in 1870, is briefly defined as "a branch of science that investigates the effect of the interrelationships between living things and their ecosystems”. Man affects the ecosystem that he lives in, namely his environment, and continues his life using the resources in this ecosystem. Unfortunately, the negative effect of human on the environment causes environmental problems. Natural resources are not unlimited. For this reason, ecological footprint is used to measure resource use and to reveal the relationships between people and the environment.

Ecological Footprint

The concept of ecological footprint was introduced by Wackernagel and Rees in the 1990s. According to Akıllı et al. (2008), it refers to a tool that calculates the biological productive area that the individuals use to meet all their needs in order to measure the

productivity and quantity of intact natural resources, and to produce solutions that prevent the destruction of nature. The ecological footprint is the biologically fertile land and water area required to reproduce resources consumed by individuals or activities, with the help of existing technology. It is expressed as “global hectare (gha)”. In addition it includes the infrastructure and the areas required for vegetation to absorb waste carbon dioxide (CO^2) (WWF Türkiye, 2012).

The main ecosystem categories for ecological footprint calculation are sea area, arable area, rural area, forest area required for absorption of CO^2 input-output and construction area (Wilson ve Anielski, 2005).

The concept of "ecological footprint" is an intuitive idea to measure impact of individuals and communities on nature. It provides us with a simple and elegant calculation tool that helps us see the effects of human consumption patterns in the world. The ecological footprints of individuals, households, cities, countries in a particular region can be measured (Schaller, 1999).

The Global Footprint Network (GFN) of the Wildlife Conservation Foundation (WWF) measures the biological capacity demands of more than 150 countries worldwide and publishes the National Footprint Accounts (NFA) (WWF-Türkiye, 2012).
According to the global footprint network data of WWF, in 2016 the world's and Turkey's global ecological footprints were, respectively, 20.60 and 0.24 billion gha, while the ecological footprint per capita were calculated as 2.06 gha and 3.36 gha (WWF 2017).

There are national (Dıştan, 1999; Çabuk and Karacaoğlu, 2003; Atasoy and Ertürk, 2008; Ertekin, 2012; Coşkun, 2013; Çetin, 2015; Akkor, 2018; Arıca and Kağar, 2018; Aşık, 2018; Baran et al., 2019) and international (Flint, 2001; Anderle, 2002; Bond, 2003; Rees, 2003; Meyer, 2004; Knaus, Löhr and Bernadette, 2005; Ryu and Brody, 2006; Klein Banai and Theis, 2011; Medina and Toledo Bruno, 2016) studies on determining the ecological footprint. The aim of this research is to determine the students' ecological footprints at Siirt University Faculty of Agriculture and to compare the ecological footprint sizes about the 8 different departments in the faculty.

MATERIAL and METHODS

The main material of the study is the survey data of 132 undergraduate students. For this purpose, some questions were asked to the students. For example; “How often do you consume meat and meat products or vegetables?” or “ What type of residence do you live in with your family?” or “How many kilometers per week do you travel with motorcycles, cars and public transport?” In addition, relevant articles, theses, reports and papers have been used.

The research was carried out in three stages. At the first stage, a literature review was made and questionnaire forms were prepared. In the first part of the questionnaires, there were multiple-choice questions related to food, travel, domestic and other vital habits to determine the ecological footprint. In the second part of the questionnaires, questions regarding demographic characteristics were included. "Ecological Footprint Calculation Survey" in the ecological footprint calculation engine was used in the preparation of the survey questions (GFN, 2019). In the second stage, the applied questionnaires were analyzed. The data obtained from the questionnaires were processed into the ecological footprint calculation engine and the ecological

footprint of the survey participants was calculated. The findings are summarized with the frequency table. Whether ecological and carbon footprint data show normal distribution or not was investigated by applying Kolmogorov-Smirnov test. Ultimately it was determined that they did not show normal distribution. Therefore, the significance levels between the variables were questioned by one of the nonparametric tests, Kruskal-Wallis test. In the third stage, all the data obtained so far have been evaluated.

RESULTS and DISCUSSION

Demographic features

The demographic characteristics of the participants are given in Table 1. According to Table 1, 45.5% of the participants are women and 54.5% are men. The proportion of participants between the ages of 18-25 is 67.5%. 48.5% of the participants have 5-7 people in their families.

Table 1. Demographic characteristics of the survey participants

Demographic characteristics	Parameters	Frequency	Percentage
Gender	Female	60	45,5
	Male	72	54,5
Age	18- 25	89	67,5
	26- 35	32	24,2
	36- 45	11	8,3
Number of individuals in the family	1-4	39	29,5
	5-7	64	48,5
	8-10	22	16,7
	More than 11	7	5,3

Ecological and carbon footprint assessment

The ecological footprint averages of the students participating in the survey were calculated as 3.5 gha and their carbon footprints were calculated as 8.9 tons. It has been determined that the calculated ecological footprint consists of a combination of resources, which are 29.1% from food-sourced, 20.0% from travel, 30.1% from domestic and 20.8% from the other (Table 2).

Table 2. Ecological and carbon footprint averages and distribution of ecological footprint components

Parameter		Value
Ecological footprint (gha)		3.5
Ecological footprint components (%)	Food	29.1
	Travel	20.0
	Domestic	30.1
	Other	20.8
Carbon footprint (ton)		8.9

When the ecological footprints of the participants were evaluated on department basis (Table 3), it was found that the department with the lowest ecological footprint was Field Crops (3.4 g ha). Landscape Architecture (3.7 g ha) and Horticulture (3.8 g ha) follow it, respectively. Among the departments, the department with the largest ecological footprint is the Agricultural Economics (4.4 g ha). The ecological footprint differs according to the departments, however, this difference was not statistically

significant (p> 0.10). In addition, the ecological footprint was analyzed according to gender, age groups and the number of individuals in the family, but there was not statistically significant difference (p> 0.10).

Table 3. Average of ecological and carbon footprint and their distribution by departments

Parameter		Horticulture	Plant protection	Biosystem Engineering	Landscape architecture	Field Crops	Agricultural Economy	Agricultural Biotechnology	Animal Science
EFP (gha) *P= 0.333*		3.8	4.1	4	3.7	3.4	4.4	4.1	4.2
EFP component (%)	Food	31.0	26.2	25.0	40.3	29.6	31.3	27.9	22.6
	Travel	19.0	26.2	26.7	7.0	20.3	21.9	26.2	30.6
	Domestic	29.3	26.2	26.7	28.0	31.5	25.0	26.2	25.9
	Other	20.7	21.4	21.6	24.6	18.6	21.8	19.7	20.9
CFP (ton) *P=0.429*		9.5	10.3	10.3	7.9	9.1	10.3	10.5	11.4

When the carbon footprints of the participants were evaluated on department basis (Table 3), it was found that the department with the lowest carbon footprint was Landscape Architecture (7.9 tons). Field Crops (9,1 tons) and Horticulture (9,5 tons) follow it. Among the departments, the department with the largest ecological footprint is the Animal Science (11.4 tons). The carbon footprint differs according to the departments, however, this difference was not statistically significant (p> 0.10). In addition, the carbon footprint was analyzed by gender, age groups and the number of individuals in the family, but there was not a statistically significant difference was found (p> 0.10).

Keleş et al. (2008) found the ecological footprint of Aksaray University Faculty of Education students as 4.04 g ha. Turkis and Çil (2017) found the ecological footprint of Ordu University classroom teaching students as 2.57 gha. Ağaç and Yalçın (2018) found the ecological footprint of Çanakkale 18 March University Faculty of Education students as 1.6 g ha. Yıldız and Selvi (2015) found the ecological footprint of 90 pre-service science teachers of a public university as 3.04 gha. In our study, the ecological footprint of students is founded as 3.5 g ha. This value is lower than Keleş et al., but it is higher than the others. In addition, the ecological footprint value in our study is above the average of Turkey and the world.

CONCLUSION

In this study, in order to measure the ecological and carbon footprint, face-to-face surveys were carried out with 132 students. As a result of the analyzes, the ecological footprint average of the students was 3.5 g ha and the average of the carbon footprint was 8.9 tons. According to these results, the ecological footprints of the students were found above the average of Turkey and the world.

Landscape architecture is one of the professions where ecology-based learnings are given intensely. Landscape architects prioritize the aims of protecting the ecological balance and creating sustainable living spaces as well as aesthetic values in their works. For this purpose, they use the ecological education they receive in their works.

An ecological footprint is a measurement tool used to determine the amount of natural resource usage. Determining the ecological footprints of individuals living in a region is also important for the landscape architecture studies to be carried out there. A low ecological footprint can be accepted as an indication of the need to maintain the natural balance in that area. Insuch areas, it is a mission to give more importance to the protection of natural balance in landscape studies. A higher ecological footprint is a criterion that indicates that studies should be done to create a natural balance in that region. Landscape architects should contribute to the formation of natural balance while working in this region. In short, landscape studies in the region can be shaped with ecological footprint data.

Besides, ecology is an issue that concerns all people today. Increased environmental problems and therefore deteriorations affect life negatively. Minimizing these effects is only possible through education. As with all levels, ecology education is now given in universities to raise awareness of university students about ecology. In this study, the ecological footprints of Siirt University Faculty of Agriculture students were calculated. The result was found 3.5 gha. Ecology-based courses are given in the faculty. Although the result is above the average of the Turkey and the world; it was lower than some of the other studies researched. This shows that students have ecological knowledge, but they do not adequately integrate this knowledge into their lives.

Living in a sustainable environment and using natural resources rationally is very important in reducing the ecological footprint. For this purpose;

- Wastes should be recycled as much as possible.
- If possible, public transport should be preferred for short or long travels.
- Energy saving applications should be made in all areas.
- Natural areas should be protected and their numbers should be increased.
- Waste should be avoided in the use of natural resources.
- Instead of materials that cannot be dissolved in nature, materials that are in harmony with nature and that can be dissolved in nature should be used.
- In order to raise the awareness of the public on the subject, more promotion, advertisement etc. applications should be made.
- The number and quality of ecology-based trainings should be increased in each age group.

As a result, it should never be forgotten that nature has a carrying capacity and natural resources are not unlimited. It should not be forgotten that in order to live in a sustainable world and leave a beautiful nature to the next generations, it is necessary to be a conscious user and consumer.

DECLARATION OF COMPETING INTEREST

The author declares that they have no conflict of interest.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

As an author, the planning, execution and writing of the article was done by me.

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